Prerequisites: One semester of college-level biology and an ecology course (can be met via BIOE342 Field Ecology at FLBS) or equivalents; or consent of instructor.

Course Description:
Principles and methods of conservation ecology applied to aquatic and terrestrial species and ecosystems with emphasis on concepts of evolution, genetics, population ecology, behavioral ecology, species interactions, and ecosystem pattern and process as key attributes to be considered in the design and implementation of nature conservation and restoration. This course emphasizes the application of basic biological research to problems in conservation and management with an eye toward the interface between science and policy. There are five primary themes to the course: defining population units of conservation; effects of introduced species (including invasive species, hybridization, and infectious disease); population viability and monitoring; habitat pattern, ecosystem dynamics, and environmental change across landscapes; and the relation of conservation science and practice to culture, policy and politics. Case studies will consider the reversibility and irreversibility of threats and of the demographic, genetic, environmental and cultural changes threats cause. These themes are applied to a diversity of case studies to illustrate general concepts in real world application. We will be spending much of our time in the field with practicing, expert conservation biologists who work for state and federal government agencies or for nongovernmental organizations.

Student Learning Objectives:
At the end of the course, you will be able to:
• Compare and contrast conservation biology from other scientific and management disciplines.
• Identify 6 major principles or concepts of ecological, evolutionary and genetic science that are critical to the conservation and restoration of biota.
• Differentiate among the conservation practices of protection, restoration, and remediation.
• Recall the basic requirements for protection of biodiversity and biological integrity of four major US environmental laws: the Endangered Species Act, The National Environmental Policy Act, the National Forest Management Act, the Clean Water Act.
• Describe field observations in a standard field notebook format
• Recognize principle threats to conservation and restoration of native species, habitats, and ecosystems in northwestern Montana and the Crown of the Continent Ecosystem including the impact of introduced species
• Evaluate population abundance data collected with a variety of methods to assess population trends.
• Interpret field observations and scientific literature, and recognize how to apply it when formulating a field study or conservation program.
• Discuss how the precautionary principle can inform the conservation decision-making or policy.
• Explain why an interdisciplinary approach (involving the domains of policy, economics, culture, ethics and science) is vital to the conservation decision-making process.
• Illustrate with examples how scientific information and analysis can be used to formulate and inform practices and policies to achieve conservation goals in the face of critical uncertainties, and in a way that openly responds to social considerations.
Text: We will read parts of the following text: Groom et al., 2006, *Principles of Conservation Biology* 3rd edition, Sinauer Publ. FLBS will provide several classroom copies of this text, but sharing will be necessary. Students who wish to have a private copy may purchase a used copy of this book (price is $12) at the FLBS bookstore.

Reference Texts: Identification guides to local biota will be available; students are strongly encouraged to bring personal copies of field guides for mammals, amphibians, fishes, flowers, trees, and other biota in the northern Rocky Mountains region of the USA.

Course and Field Supplies/Equipment: (*available for purchase at the FLBS Bookstore)

- Plenty of pencils, regular or mechanical*
- permanent-ink, weather-resistant pens are acceptable
- Hot/cold mug*
- Rite in the Rain field notebook*
- Sunscreen, sun hat, and sunglasses
- Lunch pack-up container(s) (resealable)*
- Mess kit and utensils
- Packable water bottles (total capacity at least 2 liters)*
- Digital camera with zoom (optional)
- Hip boots or waders (optional)
- Bear spray*
- Binoculars (optional but encouraged)
- Laptop (optional, but highly recommended)
- Headlamp and small flashlight, extra batteries

- Required Overnight Field Gear and Other Items to Bring Checklists: (Click to view)

  We will camp overnight one-two nights each week in the field. Food and cooking equipment will be provided, but you will need your own eating utensils, plate or bowl, cup and water bottle. We will spend time wading in cold streams and clean but leech-infested wetlands. You will need a good headlamp, good footwear for hiking over rough terrain, including snowfields, good footwear or waders for working in cold water, extra dry socks and warm clothes (click above to view required overnight and field gear). We’ll be camping out two nights and a warm sleeping back and small backpacking tent are recommended (though students ideally will share tents to avoid crowding limited campsite space). We are in grizzly country, and bear spray is strongly recommended, as is your preferred insect repellent. Do not leave food or cosmetic products in tents.

Grading (percent of final grade):

- Field Notebook (week 1): 5%
- Field Notebook (week 2): 15%
- Leading Article Discussion: 10%
- Independent Report Oral Presentation: 20%
- Final Exam (Short essay, open book, take home): 30%

Substantive participation in class discussions factored in as extra credit

NOTE: In cases where the instructor judges that a student 1) shows clear improvement in performance and cognition of material and concepts over time, or 2) shows strong bias in aptitudes even with good effort (e.g., intrinsic difficulty in oral presentation or handling exam pressures, or illness), the student’s lowest assignment score might be excluded in calculating the final grade. This is at the instructor’s discretion.
Course Policies:

The goal in this class is for students to learn and understand basic principles of conservation biology in the context of examples of real world conservation challenges in the Crown of the Continent Ecosystem. Through field visits, lectures, and participation in field studies with guest scientists, we will view how principles of conservation, ecology, and evolution inform conservation research. We will also discuss the codependent interplay between conservation science and the policy and politics of natural resource and landscape management.

Logistical notes: the majority of this course is taught outside, regardless of weather, with class plus transport time often taking 10 hours or more per day, at locations far from your housing at the Biological Station. We will hike some most days and on some days we will hike or float most of the day. Students must be prepared. If you are certain that you can hike 5–10 miles in a day, you will really enjoy this course. If you are not sure of your hiking skills in the rough terrain of mountain landscapes, but you like to exercise and are really committed to learning about Conservation Ecology in this marvelous field setting, the instructor will help teach you how to enjoy hiking as a part of the ecological experience. Please pay very close attention to the requirements you pack wet weather and cold weather gear, including a change of clothes for overnight campouts, and appropriate footwear for hiking in rough terrain and wading in smaller streams and wetlands. And remember to keep a clean camp and carry bear-grade pepper spray on your person and at the ready whenever hiking in open country or forest.

Synthesis, writing and reporting assignments

Field Notebooks: You will be graded on the comprehensiveness, content, and professional quality of notes you keep in a field notebook. You’ll be provided with guidelines on how to keep a scientific notebook. As a general rule, if you find yourself going for more than 45 minutes in the field without making any notes you should check yourself and make sure you’re allocating time appropriately. That said, the content of your notebook can and should span the full scope of classroom work, from observations to immediate, tentative questions and speculations, to retrospective thoughts you may have later in the day or week, or additional information (including answers to your questions) you might glean from follow-up discussions with instructors, guests, or peers, or from research in journals. Ideally, besides general information, your field notebook should contain the initial seeds of your written and oral reports.

Article Discussion Leading: Each student is expected to lead, or co-lead with one other student, a ca. 20-minute class discussion of one of the assigned journal articles. Please see instructor about negotiating your article choice from the reading list provided on day one, and negotiating a time for the discussion session. We’ll try to schedule article discussions on an ad hoc basis when opportunity arises in the classroom or field. Note that because of the large amount of time we spend away from desks and computers, hard copies of the articles will be provided.

Independent Written Report: Each student is required to produce one written report, due at 11:59pm on the final Friday of class. The instructor will be available to evaluate and discuss report topics and drafts with each student to improve research and writing skills. The report is to be a review and synthesis of published research on a narrowly defined topic of your choice, on any subject in conservation science or the science-policy interface, as approved by the instructor. Reports should generally follow formatting for article category of Review or Essay for the journal Conservation Biology; see http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1523-1739/homepage/ForAuthors.html, although your reports will likely be shorter, with a word count in the range of 2000–2500 words (includes any tables, figure legends, and literature cited). To produce a good review or essay of this length, it will be important to select a topic/conservation ecological question that is focused narrowly enough that no more than 10–15, but no fewer than 5–6 published articles provide the cited essential content of your review. Your report should identify a conservation problem or goal in the form of a species, community, habitat, or landscape, and identify known threats to that goal or resource. Your review should recognize apparent agreements and
disagreements among papers in the published literature, suggest ways to understand or reconcile any disagreements, and discuss the potential consequences of uncertainties arising from 1) disagreement among sources, and 2) lack of critical information for conservation management. Finally, you should suggest conservation management actions of policies that could protect the biological resource of concern in the face of recognized threats and uncertainties. It is strongly advised that you propose a topic and discuss it with the instructor by the end of the first Friday of class, June 30th, and certainly by the morning of Monday, July 3rd.

**Oral Report:** On the final Friday of class, July 7th, you will present the content of your final independent written report to the class in the form of a PowerPoint presentation or alternative oral/poster presentation (on approval from the instructor) as you would give at a scientific meeting. You are required to condense the essentials of your presentation to 10 minutes, allocating 5 minutes for questions and class discussion.

**Final Exam**

The final exam will consist of about 6 questions, from which you will choose 4 to answer. Your answers will be in the form of short essays. Questions will either 1) present as scenario and ask you to provide principles of conservation ecology relevant to resolve a key conservation question about the scenario, or conversely 2) will identify a concept or principle and ask you describe examples of how that knowledge has been, or could be fruitfully applied to a conservation problem. The final exam will be open book, but there will be limited time for research. You will not know the questions prior to the exam period (1–5 pm on the final Friday). You will need to be prepared to draw on your in-class experience and what you recall from prior readings and discussion to do well. Your answers should display an integrated understanding of the course concepts, drawing from field experiences, presentations, and literature readings, as well as the textbook. Merely reciting relevant sections of the text is not acceptable. You’ll be free to take exams out of the classroom, but they are due by 5pm sharp.

**Outside of Class**

Plan on allocating a good share of your evening hours and your intervening weekend to reading the text and research and prepare your reports. You cannot do well in this course without reading the text and keeping up with the 3–4 supplementary journal articles the instructor will provide each week.

Hiking on the off days is encouraged because there is so much to see around FLBS, but conduct your trips with an eye toward the course content, and allocate time accordingly.

**Use of Wireless Internet at FLBS:**

A reliable secure wireless connection to the Internet is available in selected areas. An online learning interface (Moodle) is used to provide electronic versions of many of the course assignments and supplementary readings for the Field Ecology course.

Students will adhere to University of Montana Student Conduct Code and Discrimination, Harassment, Sexual Misconduct, Stalking, and Retaliation Policy (policy website: [http://www.umt.edu/safety/policies/](http://www.umt.edu/safety/policies/)) and to the Biological Station Code of Conduct form signed during student registration. Students must also follow FLBS Rules and Regulations and abide by the Safety Orientation Checklist. Students who have not already completed the University of Montana PETSA training may access the Moodle module at this link: [http://www.umt.edu/petsa/](http://www.umt.edu/petsa/).

Students with disabilities may request reasonable modifications by contacting the instructor. The University of Montana assures equal access to instruction for students with disabilities in collaboration with instructors and Disability Services for Students (406.243.2243, [http://www.umt.edu/dss/default.php](http://www.umt.edu/dss/default.php)). The University does not permit fundamental alterations of academic standards or retroactive modifications.

(Schedule on pages 5-6)
**Schedule:** (Revised 6/8/18, NOTE- The schedule below is subject to change!)  
**Make sure you pack your brown bag lunch each day at breakfast!**

<table>
<thead>
<tr>
<th>Date</th>
<th>Lectures/Lab/Field Work</th>
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| Mon. 6/25/18 | **8:30 am: Ecology East Classroom:** Introductions, orientation, syllabus discussion, grading basis, report expectations, field trip logistics and prep., Field notebooks purpose, importance and protocol.  
               **10:00 am: FLBS Seminar, Elrod Lecture Hall - Germaine White** (Confederated Salish and Kootenai Tribes).  
               **11:30 am-12:00pm:** FLBS bookstore shopping, lunch.  
               **12:pm-5:00 pm:** Field Trip, Mission Mountain Face near Blue Bay, with Rich Everett (Fire Ecologist, Salish Kootenai College).  
               **5:00pm** Return to FLBS for dinner.                                                                                                                   |
| Tue. 6/26/18 | **8:30 am:** Leave for National Bison Range.  
               **9:30-10:30** Stacey Dunn (Univ. of Idaho, tent.), Pronghorn ecology at Bison Range picnic area;  
               **0:30am -2:30pm:** Bison Range Big Sleep Drive stops -Visitor Center, invasive plans and biocontrols, landscape views of bison, bighorn sheep, and pronghorn ecology.  
               **3:00-4:30pm** Brett Stevenson (SK college/Cornell U, tentative) Waterfowl Institute talk on Swan reintroduction (tentative), OR pollinator plantings site visit with Heidi Fleury (Lake County Conservation District, tentative) OR stop at CF’s home in Polson to discuss top-down ecological processes in food webs & invasive species.  
               **5:00 pm:** Return to FLBS for dinner.  
               **Evening 8-9:00pm:** Meet in classroom or Elrod Hall (TBD) to watch Hauer Floodplain ecology seminar video.                                                                                   |
| Wed. 6/27/18 | **8:30 am:** Depart FLBS to meet Craig Barfoot and colleagues (CS&K Tribes Fisheries). AM: Field tour of Upper Jocko River, ecology conservation and restoration of native westslope cutthroat trout in the face of genetic introgression and competition with nonnative species; PM: Site visits and discussion of restoration of floodplain river ecosystems on the middle and/or lower Jocko River.  
               **3:30 pm:** possible pollinator plantings site visit with Heidi Fleury (Lake County Conservation District, tentative).  
               **5:00 pm:** Return to FLBS for dinner.                                                                                                                  |
| Thu. 6/28/18 | **8:30-9:30 am Ecology East Classroom:** Pack for overnighter, weekly debriefing; watch Kyle Young salmon hatcheries video. [https://www.youtube.com/watch?v=1KjsiPTTUAc](https://www.youtube.com/watch?v=1KjsiPTTUAc)  
               **9:30am:** depart for Nyack Floodplain cabin site, Middle Fk. Flathead R.  
               **10:30-3pm:** Floodplain traverse, discussion of ongoing research, kick net and other macroinvertebrate sampling,well aquifer biota sampling with Rachel Malinson, FLBS. Pack lunch to eat on the river.  
               **3-5:30 pm:** Drift net sampling, emergence trap sampling (Malinson, Gordon Luikart, FLBS), eDNA applications discussion and demonstration. (Luikart and Steve Amish U of MT Genetics Lab).  
               **DINNER IN CAMP,** Camp setup in evening at Nyack cabin.  
               **10:00-11:55pm:** Night time fish observations and electrofishing.                                                                                   |
| Fri. 6/29/18 | **BREAKFAST IN CAMP**  
               **9-10:30am:** Transboundary conservation issues talk w Erin Sexton, (FLBS, Crown of the Continent Partnership), at Nyack cabin.  
               **10:30am-12:30pm:** Daytime electrofishing, Nyack floodpain.  
               **12:30-1:30pm:** LUNCH and breakdown camp  
               **2:00-3:30pm:** Scott Relyea, (MT Fish Wildlife and Parks) Sekokini native fish hatchery visit, Lake Five area (tent.).  
               **5:00 pm** return to FLBS for dinner.  
               **5:00pm Field Notebooks due for interim grading.**                                                                                                   |
<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Event and Details</th>
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<tbody>
<tr>
<td>Mon. 7/2/18</td>
<td>8:30-10am</td>
<td><strong>Ecology East Classroom:</strong> Class discussion, debriefing week 1 subjects; consultation time with CF re. reports/presentations and field notebooks, etc.</td>
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<td>10:00am</td>
<td>FLBS Seminar, Elrod Hall - Cody Youngbull (FLBS).</td>
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<td>11:30am</td>
<td>Depart for Glacier National Park.</td>
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<td>1-2:30pm</td>
<td>Scott Relyea, (MT Fish Wildlife and Parks) <strong>Sekokini native fish hatchery</strong> visit, Lake Five area (tent.). OR proceed to Apgar to set up camp.</td>
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<td>3-4:30pm</td>
<td>Rebecca Lawrence (National Park Service) <strong>Glacier National Park</strong> (HQ area) Native Plant Restoration Program nursery tour and discussion.</td>
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<td>5:00pm</td>
<td>CAMP at Apgar, Glacier NP (tentative; backup is possibly Nyack Cabin).</td>
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<td>Tue. 7/3/18</td>
<td>7:30-8:30am</td>
<td><strong>BREAKFAST IN CAMP</strong> + prepare and pack sack lunches.</td>
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<td>8:30-9:30am</td>
<td>BREAK CAMP and pack for day hike.</td>
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<td>9:30am</td>
<td>Depart for Going-to-the-Sun Road</td>
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<td></td>
<td>10:30am-2:30pm</td>
<td>Lunch Creek hike, alpine stoneflies diversity, endemism, and climate change with Joe Giersch (USGS Rocky Mountain Science Center),</td>
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<td>2:30-4:30pm</td>
<td>Sekokini Hatchery optional tour date (alt. tentative) OR Logan Pass short hike.</td>
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<td>5:00pm</td>
<td><strong>DINNER IN FIELD</strong> (at a Glacier NP or Middle Fk. Flathead picnic site TBD) <strong>RETURN TO FLBS after dinner, ca. 7:30pm.</strong></td>
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<td>Wed. 7/4/18</td>
<td>8:30-9:45am</td>
<td><strong>Ecology East Classroom:</strong> lecture and discussion. Forest management and stream fish conservation (CF, FLBS).</td>
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<td>10:00-11:30am</td>
<td><strong>Ecology East Classroom:</strong> Charles A.S Hall (UNY Syracuse emeritus) Energy economy, sustainability and society - lecture and discussion.</td>
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<td>11:30am+</td>
<td>Free time to work on independent project report and presentations; open consultations with instructor as desired.</td>
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<td>Thu. 7/5/18</td>
<td>8:30am</td>
<td>Depart for Swan Valley.</td>
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<td>9:45am-2:00pm</td>
<td><strong>Tabitha Graves</strong> (USGS Rocky Mountain Science Center) presentation and citizen science activity on grizzly bear foraging ecology and pollinator roles.</td>
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<td>2:00-3:30pm</td>
<td>Swan Valley pothole and riverine wetlands site visits near Porcupine Creek Road.</td>
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<td>4:30pm</td>
<td>Return to FLBS for prep time, Dinner.</td>
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<tr>
<td>Fri. 7/6/18</td>
<td>9:30am-12:00pm</td>
<td><strong>Ecology East Classroom</strong> classroom (or possibly Elrod Lecture Hall) - Independent Report presentations, in 10 minutes each +5 minutes questions.</td>
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<td>1:00-5:00pm</td>
<td>Final Exam. Open book/take home.</td>
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<td></td>
<td>5:00pm</td>
<td>Final exam and Field notebooks due. <strong>Check out with instructor at Ecology East Classroom,</strong> (Notebooks will be returned via US mail for those who are not staying at FLBS for later classes).</td>
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<tr>
<td></td>
<td>11:59pm</td>
<td>Written Independent Report Due.</td>
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