1. Course information

Title: Arctic Vegetation Ecology: Geobotany

Number: BIOL 488 / 688

Credits: 3

Prerequisites: BIOL 115 & 116, Introduction to Plant Biology (BIOL 239) or Principles of Ecology (BIOL 271) or instructor approval

Location: Murie 203

Meeting time: T, Th: 2:00-3:30 pm

2. Instructor and contact information

Prof. D.A. (Skip) Walker, Alaska Geobotany Center, University of Alaska Fairbanks, Arctic Health Building, Room 254, 474- 2460, dawalker@alaska.edu. Office hours: M, W, F: 9:00-11:00.

3. Course readings /materials

Numerous papers will be read and are in the assignments listed in the course calendar and will be posted on line at http://www.geobotany.uaf.edu. These three references provide a good overview of the Arctic Vegetation in North America and Russia and the current issues relevant to Arctic vegetation.


Required supplies:

10x-power hand lens for field identification of snow grains and plant specimens.

8.5 x 11-inch notebook or field book for field reference collection and methods notes.

Back country skis or snow shoes with appropriate boots and poles.

Clothing adequate for spending a full day outdoors during winter conducting field work, (including day pack, warm winter clothing, including long underwear, sweater, boots, parka, warm ski cap, gloves, sun glasses, sun protection).

Water bottle, sack lunch

A full list of equipment and expectations for the field trip will be provided well before the field trip.
4. Course description

Course catalog description:
BIOL F488 Arctic Vegetation Ecology: Geobotany
3 Credits Offered Spring even numbered years
Arctic plants and vegetation, including arctic plant identification, climate, geology and geography controls on arctic plant communities, snow ecology, applications to wildlife studies and current Arctic issues. Lectures with plant identification lab and winter field trip. Prerequisites: BIOL 115 and 116 or equivalent; BIOL 239 or BIOL 271; or approval of instructor. Special fees apply. Stacked with BIOL F688 (3+ 0).

Expected proficiencies for taking the course: Ability to read, comprehend, and assimilate written information in scientific texts and journals; basic math skills (including algebra); basic word processing and spreadsheets; basic writing and presentation skills, background in biology, ecology, and plants and/or other biological or Earth sciences such as geology, geomorphology, zoology, climatology and remote sensing.

More detailed description: This course consists of four major parts:

1. Lectures: Eleven lectures. This portion is a seminar focused on Arctic geobotany. Topics will include factors controlling vegetation patterns, including climate, permafrost, geomorphology, soils, animals, zonation, paleogeography, plant communities, floristics, plant adaptations, and succession patterns.

2. Arctic plant identification sessions: 14 plant identification sessions including 4 quizzes. Each session consists of an approximately half hour overview lecture and a 1-hr plant identification session using specimens from the student herbarium. Students will learn about 120 of the most common Arctic species in Alaska, including trees, shrubs, dwarf shrubs, grasses, sedges, rushes, bryophytes, and lichens. Students will be tested over their ability to identify these species.

3. Snow Ecology component: Three lectures plus a 1-day optional spring field excursion to examine snow ecosystems. A list of required equipment, including outdoor clothing, and other items will be provided prior to the field trip.

4. Student symposium (Oral presentations of research topics.) 15-minute (10 minute talk + 5 minutes for questions) presentations on Arctic vegetation topic of choice,

5. Final written papers (BIOL 688 only): Graduate students will write a 3000-4000-word research paper based on the primary literature on an Arctic Vegetation topic of your choice.

5. Course goals

Provide students with an in-depth knowledge of Arctic vegetation from a geobotanical perspective, knowledge of the relevance of Arctic vegetation to Alaskan climate- and land-use change issues, an introduction to snow ecology, and knowledge of a core set of common Arctic Alaskan plants.
6. Student outcomes:
Undergraduate students:
(1) Students will gain an understanding of the relationships of arctic plants and vegetation to climate, permafrost, geomorphology, soils, snow, and animals, and the role of these systems in climate change and land-use change issues affecting Alaska.
(2) Students will learn to identify a foundation set of 120 Arctic plant species that will allow them to better undertake vegetation sampling and understand wildlife habitat.
(3) All students will gain experience giving oral presentations as in a conference setting.
Graduate students:
Graduate students will gain the same experiences listed for undergraduate students, and in addition will achieve the following:
   a) Application of the knowledge gained from the course to a topic appropriate to their graduate student studies, which will be presented in a written paper due at the end of the course.
   b) More in depth knowledge of the literature discussed during the course, through biweekly discussions with the instructor regarding assigned readings with relevance to the students research interests.

7. Instructional method:
Lectures:
On Tuesdays, a lecture will examine botanical and geocological aspects of Arctic tundra systems. The emphasis will be on the factors controlling vegetation patterns, including climate, permafrost, geomorphology, soils, animals, zonation, paleogeography, biogeographic history, plant adaptations, and successional patterns, effects of climate and land-use change. Students are expected to attend the lectures and read the assigned literature. Attendance will be recorded. The lectures and readings are a foundation in Arctic Ecology that students should draw on for their final presentations.

Plant identification sessions:
Plant identification sessions will be conducted on Thursday. During most sessions a brief lecture will present slides and photos of the plants to be learned that day with a focus on plant family characteristics and morphological and ecological characteristics that help in identification. After the lecture, students will work with herbarium specimens and literature sources to learn to identify about 120 common Arctic Alaska plants. Students are expected to read information on plant family characteristics and supplement the class information with information available on the class website and other sources. Students are also expected to keep a notebook with key information and drawings of species covered in class. The final test will cover identification of about 75 selected plants and key plant characteristics. Students will turn in their notebook for a grade (100 points) on the day of the final exam.
# Course Schedule and Assignments  
*red = quizzes, tests, assignments due:

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Dates</th>
<th>Topic</th>
<th>Reading assignment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5-hr each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture 1</td>
<td>Jan 16</td>
<td>Introduction</td>
<td>Read syllabus</td>
</tr>
<tr>
<td>Plant ID session 1</td>
<td>Jan 18</td>
<td>Plant identification: Overview of plant terminology guides dichotomous keys. Common Arctic trees and shrubs</td>
<td>Read Web site links for family characteristics for Pinaceae, Betulaceae, Salicaceae, Plant identification: Trees tall shrubs and low shrubs (11 species) during lab.</td>
</tr>
<tr>
<td>Plant ID session 2</td>
<td>Jan 25</td>
<td>Plant identification: Arctic dwarf shrubs 1</td>
<td>Read web site links to family characteristics for Betulaceae, Ericaceae, Salicaceae, Caprifoliaceae Review required dwarf shrub species (10 species).</td>
</tr>
<tr>
<td>Plant ID session 3</td>
<td>Feb 1</td>
<td>Plant identification: Arctic dwarf shrubs 2</td>
<td>Read Web site links to family characteristics for Elaeagnaceae, Rosaceae. Review required dwarf shrub species (17 species).</td>
</tr>
<tr>
<td>Plant ID session 4</td>
<td>Feb 8</td>
<td>Plant identification: Quiz 1 trees and shrubs</td>
<td>Review species in sessions 1–3</td>
</tr>
<tr>
<td>Plant ID session 5</td>
<td>Feb 15</td>
<td>Plant identification: Grasses</td>
<td>Read Web site links to family characteristics for Poaceae, Cyperaceae, Juncaceae. Review required grasses (11 species)</td>
</tr>
<tr>
<td>Plant ID session 6</td>
<td>Feb 22</td>
<td>Plant identification: Sedges, rushes</td>
<td>Read Web site links to family characteristics for Poaceae, Cyperaceae, Juncaceae. Review required sedges (11 species), rushes (5 species) during lab.</td>
</tr>
<tr>
<td>Lecture 7</td>
<td>Feb 27</td>
<td>Snow Ecology 1: Physical and</td>
<td>Sturm, M., McFadden, J. P., Liston, G. E., Chapin, F. S., III,</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
<td>Details</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Mar 1</td>
<td>Plant ID session 7</td>
<td>Plant identification: Quiz 2, grasses, sedges, rushes Review species in sessions 5-6</td>
<td></td>
</tr>
<tr>
<td>Mar 8</td>
<td>Plant ID session 8</td>
<td>Plant identification: Forbs 1 Read Web site links to family characteristics for Apiaceae, Asteraceae, Brassicaceae, Caryophyllaceae, Crassulaceae Review photos, descriptions, and specimens of required forbs (12 species) during lab.</td>
<td></td>
</tr>
<tr>
<td>Mar 12-16</td>
<td>Spring Break</td>
<td>Snow Ecology Field Trip Date TBA</td>
<td></td>
</tr>
<tr>
<td>Mar 22</td>
<td>Plant ID session 9</td>
<td>Plant identification: Forbs 2 Read Web site links to family characteristics for Fabaceae (Leguminosae), Liliaceae, Papaveraceae, Onagraceae, Polygonaceae, Review photos, descriptions, and specimens of required forbs (12 species) during lab.</td>
<td></td>
</tr>
<tr>
<td>Mar 29</td>
<td>Plant ID session 10</td>
<td>Plant identification: Forbs 3 Read Web site links to family characteristics for Ranunculaceae, Rosaceae, Saxifragaceae, Apiaceae (Umbelliferae). Review photos, descriptions, and specimens of required forbs (12 species) during lab.</td>
<td></td>
</tr>
<tr>
<td>Apr 5</td>
<td>Plant ID session 11</td>
<td>Plant identification: Quiz 3, forbs Review species in sessions 8-10</td>
<td></td>
</tr>
<tr>
<td>Apr 10</td>
<td>Student symposium 1-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr 12</td>
<td>Plant ID session 12</td>
<td>Plant identification: Bryophytes Review Web site links to bryophyte characteristics Review photos, descriptions, and specimens of common bryophyte species (12 mosses and 2 liverworts)</td>
<td></td>
</tr>
<tr>
<td>Apr 17</td>
<td>Student symposium 5-8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Snow Ecology field trip:**
A 1-day optional field excursion will occur the first weekend of spring break. Students should plan in advance if they wish to attend. Weather may determine where we go, but the alpine site at Murphy Dome is a possibility. Lake Students will dig and describe snow pits, examine the vegetation beneath the snow, record subnivian temperatures, and examine evidence of winter animal use in the various habitats.

**Oral presentation of research topics:**
At the end of the lecture series, each student will present a 15-minute oral summary of a library research topic of the student’s choice — as long as the topics involve Arctic vegetation ecology. Guidelines for these presentations will be handed out early in the semester.

**Literature discussion sessions (BIOL 688 students only):**
Graduate students will attend biweekly 1-hr literature-discussion sessions that will cover the assigned readings in depth.

**Written presentation of research topic (BIOL 688 students only):**
Graduate students will write a 3000-4000-word (6-8 single-spaced pages + literature, figures, tables) synthetic research paper based on the primary literature on an Arctic Vegetation topic of your choice. This paper can (but not necessarily) cover the same topic as the oral presentation.

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant ID session 13</strong></td>
<td>Apr 19</td>
<td><strong>Plant identification: Lichens</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Review Web site links to lichen characteristics</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Review photos, descriptions and specimens of required lichen species (12 species)</strong></td>
</tr>
<tr>
<td><strong>Student symposium 8-12</strong></td>
<td>Apr 24</td>
<td></td>
</tr>
<tr>
<td><strong>Plant ID session 14</strong></td>
<td>Apr 26</td>
<td><strong>Plant identification: Quiz 4, bryophytes and lichen</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Review species in sessions 12-13</strong></td>
</tr>
<tr>
<td><strong>Student symposium 13-24</strong></td>
<td>Sat Apr 28, 9:00 am–2:00 pm</td>
<td></td>
</tr>
<tr>
<td><strong>Final plant ID exam</strong></td>
<td>May 3</td>
<td><strong>Plant identification: Final exam: trees thru lichens</strong></td>
</tr>
<tr>
<td><strong>Graduate student papers Due</strong></td>
<td>May 7</td>
<td><strong>Plant ID notebooks due.</strong></td>
</tr>
</tbody>
</table>

9. **Course policies:**
**Academic integrity:**
Anyone observed cheating on an examination will receive a “0” for that examination. Anyone found to have used someone else’s work without crediting that person (plagiarizing) will receive a “0” for the assignment. When in doubt, always identify your sources. This applies to all material derived from the web. Please speak with me if you have any questions about how to properly use other people’s work. For additional detail, see http://www.uaf.edu/library/instruction/handouts/Plagiarism.html

**Attendance policy:**

Students are expected to attend every class, lab, and student presentation, and be seated at the beginning of the class. Student will receive 3.57 points for attendance at each session. No points will be received for late attendance or absence without notifying the TA prior to absence or lateness. For excused absences due to medical or family emergencies please see the TA prior missing class.

**10. Evaluation:**

**Summary of grading points:**

*Undergraduate students (BIOL 488 students):*

- Attendance at lectures and labs (3.57 pts/class, 28 classes) 100 pts
- Plant identification quizzes (4@ 50 points each) 200
- Plant identification final exam 200
- Plant id and field notebook 100
- Student Symposium, oral presentation of research topic 200

**TOTAL** 800 pts

*Graduate students (BIOL 688 students):*

- Attendance at lectures and labs (3.57 pts/class, 28 classes) 100 pts
- Plant identification quizzes (4@ 50 points each) 200
- Plant identification final exam 200
- Plant id and field notebook 100
- Student Symposium, oral presentation of research topic 200
- Attend biweekly literature discussion sessions and present one summary of assigned paper 100
- Final research paper 300

**TOTAL** 1200 pts

These criteria may be modified somewhat as the course progresses.

Final grades will be as follows: greater than or equal to 90% = A; 80-89% = B; 70-79% = C; 60-69% = D; < 60% = F.

**Undergraduate student expectations and grading:**

All students are expected to accomplish the following:

(a) Attend all lectures, labs, field trips, and exams on time. There will be no make-up for missed classes or late attendance. (3.57 points for each for 28 classes, 100 total points).
(b) Give a 10-minute final talk + 5 minutes for discussion on topic of interest related to Arctic vegetation. Guidelines for the presentations and grading criteria for the presentations will be handed out early in the semester. (200 points).

(c) Do the readings, study the on-line material including lecture slides.

(d) Learn approximately 120 Arctic plant species and take 4 quizzes the final plant id exam (400 points).

(e) Optional attendance at snow ecology field trip during Spring Break.

**Graduate student expectations and grading:**
Graduate students will be graded according to the same criteria as the undergraduate students with the following additions:

(f) Attend biweekly 1-hr literature-discussion sessions that will cover the assigned readings in depth. Each student will orally present one assigned paper.

(g) Write a 3000-4000-word (6-8 single-spaced pages + literature, figures, tables) synthetic research paper based on the primary literature on an Arctic Vegetation topic of your choice. The paper can apply knowledge from the course to a topic relevant to their graduate thesis topics. Late papers will receive a deduction of 15 points of the 300 total for every day late and no credit beyond 3 days late. Students should arrange for an incomplete grade if they cannot meet this deadline (300 points).

**11. Support Services:**
Students are encouraged to contact the instructor with any questions, or to clarify the lecture or the assignments. I will be happy to review drafts of assignments and answer questions any time. AHRB, Room 254. Phone 474-2460, dawalker@alaska.edu. Home phone: 451-0800.

**12. Discrimination policy:**
The University of Alaska Board of Regents have clearly stated in BOR policy that discrimination, harassment and violence will not be tolerated on any campus of the University of Alaska. If you believe you are experiencing discrimination or any form of harassment, including sexual harassment/misconduct/assault, you are encouraged to report that behavior. If you disclose sexual harassment or sexual violence to faculty members or university employees, they must notify the UAF Title IX coordinator about the basic facts of the incident. Your choices for disclosure include:

1. You may confidentially disclose and access confidential counseling by contacting the UAF Health and Counseling Center at 474-7043.
2. You can get support and file a Title IX report by contacting the UAF Title IX coordinator at 474-7599.
3. You may file a criminal complaint by contacting the UAF Police Department at 474-7721.

**13. Disability Services:**
UAF is obligated to provide accommodation only to the known limitations of an otherwise qualified student who has a disability. Please identify yourself to UAF Disability Services by applying for accommodations. To be considered for UAF Disability Services accommodations, individuals must be enrolled for at least one
credit as a UAF student. For more information contact Disability Services at uaf-disabilityservices@alaska.edu, 474-5655 or by TTY at 474-1827.