



Summer Session 2020

Field Ecology (BIOE 342)

Syllabus

Course dates: June 22–July 17, 2020

5 Credits; Online Lectures, Labs, Field Work

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Note: This syllabus and schedule are subject to change. Weekly assignments and readings are in a separate document.

Synopsis: The course engages major concepts and approaches in modern ecology via immersive field experiences, hands-on sampling, and project-based learning in both aquatic and terrestrial habitats. Topics range from physiological and behavioral ecology to population and community ecology to ecosystem ecology and touches on themes of disturbance, invasive species, and climate change. The course will build students' natural history knowledge of the biota of the Rocky Mountain region while directly engaging them in active research projects of the instructors. This course is conducted largely outdoors regardless of weather conditions so that ecological phenomena can be examined in real time and real life. **All-day and overnight trips will be conducted throughout the course**, taking students into a range of aquatic and terrestrial environments near the BioStation and the adjacent mountain areas including Glacier National Park. **Students should be physically fit and able to hike ~10 miles or more per day.** Students will conduct directed measurements connected to ongoing research projects of the faculty, developing technical skills as well as skills in scientific analysis and interpretation in written and oral form. Lecture materials will largely be presented in video format so **students should bring a laptop, tablet, or smartphone to view materials.**

Learning Objectives:

| Scientific Process | Both A&T | | |
|---------------------|---|---|---|
| | <ul style="list-style-type: none"> • Ability to complete the steps of scientific method • Ability to formulate scientific hypotheses • Ability to visualize and communicate scientific information • Understanding of basic principles of experimental design | | |
| Technical & Methods | Both A&T | Terrestrial | Aquatic |
| | Statistics: t-test; 2-way ANOVA; regression; correlation analysis | Terrestrial community sampling methods, transect establishment, scat counts, invertebrate trapping methods, measuring light and temperature effects | Lake and stream sampling methods; equipment: van Dorn, Schindler trap, tow net, phys/chem profiler, light, Secchi / Surber, kick-net, drift nets, current meter |
| | | Lab methods and equipment: baermann funnel/biomass determinations/lichen sectioning | Lab methods and equipment: filtering; chlorophyll (fluorometer), pH, etc. |
| | | Identification: plants, lichens, insects/invertebrates, mammal tracking and scat | Identification: phytoplankton, periphyton, zooplankton, macroinvertebrates |

| Knowledge | Both A&T | Terrestrial | Aquatic |
|--------------------|---|---|---|
| | Core concepts of ecology: succession, competition, predation, parasitism, mutualism, biogeochemical cycles, biodiversity, population dynamics, physiological adaptation | Drivers of macro and micro-habitat structure / biodiversity / effects and importance of disturbance | Annual lake mixing cycle, stream hydrodynamics, plankton food webs, trophic cascade |
| Attitude / Outlook | Both A&T | | |
| | <ul style="list-style-type: none">• Critical thinking, development of alternative hypotheses• Appreciation of natural diversity• Ability to productively collaborate with others• Attention to detail and accuracy | | |

Learning outcomes: After taking this course students will have increased knowledge of major ecological concepts and improved proficiency in various field and lab methods as well as in scientific study design and analysis in field ecology.

Prerequisites: College level biology, chemistry, and mathematics or permission of instructor.

Extra assistance: You can get extra assistance on statistics, graphing, scientific presentations, and writing from Dr. Kylla Benes (kylla.benes@mso.umt.edu) who is on station and available 5-6 PM on Sundays and also Wed 3 July 6:30-7:30.

TEXTS & MATERIALS (required)

Molles Jr., M.C. *Ecology: Concepts and Applications* (6th or 5th Edition). WCB/McGraw-Hill Publishers, New York, NY. Paperback (Note that page #s refer to 6th edition)

Karban, R., M. Huntzinger & I.S. Pearse. *How to Do Ecology: A Concise Handbook* (Second Edition). Princeton University Press.

Electronic copies of other assigned readings and supplementary reference materials will be provided.

You are also required to purchase a Rite-In-The-Rain notebook (All-Weather LEVEL no. 313) for use in the class.

GRADING

Your grade in this class is determined by five components:

- 1) **Field notebooks:** Thoroughness, legibility, content of observations and data entry will be evaluated. *This is important because not just you, but fellow students, will be partly relying on data you record.* Every week you will place photos of field notebook pages and transcribe data from your field notebooks to a shared Google drive by each Friday 5 PM. These will be checked weekly by instructors. 15%
- 2) **Steller explainers.** You will create two 2-min explorations / explanations of an ecological concept using an app called Steller. Details on this are given elsewhere. Each is worth 10% (20% total).
- 3) **CURE research project report and poster presentations.** 35% of grade {(based on final written report (individual; 20%) and final poster (group; 15%)}.
- 4) **Exams** (Fridays of weeks 1 and 3 at 11 AM). Exams will cover material from textbooks, videos, and *assigned literature papers* during the relevant preceding period (week 1 for Exam 1, weeks 2-3 for Exam 2). Each exam is worth 10%. Overall, exams are 20% of grade total.
- 5) **Attitude, preparedness, and participation.** Are you ready for class? Do you work cooperatively as a team member? Do you ask good questions? Does rain not bother you too much? 10%

BRING YOUR LAPTOP COMPUTER or TABLET – nearly all materials are digital.

APPROACH AND PHILOSOPHY

The goal in this class is to give students an immersive, research-oriented, and hands-on learning experience that covers and integrates major concepts and approaches of ecology in both aquatic and terrestrial ecosystems as exemplified in western Montana. Students will learn the natural history of these habitats and get to know their inhabitants, engage in real scientific field research, and acquire skills in data acquisition, analysis, and interpretation.

Please note - the course is taught mostly outside, regardless of weather, Monday through Friday (AM), often using 10 hours or more per day. We will hike some almost every day and on some days we will hike all day, studying ecology as we go. Students must be prepared. If you are confident that you can hike at least 10 miles 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 or your paddling skills on lakes and rivers but you like to exercise and are really committed to learning ecology in this marvelous field setting, Jim and Diana will help you enjoy hiking and paddling as a part of the ecological experience. You can also expect to get wet, either from the rain or in the process of sampling of lakes and streams. You can also expect to have fun and develop lifelong friendships and professional relationships with your fellow students and with your instructors and other professionals you will meet during the course.

Also note that we seek to create a positive learning environment for all in our class. So, everyone is expected to adhere to the University of Montana Student Conduct Code and Discrimination, Harassment, Sexual Misconduct, Stalking, and Retaliation Policy (policy website: <http://www.umt.edu/safety/policies/>) and to the FLBS Code of Conduct form signed during student registration. Students must also follow FLBS Rules and Regulations and abide by the Safety Orientation Checklist. FLBS students are required to complete University of Montana Prevention Education Program courses: AlcoholEdu and Sexual Assault Prevention for Adult Learners after coursework begins and prior to completion of coursework.

We also expect you to follow norms of academic honesty. Academic misconduct is subject to an academic penalty by the course instructors. All students need to be familiar with the UM Student Conduct Code. The code is available for review online (link: <https://tinyurl.com/y85k9jga>). *Cheating WILL get you an F in this course and will be reported to the UM academic office or to your home institution.*

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>). The University does not permit fundamental alterations of academic standards or retroactive modifications. If you have a disability that adversely affects your academic activities, please let us know so we can discuss an accommodation.

CURE: Classroom-based Undergraduate Research Experience: Each student will be part of an active, “real world”, research project led by one of your instructors. This project is a major component of your class grade. This project will involve experimental manipulations leading to intensive data collection and analysis; ultimately, a paper will be published in the scientific literature. In the shorter term, each student will prepare a report on his/her results in this research and collaborate with teammates in summarizing their overall findings in a scientific poster presentation. *The purpose of the research project is to provide hands-on experience in planning, conducting, and conveying REAL ecological research.* See information elsewhere with more details about this project.

Outside of Class: Use Friday - Sunday periods to read, review, and work on assignments and project data. 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 week and then reinforce them by repeatedly revisiting concepts and processes as we encounter them during our field trips. Your grasp of these concepts will be assessed in two exams. Students are expected to take notes in the field, make directed measures in the field, and in groups or pairs to analyze and present data (group work products). You will also spend time working on samples and analyzing data from your CURE research project. If any time at all remains (!), 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 and be safe.

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

- | | |
|--|-------------------------------|
| - Rite in the Rain field notebook* | - Bear spray* |
| - Permanent ink pens and a few pencils* | - Personal first aid kit |
| - Dissecting kit* | - Headlamp and batteries |
| - Hand lens (Loupe)* | - Rain gear (incl rain pants) |
| - Hot/cold mug* | - Wading shoes or sandals |
| - Packable water bottles (total capacity at least 2 liters)* | - Sunglasses |
| - Lunch pack-up container (resealable)* | - Binoculars (optional) |
| - Mess kit | - Camera (optional) |

Required Overnight Field Gear and Other Items to Bring Checklists: <http://flbs.umt.edu/urls/lists>

If you don't have access to such gear please contact us so we can make arrangements.

Also: - Laptop computer with MS Excel & MS Word.

COURSE SCHEDULE

We follow our schedule **rain or shine**; topics may vary depending on what we encounter in the field. The schedule is kept and updated (live) at the links below. Generally, we will work on our CURE research project on Mondays while Tuesday, Wednesday, and Thursday will involve field trips and fieldwork with overnight trips to Glacier National Park in weeks 2 and 4, and Fridays will involve research project time and exams (week 1 and week 3). You will have Friday afternoons "off" though this is a good time to get caught up on reading, videos, and project work.

UPDATES PENDING FOR 2020 ▶ Master schedule: [here](#) Detailed schedule: [here](#) Simplified schedule: [here](#)

UPDATES PENDING FOR 2020 ▶ **Field Ecology – Schedule (below)**

WEEK 1: Basic concepts of ecology

MONDAY

- | | |
|-------|---|
| 8:30 | Welcome, Introductions, Intro to CURE, form Cure groups |
| 10:00 | Data and Donuts |
| 11:30 | CURE |
| 12:00 | Lunch |
| 12:30 | CURE |
| 5:00 | Wrap up |

TUESDAY

Terrestrial

- 8:30 Intro and prep
- 9:30 Leave for Wild Horse Island
- 9:30 Walking tour - History and management, geology, island biogeography, sheep ecology
- 10:30 'Speed naturalist stops' and tree ID
- 12:00 Lunch
- 12:30 Lichen labs
- 2:30 Hot spot/cold spot
- 4:00 Wrap up and head to FLBS
- 5:00 Back at FLBS

WEDNESDAY

Terrestrial

- 8:30 Lichen lab debrief
- 9:00 Decomposition lab
 - Who's using dead wood: how and when
 - Scat transect – who, what, where and when
 - Scat collections/lab set up for coprophilous fungi

Aquatic

- 12:00 Lunch
- 12:30 Lake sampling
- 3:30 Lab - sample processing
- 5:00 Wrap up

THURSDAY

Aquatic

- 8:30 Stream sampling
- 12:00 Lunch
- 12:30 lab – sample processing
- 5:00 Wrap up

FRIDAY

- 8:30 Review/summarize data from the week
- 9:30 Project time (harvest lake bioassays, learn chl method)
- 11:00 EXAM 1
- 12:00 Lunch
- 12:30 Off

WEEK 2: How does disturbance affect ecological distributions and dynamics? The case of fire

MONDAY

- 8:30 Discussions, catch up time
- 10:00 Data and Donuts
- 11:30 CURE
- 12:00 Lunch
- 12:30 CURE
- 5:00 Wrap up

TUESDAY

Terrestrial

- 8:30 Leave for Glacier National Park
- 10:00 Roger Fire (2002) – Fire ecology of Glacier National Park

11:00 Three 'speed' naturalist stops
12:00 Lunch
1:00 Fire ecology lab
5:00 Wrap up - set up camp (Apgar)
After dinner – quick Roger fire debrief

WEDNESDAY

Terrestrial

9:00 Travel to Sprague Fire
10:00 Fire ecology lab
12:00 Lunch - Sprague Fire debrief

Aquatic

12:30 Fire effects on streams and lakes
5:00 Wrap up and head to camp

THURSDAY

Aquatic

8:30 Fire effects on streams and lakes cont'd
12:00 Lunch
12:30 Fire effects on streams and lakes
? Wrap up and head to FLBS

FRIDAY

8:30 Review/summarize GNP data
9:30 Project time (harvest lake bioassays, sample benthos/stream sites for chemistry, flow, chlorophyll)
12:00 Lunch
12:30 Off

WEEK 3: How do invasive species affect ecological distributions and dynamics?

MONDAY

8:30 Discussions, catch up time
10:00 Data and Donuts
11:30 CURE
12:00 Lunch
12:30 CURE
5:00 Wrap up

TUESDAY

Terrestrial

8:30 Leave for Bison Range
9:30 Bison Range: Bighorn sheep management/weeds with Amy Lisk, wildlife biologist
12:30 Lunch at Bison Range
1:00 Leave for Mission Creek restoration site
1:15 Mission Creek Restoration with Rusty Sydnor, CSKT biologist/restoration ecologist
4:00 Head back to FLBS
5:00 Wrap up

WEDNESDAY

8:30 Catch up time

Terrestrial

9:30 What makes an invader? Naturalist speed stops, Tree ID

12:00 Lunch

Aquatic

1:30 Sample Mysis in Flathead Lake

3:30 Process samples

12:30 am Night-time Mysis sampling

THURSDAY

Aquatic

8:30 Flowering rush sampling, Polson Bay with Virgil Dupuis of SKC

12:00 Lunch

1:00 Process samples from Polson Bay and night Mysis samples

FRIDAY

8:30 Review/Project time (harvest lake bioassays, sample benthos/stream sites for chemistry, flow, chlorophyll, run chemistry analyses)

11:00 EXAM 2

12:00 Lunch

12:30 OFF

WEEK 4: Global change effects on ecological distributions and dynamics

MONDAY

8:30 Discussions, catch up time

10:00 Data and Donuts

11:30 CURE

12:00 Lunch

12:30 CURE

5:00 Wrap up

TUESDAY

Terrestrial

8:00 **Meet at 7:45 for an 8AM departure!** Leave for Glacier National Park

10:30 Siyeh Pass hike (10.5 miles) - The wicked problem of whitebark pine, climate adaption

12:00 Lunch

12:30 Siyeh Pass hike cont'd

4:30 Leave trailhead for camp @ Many Glacier

5:00 Wrap up/set up camp

WEDNESDAY

8:30 Break camp, leave for Swiftcurrent Valley hike

9:30 Repeat photography, sample newly formed periglacial Upper Grinnell Lake

12:00 Lunch

12:30 Hiking back

? Return to FLBS, dinner en route

THURSDAY

8:30 Turn in field notes. CURE Work day – finish projects

12:00 Lunch

1:00 Work on and print posters by 4:30PM

5:00 Wrap up

FRIDAY

| | |
|-------|------------------------------|
| 8:30 | Lab cleanup, equipment check |
| 9:15 | Put up posters |
| 9:30 | Poster session |
| 11:00 | Wrap up event |
| 12:00 | Lunch |
| 1:00 | DONE!!! |