

# SWS 4245/5246 WATER RESOURCE SUSTAINABILITY

3 credits/Spring Semester

## COURSE MOTIVATION AND DESCRIPTION

This course is about the global water crisis: the challenge of providing sufficient and equitable water supply for all people while also supporting ecosystem functions. Four key themes are maintained: hydrology, ecological protection, social justice, and economic opportunity.

Global demand for freshwater resources grows continuously, while at the same time there is increasing emphasis on preventing pollution and leaving enough water for natural ecosystem functions. These combined pressures define the need for sustainable water resource management. This course describes the effects of human impacts on hydrologic ecosystems (aquifers, watersheds, coastal zones, lakes, and wetlands) with quantitative measures of impacts and mitigation/attenuation efforts. Case studies from around the world are used to illustrate both the detrimental effects of unsustainable resource utilization and the benefits of implementing sustainable resource management strategies.

This course is intended for graduate and advanced undergraduate students interested in the interactions between human civilization and hydrologic systems and should be of interest to environmental and agricultural scientists and engineers, and natural resource managers.

### Instructor

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Office hours will be following class lecture or by appointment.

## BRIEF OUTLINE

Topic	Weeks
<b>Sustainability</b>	1
<b>Historical importance of water to humans</b>	2,3
<b>Equitable water allocation (meeting present and future minimum water needs)</b>	3 -5
<b>Water quality (groundwater and surface water)</b>	6
<b>Water transfers (including flow diversion and transboundary management)</b>	7 - 10
<b>Hydraulic infrastructure (including canals and dams)</b>	11-12
<b>Water institutions (including large-scale management)</b>	13-15

## INDIVIDUAL/GROUP ASSIGNMENTS

Your success as a professional will be based, in large part, on your ability to effectively communicate your ideas in both written and verbal forms. We all need practice to develop and improve these technical communication skills.

1. All students: Weekly reading assignments will require are available on the course Canvas site at <https://lss.at.ufl.edu/>. Readings are scholarly research articles, news analyses, and commentaries.

Each Friday, a written response of at least **500 words** is due. These writings should be a critical evaluation and brief synthesis of the week’s readings, not just a summary. Required components include:

- Description of the main points and fundamental concepts of the article,
- How does this information relate to previous information?
- Answer/discussion of assigned weekly questions related to the readings.

You are likely to be called upon in class to share your comments. Typed assignments are due following the discussion period (Fridays).

2. All students: Group synthesis project about water resource sustainability. Deliverables: 1) 500-word initial vision statement, 2) Final report, plan, or creation oriented to an identified client, stakeholder, or audience, including a 15-minute pre-recorded presentation posted online.
3. Graduate students: An additional assignment will be described during the first week of class. Examples in the past have included independently research and report on the answer to a topical question about global water resources and/or independently report on a site visit to at least one hydrologic/hydraulic feature related to concepts and topics discussed in class. Important: Credit can only be received through coordination with the instructor. Due by the end of Week 13.

## GRADING SYSTEM

To reflect the different skills required for professional success, the final grade in this course is based on analytical reading/writing assignments, thoughtful and consistent participation, formal essay exams, and interesting individual and group projects.

Course components	Points for grade	
	SWS4245	SWS5246
11 weekly one-page assignments (4 points each)	44	44
Exam 1	100	100
Group project	52	37
Individual project [graduate students]	--	17
Exam 2	100	100
Class participation	37	35
<b>Total points</b>	<b>333</b>	<b>333</b>

Exams are primarily essay questions linking concepts with specific information from case studies. Exam grades are historically highly correlated to class attendance. The exam dates and times are fixed FIRMLY, and no other accommodations can be made. Late assignments will be penalized in proportion to the time since the due date, with zero credit after two weeks. Class participation entails regular, on-time attendance and engagement. Class participation points will be assigned separately for each half of the semester.

### Grade Scale

A ≥ 92 > A- ≥ 89 > B+ ≥ 86 > B ≥ 83 > B- ≥ 80 > C+ ≥ 77 > C ≥ 74 > C- ≥ 71 > D+ ≥ 68 > D ≥ 65 > D- ≥ 62 > E

“The mind does not require filling like a bottle, but rather, like wood, it only requires kindling to create in it an impulse to think independently.”

- Plutarch, c. 100 AD *Moralia, On Listening to Lectures* 48C (Loeb Classic Library 1.259)

## **COURSE SCHEDULE** (Writing assignments are due on the last date listed for each module)

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### **Week 1. Getting serious about sustainability**

**7,9,10,14 January**

Why is water important?  
What is it we wish to sustain?  
What are the typical patterns of resource exploitation?  
How long will resources last?

1. Ostrom E et al., 1999. Revisiting the commons: Local lessons, global challenges. *Science*, 284(5412), 278-282.
  2. The Economist, 2019. The UN revises down its population forecasts, 22 June, <https://www.economist.com/graphic-detail/2019/06/22/the-un-revises-down-its-population-forecasts>
  3. Graedel TE and Klee RJ, 2002. Getting serious about sustainability, *Environmental Science & Technology*, 36 (4), 523-529.
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### **2-3. Water history: Timescales of variability**

**16,17,21,23,24 January**

On what time scales do Earth systems change?  
How are water resources connected to societal development and decay?  
How have human interventions in the hydrologic cycle evolved with time?

4. Hall P, 1998. *Cities in Civilization*, Chapter 22: The Imperial Capital: Rome 50BC – AD 100, Pantheon, NY. (pp. 621-656)
  5. Jacobsen T and Adams RM, 1958. Salt and silt in ancient Mesopotamian agriculture, *Science*, 128 (3334), 1251-1258
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### **4. Water availability: Uneven distribution in space and time**

**28,30,31 January**

Where is the world's fresh water?  
When is the water there?  
How are humans using freshwater?

6. Gleick PH and Palaniappan M, 2010. Peak water limits to freshwater withdrawal and use, *Proceedings of the National Academy of Sciences*, 107(25): 11155–11162.
  7. Rodell M et al., 2018. Emerging trends in global freshwater availability. *Nature*: 1.
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### **5. Water for people**

**[4],6,7 February**

Does everyone have access to clean water and toilets?  
What are the drivers of water scarcity?  
What progress is being made?

8. Gifford R, 2011. "Phnom Penh's Feat: Getting Clean Tap Water Flowing", *NPR*, 2 June, <http://www.npr.org/2011/06/02/136394058/phnom-penhs-feat-getting-clean-tap-water-flowing>
9. The Economist, 2018. How Bangladesh vanquished diarrhea, 22 March, <https://www.economist.com/asia/2018/03/22/how-bangladesh-vanquished-diarrhoea>
10. The Economist, 2018. Why India is one of the most polluted countries on Earth, 6 December, <https://www.economist.com/asia/2018/12/08/why-india-is-one-of-the-most-polluted-countries-on-earth>
11. Kurmanaev A and Herrera I, 2019. Venezuela's Water System is Collapsing, *New York Times*, 19

**6. Groundwater: The shouting present vs the whispering future**      **11,13,14 February**

- Who uses groundwater?
- Where is groundwater?
- What happens when groundwater is pumped?
- How can groundwater be used sustainably?

12. Lightfoot DR, 1996, Syrian qanat Romani: history, ecology, abandonment, *Journal of Arid Environments*, 33, 321-336.

13. Steward, D.R., et al., 2013. Tapping unsustainable groundwater stores for agricultural production in the High Plains Aquifer of Kansas, projections to 2110, *Proceedings of the National Academy of Sciences of the United States of America*, 110(37): E3477-E3486.

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**7. Water quality: Societal response to resource degradation**      **18,20,21 February**

- How does water get contaminated?
- What are the effects of contamination?
- What are likely trajectories of societal response?

14. Pearce F, 2004. *Keepers of the Spring*, Island Press. pp. 89-107 [Arsenic in Bangladesh]

15. Maag C, 2009. From the ashes of '69, a river reborn, *New York Times*, 21 June.

16. Adler JH, 2004. Smoking out the Cuyahoga fire fable, *National Review*, 22 June.

17. The Memory Palace podcast, 2016. Oil, Water. Episode 92: 14 July.  
<https://thememorypalace.us/2016/07/oil-water/>

18. Natural Resources Defense Council, 2019. Flint Water Crisis: What's at Stake, 4 December,  
<https://www.nrdc.org/flint>

19. Gómez H and K Dietrich, 2018. The children of Flint were not 'poisoned', *New York Times*, July 22,  
<https://nyti.ms/2LFKcPB>

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**8. Water transfer: Local consumption, distant impacts**      **[25],27,28 February**

- Who uses surface water?
- Where are the important watersheds?
- How is water redistributed, both physically and virtually?
- Where are water transfers important?

**MIDTERM EXAM 28 February**

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**9. SPRING BREAK**      **2-6 March**

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**10. Water transfer: Restoration and rigidity traps**      **10,12,13 March**

- What are the impacts of water transfer?
- Can detrimental impacts be reversed?
- What is the future of water transfer?

20. China Daily, 2017. South-to-north water diversion benefits 50 million Chinese, 14 September,  
[http://www.chinadaily.com.cn/china/2017-09/14/content\\_32000250.htm](http://www.chinadaily.com.cn/china/2017-09/14/content_32000250.htm)

21. The Economist, 2018. China has built the world's largest water-diversion project, April 18, <https://www.economist.com/china/2018/04/05/china-has-built-the-worlds-largest-water-diversion-project>
22. Pearce F, 2004. *Keepers of the Spring*, Island Press. pp. 109-122 [Aral Sea]
23. Surkes S, 2019. Sinking Israel-Jordan relations leave Dead Sea, a natural wonder, low and dry, *Times of Israel*, 7 November. <https://www.timesofisrael.com/sinking-israel-jordan-relations-leave-dead-sea-a-natural-wonder-low-and-dry/>

## GROUP PROJECT VISION STATEMENT DUE 14 MARCH

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### 11. Infrastructure: Canals for transport and redistribution 17,19,20 March

What are the purposes of hydraulic structures?  
 How has the role of canals evolved over time?  
 Where are canals important?

24. Godfrey MC, and Catton T, 2011. Ch. 2 Federal Intervention: The Central and Southern Florida Flood Control Project, 1948, In *River of Interests: Water Management in South Florida and the Everglades, 1948-2010*, US Army Corps of Engineers, [pp. 19-32]
25. Godfrey MC, and Catton T, 2011. Ch. 5 Flexing the Environmental Muscle: The Cross-Florida Barge Canal, the Everglades Jetport, and Big Cypress Swamp, In *River of Interests: Water Management in South Florida and the Everglades, 1948-2010*, US Army Corps of Engineers, [pp. 69-89]

### 12. Infrastructure: Dams and flood protection structures 24,26,27 March

Why are dams built?  
 Where are dams important?  
 What is the future of hydraulic structures?

26. Yardley J, 2007. Chinese Dam Projects Criticized for Human Costs, *New York Times*, 19 November, <http://www.nytimes.com/2007/11/19/world/asia/19dam.html>
27. O'Connor et al., 2015. 1000 dams down and counting, *Science*, 348:496-497.
28. Rivera JD, and DS Miller, 2007. Continually neglected: Situating natural disasters in the African American experience, *Journal of Black Studies*, 37(4): 502-522.
29. Turrentine J, 2017. L.A.'s Concrete River Gets Real, *onEarth*, April 20, <https://www.nrdc.org/onearth/concrete-river-gets-real>

### 13. Institutions: Spatiotemporal scales of water management 31 March, [2,3],7 April

What rules are used to allocate water among competing demands?  
 How are transboundary waters managed?  
 How do asymmetries in political/economic/military power affect water allocation?

30. Munson AB, Delfino JJ, and Leeper DA, 2005. Determining minimum flows and levels: The Florida experience, *Journal of the American Water Resources Association*, 41(1): 1-10.
31. 99% Invisible podcast, 2013. Reversal of Fortune, Episode 86: August. <https://99percentinvisible.org/episode/episode-86-reversal-of-fortune/>
32. Pires M, 2004. Watershed protection for a world city: The case of New York, *Land Use Policy*, 21(2): 161-175.

## GRADUATE STUDENT INDIVIDUAL PROJECT DEADLINE

### 14. Water Institutions: Humans vs Humans, Cooperation vs Conflict 9,10,14 April

Will future wars be fought over water?

How do asymmetries in political/economic/military power affect water allocation?

33. Barnaby W, 2009. Do nations go to war over water? *Nature*, 458: 282-283.

34. Gleick PH, 2016. Water strategies for the next administration: Water policy offers opportunity for nonpartisan agreement, *Science*, 4 November, 354: 555-556.

### GROUP PRESENTATION RECORDINGS DUE 12 APRIL (SUNDAY!!)

### 15. Synthesis

16,17,[21] April

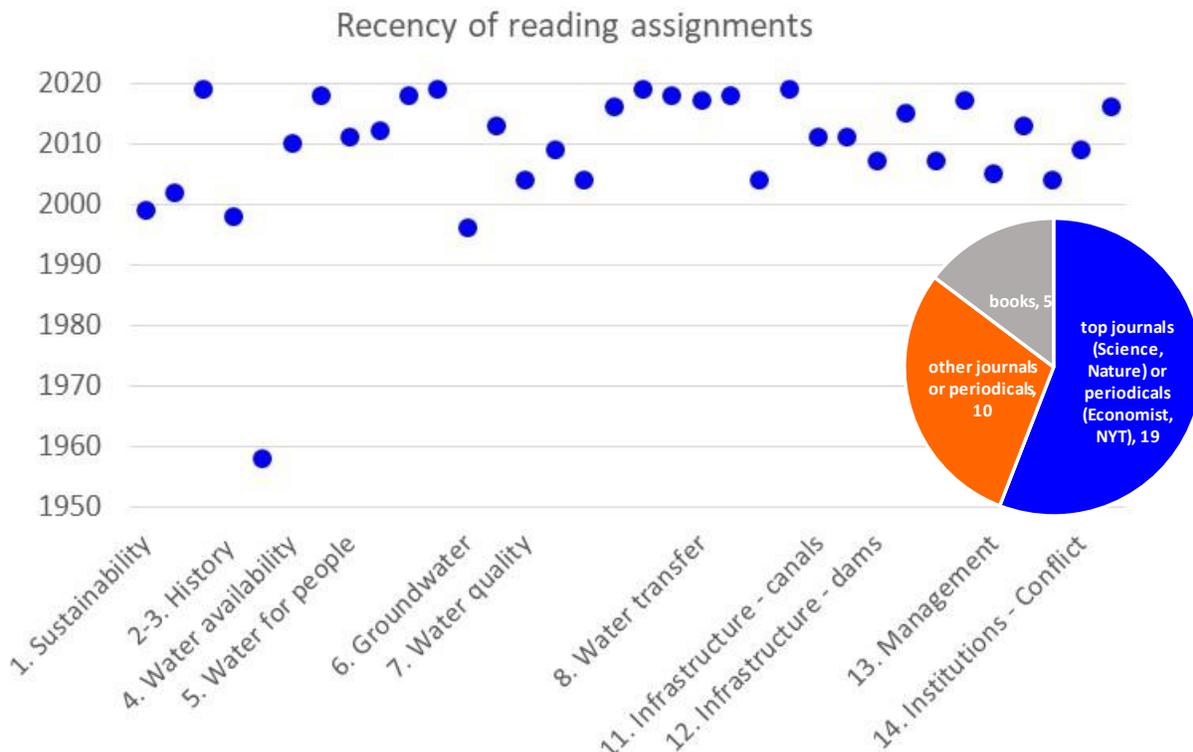
What strategies should water managers pursue to support water resource sustainability?

What about political leaders at local, state, and federal levels?

### GROUP PROJECT ROUNDTABLE 17 APRIL

### EXAM 2: 1 May 10:00-12:00 (sorry, it is not possible to take this earlier)

Reading assignment median publication year: 2011



### ***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://gatorevals.aa.ufl.edu/>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://gatorevals.aa.ufl.edu/>.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### ***Campus Resources:***

#### ***Health and Wellness***

#### **U Matter, We Care:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or  
<http://www.police.ufl.edu/>.

Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling.  
<https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints**: <http://www.distance.ufl.edu/student-complaint-process>.