



Rocky Mountain Ecosystems

June 13-July 11, 2024

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Office Hours: After class, or by appointment

Course Description: In this field-based course, you will explore mountain ecosystems as a scientist. Learn to identify and study the characteristic flora and fauna of a variety of Rocky Mountain ecosystems, both aquatic and terrestrial, by visiting the diverse ecosystems that surround RMBL. The course is designed around a series of guided field studies along the elevational gradient from low sagebrush grasslands and rocky outcroppings to montane meadows, willow-lined streams, and aspen forests all the way up to the highest elevation subalpine spruce-fir forests and alpine tundra. Additional classroom work and assignments will train you to read and discuss scientific literature, formulate and test hypotheses in the field, analyze and interpret data, and present scientific results.

Course Objectives: Students will...

- Explore the diverse mountain ecosystems surrounding RMBL;
- Learn the skills necessary to systematically survey, collect, and identify the characteristic flora and fauna of the major mountain ecosystems;
- Relate elevational patterns of species distributions to biotic and abiotic factors;
- Learn to formulate ecological questions, practice the methods and analyses used in ecological field research, and discuss and communicate scientific ideas.

Prerequisites: None

Textbooks: There is no formal textbook for this class. Electronic copies of readings will be made available.

Equipment: Daypack, field notebook, pencils, water bottle(s), sweater/fleece jacket, waterproof shell, spare hiking socks, hat, sunscreen, sunglasses, hiking boots, and binoculars (optional). You are responsible for making yourself comfortable in the outdoors. Be prepared to hike 4-6 miles at elevation (9,000-11,000 ft) on field days.

Be Courteous: You are expected to do your own work, be honest, and not be disruptive or disrespectful of others. Please turn off all personal electronic devices while in class and during field activities.

Assessment:

Student proficiency will be based on article discussions, quizzes, a field journal, species list, graphs, and in-class group presentations.

Point Values:

Article Discussions (4x 10 pts)	40
Quizzes (4x 10 pts)	40
Field Notebook (4x 20 pts)	80
Species list	40
Abstracts/Graphs (4x 25 pts)	100
<u>Group Presentations (4x 25 pts)</u>	<u>100</u>
Total Possible Points	400

Grading System:

Grades will be calculated based on the assignments described above. Students will receive a pass ($\geq 70\%$) or fail unless you want a letter grade.

Letter grades are as follows: A = 90 – 100%
B = 80 – 89%
C = 70 – 79%
D = 55 – 69%
F = < 55%

Plus or minus grades will be awarded at the discretion of the instructor.

Article Discussions:

Each week students will read an article or two in preparation for the upcoming field activity. After carefully read the article(s) students will participate in a class discussion. Points are earned by contributing to the discussion. For example, students can summarize an experiment, interpret a graph/table or answer a question posed by another student to contribute. (10 pts/discussion)

Quizzes:

Quizzes on the assigned article(s) and lecture will be given prior to the article discussions. (10 pts each)

Field Notebooks:

Students are required to keep a detailed notebook documenting our field activities. Record as much detail as possible about the location, environment, weather conditions, flora and fauna. Sketch maps and descriptive drawings if they are useful to you. Entries in your notebook will also help you compile your species list. The more detailed your notebook is the better I can evaluate your personal progress as an ecologist. (20 pts/field day)

1. Obtain a notebook that you can easily access and carry in the field. A composition book, “write-in-the-rain” or hard-backed notebook with loose-leaf paper works best.
2. Leave the first page blank. This will serve as your table of contents. Provide a title and page numbers for each activity.
3. Enter notes in ballpoint ink or pencil. Put observations down at once. Once an entry is made do not erase it; ~~draw a line through it~~ but do not remove it.
4. Record the time of day each observation is made. Add an entry for every observation, even if witnessed the same phenomena several times. You can never take too few notes!

Species List:

Students will observe a wide range of flora and fauna over the summer. To better appreciate the diversity of species encountered, each student will create a list of all the species recorded, along with any relevant notes and total species counts/abundances observed. The final species list must be typed and include scientific and common names (if available) and arranged taxonomically. Species observed during each field day must be included in the list (40 pts).

Presentations:

In groups of 3-4, students will design an experiment to address questions/hypotheses generated by the article discussion. The groups will then spend a day in the field to carry out the study. Following a brief period to summarize and interpret your results, each group will give a 10-15 minute “chalk talk,” where students write or create real-time illustrations on the white board to convey any relevant information. Group members will all earn the same point value for the presentation.

Rubric for presentations (25 pts)

Visual Presentation (10 pts)

Made effective use of the white board to visually convey information.

Minimum of one graph depicting results, properly labeled.

Quality of content presented (10 pts)

Presented in organized and logical manner.

Adequately summarized background, questions/hypotheses, methods, results and conclusions.

Talked with interest to audience (5 pts):

Faced the audience and made eye contact.

Sounded interested. Did not read verbatim notes.

Presentation not too fast or too slow.

Abstract & Graphs:

Following the presentations, student must independently write an abstract and create two graphs that summarize their results. The abstract and captions must be typed, while the graphs must be hand drawn.

Rubric for abstract & graphs (25 pts)

Title & abstract (5)

Contains informative title for the project.

Abstract succinctly summarizes the entire report in one or two paragraphs.

Graphs (20)

Graphs are hand drawn and use a single sheet of graph paper. Axes are properly spaced and labeled.

Contains a key that explains the colors, shading, or line patterns used to indicate different groups.

Caption effectively explains the data that is being presented. Mean and SD (or SE) values are included.

Reading List:

Ladrera, R., Gomà, J., and Prat, N. 2018. Effects of *Didymosphenia geminata* massive growth on stream communities: Smaller organisms and simplified food web structure. *PLoS ONE* 13(3): e0193545. <https://doi.org/10.1371/journal.pone.0193545>.

Merriam, C.H. 1890. Results of a biological survey of the San Francisco Mountains region and desert of the Little Colorado in Arizona. Department of Agriculture, Div. Ornithology and Mammalogy. *North American Fauna* 3: 1-34.

Mooney E.H., Phillips JS, Tillberg CV, Sandrow C, Nelson AS, Mooney KA. 2016. Abiotic mediation of a mutualism drives herbivore abundance. *Ecology Letters* 19:37-44. doi: 10.1111/ele.12540.

Wright, I. J., Reich, P. B., Westoby, M., Ackerly, D. D., Baruch, Z., Bongers, F., Cavender-Bares, J., Chapin, T., Cornelissen, J. H., Diemer, M., Flexas, J., Garnier, E., Groom, P. K., Gulias, J., Hikosaka, K., Lamont, B. B., Lee, T., Lee, W., Lusk, C., Midgley, J. J., ... Villar, R. 2004. The worldwide leaf economics spectrum. *Nature*, 428(6985), 821–827. <https://doi.org/10.1038/nature02403>

Tentative Schedule*: We will have a total of eight meetings, split between morning (8:00am-12:00pm) and afternoon (1:00pm-5:00pm) sessions. Each week we will spend approximately one day in the field where we will explore the local flora and fauna, meet with researchers, and carryout your research projects (expect to hike 4-6 miles). Days we are not in the field will largely be devoted to lectures, article discussions, planning of research projects, interpreting data and presenting results.

*Note that inclement weather may require us to shift field activities to another day.

Week 1		<u>Thursday June 13</u>
	Morning 8:00-12:00	Lecture: Rocky Mountain Ecosystem Discuss: Merriam 1890
	Afternoon 1:00-5:00	Explore Gothic Valley

Week 2		<u>Tuesday June 18</u>	<u>Thursday June 20</u>
	Morning 8:00-12:00	Summarize data Group Presentations	Field trip: Jack's Cabin Cutoff Visit with Dr. Ian Breckheimer
	Afternoon 1:00-5:00	Lecture: Population Ecology Discuss: Wright et al. 2004	Sagebrush Community Project

Week 3		<u>Tuesday June 25</u>	<u>Thursday June 27</u>
	Morning 8:00-12:00	Summarize sagebrush data Group Presentations	Visit with Bobbi Peckarsky
	Afternoon 1:00-5:00	Lecture: Diversity & Community Ecology Discuss: Landera et al. 2018	Aquatic invertebrates project

Week 4		<u>Tuesday July 2</u>	<u>Thursday July 4</u>
	Morning 8:00-12:00	Summarize aquatic invertebrate data Group Presentations	No Class 4th of July
	Afternoon 1:00-5:00	Lecture: Species Interactions Discuss: Mooney et al. 2016	

Week 5		<u>Tuesday July 9</u>	<u>Thursday July 11</u>
	Morning 8:00-12:00	Visit with Emily Moony	Summarize plant-herbivore-ant data Group Presentations
	Afternoon 1:00-5:00	Plant-herbivore-ant project	Wrap up summer species list due