Syllabus

Arctic Vegetation Ecology: Geobotany (BIOL 488/688) and
Arctic Geobotany Seminar: (BIOL 492, Distance Education Seminar), Spring 2014

Notes:
1. The attached Lecture schedule applies to both of BIOL 488/688 (Arctic Vegetation Ecology: Geobotany, 3 credits) and BIOL 492 (Arctic Geobotany Seminar, 2 credits, taught via teleconference).
2. The attached Lab Schedule applies only to BIOL 488/688.

1. Course information
Title:
1. Arctic Vegetation Ecology: Geobotany (BIOL 488/688), 3 credits (Lecture & Lab)
2. Arctic Geobotany Seminar (BIOL 492, distance education taught via teleconference), 2 credits (Lecture only)
Prerequisites: BIOL 115 & 116, Introduction to Plant Biology (BIOL 239) or Principles of Ecology (BIOL 271) or instructor approval

Location:
BIOL 488/688: Lecture (Tuesdays), TBN Building, Room TBN; Lab (Thursdays): Murie Building, Room 103.
BIOL 492: Distance Education taught via teleconference (local arrangements vary).

Attendance at Snow Ecology field trips in Fairbanks during Spring Break is required for both courses. Meeting location and time will be announced prior to the field trips.

Meeting time: Lecture (BIOL 488/688 and BIOL 492): T, 2:00-3:30; Lab (BIOL 488/688: only): Th: 2:00-5:00 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, email: anytime.

3. Course readings /materials
Numerous papers will be read and are in the assignments listed in the lecture schedule and will be posted on line at http://www.geobotany.uaf.edu.

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

4. Course description
Course catalog descriptions:
BIOL F488 Arctic Vegetation Ecology: Geobotany
3 Credits Offered Spring even numbered years
Arctic plants in relationship to the Earth, including arctic plant identification, climate, geology and geography controls on arctic plant communities, snow ecology, applications to wildlife studies and current Arctic issues. Lectures, labs, and 1 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 (2 + 3).

BIOL F492 Arctic Geobotany Seminar
2 Credits Offered Spring even numbered years
Arctic plants in relationship to the Earth, including climate, geology and geography controls on arctic plant communities, snow ecology, applications to wildlife studies and current Arctic issues. Lectures and 1 winter field trip. Prerequisites: BIOL 115 and 116 or equivalent; BIOL 239 or BIOL 271; or approval of instructor. Special fees apply.

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 six major parts:
1. Lectures: 10 lectures. This portion will examine the tundra plant communities and ecology of Arctic tundra. The emphasis will be on Arctic Geobotany, i.e. the relationship of arctic plants and vegetation to the Earth. The focus will be on the factors controlling Arctic vegetation patterns, including climate, permafrost, geomorphology, soils, animals, zonation, snow, paleogeography, plant communities, floristics, plant adaptations, and succession patterns.
2. Literature discussion sessions: Each week we will read and discuss one key paper related to the week’s lecture.
3. Snow Ecology field trips: Two field trips during the first weekend of Spring Break will examine the boreal forest and alpine tundra systems in winter conditions.
4. Written research papers (BIOL 688, graduate students): In-depth literature review on Arctic Vegetation topic of choice.
5. Student Research Symposium: At the end of the course, a one-day symposium where all students present the results of their research papers in a conference.
atmosphere.

6. **Plant identification labs (Thursdays for BIOL 488/688 students only):**
Fourteen labs. Students will learn about 160 of the most common Arctic species in Alaska, including trees, shrubs, dwarf shrubs, grasses, sedges, rushes, bryophytes, and lichens. Students will keep a notebook of plant identification and will be tested over their ability to identify these species.

5. **Course goals and student learning outcomes:**

**General 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.

**Student outcomes:** (1) Students will gain an understanding of the relationships of Arctic plants and vegetation to climate, permafrost, geomorphology, soils, and animals, and the role of these systems in climate change and land-use change issues affecting Alaska. (2) During the snow-ecology portion of the course they will gain an in-depth understanding of the physical, chemical and biological properties of snow cover. They will learn to describe snow profiles, identify plants in winter, keep field notebooks for their field observations, and learn modern approaches of snow ecological research. (4) All students will gain experience giving oral presentations during literature discussions and during presentation of their research papers regarding an Arctic-vegetation topic of their choice.

6. **Instructional method:**

1. **Lectures:**
On Tuesdays, a 45-minute lecture will examine Arctic tundra. The emphasis will be on the factors controlling vegetation patterns, including climate, permafrost, geomorphology, soils, animals, zonation, paleogeography, biogeographic history, plant adaptations, and succession patterns, effects of climate and land-use change. Students are expected to attend the lectures and read the assigned literature. Attendance will be recorded and points awarded for attendance (10 points for 10 lectures, 100 points total). Distance education students will view and participate in the lectures via teleconference.

2. **Literature discussion sessions:**
Following the lecture each week, we will read and discuss one key paper related to the week’s lecture. A group of 4 students will be assigned to present the paper during a 20-minute oral presentation. Each student will present a separate portion of the paper [e.g., 1) abstract, introduction, background, 2) methods, 3) results and discussion, and 4) summary, significance]. These overviews should focus on the principal points of the paper and major concepts, the significance of the paper in relationship to the week’s lecture and to other Arctic issues. All students in the class are expected to read the papers and participate in the discussion. **Total time for each paper presentation and discussion is 45 minutes.** Students making the presentation will be graded on criteria that will be handed out early in the semester. Each student is expected to present summaries of material from 2 papers during the semester (50 points for each paper, 100 points total).
3. Snow Ecology field trip:
Two 1-day mandatory field excursions near Fairbanks will occur the first weekend of spring break. The focus will be on snow as a habitat. Activities will include describing snow profiles, observing snow and snow-free habitats and their use by plants and animals in winter, identifying plants in their winter conditions, examining subnivian environments and the effects of topography and snow distribution patterns on plant and animal habitat distribution. A list of required equipment will be provided prior to the field trip. Distance Education students should plan in advance to attend. Students will receive credit for attendance during the two days of the field trip (50 points each day, 100 points total). Students will keep a field book of their observations and hand in two snow profile descriptions from snow pits in the forest and the alpine with interpretation (100 points total).

4. Written presentation of research topics (Graduate students):
All students will research an Arctic vegetation ecology topic of their choice. Graduate students (BIOL 688) will be expected to write a 5000-word written paper in a style comparable for submission to the journal Ecology (400 points). Guidelines for written papers will be handed out early in the semester.

5. Student Research Symposium (Undergraduate and graduate students):
All students will present an oral summary of their research topic. At the conclusion of the course, a 1-day symposium (tentatively a Saturday) will be arranged for all students to present an oral summary of their research papers. The format will be similar to a conference with each student having 20-minutes for the presentation (15 minutes for the talk, 5 minutes for audience questions). The presentations will be broken into 4 sessions, with a student session chair assigned to each session to introduce the speakers, keep the schedule, and moderate questions. Students will be graded according to oral presentation content and format criteria that will be handed out early in the semester.

7. Plant Identification Labs (Thursdays for BIOL 488/688 students only):
Plant identification labs will be in the Murie Building Room 103 on Thursday, 2-5 pm. During most most labs 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. Students will work with herbarium specimens and literature sources to learn to identify about 160 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 web site. Students are also expected to keep a notebook with drawings and key information for each species covered in class. Students will turn in their notebook for a grade (100 points). Four quizzes will cover each of the major groups covered: woody plants, graminoids, forbs, cryptogams (100 points total). The final exam will cover identification of about of 75 selected plants and questions on key family characteristics (200 points).

8. 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 and presented on Powerpoint slides during oral presentations. 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 lecture and literature discussion session and be seated at the beginning of the class. Student will receive 5 points for attendance at each lecture and 5 points for participation in the literature discussion, demonstrating that you have read the assigned papers. 5 points will be deducted for late attendance.

9. Evaluation:

Summary of grading points for Lecture portion of BIOL 488 and BIOL 492:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance and participation at lectures and literature discussions</td>
<td>100 pts</td>
</tr>
<tr>
<td>Presentation of a portion of two assigned readings during Literature</td>
<td>100</td>
</tr>
<tr>
<td>Discussion sessions (2 papers, 50 pts each)</td>
<td></td>
</tr>
<tr>
<td>Attendance and participation in snow ecology field trips</td>
<td>100</td>
</tr>
<tr>
<td>(2 trips, 50 pts each)</td>
<td></td>
</tr>
<tr>
<td>Written snow profile descriptions and interpretation</td>
<td>100</td>
</tr>
<tr>
<td>(100 points)</td>
<td></td>
</tr>
<tr>
<td>Oral presentation during Student Research Symposium</td>
<td>200</td>
</tr>
<tr>
<td>TOTAL</td>
<td>600 pts</td>
</tr>
</tbody>
</table>

Summary of grading points for Lecture portion of BIOL 688:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance and participation at lectures and literature discussions</td>
<td>100 pts</td>
</tr>
<tr>
<td>Presentation of a portion of two assigned readings during Literature</td>
<td>100</td>
</tr>
<tr>
<td>Discussion sessions (50 pts each)</td>
<td></td>
</tr>
<tr>
<td>Attendance and participation in snow ecology field trips</td>
<td>100</td>
</tr>
<tr>
<td>(2 trips, 50 pts each)</td>
<td></td>
</tr>
<tr>
<td>Written snow profile descriptions and interpretation</td>
<td>100</td>
</tr>
<tr>
<td>(100 points)</td>
<td></td>
</tr>
<tr>
<td>Final written paper (300 points)</td>
<td>300</td>
</tr>
<tr>
<td>Oral presentation during Student Research Symposium</td>
<td>200</td>
</tr>
<tr>
<td>TOTAL</td>
<td>900 pts</td>
</tr>
</tbody>
</table>

Summary of grading points for Plant Identification Labs (BIOL 488/688 only):

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance and participation in labs (10 pts/lab, 10 labs)</td>
<td>100</td>
</tr>
<tr>
<td>Lab quizzes (25 points/quiz, 4 quizzes)</td>
<td>100</td>
</tr>
<tr>
<td>Lab notebook (100 pts)</td>
<td>100</td>
</tr>
</tbody>
</table>
Final plant identification exam (200 points) 200
TOTAL 400 pts

Final grades will be as follows: \( \geq 90\% = \text{A} \); 80-89\% = \text{B}; 70-79\% = \text{C}; 60-69\% = \text{D}; < 60\% = \text{F}.

- BIOL 492 grades will be based on Lecture portion only (650 total points)
- BIOL 488 grades will be based on Lecture and Lab portions (650 + 400 = 1050 points)
- BIOL 688 grades will be based on Lecture portion for 688 students and Lab portion (850 + 300 = 1250 points).

These criteria may be modified somewhat as the course progresses.

**Student expectations and grading:**
All students are expected to accomplish the following:

(a) Attend all lectures and field trips on time. Five points for attendance and 5 points for participation in discussions demonstrating that you have read the assigned material (10 points for each lesson). 5 points will be deducted for late attendance and no credit for absence without prior approval. (10 points for each of 10 lectures, 100 points total).

(b) Present material at two literature discussion sessions (50 points each, 100 points total)

(c) Attend the 2 day-long snow ecology field trips (100 points).

(d) Describe two snow profiles (25 points each, 50 points total).

(e) Write a 2000- to 3000-word final literature-review paper in a style comparable to a book review for a journal (200 points). Graduate students will write a 5000-word paper (10 single-spaced pages, Times Roman 12 point, excluding references, figures and tables).

(f) Present the review paper at the Student Research Symposium at the end of the course (100 points).

**10. 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.

**11. Disabilities services:**
The instructor will work with the Office of Disabilities Services (208 WHIT, 474-5655) to provide reasonable accommodation to students with disabilities. Any student needing special accommodation should talk with the instructor before the class or lab in question. These discussions will be held confidential.
<table>
<thead>
<tr>
<th>Lecture</th>
<th>Dates (Tuesdays)</th>
<th>Topic</th>
<th>Reading assignments</th>
<th>Guidelines and grading criteria for oral presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture 1</td>
<td>Jan 21</td>
<td>Introduction, Overview of Arctic Ecosystems:</td>
<td>See links to Reading Assignments for PDFs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lecture 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Read syllabus. Scan the following chapters:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture 2</td>
<td>Jan 28</td>
<td>The role of the oceans and climate, Bioclimatic zonation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lecture 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture 3</td>
<td>Feb 4</td>
<td>The role of permafrost patterned ground and microtopography.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lecture 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture 4</td>
<td>Feb 11</td>
<td>The role of soils: pH, texture, moisture, toposequences</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lecture 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture 5</td>
<td>Feb 18</td>
<td>The role of soil continued, Arctic terrestrial carbon budgets</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lecture 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture 6</td>
<td>Feb 25</td>
<td>The role of history: Beringia, relevance of vegetation to the Pleistocene fauna</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lecture 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guest lecture</td>
<td>Apr 8</td>
<td>Skip at Arctic Science Summit Week (Helsinki)</td>
<td>Work on final written and oral papers. Guidelines and grading criteria</td>
<td></td>
</tr>
</tbody>
</table>
| Review 1 | Apr 15 | 1. Review period, discussion of written papers and oral presentations.  
| Review 2 | April 22 | 1. Review period, discussion of written papers and oral presentations. Discussion to compare and contrast:  
<table>
<thead>
<tr>
<th>Event</th>
<th>Date/Time</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Research Symposium</td>
<td>Tentative date Saturday, April 26, 8 am to 5 pm.</td>
<td>Student presentations</td>
</tr>
<tr>
<td>Finals Week</td>
<td>May 6-9</td>
<td>Final papers due 6 May, 5 pm.</td>
</tr>
<tr>
<td>Lab No.</td>
<td>Dates (Thurs)</td>
<td>Topic</td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td>-------</td>
</tr>
</tbody>
</table>
| Lab 1  | Jan 23        | Plant identification: Overview of plant terminology guides dichotomous keys. Plant identification: trees & tall shrubs | 1. Lab 1  
2. family characteristics for Pinacea, Betulaceae, Salicaceae.  
3. Plant identification: Trees (6 species) and tall shrubs (4 species). |
| Lab 2  | Jan 30        | Plant identification: low shrubs. | 1. Lab 2  
2. family characteristics for Betulaceae, Salicaceae, Caprifoliaceae, Elaeagnaceae, Myricaceae, Rosaceae.  
| Lab 3  | Feb 6         | Plant identification: Arctic dwarf shrub | 1. Lab 3  
2. family characteristics for Betulaceae, Salicaceae, Cornaceae, Cupressaceae, Rosaceae, Ericaceae, Diapensiaceae, Empetraceae, Caprifoliaceae, Pyrolaceae.  
| Lab 4  | Feb 13        | Quiz over all trees and shrubs (47 species), (25 points). | 1. Review all shrubs in the teaching collections.  
2. Tree and Shrub Flashcards  
3. Quiz will present 15 species and 10 Family Characteristic terms. |
| Lab 5  | Feb 20        | Plant identification: Grasses | 1. Lab 5  
2. family characteristics for Poaceae,  
| Lab 6  | Feb 27        | Plant identification: Sedges, and rushes | 1. Lab 6  
2. family characteristics for Cyperaceae and Juncaceae,  
3. Plant identification: Cyperaceae (11 species) and Juncaceae (5 species) |
| Lab 7  | Mar 6         | Quiz over all graminoids (grasses, sedges and rushes) (27 species) (25 Points) | 1. Review all grasses, sedges and rushes in the teaching collections.  
2. Graminoid Flashcards  
3. Quiz will present 15 species and 10 Family Characteristic terms. |
| Lab 8  | Mar 13        | Plant identification: Forbs 1 | Lab 8 family characteristics for Apiaceae (Umbelliferae), Asteraceae (Compositae), Brassicaceae (Cruciferae) Caryophyllaceae, Fabaceae (Leguminosae), Liliaceae.  
Plant identification: Forbs-1 (about 25 species). |
| Lab 9  | Mar 27        | Plant identification: Forbs 2 | 1. Lab 10  
2. family characteristics for Onagraceae, Orobanchaceae, Papaveraceae, Polygonaceae, Ranunculaceae, Rosaceae, Rubiaceae, Santalaceae, and Saxifragaceae.  
| Lab 10 | Apr 3         | Quiz over all forbs (50 species) (25 points) | 1. Review all forbs in the teaching collections.  
2. Forbs Flashcards  
3. Quiz will present 20 species and 10 Family Characteristic terms. |
| Lab 11 | Apr 10        | Plant identification: Mosses, liverworts, lichens | 1. Lab 11  
2. bryophyte characteristics  
3. Review photos, descriptions, of common bryophyte species (14 mosses and 2 liverworts). |
| Lab 12 | Apr 17        | Plant identification: Lichens | 1. Lab 12  
2. Lichen characteristics  
3. Review photos, descriptions, of common lichen species (22 species). |

**Spring Break Mar 17-21**
### Lab 13
**Apr 24**
- **Quiz over all mosses, liverworts, and lichens (38 species) (25 points)**
- **Review all moss liverwort and lichen flashcards**
- **Quiz will present 15 species and 10 Family Characteristic terms.**

### Lab 14
**May 1**
- **Review session for all plant species**
- **Review all flash cards, plant collections, family characteristics and plant terminology.**

### FINAL EXAM
**May 8**
1. **Identify 75 plant specimens, and 50 questions on family characteristics and plant terminology.**
2. **Turn in Plant ID Notebooks at end of exam.**