

Biology 3475 Fall 2009/10

August 2009

Physiology of Alpine Plants – Field Trip

Course deals with plant response to environmental conditions and stresses, seed germination physiology, growth in relation to various substrates, induction of flowering, pollination and flower development. Field trips will focus on mountain geomorphology and climate in relation to plant life. Student evaluation will be based on a written essay, field notebook/digital document and practice writing.

Course will normally be offered two weeks prior to the start of the Fall semester.

COURSE OUTLINE - Fall 2009

Course objectives:

To introduce students to the high mountain environment, highlighting the role of plants in the subalpine and alpine ecosystems. Emphasis will be placed on exciting students about the study of plant structure and function, in the context of the extreme environmental conditions of the mountain landscape. In addition to introducing basic principles of plant stress physiology, emphasis will be on written and oral communication of scientific information.

COURSE DELIVERABLES AND GRADING:

1. A review paper on a topic of your choice, pertaining to the **physiology of alpine plants**. Topics will be discussed during the organizational meeting in the Spring and decided on by the payment-due-date. The paper should be based on your own reading of the pertinent literature and an **outline and reference list should be ready for submission on the first day in the mountains**. You should be prepared to give the other participants a 10-15 minute run-down on your proposed paper content. Essay due the first Monday of October - 40% of total course mark.

2. Two one-page assignments A) prepared BEFORE the course and due the first day of field class and B) prepared DURING the field course:

A) one-page discussion/definition of a biological species concept in the context of plants likely to be found and observed in the mountain environment. This should be based on you past training in biology and additional reading on the species concept. **Due first day of field trip (20% of final mark).**

B) Description/observation of your chosen plant species, or comparison/contrast of two plant families or genera. Focus on the phenotypic (developmental) plasticity imposed by the mountain environment and discuss the difficulties in applying the species concept or classification ranking to your chosen plants. Draft due in the middle of the course and final version at the conclusion of the course (20% of total course mark).

3. Any one of (or combination of) the following: notebook with field notes, diary, set of labeled photographs or drawings, herbarium plant collection, video. This item will focus on some specific aspect of alpine biology or alpine science in general – preferably in relation to your specific observations during the course. It may be related to the topic of your paper. If not, you should have some idea of what information you wish to convey in

your submission (i.e. **have a PLAN prior to departure!**). Spend a good deal of time with “your nose close to the ground” during the field trips, especially if you get ahead of the group. This is designed to keep the group together and not to make the hikes athletic marathons..... Due the first Monday of October – 20% of total course mark.

Final grades will be submitted within the time limits of the Fall semester.

COURSE WEIGHT and EVALUATION:

6+ hours of instructional time per day (for 11 days) plus informal introduction/discussions of scientific information during travel and “leisure” time fully justify the weight of this course as one half-course equivalent (HCE) with laboratory. Voluntary course evaluation will be made possible at students’ convenience.

TIME-LINE:

Organizational meeting in CB 3010A - in March.

Students go through normal **EARLY** registration, including Biology 3475 on their class selection list.

University course registration deadlines, fee payments, and withdrawals as shown in the Calendar apply!

Field trip fee for this optional course is payable as a non-refundable deposit of \$ 250 (to ensure reservation at Alpine Club cabin) on April 15th of the year of the trip into Lakehead University **Account 10-16060000-63802**. Remaining \$750 is payable by June 30th into the same account. See below for breakdown of fees and **note that unused portion of fees is refundable to you.**

August 20th (Thursday) depart Thunder Bay (or elsewhere), meet in Calgary airport at 12-4 PM, rent vehicles, one pick up can be arranged in West Calgary along the Trans Canada hwy around 4PM, depart for ACC clubhouse in Canmore (40 min trip), settle in, buy groceries.

August 21st course orientation, safety and introductory lecture

August 22nd to 26th course activities

August 27th Thursday – day off

August 28th to September 2nd course activities (one night - Friday 28th - in Stanley Mitchell or other back-country ACC hut – depending on availability).

September 3rd (Thursday) depart for Calgary airport and travel back to Thunder Bay.

Classes start September 4th.

Assignment due-dates as shown below.

Costs:

Lakehead university registration as a regular Fall term course (through regular channels). We reserve the right to cancel the course if fewer than 5 students register and pay fees by the April 15th deadline. Please, also purchase ACC club membership, as this lowers room fees significantly. This can be done at:

https://admin.alpineclubofcanada.ca/mship/new_start

for \$36 if unaffiliated, \$46 if you wish to support the Thunder Bay section - they will rent you equipment and have beginners rock and ice climbing sessions for VERY reasonable prices.

The field school fee of \$1,000 includes ACC clubhouse accommodation, course materials and incidentals (park permits, entrance fees, lift tickets), local transportation (van rental, adequate insurance, and gas). Transportation between Thunder Bay (or elsewhere) and Calgary and food costs are borne separately by individual participants.

Participants are expected to sign a legal release document, behave in a safe and responsible manner according to the safety regulations of the Biology department (as outlined on the first day of the course) and will be responsible for their own health insurance.

Food:

This will be the responsibility of individual participants. You may wish to “team up” with others to save on money and effort. The club house has cooking facilities. There will be regular opportunities to buy supplies in Canmore, which is about 3km hike from the ACC clubhouse.

Physical demands:

Walking in steep terrain, sometimes on scree. You should be in a reasonably good physical condition to complete up to 16 km (10 mile) hike and be able to move slowly, but comfortably in steep terrain. You will not be placed into dangerous conditions beyond the limits of your ability.

Daily schedule:

This will largely depend on weather conditions, but the target of about 30 hrs of lectures and discussion sessions and 40 hours in the field will be easily reached.

- In reasonable weather, field trips away from ACC clubhouse base will start at 8:30AM, with expected return time at about 4-5PM.
- In reasonable weather, local field trips starting at 8:30AM, with return around noon, followed by lunch and two one-hour lectures in the afternoon.
- In bad weather, two one-hour lectures in the morning and two one-hour lectures in the afternoon. Lectures may take the form of discussion sessions and video presentations.
- Evenings – free time every other day, or informal lectures, entertainment organized by volunteers, DVD movies and/or biology-related documentaries.

Places we will visit:

Several short trips in the immediate vicinity of Canmore – mainly Spray Lakes and Kananaskis River Valley: karst formation with marmot colony, alluvial fans, mountain ridges, alpine tarn lake, subalpine forests, etc.

Locations farther away:

Burstall Lakes and Valley (possibly Burstall Pass – long day), Highwood Pass, Kananaskis Lakes.

Day trips in Banff national Park – Johnson Canyon and Douglas fir montane forest, Bow Lake glacial flood plain, tea house and ski lift at Lake Louise – subalpine and alpine zones.

Day off optional trip to visit Banff – tourist sites – historical Whyte Museum of the Rockies, Banff Centre for the Arts are recommended. Dinner on your own at a place of your choice (from McDonald's to top end restaurants). Leave Banff 8PM.

WHAT TO BRING

Small rucksack/daypack for daily outings, one large or two intermediate size pieces of luggage. Keep in mind there is a two day hike to one of the backcountry Alpine Club huts at the end of the course – you will need a more capacious rucksack for this, to carry food, extra clothing and a sleeping bag. The bag can be light, since the huts and the clubhouse are reasonably warm.

The daypack should fit extra warm clothing, raingear, personal hygiene items, lunch, drink bottle and equipment you may want for making your field project work – notebook, camera(s), collecting equipment, pen knife, binoculars, etc. Bear spray is OK if it makes you feel more comfortable.

In general, you should have:

Rain gear, **solid hiking boots (no street or tennis shoes for hikes!)**, tennis shoes and/or sandals to change into (these are inadequate for walking in boulder fellfields, fresh snow or firm snow fields, which we have encountered in all the years so far!!!). Reasonably warm clothing, temperatures can range from summer heat (light hat, shorts and T-shirt) to winter conditions (toque, woolen socks, layered clothing – fleecy or sweater, outer breathable shell, long pants). Several changes of underwear and socks, two sets of outerwear including about three shirts should be adequate (laundry facilities are available). Sunglasses, UV protection cream, bug repellent. Extra towel is recommended. Small first aid kit with drugs you feel you may need or which you routinely take. Large communal first aid kit will be available.

Bottle for drinking, personal cup and utensils if desired (these are provided at ACC facilities), special food items if wanted (chocolate bars)

Recreational items for the evenings – (no Walkmen or books during daily field trips) - books, magazines, DVD movies, CDs, games, musical instruments (except pianos and tubas). Small sports equipment items. Cell phones work in the main TransCanada Highway corridor and part way into Kananaskis Valley, but **NOT IN THE MOUNTAINS!!**).

Essay format:

The mode of exposition should be either a description of a process or cause and effect. It should be aimed toward a general audience with at least high school education and the format of an educational article for general public (Nature Canada, Canadian Geographic) OR a scientific mini-review article (indicate which on the title page). It should be concise, at most 10 pages long (in 12 point font, double spaced), including extensive bibliography. Points made are expected to be supported by primary references as much as possible.

Paper topics:

HINT: If you have interest in molecular biology, feel free to link molecular approaches (stress proteins, chaperones, photoinhibition of photosynthesis, antifreeze proteins, reverse genetics, etc.) to problems of alpine ecophysiology. After the literature

introduction, you can even outline, in a separate section, a proposal for a potential interesting research project.

Tree line – formation, environmental factors and theories attempting to explain it.
Nutrient input into the alpine zone – atmospheric deposition, pollutant deposition, insect influx (“rain”).

Pollination mechanisms in select species – timing of flower development, pollinator activity and temperature.

Seed development under environmentally limiting conditions.

Seed development on continuously flowering species – degree of maturity and dormancy attained at different levels of the parent plant (oldest to youngest flowers).

Seed dormancy breaking treatments.

Seed germination (preferably under alpine conditions)

Seedling establishment – the role of nurse plants, soil conditions (mineral vs. organic soil, nutrient input, moisture, etc.)

Symbiotic relationships in alpine plant seedling establishment – mycorrhizae, soil microbes, allelopathy

Flowering induction – photoperiodism versus appropriate conditions for floral development.

Plant biochemistry under extreme environmental conditions.

“Extremophiles” – particularly high temperature effects, global climate change

UV light effects on plant metabolism (photosynthesis)

Mineral rock/substratum weathering and soil development

Lecture topics:

Alpine geomorphology

Climate alpine plants experience

Safety in the alpine environment

Life under snow

Principles of freezing tolerance in plants

Seed germination physiology

Mineral nutrition in relation to geological substratum

Water relations – particularly flooding

Plant pigments – flowers, photosynthesis, UV protection

Growth dynamics – cell cycle and tissue formation

Flowering and pollination

Insectivorous alpine plants

Alpine treelines

Soil development under alpine conditions

Alpine land use, development vs. restoration