

Ecohydrology

GEO 371C (27745) and GEO 391 (27960)

Fall 2013

Tuesday and Thursday 9:30am – 10:45am

Jackson Geosciences Building (JGB) 3.116

Instructor: Dr. Kevan B. Moffett
Email: kbmoffett@jsg.utexas.edu
Phone: 512-471-5290
Office Hours: Tuesday 11am-noon
Office Location: EPS 2.202

Instructor accessibility:

- Office: It is best if you attend office hours. Otherwise, please make an appointment to meet me outside office hours.
- Email: I typically receive email on weekdays between 8am and 4pm and will try to address your message promptly but may not be able to respond immediately. Please be judicious about sending emails. I am happy to receive them, but would prefer to address questions in office hours or quick questions before or after class.
- Phone: I highly recommend sending me an email rather than calling – I rarely answer my office phone or check its voicemail.

TA: TBA
Email: TBA
Office Hours: Thursday 1pm-2pm
Office Hours Location: JGB 6.312

TA accessibility:

- Office: It is best if you attend office hours. Please respect your TA's need to spend some time on her own coursework and research. If you wish to meet with her outside office hours, please arrange an appointment.
- Email: Please be judicious about emailing your TA so her inbox does not get clogged.

Course Content

This course is intended to expand your foundational knowledge of hydrology to appreciate the role of plants in the hydrological cycle and related earth system processes. The course is divided into parts:

- I. Mechanics of plants and water – how water is transported and used in plants; how water, energy, and carbon are coupled at the leaf scale.
- II. Canopy biophysics and evapotranspiration – theory, measurement, and modeling of canopy water, energy, and carbon budgets; emphasis on the variety of evapotranspiration measurement and modeling methods, their relative strengths and weaknesses.
- III. Ecohydrology in regional and global landscapes – interaction of plant-water relations with other major components and processes of the earth system including human agricultural water use, land cover and land use, geomorphology, biogeochemistry, and climate.

Learning Goals

- 1) Develop the vocabulary to understand and communicate about plant-water relations and their role in the hydrological cycle and, more generally, in the earth system.
- 2) Empower you to choose appropriate methods and make quantitative measurements and calculations of evapotranspiration and the surface energy balance.
- 3) Understand both the ‘green water’ and ‘blue water’ components of hydrology, how they interrelate, and why they are important in other fields of science and society.

Class Format

- You are expected to learn the majority of the factual background content of the course via the course readings. You are expected to complete the assigned readings thoroughly by the date they are due.
- Each class session will briefly review the assigned readings and homework questions but will focus on an applied class activity.

Prerequisites

[GEO 376S or 382S] OR [GEO 346C AND coursework in ecology, plant biology, or physical climatology]

Expectations

- **Attendance:** 100% on-time class attendance and participation is expected.
- **Questions:** You are strongly encouraged to ask questions and make topical comments.
- **Conduct:** Courteous, kind, and honest conduct is expected at all times toward the instructor, the TA, and your peers.
- **Collaboration:** Homework solutions must be written up and handed in individually unless you are instructed otherwise. In general, reading-related questions should be completed individually.
- **University Honor Code:** All students are expected to abide by the UT Honor Code. The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. (<http://registrar.utexas.edu/catalogs/gi09-10/ch01/index.html>).
- **Use of Internet-enabled Devices and Cell Phones:** Except during tests and quizzes, you are invited to use internet-enabled devices or cell phones during class to supplement and enhance your learning of course-related topics. You are expected to refrain from email, social communication, and working on homework (unless instructed to do so) during class.
- **Interruptions:** Non-topical interruptions of class (e.g., cell phone calls) are prohibited. Please silence your phone. Please leave the room if you must answer an urgent call.

- **Religious Holy Days:** According to UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, I will give you an opportunity to complete the missed work within a reasonable time before or after the absence.
- **Documented Disabilities:** Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities (SSD) at (512) 471-6259 (voice) or 1-866-329-3986 (video phone). Faculty are not required to provide accommodations without an official accommodation letter from SSD. Please notify me as quickly as possible if the material being presented in class is not accessible to you.

Course Readings and Materials

- **Textbooks:**
 - Two textbooks are required for all sections of the course (GEO 371C and GEO 391):
 - *Ecological Climatology: Concepts and Applications* by G.B. Bonan (2008)
 - Obtain from UT Co-op or your favorite bookstore.
 - This book provides nicely-written overviews of the topics of this course from plant to global scales at a moderate level of detail.
 - *Plant Physiological Ecology* by H. Lambers, F.S. Chapin III, and T.L. Pons (2008)
 - FREE ONLINE ACCESS: go to <http://www.lib.utexas.edu/>, type *Plant Physiological Ecology* in the scoUT search box, and follow the links.
 - This book has more helpful detail about plant anatomy and physiology than can generally be found in hydrology or ecohydrology textbooks.
 - One additional textbook is required for the graduate section of the course (GEO 391):
 - *An Introduction to Environmental Biophysics* by G.S. Campbell and J.M. Norman (2000)
 - This book is a great reference for hydrological and evapotranspiration research, with high mathematical content and detailed text.

These texts have been placed on 24hr reserve in the Geology Library.

When other readings are required for homework they will be posted on Blackboard or the citations will be provided so you can obtain a copy for your reference.

- **Blackboard:** In this class I use *Blackboard*, a Web-based course management system with password-protected access at <http://courses.utexas.edu>, to distribute course materials, to communicate, to post grades, and to administer assignments, quizzes, and surveys. You can find support in using Blackboard at the ITS Help Desk.
- **Use of E-mail for Official Correspondence:** All students should become familiar with the University's official e-mail student notification policy. It is the student's responsibility to keep the University informed as to changes in his or her e-mail address. Students are expected to check e-mail on a frequent and regular basis. It is recommended that e-mail be checked daily. The complete text of this policy and instructions for updating your e-mail address are available at <http://www.utexas.edu/its/help/utmail/1564>.
- **Emergency Evacuation:** Occupants of buildings on the UT Austin campus are required to evacuate and assemble outside when a fire alarm is activated or an announcement is made. Please be aware of the following policies regarding evacuation:
 - Familiarize yourself with all exit doors of the classroom and the building. Remember that the nearest exit door may not be the one you used when you entered the building.
 - If you require assistance to evacuate, inform me in writing during the first week of class.
 - In the event of an evacuation, follow my instructions or those of other instructors.

- Do not re-enter a building unless you're given instructions by the Austin Fire Department, the UT Austin Police Department, or the Fire Prevention Services office.

Exercise Formats

Five types of exercises will contribute to your final grade:

- **Reading and Questions:** You are expected to learn the majority of the factual background content of the course via the course readings. You are expected to complete the assigned readings carefully and thoroughly by the date they are due. This is a somewhat reading-heavy course, but that is how we earn the time to do neat hands-on things during class. Answers to questions related to the assigned readings are due by the beginning of class, each class period. Late answers will not be accepted (except in cases of extreme qualified absences) since answers will be reviewed in class.
- **Class Participation and Activity Reports:** In-class activities are intended to be an aid to learning and constitute a majority of class time. In some cases you are asked to bring in materials to contribute to the activity, so your participation is indispensable. During the in-class activities you will be expected to participate and learn the equipment, methods, and concepts being demonstrated via your own hands-on process of inquiry. During this exploratory process, the 'why' of the activity may become partly subsumed in the 'what' of doing it. Therefore, you will be provided an opportunity after-the-fact to analyze and reflect prior to handing in your report of the data and analysis from the activity. More details will be provided for each assignment.
- **Class Presentations:** On a few occasions you will prepare a 1-slide presentation for the class to review an assigned topic or vocabulary word; we will then compile all the contributed slides into reference materials for the whole class.
- **Quizzes:** Three major unit-quizzes are intended to provide periodic focal points for your studies during the semester so we can be sure earlier material is well-understood and reading completed before progressing to later material. Each unit-quiz is largely non-cumulative: it will focus on the material from the most recent third of the course, although later material will draw on your understanding of earlier material. I also reserve the right to administer pop-quizzes related to recent readings or class activities, if I deem them necessary to maintain participation and enhance learning.
- **Final Project:** You will develop a final report and presentation in groups, on a topic chosen by your group and approved by the instructor. The report will include elements of literature review, data analysis, and discussion. Presentations will occur during the final two class periods. Further details will be provided upon assignment of the project.

No final: There will be no cumulative final exam during Finals Period. All class exercises are intended primarily to enhance learning (that's what we're here for!) and only secondarily to provide a means of evaluation. In this context, a cumulative final exam serves little purpose to enhance learning once all previous exercises have been completed.

Grading It is expected that the above types of exercises will contribute to the final grade in proportions:

Reading Questions	49%
Activity Reports	14%
Unit Quizzes	21%*
Class Presentations	5%
Final project	11%
Total	100%

* If administered, pop quiz points will add to the overall point total and percentages adjust accordingly.

Tentative Course Schedule

This schedule is a guideline only. I reserve the right to alter this schedule and add or subtract material by notifying you of changes as promptly as possible.

Class	Wk	Date	Topics	Major Assignments Due
1 Th	0	29-Aug	Introductions, Syllabus	
2 Tu	1	3-Sep	Review of the Earth System, Water Properties, Water Balance	
3 Th		5-Sep	Roots and Soil Physics	
4 Tu	2	10-Sep	Plant Stem Hydraulics	soil & root report
5 Th		12-Sep	Plant Leaf Hydraulics	
6 Tu	3	17-Sep	Plant Carbon Balance	stem & leaf report
7 Th		19-Sep	Diurnal and Seasonal Cycles	
8 Tu	4	24-Sep	Water Limitation and Excess	carbon & drought report
9 Th		26-Sep	Micrometeorology	
10 Tu	5	1-Oct	Energy and Radiation Budgets	
11 Th		3-Oct	Turbulent Fluxes	Unit 1 take-home Quiz
12 Tu	6	8-Oct	Canopy Structure & Light	
13 Th		10-Oct	ET: simple models	
14 Tu	7	15-Oct	ET: combination models	
15 Th		17-Oct	ET: direct measurements	
16 Tu	8	22-Oct	ET: micrometeorological measurements	ET measurement report
17 Th		24-Oct	ET-carbon coupling	
18 Tu	9	29-Oct	ET remote sensing	ET modeling report
19 Th		31-Oct	Water Limitation Models	
20 Tu	10	5-Nov	Agro-ecohydrology	
21 Th		7-Nov	Ecohydrology Scaling: watersheds, regional, global	Unit 2 take-home Quiz
22 Tu	11	12-Nov	Disturbance, Land Use, and Ecogeomorphology	
23 Th		14-Nov	Vegetation Patterning	
24 Tu	12	19-Nov	Ecohydro-biogeochemistry	
25 Th		21-Nov	Regional and Global Ecohydrology	
26 Tu	13	26-Nov	Ecohydrology and Climate	
Th		28-Nov	THANKSGIVING BREAK	
27 Tu	14	3-Dec	Final Project Presentations	
28 Th		5-Dec	Final Project Presentations	Unit 3 take-home Quiz Final Project Report