

Climates of the past and climate change

Geography 450

3 Credits

This course fulfills the advanced Natural Science requirement (non-lab) for the BS in the School of Letters and Science. It is open to graduate students for credit.



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Office Hours:	By appointment or if my door is open, feel free to drop in!!
Time / Location:	Monday & Wednesday 9:30-10:45am, Bolton B95 or Lapham 271 for computer practicals (see schedule below)
Final exam:	Wednesday 15 May 2013, Bolton B95, 10.00am-12.00pm

Course introduction

Climate has continuously changed ever since the dawn of time, and climate scientists have endeavored to explain and make sense of these changes. For example, we know that, in the past, Wisconsin was both much warmer and much colder than it is today. But how exactly do we know this and how is it possible to accurately reconstruct past climates? These are some of the questions we will explore during the first part of this course.

Before humans inhabited the Earth climate was exclusively driven by natural forces, such as changes in the pattern of movement of the Earth around the sun caused the climate to oscillate by changing the angle at which the sun's rays strike the surface of the planet. In addition, during periods of volcanic activity, vast amounts of CO₂ are released into the atmosphere causing a warming effect whereas during periods when rates of chemical weathering of rock is faster than usual CO₂ is removed from the atmosphere causing the climate to cool. Also, movement of the continents due to plate tectonics changes their relative positioning resulting in places experiencing a change in the climate from their original location. Evidence of historic climate change comes in many different forms, which we will examine during this class, for example, by examining the organisms found in layers of sediment in the sea bed it is possible to

determine the particular climate in which the organisms originally grew. This in turn gives us a clue to past climates.

More recently, due to an increase in the global human population, the climate is not only experiencing changes due to natural forces but it has been scientifically proven that human activity has significantly altered the global climate. Current climate change is occurring at a faster rate than at any time in the past and is a direct consequence of an increase in the concentration of greenhouse gases in the atmosphere resulting primarily from the burning of fossil fuel. During this class we will explore the evidence for these claims.



So what does the future hold as regards climate? The predictions are for some areas of the planet to get warmer, some to experience more severe and frequent extreme weather events and others to experience more coastal flooding and erosion. During the class we will use a computer model coupled with GIS to demonstrate how these predictions are made for different areas of the world. In addition, we will briefly examine the impact of rising temperature on plants and animals by examining the timing of key life-cycle events

(phenology) of a range of species and correlating this with temperature. Since temperature is a key driver of plant and animal development we would expect future changes to impact wildlife.

The purpose of this course is to explore climates of the past, present and future. We will examine a range of different methods used to reconstruct past environments and assess the body of evidence relating to recent climate change. In addition, we will examine methods used to predict future climate & consider ways of demonstrating the impact of warming on wildlife.

Course format

The course is divided into 3 blocks each of which comprises 5 weeks. Each block will consist of a series of lectures, some kind of in-class practical work and an assessment.

Lectures The lectures will be approximately 1hr and 15 mins in length and will be available on the course website on D2L.

Practical work The practical work will take the form of a) interpretation of a pollen diagram in the first block, b) a phenology data interpretation exercise in the second block and c) a modeling and GIS exercise in the third block. Each of these activities will be conducted during class time.

Assessment Two of the practical exercises (pollen & modeling) will be assessed in groups and the third (phenology) on an individual basis. In addition, there will be a mid-term exam and a final exam both of which will comprise a series of short questions based on material covered in the lectures.

Course Materials

Textbooks:

Ruddiman, W.F. *Earth's climate, past and future* 2nd edition, W. H. Freeman and Company, 2008.

Burroughs, W.J. *Climate change: a multidisciplinary approach*, 2nd edition. Cambridge University Press, 2007.

Dessler, A. *Introduction to modern climate change*. Cambridge University Press, 2012.



Other material will be made available as necessary on D2L.

UWM email account: In order to succeed in this course, you need to check your UWM email account regularly. When composing emails please be sure to write “Geog. 450” at the beginning of the subject line in any emails you send; address your emails to me by name; consider the *tone* of your emails carefully; and, finally, sign your emails by name. Please do not send emails from any non-UWM email account.

The best way to reach me outside of class is via email (donnela@uwm.edu). I generally check and respond to email frequently, and except in unusual circumstances I will try to answer you within 24 hours. Finally, I would be delighted to meet with you in person. Please set up an appointment, or if my office door is open, you’re free to drop in if you have a question.

Desire2Learn Website (D2L): We will use D2L for this course. You will gain access to lecture slides, assignments, and any other relevant information through the course D2L site (<http://d2l.uwm.edu/>). Lecture notes can be downloaded from the D2L website. In addition, assignments and discussions will also be conducted in D2L.

Course Learning Objectives, Assessments, and Grades

By the end of the semester, you should be able to do the following:

Learning objectives	Assessment	% of grade
1. Demonstrate knowledge and understanding of (i) past, present and future climates, (ii) recent climate change, and (iii) the impacts of climate change on wildlife.	Midterm exam Final exam	20% 40%
2. Interpret past vegetation types in order to attempt a reconstruction of past climates.	Class presentation (5%) Interpretation of pollen diagram (5%)	10%
3. Graphically present, determine and interpret trends in spring phenology data from a range of species.	Produce a report	10%
4. Demonstrate understanding of the link between climate warming and plant and animal phenology.		
5. Gain skills and knowledge of how a climate model works. Gain skills is using GIS to spatially display baseline, future and changes in temperature across a given global region.	Presentation to class (10%)	20%
6. Design, plan and produce a group report on how future climate change may impact a particular global area.	Produce a report (10%)	

Grading information

1. **Examinations (60% of the final grade):** You will take 2 exams: a midterm worth 20% of your grade, and a final exam worth 40% of your grade. The exams will comprise short answer questions (based on material covered during lectures). Both exams are required. Later in the semester, you will receive more information about the exams. We will have a brief in-class review session before each exam.

Make-up exams may be permitted at the discretion of the instructor for legitimate reasons only, such as a documented illness. However, requests for make-up exams will be considered *only* if the student contacts me in a timely manner, preferably before the exam, but within 24 hours following the date of the exam, and provides a verifiable written documentation of their absence. *Do not assume* that you will automatically be allowed a make-up exam.

2. **Interpretation of pollen diagrams (10% of the final grade):** The class will be divided into pairs to work on this assignment. Each pair will work on six pollen diagrams, four of which will be from a given region in the US and the remaining two will be from either South America or Europe. A comparison of the vegetation types of the pollen diagrams will be made and from that the climate under which the vegetation grew will be reconstructed. A short class presentation (5% of grade) and report (5% of grade) will be submitted for grading by each pair.

THIS EXERCISE WILL TAKE PLACE IN LAPHAM HALL ROOM 271 ON 4 AND 6 FEBRUARY. THE CLASS PRESENTATIONS WILL TAKE PLACE IN B95, OUR USUAL CLASS ROOM.

3. **Interpret how plants and animals respond to recent climate warming (10% of the final grade):** This assignment will be carried out individually. You will be given data on the timing of spring phenological events of trees, insects and birds over a 30 year period. In addition you will also be given temperature data for the same time period. The exercise will be to interpret how wildlife responds to temperature and to determine the consequences of future rising temperature on these species.

THIS EXERCISE WILL TAKE PLACE IN LAPHAM HALL ROOM 271 ON 1 AND 3 APRIL.

4. **Climate change model and GIS (Geographic Information Systems) (20% of the final grade):** This is group exercise where you will work in pairs. You will use a computer model to run different climate scenarios to examine how a particular global region may respond to rising future temperatures. In addition, you will display the maps in GIS for comparison between baseline (current) and future projections. A short class presentation (10% of grade) and report (10% of grade) will be submitted for grading by each pair.

THIS EXERCISE WILL TAKE PLACE IN LAPHAM HALL ROOM 271 ON 15, 17 AND 22 APRIL. THE CLASS PRESENTATIONS WILL TAKE PLACE IN B95, OUR USUAL CLASS ROOM.

Grading Policy

See the following site for official UWM policy on grades and grading:
<http://www4.uwm.edu/secu/docs/other/S29.htm>.

Guide to grades

93-100%	A	Achievement of outstanding quality
90-92%	A-	Achievement of slightly less than outstanding quality
86-89%	B+	Achievement of slightly more than high quality
83-85%	B	Achievement of high quality
80-82%	B-	Achievement of slightly less than high quality
76-79%	C+	Work of slightly more than acceptable quality
73-75%	C	Work of acceptable quality
70-72%	C-	Work of slightly less than acceptable quality
66-69%	D+	Work slightly below the quality expected
63-65%	D	Work below the quality expected
60-62%	D-	Work barely above failing
0-59%	F	Failure

Special Consideration. *The principle of equal treatment of all students shall be a fundamental guide in responding to requests for special consideration. No student should be given an opportunity to improve a grade that is not made available to all members of the class. This policy is not intended to exclude reasonable accommodation of verified student disability, or the completion of work missed as the result of religious observance, verified illness, or justified absence due to circumstances beyond the student's control.*

Comments: This policy applies to requests for special consideration both before and after a course is completed (See also Grade or Record Changes). It is usually impossible to make opportunities for grade improvement available to all students in a course after the course has ended. Examples of unacceptable opportunities for an individual student include extra work, retaking an examination, taking an extra examination, or an extension of time on an assignment or examination. The policy on incompletes (UWM Select Policies and Procedures, S-31) explains the circumstances in which a student may be given extra time for the completion of a course. This policy should reassure students who are not seeking special consideration and it should also protect instructors from student pressure for special consideration.

Workload

This is a 3-credit course. As a general rule of thumb, you should expect to spend 4-5 hours outside of class for every class. Since we will have 2 classes each week, you can expect to spend approximately 8-10 hours each week outside class preparing for class, working on assignments and studying for exams. You will be responsible for managing your time in order to complete your work.

Activity	# hrs
Time in the classroom (face-to-face lecturing) 20 sessions	25
Time spent online reading lecture and other material	32
Time doing practical work (pollen 2.5hr; modeling 3.75hrs)	6.25
Time taking exams (1hr 15 mins midterm and 2hr final)	3.25
Time for class presentation (pollen and modelling)	2.5
Time completing assignments (3h per week on average)	45
Time for preparation and study (2hrs on average per week)	30
Total for term	144
Average per week	9-10

NOTE: THESE NUMBERS ARE APPROXIMATE!!!

Classroom conduct

I expect that you will conduct yourself in lectures and during assignments in the same manner that you yourself would like to be treated and *to respect the rights of other students to learn*. Class disruptions will not be tolerated, as it erodes the educational environment for everyone. Please be respectful of your fellow classmates. **Come to class on time, stay until the end, and remain quiet during lectures** (unless I'm trying to get you to contribute to a conversation in class, in which case quiet is the last thing I want you to be!!). I also expect you to *acknowledge and respect the diversity of participants in the class*. Even if you disagree with points of view expressed by your instructor or your fellow students, as citizens of this class you are responsible for considering different points of view respectfully. The instructor will do the same.

Unless you have a VISA from the Student Accessibility Center or other documentation that you have special needs, **you will not need laptops or other electronic devices during class** unless otherwise stated. All wireless and electronic devices must be shut down or in silent mode during the class period.

Late work

To be fair to students who turn their work in on time, **you will not receive credit for assignments turned in late**, unless a documented medical or personal emergency arises. Please contact the instructor immediately if an emergency arises, or if you know you will have a problem turning your work in on time. Please note that “the D2L dropbox didn’t work” is not an acceptable excuse for a late assignment; you are responsible for making sure your assignment reaches the dropbox or discussion forum. You should email the instructor immediately—and before the assignment is due—if you have technical difficulties submitting your assignment to the D2L site.

Make-up exams

In order to be fair to all students in the course, you may not make up exams or resubmit coursework unless a documented medical or personal emergency arises. In the event that you must be absent on the day of an exam, you must contact the instructor immediately to reschedule a make-up exam.

Technology

D2L site: You will gain access to lecture slides, assignments and other material through the course D2L site: <http://d2l.uwm.edu/>. In order to reach the site, simply log in using your Panther ID and password, and then follow the instructions to find the course site. If you need help getting access to the site or to D2L, please use the UWM Help Desk (available 24 hours a day, 7 days a week), which should be your first point of contact for any technical issues you encounter:

Help Desk web site: <https://www4.uwm.edu/uits/help/>

Help Desk Telephone: (414) 229-4040

Submit Help Request: GetTechHelp.uwm.edu

Help Desk Location: Bolton 225

For a handout on accessing D2L visit:

<http://www.uwm.edu/Dept/LTC/docs/firstdayhandout.doc>

University policies and special notes

For the University of Wisconsin-Milwaukee's official policies on **disabilities, religious observances, active military duty, incompletes, discriminatory conduct, academic misconduct, complaint procedures, and grade appeal procedures**, please see the following web site: <http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf>. Geography 304 adheres to these policies.

Students with Disabilities: If you have a disability and need accommodations of any kind (e.g., a notetaker, special accommodations for tests, etc.), please see me and submit your VISA from the Student Accessibility Center ***within the first two weeks of the semester***. I'll be happy to work with you to make any necessary arrangements. For more information, see the following: <http://www4.uwm.edu/sac/SACltr.pdf>.

Religious observances: If you require accommodations for religious observances, I'm happy to work with you to make necessary arrangements. Please note that ***you are required to notify me within the first three weeks of the semester*** of the specific dates on which you will request relief from an examination or academic requirement: <https://www4.uwm.edu/secu/docs/other/S1.5.htm>.

Academic misconduct: You are responsible for reading and following UWM guidelines on academic misconduct, including cheating and plagiarism: <http://www4.uwm.edu/osl/dean/conduct.cfm>. If any instructor suspects academic misconduct, we are required to follow the procedures described here: http://www4.uwm.edu/acad_aff/policy/academicmisconduct.cfm.

Incompletes: "An Incomplete may be given to a student who has carried a subject successfully until near the end of the semester but, **because of illness or other unusual and substantiated cause beyond that student's control**, has been unable to take or complete the final examination or to complete some limited amount of term work. **An Incomplete is not given unless the student proves to the instructor that s/he was prevented from completing course requirements for just cause as indicated above.**" (quoted from UWM policy: <http://www4.uwm.edu/secu/docs/other/S29.htm>)

If you have questions or concerns about the class, please do not hesitate to contact the instructor. evidence

Tentative Lecture Schedule – subject to change at a moment’s notice!!!

Block 1: Climates of the past (Chpts. refers to Ruddiman unless otherwise stated)			
Wk 1	Jan 23	1. Introduction to class	
Wk 2	Jan 28	2. Overview of the climate system	Chpts. 1 & 2
	Jan 30	3. Climate proxies and dating	Chpt. 2
Wk 3	Feb 4	4. Pollen diagram interpretation (LAPHAM 271)	D2L
	Feb 6	5. Pollen diagram interpretation (LAPHAM 271)	D2L
Wk 4	Feb 11	6. Class pollen diagram presentations	<i>Report due 15 Feb. 5pm</i>
	Feb 13	7. Long-term climate, plate tectonics and CO ₂	Chpts. 3 & 4
Wk 5	Feb 18	8. Greenhouse and icehouse climates	Chpts. 5 & 6
	Feb 20	9. Mid-term exam	
Block 2: Climate change and climate change impacts			
Wk 6	Feb 25	10. Changing orbit and insolation cycles	Chpts. 7 & 8
	Feb 26	11. Polar ice-caps and greenhouse gases	Chpts. 9 & 10
Wk 7	Mar 4	10. The last glacial maximum	Chpts. 12 & 13
	Mar 6	13. Humans and climate	Chpts. 15 & 16
Wk 8	Mar 11	14. Recent climate change	Chpt. 17
	Mar 13	15. Current climate change	Chpts. 18 & 19
Wk 9 March 17-24 Spring Recess – No classes			
Wk 10	Mar 25	16. Phenology and climate change	D2L
	Mar 27	17. Phenology mismatches	D2L
Wk 11	Apr 1	18. Phenology data exercise (LAPHAM 271)	<i>Reports due in dropbox Mon. 8 Apr., midnight</i>
	Apr 3	19. Phenology data exercise (LAPHAM 271)	
Block 3: Future climate change			
Wk 12	Apr 8	20. Modelling climate change	Chpt. 10 Burroughs
	Apr 10	21. Predicting climate change	Chpt. 11 Burroughs
Wk 13	Apr 15	22. Climate modeling GIS exercise (LAPHAM 271)	<i>Details will be available on D2L. Reports due in dropbox Apr. 29, midnight</i>
	Apr 17	23. Climate modeling GIS exercise (LAPHAM 271)	
Wk 14	Apr 22	24. Climate modeling GIS exercise (LAPHAM 271)	
	Apr 24	25. Class presentations climate modeling GIS	
Wk 15	Apr 29	26. Consequences of climate change	Chpt. 9 Burroughs
	May 1	27. Economic impact of climate change	Chpt. 9 Burroughs
Wk 16	May 6	28. Climate change policies	Chpts. 11-14 Dessler
	May 8	29. Review for final exam	Blocks 2 and 3 only

Final exam: Wednesday 15 May 2013, Bolton B95, 10.00am-12.00pm