Revised (10/12/12) Syllabus for
BIOL 475 / 689, Vegetation Description and Analysis, Fall 2012

1. Course Information

Title: Vegetation Description and Analysis
Course number: BIOL 475 / 689
Credits: 3 credit-hours, 2 lecture + 3 laboratory
Prerequisites BIOL 115, BIOL 116; BIOL 239 Introduction to Plant Biology, or BIOL 271 Principles of Ecology, or BIOL 331 Plant Systematics, or permission of instructor
Location: lectures **–** Irving I 208; Field Trips – mostly within North Campus Lands; Indoor laboratories – Irving I, Bunnel and O'Neill.
Meeting Time: Lecture M 2:15-4:15, Lab: W 2:15-5:15

2. Instructor

Prof. Skip Walker, 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: 09:00-12:00

3. Course Readings/Materials

Recommended reading will include sections of books, relevant journal articles and reports to supplement the material covered in class. I would recommend purchasing Kent (2012) and McCune and Grace (2002) as a good general references for the course. Most of the reading will be from these two texts. This reading is recommended to broaden students' understanding of the topics and fill any gaps in students' background, and is required if a student is having difficulty understanding a topic. Some materials are included so students can peruse and become familiar with the reference material available.

Those materials that are available electronically will be put on the class web site http://www.geobotany.uaf.edu/teaching/biol475-689/index.php. Books will be put on reserve in the Biosciences Library in the Arctic Health Building. These will include:

Kent, M. 2012. *Vegetation description and data analysis: a practical approach*. New York, John Wiley.

Mueller-Dombois, L. D. and Ellenberg, H., 1974: *Aims and Methods of Vegetation Ecology*. John Wiley and Sons, New York (reprinted in 2003 by Blackburn Press)

McCune, B. and Grace, J., 2002: *Analysis of ecological communities*. Gleneden Beach, Oregon: MjM Software Design, 300 pp.

Tichý L and Holt J 2011 JUICE program for management, analysis and classification of ecological data, 2nd Edition of Program Manual (Brno: Vegetation Science Group, Masaryk University)

Required supplies:
10x-power hand lens for field identification of plants
8.5 x 11 inch notebook for field reference collection and methods notes
Clothing adequate for spending several hours outdoors conducting field work (including day pack, rain gear (top & bottom), waterproof boots, coat/sweater, hat, gloves)

4. Course Description

Catalog description:

BIOL F475 Vegetation Description and Analysis

3 Credits Offered Fall Even-numbered Years
Methods of vegetation science including sampling, classification, gradient analysis, ordination, field description and mapping. Field trips to the plant communities of interior Alaska. Special fees apply. Prerequisites: BIOL 239 or BIOL 233 or BIOL 271, or BIOL 331 or permission of instructor. Stacked with BIOL F689 (2+3)

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 will give students a broad overview of concepts and methods of description and analysis of plant community data. These methods include vegetation sampling, classification, and gradient analysis, and exploration of the relationship of species distributions to their environment. Most of the class will be devoted to obtaining comprehensive skills for vegetation sampling and analysis. The first 4-6 labs will be in the field before the weather turns cold and snowy. The second part of the course will be in the herbarium, soils lab, and computer lab, where we will analyze the data collected from the field. Students will collect a set of field data that they will use for analysis and production of an oral report and final written report that will be due at the end of the course. There are no exams. There are several graded exercises that are essential to understanding the material.

5. Course Goals

General course goals: The goals for the course are to provide students with a comprehensive set of sampling and analysis methods used in vegetation science.
Student outcomes: (1) Students should become proficient in a suite of field sampling techniques including the Braun-Blanquet relevé method, several point sampling methods, and the point-center quarter method, the methods of making a vegetation database and use of classification and ordination software (TurboVeg, JUICE and PC-Ord) and (2) to develop an understanding and appreciation of vegetation, its composition, structure and function, and diversity.

6. Instructional Methods

Lectures:
Mondays: Short lectures on practical methods will precede the Monday lab session. These lectures will cover field sampling methods, herbarium and plant identification, soils analysis, methods of ordination, vegetation classification, and vegetation mapping.

Wednesdays will be devoted to hour long lectures and discussion of the history, theory and approaches to sampling and vegetation analysis. Several of the Wednesday sessions will have

Literature Discussion Sessions led by graduate students (see below), or student oral presentation (also see below).

Students are expected to attend the lectures and read the assigned literature. Students will need to read the assigned material to understand the methods covered in this course.

Labs:
Monday laboratories will be spread among the following activities: 6 labs for field sampling methods; 1 lab for herbarium and plant identification; 1 lab for soil analysis; 6 labs for vegetation analysis methods: 3 for ordination, 2 for classification, and 1 for vegetation mapping.

Lab write-ups:
There will be 5 lab write-ups. These are designed to give the students an opportunity to apply analytical skills they have learned to data they have collected. These analyses will contribute to the oral and written presentations summarizing the data.

Literature discussion sessions led by graduate students (we will do this only if we have an extra class session):
Starting in October, students will read one outstanding paper per week that uses vegetation science methods. **An assigned graduate student will present a 20-30 minute summary of the paper to the class.** These presentations can include slides of key figures and major discussion points. Presenters are expected to bring other literature to bear on the topic, and discuss the relevance and significance of the paper. These overviews should focus on the principal points of the paper and major concepts, but also discuss methods that shed light on methods taught in the course. Students making the presentation will be graded on criteria that will be handed out early in the semester.

Following the presentation, the speaker will answer questions, followed by an open discussion. All students are expected to read the assigned paper and actively participate in the discussion. All students will be graded on their full participation in the presentations and discussions.

Vegetation Description & Analysis Notebook:
Each student will fill keep a notebook with field collections for plant identification, and methods covered in the class and observations made during the field component of the course. The purpose of this assignment is for each student to finish the class with a methods book that he/she can refer to in the future, including definitions, methods, field observations, field collections, examples, references, etc. The notebooks can also contain lecture notes if desired. The notebook should be filled with whatever material the student finds most helpful. The notebook will be checked twice during the semester, and graded at the end.

Final papers:
Undergraduate students: Each undergraduate student will choose one analytical approach used in the class (classification, ordination, descriptive statistics of field data), and write a 1000-2000 paper describing the application of that approach to the data collected by the class in the North Campus Lands. The paper can include the results developed as part of the class assignments. The paper will be in standard scientific format, with an abstract, introduction, methods, results,

discussion, conclusion, acknowledgements and references, with a minimum of 5 peer-reviewed journal articles referenced.

Graduate students: Graduate students will choose 2-3 analytic approaches used in the class (or other approaches if appropriate) and apply them either to the North Campus Lands data or another appropriate data set, for example data for a thesis. These papers should present a thorough analysis of the data with considerable part of the paper devoted to background, questions, hypotheses and thorough description and analysis of the data; in other words the paper should synthesize material from a wide spectrum of the class analytical methods applied to either the vegetation of the UAF North Campus Lands, or a data set of the students choosing. The paper should be 2500-3500 words, in standard scientific format, with an abstract, introduction, methods, results, discussion, conclusions, acknowledgements and references, and figures and tables at the end of the paper, with a minimum of 15 peer-reviewed journal articles.

Final oral presentations:
Each student will present their final paper to the class in a conference-style oral presentation, for about 20 minutes for undergraduate students (30 minutes for graduate students), with 10 minutes for questions. Criteria for grading both the written and oral presentations that be handed out early in the semester.

7. Course Schedule and Assignments

Readings:
Kent = Kent, M., 2012: *Vegetation Description and Data Analysis: A Practical Approach*. New York: John Wiley and Sons.
MD&E = Mueller-Dombois, L. D. and Ellenberg, H., 1974: *Aims and Methods of Vegetation Ecology*. Boca Raton: CRC Press.
McC&G = McCune, B. and Grace, J., 2002: *Analysis of ecological communities*. Gleneden Beach, Oregon: MjM Software Design, 300 pp.

Date	**Topics/Activities (labs are highlighted in gray)**	**Reading assignments (read prior to class)**	**Assignments DUE**
Wed 5 Sept	Brief Lecture 1 (1 hr): Introductions, Overview of course Lab 1a, (2 hr): Site selection and species identification in North Campus Lands Wear appropriate clothing for being outside for several hours. Rain gear (jacket and pants), water-proof boots, coat, hat, gloves, small pack, water, snack. Bring hand lens, 8.5 x 10-inch notebook, pencil.	1. Course syllabus 2. Kent, Chapter 1 (p. 1-21) "Quantitative plant ecology and vegetation science"). 3. Relevé data forms 4. MD&E Chapter 5, (45-66, The relevé method (optional).	
Mon 10 Sept	Lab 1b, Relevé method, Plot 1 Goal is to collect 4 relevés from	Kent, Chapter 2 (p. 23-48), "Environmental gradients,	

	each position along the toposequence (hill crest or shoulder, side slope, footslope, 12 relevés total). Be sure to carefully mark corners of plots with pin flags and get GPS coordinates so you can return to these sites.	plant communities and vegetation dynamics"	
Wed 12 Sept	Lab 1c, Relevé method, Plot 2	1. Kent, Chapter 3. Focus on p. 60-65 ("Quadrats"). 2. Be familiar with identification of common boreal plants. Review trees, and shrubs at http://www.geobotany.uaf.edu/teaching/biol474/allplants.php	Hand in relevé sheets at end of class for check.
Mon 17 Sept	Lab 1d, Relevé method, Plot 3	1. Kent, Chapter 3, (p. 65-78) "Measures of species abundance") 2. Appendices for USNVC approach, Appendix 2A, "Example Field Data Forms and Instructions" ***Supplementary material for graduate students: Westhoff, V. and E. van der Maarel. 1978. The Braun-Blanquet approach. Pages 287-399 in R. H. Whittaker, editor. Classification of Plant Communities. W. Junk, Den Haag. To be read during next seveal lessons.	Hand in relevé sheets at end of class for check.
Wed 19 Sept	Lab 1e, Relevé method, Plots 4 and 10		Hand in relevé sheets at end of class for check
Mon 24 Sept	Lab 1f, Relevé method, Plots 5 and 11	Vegetation Field descriptions Handout	**Field description 1, due Wed 24 Sep**
Wed 26 Sept	Lab 1g, Relevé method, Plots 6 and 12	1. Review relevé method and compare with Appendix 2A in USNVC approach.	**Field description 2, due Mon 1 Oct**
Mon. 1 Oct	Lab 1h, Relevé method, Plots 7, 8, and 9.		**Field description 3, due Fri 5 Oct**

Wed 3 Oct.	Lab 1i, Collect soils from all relevés and clean up plot markers	1. NRCS (Natural Resources Conservation Service). 2004. Soil survey of the greater Fairbanks area, Alaska. Read p. 11-15, skim rest of document.	
Mon 8 Oct	Lab 2: Forest sampling, plotless sampling, point-centered quarter method	1. MD&E Chapter 7 (p. 93-135) "Count plot method and plotless sampling methods" 2. Lab 2 handout, including calculation of importance values.	
Wed 10 Oct	Lab 3: Point-intercept sampling approach, Buckner optical sighting device, and tree heights	1. MD&E. Chapter 6, (p. 84-92), "Point intercept method" 2. Lab 3 Handout. Including sampling protocols for Optical Sighting Device and Sunto clinometer.	
Mon 15 Oct	1. Lecture 2: Community Concepts 2. Review revised syllabus and grading criteria 3. Labs 1, 2, & 3 status 4. Mid-term notebook check 5. Discussion of Final Presentation ideas	Review: Kent, Chapter 1 (p. 1-21) "Quantitative plant ecology and vegetation science"). Kent, Chapter 2 (p. 23-48), "Environmental gradients, plant communities and vegetation dynamics"	**1. Mid-term notebook check**
Wed 17 Oct	1. Lecture 3: Vegetation sampling. Subjective vs. objective sampling, Relevé sampling, USNVC sampling, minimal area, measuring cover, frequency, density. 2. Lab 4: Data entry of relevé data (Bring your lap tops)	Review: 1. Kent, Chapter 3. Focus on p. 60-65 ("Quadrats"). 2. Kent, Chapter 3, (p. 65-78) "Measures of species abundance")	**1. Lab 2 (PCQ method) due Wed 17 Oct** **2. Lab 3 (Point sampling and tree heights) due Fri 17 Oct**
Mon 22 Oct	Lecture 4: Soils	1. Barbour et al. (1987). Chapter 17. Soils, p. 407-433.	

Wed 24 Oct	Lab 4: Herbarium: plant identification (Museum Herbarium)	1. Lab 4 Handout (Herbarium Lab). 2. Flora of Alaska boreal forests and tundra, plant identification keys 3. Be familiar with identification of common boreal plants at http://www.geobotany.uaf.edu/teaching/biol474/allplants.php.	1. Replace temporary species with confirmed names species names on Relevé forms. Submit for checking. **2. Proposals for final papers (25 points)**
Mon 29 Oct	Lecture 5: Ordination 1:Direct gradient analysis, weighted averaging	1. Kent, Chapter 6 "Ordination methods" through "the continuum index and weighted averages ordination (p. 171-178). 2. McC&G, Chapter 5 "Species on environmental gradients" (p. 35-43).	
Wed 31 Oct	Lab 5: Soils analyses: pH, grain size, soil color (Soils Lab, 335 O'Neil Bldg)	1. Review: Barbour et al. (1987). Chapter 17. Soils, p. 407-433. 2. Lab 5 Handout (Soils).	**1. Preliminary outlines final papers and oral presentations (25 points).** 2. Turn in soils data for checking (Volunteers needed for keypunching)
Mon 5 Nov	Lecture 6: Ordination 2: Indirect ordination: Bray and Curtis ordination (polar ordination, PO)	1. Kent Chapter 6, "Ordination methods" through "Bray and Curtis (polar) ordination" (pp. 178-194).	
Wed. 7 Nov	Lab 6: Species and environmental data matrices, relevé data entry and preparation for ordination with PC-Ord (computer lab, 301 Bunnell Bldg.)	1. Lab 6 Handout (Releve Data entry). 2. Kent Chapter 4 "Nature and properties of vegetation data, pp. 101-120.	Submit Lab 6 Final species and environmental data matrices at end of lab for check.
Mon 12 Nov	Lecture 7: Ordination 3: Review of Bray and Curtis (Polar) ordination and Principal	Kent, Chapter 6, "Ordination methods" through "Principal components analysis (PCA)"	

	components analysis (PCA), ,	(pp. 194-214).	
Wed 14 Nov	Lab 7: Introduction to PC-ORD - Polar ordination,	1. Lab 7 Handout (Polar ordination). 2. Lab 7-8 Report: Indirect ordination. 3. McC&G, Chapter 13 "Introduction to Ordination (p. 102-113); Chapter 17 "Bray and Curtis (Polar) ordination (p. 143-148); Chapter 14 "Principal components analysis" (p. 114-121).	
Mon 19 Nov	Lecture 8: Ordination 4: Reciprocal Averaging (RA), Correspondence analysis (CA), Detrended correspondence analysis (DCA)	1. Kent Chapter 6, through "Detrended Correspondence Analysis (pp. 214-236).	
Wed 21 Nov	Lab 8 – PC-ORD (2) Ordination using eigenvector methods; Detrended correspondence Analysis (DCA). Exploration of NMDS, CCA, dendrograms and TWINSPAN in PC-ORD.	1. Kent Chapter 6, through "Ordination and multivariate analysis as panacea" (pp. 237-254). 2. Kent Chapter 8 "Numerical classification, cluster analysis and phytosociology" (p. 307-338).	Write up of Lab 7-8 (Indirect ordination) is due Monday 26 Nov.
22-25 Nov	THANKSGIVING BREAK		
Mon 26 Nov	Lecture 9: Overview of: 1. Braun-Blanquet Table analysis & syntaxonomy 2. US National Vegetation Classification	1. Kent, Chapter 7, (p. 243-275, Phytosociology and the Zurich-Montpellier (Braun-Blanquet) school of subjective classification) 2. Faber-Langendoen, D., R. H. Crawford, and D. L. Tart. 2009. Contours of the revised U.S. national vegetation classification standard. Bull. Ecol. Soc. Am.:87-	**Submit Lab 7-8 "Indirect Ordination" for grade (100 pts).**

		93. 3. Assign readings for Mon 3 Dec.	
Wed 28 Nov	Lab 9 – Table sorting and classification of class data using Excel.	1. Lab 9. Sorted Table analysis. 2. MD&E Chapter 5, 45-66, The relevé method.	**1. Notebooks due for grade (200 pts)** 2. Submit Lab 9 Sorted Table analysis for check. Note: Final Table is due Wednesday 5 Dec.
Mon 3 Dec	Lecture 10: Discussion of Hollingsworth et al. (2006) and Schickhoff et al. (2002) papers.	1. T. N. Hollingsworth, M. D. Walker, F. S. Chapin III, and A. L. Parsons, "Scale-dependent environmental controls over species composition in Alaskan black spruce communities," *Canadian Journal of Forest research*, vol. 36, no. 7, pp. 1781–1796, 2006. 2. U. Schickhoff, M. D. Walker, and D. A. Walker, "Riparian willow communities on the Arctic Slope of Alaska and their environmental relationships: A classification and ordination analysis," *Phytocoenologia*, vol. 32, no. 2, pp. 145–204, 2002.	
Wed. 5 Dec	Lab 10 - Table sorting, analyses for final paper		**Submit Lab 9 "Sorted Tables" for grade (100 pts).**
Mon. 10 Dec.	Questions and writing on papers		**First draft of papers due for check of progress**
Wed Dec 12	Student oral presentations		**Send copy of oral presentations to Skip (100 pts for undergraduates, 200 pts for graduate students)**
Fri 14 Dec.			**Final papers due Send .doc file to Skip. (100 pts for**

			undergraduates, 300 pts for graduate students)

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

Attendance & participation:

Students are expected to attend every class and lab, which will begin promptly. Attendance will be taken, and 10 points given for on-time attendance. Late students will receive 5 points. Students are expected to participate in class discussions. Both attendance and participation will contribute to the final grade.

9. Evaluation

Grades:

Grades will be based on the following criteria:	Undergraduate	Graduate
Attendance (30 @10 points/ class)	300	300
Vegetation descriptions (2 @100 points)	200	200
Lab report assignments (4 @100 points/report)	400	400
Vegetation description & analysis notebook	200	200
Final paper proposal and outline	50	50
Final paper	100	300
Oral presentation to class	100	200
TOTAL	1350	1600

Undergraduate student expectations and grading:

All students are expected to accomplish the following:

(a) Attend all lectures, literature discussion groups, labs and exams on time There will be no make-up for missed classes and half credit for late attendance. Good reasons for missing the classes will be accepted if cleared with the instructor before the class. (10 points for each for 30 sessions, 300 total points).

(b) Written lab reports describing the methods and the results of the exercise. Five reports @100 points = 500 total points). Expectations for lab reports will be provided at each lab.

(c) Vegetation descriptions and analysis notebook (see above for description and contents). The notebook will be checked twice during the semester and handed in at the end for a grade (150 points).

(d) The final paper (described above in 6) is worth 100 points for undergraduate students. Guidelines for the presentations and grading criteria for the presentations will be handed out early in the semester. Late papers will receive a deduction of 10 points of the 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.

(e) Twenty-minute oral presentation of the final paper (described above in 6) is worth 100 points for undergraduate students. Guidelines for the presentations and grading criteria for the presentations will be handed out early in the semester.

Graduate student expectations and grading:
Graduate students will be graded according to the same criteria as the undergraduate students except for the following:

(d) The final paper for graduate students is expected to use 2-3 analytical methods, and be more of a synthesis of either the class sampling activities, or the analysis of data set of the student's choosing. The paper is worth 300 points.

(e) The final oral presentation for graduate students will be somewhat longer than for undergraduates (30 minutes), cover more material, and provide a more thorough analysis of the vegetation of the topic. The presentation is worth 200 points.

(f) The graduate student literature presentations (described above in 6) are worth 100 points (only if we have an extra class session).

Note: 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.

Assignments are due at the beginning of class on the days shown in the syllabus. 5% of the total points will be deducted for every day an assignment is late.

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. Arctic Health, 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.