Prerequisites: One year of college-level biology, chemistry, and mathematics or equivalents; or consent of instructor.

Course Description:
Ecology is the study of biophysical controls on the distribution and abundance of biota, including human influences. Prerequisites: One year of college-level ecology, biology, chemistry, and mathematics. The course provides detailed study and discussion of ecological phenomena including: behavior and life cycles of organisms; population, community and landscape dynamics; biodiversity and productivity; biophysical processes (e.g., climate change, nutrient cycles, herbivory, predator–prey interactions) and organization (e.g., genomes, ecosystems, biomes, ecoregions) across space (local to global) and time scales; and ecological economics and human ecology. Natural history observations, ecological principles and results of scientific studies are used to explain biological patterns, processes, responses and complex interactions as influenced by changing environmental conditions. Lectures build upon the laws of thermodynamics, evolution, trophic dynamics and other unifying principles to present ecology as a key discipline of the natural world and essential to human well-being. This course is conducted outdoors regardless of weather, including all lectures and lab exercises, so those ecological phenomena can be examined in real time and real life. All day and overnight trips, mainly by foot, will be conducted throughout the course, taking students into the full range of aquatic and terrestrial environments near the Biological Station and the adjacent mountain areas, including Glacier National Park. Students are expected to take detailed notes and conduct directed measurements that will require analysis and interpretation through written and oral presentations and written reports edited by the professor. Meets writing requirement.

VERY IMPORTANT NOTE—To enjoy this course and to learn the content fully, you must be: in good physical condition, able to hike up to 10+ miles a day in strenuous conditions at altitude (sometimes off established trails), and properly equipped for a great deal of hiking. If you are unsure about your hiking skills, please contact flbs@flbs.umt.edu.

Student Learning Objectives:
After completing this course, students will be able to:
1. Identify common ecosystems types and dominant or key species in Northwestern Montana
2. Describe how natural and human history contributed to the modern day ecosystems in the region
3. Demonstrate the use of standard ecological field sampling tools and basic statistical procedures
4. Apply ecological theory to field observations
5. Describe field observations in written field notebook format
6. Synthesize data from disparate habitat types and relate to recognized ecological principles
7. Compare patterns in ecosystem structure and function locally and globally
8. Interpret, synthesize, and apply a wide range of scientific literature in the ecological and environmental sciences
9. Develop hypotheses and questions based on ecological patterns observed in natural history observation
10. Distinguish testable predictions from hypotheses and use these predictions to design a coherent field ecological study
11. Generate a research project (either observational or experimental) based on field observations to evaluate how environmental factors affect living organisms
12. Apply standard analytical procedures to study the environment
13. Prepare an oral and written report describing and interpreting the results of the research project

**Required Books:** (Books are available for purchase at the Biological Station Bookstore.)


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

- Rite in the Rain field notebook (8.5 X 11)*
- All weather permanent ink pen and a few pencils*
- Hot/cold mug*
- Packable water bottles (total capacity at least 2 liters)*
- Resealable lunch pack-up container*
- Mess kit
- Wading shoes or sandals
- Broken in hiking boots
- Binoculars & camera (optional, but great scenery)
- Bear spray*
- Laptop computer with MS Excel, MS Word and (good stats package—optional but very useful)
- Rain gear including umbrella (optional, but very useful in drizzle)
- Personal first aid kit
- Layered outer wear

- REQUIRED Overnight Gear and Other items to bring checklists: [Click to view](#)

**Grading:**

**Exams and Grading**  Hand in all written assignments on Moodle except notebooks

1) **Participation/Professionalism for 20% of grade,** based on attendance, attitude, preparedness and:
   a) Field notebooks—thoroughness, legibility, content of questions and observations. *Important because not just you, but fellow students will be partly relying on data you record.* Field notebooks turn in at end of week two and will be returned to your mailbox by soon after. Field notebooks are also due last day of class. Average of mid-course and end of course grade.
   b) Journal article mini seminars—informal small group presentation and discussions based on published papers assigned by the instructor and relevant to the field trips.
   c) Attendance – All activities are required unless alternatives are agreed upon
2) Brief Written Field reports: One due per week/ 1st week is Lichen Lab, after that choose which field trip and sites(s) or aspect of field observations and sampling from that week you want to focus on. Introduction (importance of problem, identify research question), Methods, Results (must include field data and analysis of it, including one or more tables, graphs; photographs also where they provide information specific to the field study), Discussion and Conclusions (include shortcomings and next steps to improve or expand results), Literature Cited (3 or more citations), and a 50-word Abstract. Total ca. 4–6 pages single-spaced, plus any figures or photographs you include. Your three best report grades will be averaged to total 30% of grade.

3) Independent research project report and Powerpoint presentations: Initial project idea verbally discuss with Chris Frissell and Eric Richins by end of day July 4th. Each student is required to write a 2-page written research proposal by end of week two. Written report and 5-minute summary power point presentation due 4th week of class (there may be an interim deadline for drafts to Eric prior to this); 30% of grade (based on powerpoint proposal, final written report and final powerpoint summary).

4) Final Exam–last class day. 20% of grade

Course Policies:
The goal in this class is for students to thoroughly understand ecology in a functional process context through observation and directed analyses in the Crown of the Continent Ecosystem. We will learn common plants and animals of this region, how they interact along complex biophysical gradients and how ecosystems like this one provide goods and services that are essential to human well-being.

Please note – the course is taught entirely outside, regardless of weather, Monday through Thursday, often using 10 hours or more per day. We will hike some every day and on some days we will hike all day, studying ecology as we go. Students must be prepared. If you are absolutely certain that you can hike at least 10 miles and maybe can do 18 miles in the mountains with a light pack 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 Ecology in this marvelous field setting, Eric and TBA will teach you how to enjoy hiking as a part of the ecological experience.

Analysis and writing assignments based on in-class data collection
Each student is required to complete directed analysis of data collected by the class and produce written reports. The instructors will evaluate and discuss reports with each student to improve writing skills. So, special attention is paid to how reports are prepared. All reports should generally follow formatting for the journal Ecology. See Moodle Day 1 for a link to the Ecology webpage with instructions for authors. In short, include a title, a short abstract less than 150 words, Introduction, Methods, Results, Discussion, Literature Cited, Tables and Figures. The results section will include graphical presentation of the analyses and statistical interpretation of the data. Handouts are provided in electronic format on Moodle with information on how to conduct the work and with questions that should be addressed in the write up. The objective of these reports is to introduce the student to scientific method in ecology, proper approaches to data collection and analysis and conduct of scientific writing. Reports typically are 3–5 pages in length, including graphics.

Each week you will be assigned a report or an alternative assignment as planned by the instructors.
Projects

Each student is required to conduct an independent research project on an ecological phenomenon. The project may be observational or experimental, but must be empirical. A written proposal or study plan approved by the instructors is required prior to conduct of the study, by the end of week one (prior to start of Field Day 5). Draft project reports are due prior to the start of the first day of the 4th week of the course. Example reports from previous classes are available for perusal on the Moodle course interface under Day 1. Instructors will edit the reports and return them to the student for revision. Final reports are due on the last day of the course when each student also will make a PowerPoint presentation to the class describing his/her project in scientific terms. The purpose of independent projects is to provide hands-on experience in planning, conducting and conveying ecological research.

Outside of Class

Use Friday afternoon–Sunday periods to read, review and work on assignments and projects. You cannot do well in this course without reading the text. We will cover many of the major topics in the book during the first two weeks and then reinforce them by repeatedly revisiting concepts and processes as we encounter them during our field day jaunts. Students are expected to take notes in the field, make directed measures (focused field studies) and in the evenings work in groups to analyze and present the data (group work products). Some of the focused field data will be analyzed individually and presented to the professor as written reports.

Hiking on the off days is encouraged because there is so much to see around FLBS, but conduct your trips in the context of the course content.

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 with disabilities may request reasonable modifications by contacting FLBS and 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). The University does not permit fundamental alterations of academic standards or retroactive modifications.

Schedule: (Revised 6/23/17) Note: The schedule below is subject to change.
We follow this schedule rain or shine; topics may vary depending on what we encounter in the field. Be sure to pack your brown bag lunch each day at breakfast!

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lectures/Labs/Field Work</th>
</tr>
</thead>
</table>
| 1    | Mon. 6/26/17 | **8:30am: Lakeside classroom** - Introductions, orientation, syllabus discussion, grading basis, report expectations, field trip logistics and prep.  
      |                                                      | **10:00am-11:00am: Elrod Lecture Hall** - Data and Donuts Seminar  
      |                                                      | **11:30am-12:00pm: Elrod Lecture Hall** - Field notebook format and content.  
      |                                                      | **1:00pm-3:00pm: Elrod Lecture Hall - Joint lectures and discussion with Cons. Ecology** - Lectures: Understanding evolution (ER); The domestication of life (ER);  
      |                                                      | **3:15PM-5:00PM Elrod Lecture Hall - Len Broberg (U of MT Env. Studies)** |
      | Tues. 6/27/17 | **8:30am: Leave for Bison Range** with Conservation Ecology  
      |                                                      | SKT and USFWS/NBR staff-Germaine White, tribal history, culture, ecogeography, and geopolitics; Stacey Dunn, Pronghorn ecology; stop at Chris Frissell’s home in Polson to discuss top-down ecological processes & invasives.  
      |                                                      | **5:00pm: Return to FLBS** |
      | Wed. 6/28/17  | **8:30am: Board the Jesse B for hike on Wildhorse Island** - Looking for patterns; Lichen lab: Asking and answering ecological questions with hypotheses and predictions.  
      |                                                      | **2:30pm: Return to FLBS**  
      |                                                      | **3:00pm Lakeside classroom** - Lecture: Community ecology (ER). |
      | Thu. 6/29/17  | **8:30am: Board the Jessie B** for Flathead Lake limnological monitoring day trip with Tyler Tappenbeck and Phil Matson of FLBS.  
      |                                                      |                                                                 |
      | Fri. 6/30/17  | **8:30am-12:00pm - Lakeside classroom** - Statistics lab: summary statistics, t-tests, and regression.  
      |                                                      |                                                                 |
      | Mon. 7/3/17   | **8:30am: Lakeside classroom** - Build emergence traps and see examples of how they are used.  
      |                                                      | **10:00am-11:00am: Elrod Lecture Hall** - Data and Donuts Seminar  
      |                                                      | **11:30: Depart for Swan Valley wetlands field trip** - Wetland ecology and diversity  
      |                                                      | **5:00pm: Return to FLBS** |
      | Tues. 7/4/17   | **8:30am-12:00pm: Lakeside classroom** – Whiteboard time: Brainstorm project ideas, form project groups, sketch out project proposals  
      |                                                      |                                                                 |
      | Wed. 7/5/17  DINNER IN CAMP | **9:00am: Depart for Logan Pass w/ Conservation Ecology class and Joe Giersch (USGS) at noon**, stream insect diversity, endemism, and climate change.  
      |                                                      | **4:30pm: Depart for Group camp in Apgar Campground in Glacier**  
      |                                                      |                                                                 |
      | Thu. 7/6/17  BREAKFAST IN CAMP | **9:00am: Depart** for Multiple insect collection techniques on Nyack  
      |                                                      | **12:30pm: Depart** for FLBS  
      |                                                      | **2:30pm: Lakeside classroom** - Lecture and discussion on how rivers work (ER)  
      |                                                      | **4:30pm: Load rafting gear-Find a PFD that fits!**  
      |                                                      | **After Dinner: Elrod Lecture Hall** - River conservation film festival  
      |                                                      |                                                                 |
      | Fri. 7/7/17   | **8:00am: Depart for Buffalo Rapids** (From Selis, Ksanka and Qlispe Dam to Buffalo Bridge) - Lower Flathead River. River continuum and River discontinuum concepts.  
      |                                                      | **~5:00pm: Return to FLBS** |
      | Mon. 7/10/17  DINNER IN | **8:30am: Load** boats, paddles, and PFDs for Nyack  
      |                                                      | **10:00am-11:00am: Elrod Lecture Hall** - Data and Donuts Seminar  
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|                                                      |                                                                 |</p>
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>CAMP</td>
<td></td>
<td>11:30am: <strong>Depart for North Fork of the Flathead</strong> for fire and stream ecology. 6:30pm: <strong>Arrive at Nyack</strong> cabin to set up camp.</td>
</tr>
<tr>
<td>Tue.</td>
<td>7/11/17</td>
<td>8:30am: Float and hike the <strong>Nyack floodplain</strong> reach with Tom Bansak (FLBS). Large river floodplain hydrology, disturbance and succession, surface and hyporheic ecosystems processes, habitat diversity, faunal diversity. 5:00pm: Retire for dinner and recreation.</td>
</tr>
<tr>
<td>Tue.</td>
<td>7/11/17</td>
<td><strong>BREAKFAST &amp; DINNER IN CAMP</strong></td>
</tr>
<tr>
<td>Wed.</td>
<td>7/12/17</td>
<td>8:30am-midmorning: Collect insects from traps from <strong>Nyack floodplain</strong> &amp; return to FLBS. 12:30pm-3:30pm: <strong>Lakeside classroom</strong> - Processing insect samples. 3:45-5:00pm: <strong>Lakeside classroom</strong> - Discussion - Wilson text and related issues.</td>
</tr>
<tr>
<td>Wed.</td>
<td>7/12/17</td>
<td><strong>BREAKFAST IN CAMP</strong></td>
</tr>
<tr>
<td>Thu.</td>
<td>7/13/17</td>
<td>8:30am: Depart for fire and forest ecology trip near Blue Bay on Reservation with Rick Everett from Salish Kootenai College. 5:00pm: Return to FLBS</td>
</tr>
<tr>
<td>Fri.</td>
<td>7/14/17</td>
<td>8:30am-12:00pm: <strong>Lakeside classroom</strong> - Group discussions on status of independent projects; individual meetings on projects if desired; field work on projects.</td>
</tr>
<tr>
<td>Mon.</td>
<td>7/17/17</td>
<td>8:30am: <strong>Lakeside classroom</strong> - Group discussions on the status of projects. 10:00am-11:00am: Elrod Lecture Hall - Data and Donuts Seminar 11:30am: <strong>Lakeside classroom or fieldwork</strong> on projects, with 1-2-hour consultations and analysis with Chris and Eric.</td>
</tr>
<tr>
<td>Tue.</td>
<td>7/18/17</td>
<td>8:30am: <strong>Depart for Moiese and Arlee</strong> for restoration ecology. 5:00pm: Return to FLBS</td>
</tr>
<tr>
<td>Wed.</td>
<td>7/19/17</td>
<td>8:30am: <strong>Lakeside Classroom</strong> - Work on projects all day with open analysis consultations with Chris and Eric.</td>
</tr>
<tr>
<td>Thu.</td>
<td>7/20/17</td>
<td>8:30am: <strong>Lakeside classroom</strong> - Last minute presentation preparation/consultation time. 10:00am-12:00pm: <strong>Final Project Presentations</strong> (10 minutes + 5 minutes Q&amp;A each) 1:00pm-4:00pm: <strong>Final Project Presentations</strong> 4:00pm-5:00pm: Open discussion/review session of exam material.</td>
</tr>
<tr>
<td>Fri.</td>
<td>7/21/17</td>
<td>9:30am-12:00pm: <strong>Final Exam</strong></td>
</tr>
</tbody>
</table>
