GEOGRAPHY – GEOLOGY

QUATERNARY VEGETATION DYNAMICS

SPRING 2013

Instructor: John (Jack) W. Williams, Professor, Department of Geography
Science Hall 208, jww@geography.wisc.edu
Office Hours: Weds 1:30-3:30pm, or by appt.

TA: Yue Wang, Department of Geography
Science Hall 201, ywang327@wisc.edu
Office Hours: Tues 11:30am-12:30pm, Thurs 11:30am-12:30pm

Classtime: Lecture: TTh, 1-2:15pm, Science Hall 378*

* On some Tuesdays we will meet in the Science Hall Computer Lab, room 380. See schedule.

INTRODUCTION

The Quaternary (the last 2.4 million years) offers a natural laboratory for studying the responses of plant species and ecosystems to large-scale climatic and environmental change. These climatic oscillations occurred frequently and often abruptly, and at glacial-interglacial timescales are closely linked to large swings in atmospheric CO_2. Humans dispersed across the world over the last 100,000 years, and, not coincidentally, many species, large vertebrates in particular, went extinct. In response to these environmental changes, the abundances and distributions of plant species changed dramatically during the Quaternary, and communities dissolved and reformed over time. We can therefore use the Quaternary to ask questions about the mechanisms driving vegetation change, and apply the answers to refine our projections of vegetational responses to 21^{st}-century change.

The goals of this course are 1) to provide an advanced understanding of late-Quaternary vegetation dynamics, including both the patterns of past changes and the causal processes, 2) to draw connections between past phenomena to current questions in global change ecology and conservation biology, 3) provide you with an hands-on understanding of the statistical tools used in analyzing paleoecological data, and 4) sharpen your critical-thinking and writing skills.

COURSE MECHANICS

There are three main components to this course: 1) **Classes**, which are discussion-oriented, with a bit of lecturing mixed in, and will draw heavily on readings you'll do in the scientific literature, 2) **Tools**, which will offer hands-on experience in working with paleoecological data, and 3) a **Term Paper**, which will give you a chance to dig deeper and critically explore a topic of interest.

For each class, there will be 1-3 (usually 2) papers that I expect you to have read prior to class and be ready to discuss. For each class, I will begin with a short review (15 minutes) of key concepts and a general context for the topic. After this presentation, we'll move to discussion. ***As preparation for the discussion, I expect you to generate four questions based on your readings of the papers, prior to each class.*** Print out and bring to class a paper copy of these questions– they will be the starting points for our discussion, and I'll collect them at the end of class.

We'll hold a 'Tools' class every other Tuesday, in which we'll get hands-on experience in working with paleoecological datasets, on-line data repositories, and statistical analyses. I'll begin with a lecture (30-40 minutes), after which we'll do a hands-on exercise. These exercises will be due in class the following Tuesday.

The term paper will give you both a chance to delve deeper into a topic of interest and a chance to practice the peer-review process. For more details, see the term paper instructions.

GRADING

Discussion & Participation	45%
Lab Exercises	25%
Term Paper	30%

READINGS

No textbook. Readings will be drawn from the primary literature. On average, 2-3 papers will be linked to each discussion. Readings will be posted as PDFs to Learn@UW learnuw.wisc.edu or handed out in class. See the Course Readings for more information.

Prerequisites

Open to juniors, seniors, and graduate students. Although no formal course prerequisites are set, a familiarity with basic principles in ecology and physical geography is assumed. Useful (but not required) prior courses include Geography 331 (Climatic Environments of the Past) and 338 (Biogeography). Geog 360 or other introductory statistical class is helpful, but not required.

Week	Class	Date	Lectures	Room	Notes
1	1	1/22	Introduction	378	
	2	1/24	Late-Quaternary Climates	378	
2	3	1/29	*Tools: Pollen Theory and Practice*	378	
	4	1/31	Species Responses to Climate Change: Mechanisms and Scale	378	
3	5	2/5	Spatial Responses of Plants to Past Climate Change	378	Exercise 1 due
	6	2/7	A Conceptual Framework: Species Individualism & Gradients	378	
4	7	2/12	*Tools: Introduction to R*	**380**	**Paper Topic Due**
	8	2/14	A Conceptual Framework: Niche Theory	378	
5	9	2/19	Species Distribution Models & Hindcasting	378	Exercise 2 due
	10	2/21	No-Analog Communities & Climates	378	
6	11	2/26	*Tools: Neotoma Database*	**380**	
	12	2/28	Migration Rates	378	
7	13	3/5	Genetic Legacies of Past Range Shifts	378	Exercise 3 due
	14	3/7	Climate Refugia	378	
8	15	3/12	*Tools: 14C Dating & Age-Depth Models*	**380**	
	16	3/14	Plant Extinctions and Climate Change	378	
9	17	3/19	Megafaunal Extinctions and Vegetation	378	Exercise 4 due
	18	3/21	Gasping for CO2	378	
SPRING BREAK (March 25-29)					
10	19	4/2	*Tools: Exploratory Analyses of Multivariate Data*	**380**	
	20	4/4	A Conceptual Framework: Climate Change, Dynamic Equilibrium, & Disequilibrium	378	
11	21	4/9	Hydrological Variability in the Holocene	378	Exercise 5 due
	22	4/11	Drought, Insects, and Tree Mortality	378	
12	23	4/16	*Tools: Ordination and Principal Components Analysis*	380	**First Draft Due**
	24	4/18	A Conceptual Framework: Abrupt Change, Tipping Points, and Regime Shifts	378	
13	25	4/23	Vegetation and Fire	378	Exercise 6 due
	26	4/25	Human Influences	378	**Peer Reviews Due**
14	27	4/30	*Tools: Dissimilarity metrics and modern analog technique*	380	
	28	5/2	Student Paper Presentations	378	
15	29	5/7	Student Paper Presentations	378	Exercise 7 due
	30	5/9	Student Paper Presentations	378	
		5/14	Exam Period		**Final Paper Due**