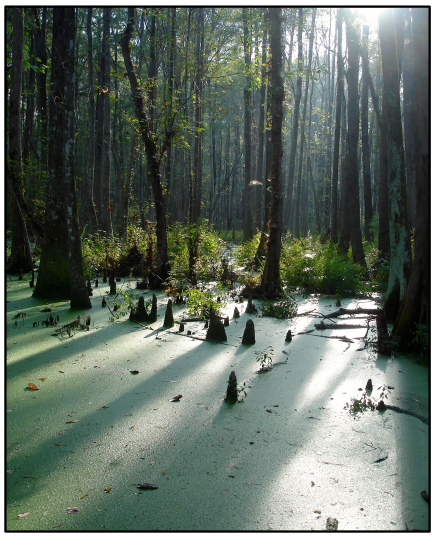
Wetland Treatment Systems

ENV 6932 (Sections 02G4, 09B4, 09B5) – Fall 2013




Catalog Description: 3 credits. Applied and theoretical aspects of wetlands use for water quality management; natural and constructed treatment wetlands; engineering and ecology of wetland systems; design for sustainability and for ancillary benefits.

Instructor: Dr. David Kaplan, Environmental Engineering Sciences
dkaplan@ufl.edu
www.watershedecology.org

Contact: Class website (UF e-Learning): https://lss.at.ufl.edu
Course e-mail: use e-Learning for correspondence
Office Hours: immediately after class and by appointment (6 Phelps Lab)

Prerequisite: Wetland Ecology (EES 6308) or instructor permission

Time and Location:

- Tuesday 11:45-1:40 (periods 5-6) in CSE E122
- Thursday 12:50-1:40 (period 6) in CSE E118

Course Description: Wetlands have been shown to remove or assimilate large quantities of nutrients (i.e., nitrogen and phosphorous), suspended sediments, and biological oxygen demand from inflowing waters. Both natural and constructed wetlands are increasingly being used to remove nutrients, metals, pesticides, and even industrial solvents from a variety of source waters including municipal, agricultural, and stormwater runoff. The primary benefit of wetland treatment systems is the low input of non-renewable energy relative to conventional water treatment systems. This graduate level course provides a thorough review of the physical, chemical, and biological processes that drive contaminant removal and gives students the opportunity to develop expertise in the planning, design, operation, and trouble-shooting of wetland treatment systems. This course was originally developed by Bob Knight, co-author of Treatment Wetlands, and benefits greatly from his vast expertise in the field.

Who Should Take This Course? This course is offered to those interested in treatment wetlands from a management or administrative perspective and for those who wish to develop their design skills. Multiple scientific and engineering disciplines are integral to treatment wetland design. This course will be of value to anyone involved with or interested in the treatment wetland technology: environmental, civil, agricultural, and wastewater engineers; biologists; environmental scientists; landscape architects; utility managers; treatment plant operators, and environmental advocates.

Reading Material:

- Required Text: Kadlec and Wallace, 2009. Treatment Wetlands, Second Edition, CRC press.
- Additional reference texts: (1) International Water Association, 2000. Constructed Wetlands for Pollution Control: Processes, Performance, Design, and Operation; (2) Wallace and Knight, 2006. Small-Scale Constructed Wetland Treatment Systems: Feasibility, Design Criteria, and O&M Requirements, WERF.
- Additional readings: Scientific literature, case studies, and agency reports; these will be made available in the course website.

Grading Scheme and Assignments:

Participation:	10%
Mini-Projects:	30%
Mid-term Exam (Oct 10th):	20%
Synthesis Paper (due November 21st):	20%
Semester Project & Presentation (due Dec 3rd):	20% (10% + 10%)

Attendance and Participation: Attending class is required (for on-campus students), and your in-class participation is strongly encouraged; it will make class a lot more interesting. For all students, your participation grade will be earned by: 1) posting a short (1-paragraph) critical write-up of each of the assigned readings and 2) replying to at least one of your classmates' posts on the course website.

Mini-Projects: Three individual and/or group mini-projects will be assigned during the semester. Consider these like homework assignments. You will have two weeks to work on each assignment.

Synthesis Paper: An original, well-written and thoroughly researched synthesis paper, focused on emerging topics in the use of wetland systems for wastewater treatment. Ideally, this paper will cover a topic that bridges your own research and the central concepts of this course. Papers should be 10-15 pages long (double-spaced, excluding figures and references). Original figures or tables (i.e., ones you develop using data from multiple sources) synthesizing information from a broad variety of sources are strongly encouraged.

- **A brief (2-paragraph) summary of your chosen topic is due to the instructor by September 17th**
- Identify potential topics by **compiling a list of 5-10 recent (2005 or later) references** about an emerging theme or application of wetland treatment systems
- **START EARLY—the paper and project (see below) are both due near the end of the semester**

Semester Project and Presentation: Group projects (3-4 students) will integrate the theoretical and applied aspects of the course. Groups will design a WTS for a specific wastewater source and location, and will produce a Basis of Design Report (BODR) and an in-class presentation. The BODR consists of a description of the problem, project goals, alternatives analysis, a description of the preferred

alternative, and implementation details (construction, permitting, budget, operations and maintenance requirements). Specific group assignments and further instructions will be distributed after the midterm (October 15th). Groups will have ~8 weeks to produce a succinct (<15 page) project report and 30-minute presentations (EDGE students will attend/present virtually, details TBD).

Grading Scale: A (≥93), A- (≥90 & <93), B+ (≥87 & <90), B (≥83 & <87), B- (≥80 & <83), C+ (≥77 & <80), C (≥73 & <77), C- (≥70 & <73), D+ (≥67 & <70), D (≥63 & <67), D- (≥60 & <63), E (<60)

Course Topics and Schedule: This schedule is tentative and subject to change based on the timing of fieldtrips, guest lecturer schedules, student interests, current events, and the whim of the instructor.

Week of	Tuesday Lecture/Discussion	Thursday Lecture/Discussion/Activity	Readings*
Aug 18	None	Introduction to Wetland Treatment Systems (WTS)	KW (1)
Aug 25	Wetland Ecology 101	Wetland Flora and Fauna	KW (2), 1
Sep 1	Wetland Hydrology	Wetland Hydraulics: The Basis for Design	KW (3), 2
Sep 8	Energy Flows and Chemistry in WTS	WTS Design I: Performance Expectations	KW (4, 5)
Sep 15	WTS Design II: WQ Modeling Tools	WTS Design III: Combining Hydraulic and WQ Models	KW (6), 3
Sep 22	WTS Data sources and Databases	Contaminant Removal Processes I: Solids and BOD	KW (7, 8)
Sep 29	Contaminant Removal Processes II: Nitrogen	Contaminant Removal Processes III: Phosphorus	KW (9, 10), 4
Oct 6	Contaminant Removal Processes IV: Metals, Organics, Pathogens, and Emerging Contaminants	**Review****	KW (11, 12, 13)
Oct 13	**Midterm (in class) – covers material through Contaminant Removal Processes IV**	Design Basis I – Planning, Permits, and Regulations	KW (16)
Oct 20	Design Basis II – Source Characterization and Wetland Type	Sizing WTS I – Event-Driven Systems	KW (14)
Oct 27	Sizing WTS II – Steady FWS Systems	Sizing WTS III – Steady SSF Systems	KW (17, 20)
Nov 3	WTS Design I – Design, Plans, and Specifications	WTS Design II – Vegetation, Construction, Planting, and Startup	KW (18, 21)
Nov 10	Management, Operations, and Maintenance	Economics	KW (22, 23)
Nov 17	Advanced Applications I: Animal Wastes + Everglades STAs	Advanced Applications II: Landfill Leachate	KW (25), 5, Video
Nov 24	Advanced Applications I: Industrial Wastewater	Thanksgiving – No Class	None
Dec 1	**Final Project Presentations*****	Reading Days – No Class	
Dec 8	**NO FINAL EXAM!**		

*KW = Kadlec and Wallace, 2009; numbered readings correspond to reading list below

**EDGE students may participate live online (details TBD)

***EDGE students must participate live online (details TBD)

Field Trips: One or two field trips will be organized to visit regional treatment wetlands. Participation is optional but strongly recommended to help you fully appreciate the material covered in this course. Trip locations and dates are TBD and will be finalized in the first few weeks of class.

Preliminary Reading List: The following readings are all available (online) through the UF Library. I will also upload them to the course website. List subject to grow, shrink, and/or change.

1. Odum, E.P., 1969. The strategy of ecosystem development. Science, 164: 262-270.
2. Hsu, C. B., Hsieh, H. L., Yang, L., Wu, S. H., Chang, J. S., Hsiao, S. C., ... & Lin, H. J. (2011). Biodiversity of constructed wetlands for wastewater treatment. *Ecological Engineering*, *37*(10), 1533-1545.
3. Kaplan, D., Bachelin, M., Muñoz-Carpena, R., & Chacón, W. R. (2011). Hydrological Importance and Water Quality Treatment Potential of a Small Freshwater Wetland in the Humid Tropics of Costa Rica. *Wetlands*, *31*(6), 1117-1130.
4. Knight, R. L., Gu, B., Clarke, R. A., & Newman, J. M. (2003). Long-term phosphorus removal in Florida aquatic systems dominated by submerged aquatic vegetation. *Ecological Engineering*, *20*(1), 45-63.
5. Nahlik, A. M., & Mitsch, W. J. (2006). Tropical treatment wetlands dominated by free-floating macrophytes for water quality improvement in Costa Rica. *Ecological Engineering*, *28*(3), 246-257.

Academic Honesty: The University of Florida requires all members of its community to be honest in all endeavors. Cheating, plagiarism, and other acts diminish the process of learning. When students enroll at UF they commit themselves to honesty and integrity. Your instructor fully expects you to adhere to the academic honesty guidelines you signed when you were admitted to UF. As a result of completing the registration form at the University of Florida, every student has signed the following statement: *"I understand the University of Florida expects it students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University."* Furthermore, on work submitted for credit by UF students, the following pledge is either required or implied: "*On my honor, I have neither given nor received unauthorized aid in doing this assignment.*" It is to be assumed all work will be completed independently unless the assignment is defined as group project, in writing by the professor. This policy will be vigorously upheld at all times in this course.

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.

Campus Counseling Resources: Students experiencing crisis or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. Both the Counseling Center and Student Mental Health provide confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal or lacking clear career and academic goals, which interfere with their academic performance. The Counseling Center is located at 301 Peabody Hall (next to Criser Hall). Student Mental Health is located on the second floor of the Student Health Services in the Infirmary.

1. *University Counseling Center*, 301 Peabody Hall, 392-1575; personal and career counseling: www.counsel.ufl.edu
2. *Student Mental Health*, Student Health Care Center, 392-1171, personal counseling:

www.hsc.ufl.edu/shcc/smhs.htm

3. *Sexual Assault Recovery Services (SARS)*, Student Health Care Center, 392-1161, sexual assault counseling; and

4. *Career Resource Center*, Reitz Union, 392-1601, career assistance and counseling.

Students with Disabilities Act: The Dean of Students Office coordinates the needed accommodations of students with disabilities. This includes the registration of disabilities, academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services, and mediating faulty-student disability related issues. *Dean of Students Office*, 202 Peabody Hall, 392-7066, www.dso.ufl.edu.