

EV 351: Hydrology | Block 8 2019

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Goals and Scope of the Course | This course provides a quantitative, process-based understanding of hydrologic processes in the context of watersheds, using data analysis and statistics. In addition, the course introduces the very real water resource challenges locally, regionally, and facing more than a billion people, globally using through the lens of ecosystem services. My hope is that by the end of the class all students will be able to do the following:

- critically evaluate information (also known as thinking!),
- acquire fundamental knowledge about the water cycle, its key processes, and storage reservoirs,
- to quantitatively understand and calculate hydrologic variables relevant to a water budget,
- to recognize and understand the inequity inherent in water resource challenges.

Class Structure | Classes will begin at 9 AM and will involve a mix of lectures, labs, and discussions. Please note the days we have afternoon lab and/or optional help sessions. I strongly encourage you to block out even the *optional* times in your schedule so you can take advantage of the time if you need it. In addition to these help sessions and my office hours, please utilize Nick and the QRC for additional assistance.

In class, I will introduce new concepts, and we will usually do a few exercises during the day to reinforce these concepts. There will be occasions where you will need to be able to answer questions on this reading and/or material covered in previous classes – these short exercises serve multiple purposes: it provides me feedback on concepts you may be having trouble with, helps keep you engaged with the material outside of the classroom, and provides you a way to assess how you are doing (answering these questions will count towards your grade). Every evening as a review, you should look over your notes (and potentially the reading for that day) and make notes on anything that still confuses you. I will always go over any questions you have before going on to new material – so if you have a question, please ask! Keep in mind that study groups are a great way to learn and review the different concepts we cover. I encourage you to work with your classmates on all problem sets and labs, unless expressly told otherwise.

Attendance. We will be covering a lot of material in this course, with every day building on the previous day. In order to learn from and with each other and include all voices, attendance at all class meetings is expected. It is your responsibility to contact me directly if you are unable to attend class due to an emergency. Please note that if you get sick during the block I will do everything I can to help you catch up on the material – but you need to have a note from Boettcher or another doctor for an *excused* absence.

If you need to miss class for any justifiable reason during the block (e.g., athletic team travel, religious observance), please notify me **on the first day of class** so we can arrange on how you will receive the material for that day.

Note about assignment deadlines and student-teacher-human well-being. I am dedicated to providing you thorough and specific feedback to help you improve your work; this means I have dedicated time in my own schedule for reviewing assignments. Sometimes life gets in the way, and we have to submit something we know is not our best work. I would much rather have

you turn in something that is a work in progress than delay and become overwhelmed with too many overdue assignments at the end of the block. I am not a huge fan of taking “points off” for lateness, as it contradicts the developmental and human-focused commitments I have made as an educator. I have set deadlines in a way that I hope provides you the maximum flexibility in completing assignments, yet keeps you on pace to not get behind in the necessary “practice” of working with scientific concepts. I will usually be able to accommodate a day or two extension, but please keep in mind that the pace of the block is unforgiving and things WILL build up. In addition, if you turn something in *after* the deadline, feedback could be delayed (potentially significantly). I highly encourage you to schedule time off on the weekends to spend with your friends or family, engaging in creative and activist endeavors, going outside for a hike, or to the movies, or to simply relax. Whenever possible the course schedule encourages said “mental breaks.”

Commitment to Diversity, Equity, & Inclusion. I am committed to making the classroom a place that enhances all students’ learning, a place where students feel both respected and challenged. To the best of my abilities, I seek to make pedagogical choices that advance this goal. Outside of class, I run [mentoring programs](#) aimed at increasing the retention of women in earth and environmental sciences and conduct [bystander intervention trainings for faculty](#) to improve workplace climate. My commitment to diversity, equity, and inclusion does not mean I think I am perfect - all of us make mistakes. I will do my best to acknowledge these, along with my privilege and biases; I ask that you do the same. This is not easy. It is uncomfortable. I recommend using “ouch and educate” as a way to let your peers know that you are hurt and why. Colorado College is our community and it is up to each of us to make it a safe and welcoming place for all to learn and succeed.

Required Reading

- Hornberger et al. 2014. Elements of Physical Hydrology. 2nd Ed, John Hopkins Press.
- readings posted on Canvas

Field Trips | While we will be measuring streams in and around campus there is only one trip that will take us out of Colorado Springs – Monday of week 3 - where we will drive out towards Fairplay, CO to think about stream flow and stream geomorphology.

Office hours | I will have office hours on many afternoons (in addition to the course help sessions) throughout the block. You can sign up for time [here](#). Please note, scheduled help sessions are so that I can assist many of you at once, I strongly recommend adding them to your schedule even if you intend on never attending. If these times do not work for you, please talk with me before, after class, or via email.

Canvas | I will use Canvas extensively throughout the course. I will do my best to have readings posted multiple days in advance. In addition, there will occasionally be writing prompts on Canvas that you must complete. The goals of these questions/prompts is for me to (1) assess your comprehension on material, (2) to get you to start thinking about the material prior to classroom discussions, and (3) introduce you to how I ask questions so you are better prepared for quizzes.

Exams & Projects | There will be one **oral exam** in the course (3rd Friday of block). The exam will ask you to integrate material covered in lecture, discussions, and labs, as well as material from the textbook and readings – the oral exam will consist of four questions chosen randomly (student generated). Please speak to me ASAP if this exam format will pose problems for you – we can figure out an alternative.

During the first three weeks of class you will have multiple **problem sets** and **reflections** that reinforce many of the ideas we will discuss in class, I expect the work you turn in to be your own but you are welcome to discuss ideas and problem solving techniques with each other. You will also start working on your **Women in STEM Wikipedia Biography** from the start of the course. All students will present **one article** (co)authored by your scientist as well as produce a Wikipedia-worthy **biography** for their scientist (due at the end of week 3). Throughout the block, we will link the various pieces of the hydrologic cycle to ecosystem services. You will work in small groups (2-4 people) to investigate a specific **Water Justice** issue within the United States and produce an educational &/or social media **campaign** (as a group) as well as a short (<5 page) research paper (individually).

Grading:

Problem Sets & Reflections	30%
Water Justice Project	20%
Women in STEM Project	15%
Final Exam	25%
Engagement	10%

Grade Assignments:

93 ≤ A	73 ≤ C < 77
90 ≤ A- < 93	70 ≤ C- < 73
87 ≤ B+ < 90	(S ≥ 70)
83 ≤ B < 87	65 ≤ D < 70 (CR)
80 ≤ B- < 83	NC < 65
77 ≤ C+ < 80	

Grades of D+, D, CR, and NC do not fulfill EV Department major requirements.

Honor Code | Failure to properly document sources in papers, plagiarism, copying from other student's work, or turning in assignments that have already been submitted for credit in other courses are among some of the actions considered intellectual theft under the Colorado College Honor System. I encourage you to work together and talk through problems and assignments, but **your final work must be your own**, unless noted on the assignment (e.g. some labs you are welcome to turn in joint assignments). We will give you further information on how the honor code applies to specific assignments as we go. If you are uncertain about the Honor Code's application to a particular project, please ask. If you have questions or to read further details of the Honor Code see: <http://www.coloradocollege.edu/other/honorcouncil/constitution-bylaws/constitution.dot>

Disability Accommodations | If you have a disability and require accommodations for this course, please speak with me privately today or tomorrow so that your needs may be appropriately met. You may also simply email me your accommodations letter; if I have any questions I will ask you directly. If you have not already done so, you will need to register with Accessibility Resources (Learning Commons in Tutt Library, 227-8285), the office responsible for coordinating accommodations and services for students with disabilities.

My goal is to make this course successful for all. If you have a need for classroom / course accessibility that is not covered by the above statement or disability accommodations, you are welcome (not required) to discuss with me how I can best support you and your success in this class.

Tentative Course Schedule | the syllabus and schedule are **subject to change**. I have done my best to create a schedule that allows you to learn while enjoying block 8 festivities. As you all know – the success of the class requires an investment in time from everyone, the professor AND the students – please do your part.

Week 1

Day 1 – Introduction, Water Properties, Water Cycle & Water Budgets

- Hornberger Chapter 1
- Gleick 2001 Scientific American, *Making Every Drop Count*
- **PS #1** hydrologic unit conversions & basic statistics **due 4/23 9 AM**

- *Optional Help Session Tutt Science 105: 2 -3:30*

Day 2 – Ecosystem Services

- *Guest Speaker: Kate Brauman*
 - Brauman et al. 2007 Annual Review of Environment & Resources
 - Brauman 2015 Integrated Environmental Assessment & Management
- **Reflection #1** Popular Press & Hydrologic Ecosystem Services **due 4/24 8 AM**

- **Choose your scientist?** on Canvas, **due 4 PM**

Day 3 – Atmospheric Water & Precipitation

- Hornberger Chapter 2 until pg 39
- **PS #2** precipitation & where does it go? **due 4/25 4 PM**

- *Optional Help Session Tutt Science 105: 2 -3:30*

Day 4 – Interception, Evaporation, Transpiration

- Hornberger remainder of Chapter 2

- *Optional Help Session Tutt Science 105: 2 -3:30*

- *Linnemann Lecture: Dr. Diana Liverman 6 PM Celeste Theater, Cornerstone*
- **Reflection #2** Hydrologic Services in a warmer world* **due 4/26 9 AM**
**if you cannot attend the Linnemann Lecture, please let me know ASAP so that I can provide an alternative assignment for Reflection #2*

Day 5 – Infiltration & Soil Moisture

- Hornberger Chapter 8
- **PS #3** Soil & Water **due 4/29 4 PM**
- **What is notable about your scientist?** on Canvas, **due 6 PM**

Sat/Sun.

- Go over your notes; are there things you do not understand? Check out the optional reading – it is there to provide greater understanding. Perhaps one author explains it better than the other does. Please ask me questions! Send me an email; it will help me prepare my review for Monday.
- Are you on track for the Wikipedia project?

Week 2

Day 6 – *Water in the West I: Where does the Front Range get its Water?*

- Guest Speaker: Eric Hecox
 - Citizens Guide to CO Water Law available online:
<https://www.watereducationcolorado.org/publications-and-radio/citizen-guides/citizens-guide-to-colorado-water-law/>
 - Article/white paper of your choosing as related to topic OR Baldassarre et al. 2018 Nature Sustainability
- **Reflection #3:** So many straws! **due 8 AM** on Canvas

– Groundwater

- skim Hornberger Chapter 6
- **PS #4** groundwater due **4/30 4 PM**
- *Optional Wikipedia Work Session Tutt Science 105: 1:30-3:30 PM*

Day 7 – *Groundwater con't & Flow Paths & Runoff*

- **Facts about your scientist** on Canvas, **due 9 AM**
- Hornberger Chapter 6 *if you didn't read it for yesterday*
- Hornberger Chapter 10 through pg 267
- *Optional Help Session Tutt Science 105: 1:30-3:30 PM*
- *Roberts Lecture:* Dr. David Montgomery: Soil and the Fate of Civilizations, **7:30 PM**
- **Reflection #4** Shifting Hydrology, Shifting Soils?* **due 5/1 8 AM**
**if you cannot attend the Roberts Lecture, please let me know ASAP so that I can provide an alternative assignment for Reflection #3*

Day 8 – *Ecosystem Services II: Agriculture Conservation: Soil & Water*

- Guest Discussant: Dr. David Montgomery
 - Montgomery 2007 PNAS
 - Brauman et al. 2013 ERL
- GIS Lab (Tutt Library, 1st floor) mid-morning to start lab
- **1:30 Lab:** GIS Lab in the Tutt Library, 1st floor (**PS #5** Monument Creek **due 5/2 4 PM**)

Highly Recommended: 7 PM Roberts Symposium: Beyond Climate Change – The Earth in the Anthropocene

Day 9 – *Hydrographs*

- Hornberger Chapter 5
- **PS #6** Hydrograph controls **due 5/3 4 PM**
- *Optional Help Session Tutt Science 105: 1:30-3:30 PM*

Day 10 – *Water in the West II: Fire*

- **Water Justice Project Group & Topic** (Canvas) **due 9 AM**
- Robichaud 2000 J Hydrology
- Martin 2016 Phil Trans R Soc B
- DeBano et al 2000 J Hydrology

Sat/Sun

- Are you on track for Wikipedia project? Need to rethink your Water Justice project?
- Take a break! Go for a hike; veg out in your room. I beg of you, do something that helps you rejuvenate for the last week and a half of the academic year!

Week 3

Day 11 – Channel Morphology, Pebbles & Power

- *Field Trip* – South Platte & Arkansas River. Tentative schedule: meet at **8:15 AM** on Nevada side of Tutt Science (bring a lunch, snacks, water) back by 4 PM.
- Allen Chapter 3 (Canvas)
- skim Rosgen 1994 (Canvas)

Day 12 – Water meets Reality – a bit about law & policy *Honors Convocation, class ends at 10:50

- Guest Speaker: Dr. Adam Ward
 - Walsh & Ward 2019 Frontiers in Water
 - Thomas 2018 The Federal Lawyer
- **Reflection #5: The ever evolving definition WOTUS due 8 AM**
- **Wikipedia draft due 1:30 PM**
- Wikipedia Peer Review, 1:30 PM Tutt Science 105

Day 13 – Salt Tracer addition Lab MESA CREEK

- *Salt Tracer on Mesa Creek*
- **PS #7 Discharge of Mesa Creek? due 5/9 4 PM**

Day 14 – Work Day – Wikipedia Pages, Water Justice Project

- Suggested Final Exam Questions due by 9 am (Edited list posted ~10 AM)
- *Optional Exam Review, Tutt Science 105 with Nick, time TBA*

Day 15 – Oral Exam (comprehensive) sign up for a time on google doc

- **Wikipedia Biography finalized** in sandbox by **Saturday at noon.**

Sat/Sun. Llamapalooza – have fun and be responsible. Being a college student is not just about being a student but choices have consequences. Please plan accordingly.

Week 4:

Day 16 – Peer Review of papers with nourishment!

- **Draft of Final Paper due by 10 AM** (class starts at 10 AM)

Day 17 – Water Justice Campaigns

- **9 AM** Water Justice Campaign group **Presentations**
- **Final individual Papers due by 5 PM.**

Day 18 – Wrap up and celebrate your hydrologists!

- **One slide celebrating your hydrologist**