Syllabus for
BIOL 492 / 692, Arctic Ecosystems in a Changing Climate, Seminar, Spring 2015

1. Course information
Title: Arctic Ecosystems in a Changing Climate: Seminar
Number: BIOL 492 / 692
Credits: 2
Prerequisites: BIOL 115 & 116, Introduction to Plant Biology (BIOL 239) or Principles of Ecology (BIOL 271) or instructor approval
Location: Murie 330
Meeting time: Thursday: 2:00-4:00 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: T, Th 9:00-11:00 and 3:30-5:00 pm.

3. Course readings /materials
Relevant chapters in three major recent synthesis of long-term change across the Arctic will read and are in the assignments listed in the course calendar and will be posted online at http://www.geobotany.uaf.edu. These four references will provide the core of the course.

Course catalog description:
BIOL F492/692 Arctic Ecosystems in a Changing Climate, Seminar
2 Credits, Offered Spring
Examination of the major climatic and geographic controls on Arctic ecosystems and diversity of organisms in the High and Low Arctic. Three major recent synthesis of information will be reviewed during 12 Lessons. Students will prepare papers reviewing literature over a relevant topic. Includes 3-day field trip during spring break. Special fees apply. Stacked with BIOL F695 (2) To be taught in spring 2015.
More detailed description: This course consists of four major parts:

1. **Lessons:** Fourteen Lessons will examine the tundra ecosystems, biogeography, and biodiversity. The focus will be on the factors controlling biological patterns and diversity in a changing climate. Each lesson will have a 40-60 minute lecture followed by two 20-minute student literature reviews of articles or chapters that pertain to the lecture topic. Usually these articles will compare observed changes in the High Arctic vs. the Low Arctic.

2. **Snow Ecology component:** Changes in snow regimes are expected to have major effects on Arctic ecosystems. Major changes have already been documented in some parts of the Arctic. Two field excursions during the first weekend of spring break will examine snow in the taiga near Smith Lake and the tundra on Murphy Dome. The focus will be on snow as a habitat and how changing snow patterns affect northern ecosystems. Activities will include describing snow profiles, observing snow and snow-free habitats and their use by animals in winter, identifying plants in their winter conditions, examining subnivian environments and the effects of topography and snow distribution patterns on plant-habitat distribution. Students will keep a field book of their observations. They will be graded on their attendance, snow descriptions and their field notebook. A list of required equipment, including outdoor clothing and other items will be provided prior to the field trip.

3. **Oral and written (graduate students only) presentations of research topics:** Presentations of in-depth literature review on Arctic biogeography or biodiversity topic of choice.

5. **Course goals and student learning outcomes:**
   **General course goals:** Provide students with an in-depth knowledge of Arctic ecosystems.

   **Student outcomes:** (1) Students will gain an understanding of the controls of climate, permafrost, geomorphology, soils, and history, on High and Low Arctic ecosystems. Two recent syntheses from long-term Arctic Research stations at Toolik Lake (Hobbie & Kling 2014) and Zachenberg (Meltofte et al 2008) will form the core of the course, along with an international assessment of Arctic biodiversity (Meltofte 2013). (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. (3) All students will gain experience presenting oral presentations regarding Arctic-ecological topics of their choice. (4) Graduate students will gain experience writing reviews of the key literature regarding Arctic vegetation and summarizing and presenting material in a conference format.

6. **Instructional method:***
   **Lessons:**
   A series of lessons that will examine the controls on Arctic ecosystem patterns and biodiversity. Each Lesson will address a topic, followed by an hour of literature
discussion. The emphasis of the Lessons 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 Lessons and read the assigned papers. There will be no tests over the Lessons; 10 points will be awarded for attendance at each Lesson.

**Literature discussions:**
Following each lecture students will review the relevant chapters from the recent long-term ecology syntheses at Toolik Lake, Alaska and Zachenberg, Greenland to examine progress by the research community to address the issue of climate change on Arctic ecosystems. Depending on the number of students in the course, each student will present summary/reviews of 2 papers during the course. Each week two papers will be presented.

**Oral and written presentation of research topics:**
At the end of the Lesson series, each student will present 30-minute oral summary of an individual library research topics of the student’s choice during a day-long student research symposium. Guidelines for these presentations will be handed out early in the semester. Graduate students will be expected to also turn in a 2000-3000-word paper on an Arctic Vegetation topic of their choice at the end of the course. This paper can (but not necessarily) cover the same topic as the oral presentation.

**Snow Ecology field trip:**
Two mandatory day-long field excursions will occur the first weekend of spring break. Students should plan in advance to attend. We will visit a variety of sites with different snow regimes, examine the vegetation beneath the snow and on exposed sites, record subnivian temperatures, observe plants in their winter condition, and examine evidence of winter animal use in the various habitats. Students will receive credit for attendance at two field trips, and will be graded on their field notebooks, and field descriptions of snow pits.

**Lesson Schedule:**

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<tr>
<th>Lesson</th>
<th>Dates (Thur)</th>
<th>Topic</th>
<th>ASSIGNMENTS:</th>
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<tbody>
<tr>
<td>1</td>
<td>Jan 15</td>
<td>Introduction, Overview</td>
<td>1. Preview the Lesson slides before the day of the Lesson.</td>
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<td>2. Read the reading assignments.</td>
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<td>3. PDFs of reading assignments and Lessons will be posted on Blackboard prior to each Lesson.</td>
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<td><strong>Students presenting the literature reading assignments are shown in BOLD CAPITALIZED ITALICS below (to be added once the class starts).</strong></td>
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<td>(4) Meltofte and Rasch. The study area at Zachenberg, p. 101-110.</td>
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<tr>
<td>2</td>
<td>Jan 22</td>
<td>Arctic climate and bioclimate</td>
<td><strong>Toolik book:</strong></td>
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<td></td>
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<td>(1) Cherry et al. Chapter 2, Climate and hydrometeorology of the Toolik Lake Region and the Kuparuk River basin, p. 21-60.</td>
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<tr>
<td>Date</td>
<td>Event</td>
<td>Source(s)</td>
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| 3 Jan 29 | Quaternary history   | **Toolik book:**  
(2) Oswald, W.S. et al. Chapter 4. Late-Quaternary environmental and ecological history of the Arctic Foothills, northern Alaska, p. 81-89.  
**Zachenburg book:**  
(3) Bennike et al. Late Quaternary environment and cultural change in the Wollaston Forland region, Northeast Greenland, p. 45-79. |
| 4 Feb 5    | Permafrost and patterned ground | **Toolik Area:**  
**Zachenburg book:**  
**Send titles and preliminary oral presentation outlines to (dawalker@alaska.edu)** |
| 5 Feb 12 | Soil–plant interactions | **Toolik Area:**  
**Toolik book:**  
**Zachenburg book:**  
(3) Eberling, B. et al. Soil and plant community-characteristics and dynamics at Zachenberg, pp. 223-248. |
| 6 Feb 19 | Soil carbon and nutrients | **Circumpolar:**  
**Toolik book:**  
**Zachenburg book:**  
(3) Eberling, B. et al. Soil and plant community-characteristics and dynamics at Zachenberg, pp. 223-248. |
| 7 Feb 26 | Trace gas fluxes      | **Toolik Area:**  
**Zachenburg book:**  
(3) Eberling, B. et al. High-Arctic soil CO2 and CH4 production controlled by temperature, water, freezing and snow. pp. 441-472. |
| 8 Mar 5 | Snow 1: Physical characteristic of snow | **Circumpolar:**  
**Toolik book:**  
### 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. 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](http://www.uaf.edu/library/instruction/handouts/Plagiarism.html)
Attendance policy:
Students are expected to attend every class and lab and be seated at the beginning of the class. Student will receive 10 points for attendance at each Lesson and each of the student oral presentation classes.

9. Evaluation:

Summary of grading points:

Summary of grading points for BIOL 492:
- Attendance and participation at lectures and literature discussions (7 pts/lecture, 14 lectures) 100 pts
- Presentation of two assigned readings during Literature Discussion sessions (2 papers, 50 pts each) 100
- Attendance and participation in snow ecology field trips (2 trips, 50 pts each) 100
- Written snow profile descriptions and interpretation (2 profiles, 25 points each) 50
- Oral presentation during Student Research Symposium 250
- TOTAL 600 pts

Summary of grading points for BIOL 692:
- Same as grading points for BIOL 488 600
- Plus final written paper (3000 words + references) 300
- TOTAL 900 pts

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

These criteria may be modified somewhat as the course progresses.

10. Support Services:
Students are encouraged to contact the instructor with any questions, or to clarify the Lesson 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 (203 WHIT, 474 7043, to provide reasonable accommodation to students with disabilities.