ECOHYDROLOGY
FOR 6934 (3 credits)
Fall 2011

GENERAL COURSE OVERVIEW

It is widely acknowledged that hydrological processes regulate ecological ones, but reciprocal controls - i.e., the manner and magnitude of ecological regulation of hydrologic processes (broadly construed to include geomorphic and geochemical processes) - are frequently overlooked. These ecological feedbacks are responsible for non-linearities in ecosystem responses to hydrologic perturbations, underly the development of arid and wetland patterned landscapes, help explain unexpected observations in watershed responses to rainfall, and establish a set of system-scale evolutionary constraints on organisms (the concept of "extended phenotype"). Moreover, reversing degradation of aquatic systems requires understanding the influence of, and hysteresis induced by, reciprocal controls so that the appropriate ecosystem levers can be manipulated and restoration success can be evaluated.

This course will introduce students to the field of ecohydrology via targeted examples drawn from model systems, including arid land plant-water relations, Everglades and boreal peatland patterned landscapes, biogeomorphology and nutrient chemistry of karst landscapes, continental-scale ecological (and agro-ecological) control over the hydrologic cycle, and analytical models of watershed rainfall-runoff response. Students will be expected to synthesize recent literature and demonstrate experimental competence in ecohydrologic systems analysis.

PREREQUISITES

Basic water resources course **or** Instructor Permission

HOURS AND LOCATION

Class Time: Friday 11:45-2:45 **Location:** Newins-Ziegler Hall 222

INSTRUCTOR

Matthew Cohen (Associate Professor) mjc@ufl.edu
328 Newins-Ziegler Hall (352) 846-3490
Class Website – http://sfrc.ufl.edu/ecohydrology/ecohydro.html

RECOMMENDED TEXT(S)

- *Hydroecology and Ecohydrology: Past, Present and Future.* 2007. P.J. Wood, D.M. Hannah and J.P. Sadler (eds.)

ADDITIONAL REFERENCE MATERIALS

This course leans heavily on the primary literature. Relevant papers will be assigned on each topic area. A subset of the key citations include:

- Belyea, L.R. and A.J. Baird 2006. Beyond "The Limits to Peat Bog Growth": Cross-scale feedback in peatland development. *Ecological Monographs* 76:299-322
- Brooks, P.D. and E.R. Vivoni. 2008. Mountain ecohydrology: Quantifying the role of vegetation in the water balance of montane catchments. *Ecohydrology* 1:187-192 [*inaugural issue*]
- Corenblit, D., A.M. Gurnell, J. Steiger and E. Tabacchi. 2008. Reciprocal adjustments between landforms and living organisms: Extended geomorphic evolutionary insights. *Catena* 73:261-273
- Dietrich, W.E. and J.T. Perron. 2006. The search for a topographic signature of life. *Nature* 439:411-418
- Eppinga, M.B., M. Rietkerk, W. Borren, E.D. Lapshina, W. Bleuten and M.J. Wassen. 2008. Regular Surface Patterning of Peatlands: Confronting Theory with Field Data. *Ecosystems* 11:520-536
- Fisher, S.G., J.B. Heffernan, R.A. Sponseller and J.R. Welter. 2007. Functional ecomorphology: Feedbacks between form and function in fluvial landscape ecoystems. *Geomorphology* 89:84-96
- Hatton, T.J., G.D. Salvucci and H.I. Wu. 1997. Eagleson's Optimality Theory of Ecohydrological Equilibrium: Quo Vadis? *Functional Ecology* 11:665-674
- Huxman, T.E., B.P. Wilcox, D.D. Breshears, R.L. Scott, K.A. Snyder, E.E. Small, K. Hultine, W.T. Pockman and R.B. Jackson. 2005. Ecohydrological Implications of Woody Plant Encroachment. *Ecology* 86:308-319
- McCarthy, T.S., W.N. Ellery and I.G. Stanistreet. 1992. Avulsion mechanisms on the Okavango fan, Botswana: the control of a fluvial system by vegetation. *Sedimentology* 39:779-795
- McKenney, R., R.B. Jackson and R.C. Wertheimer. 1995. Woody vegetation and channel morphogenesis in low-gradient gravel-bed streams in the Ozark Plateaus, Missouri and Arkansas. *Geomorphology* 13:175-198
- Newman, B.D. et al. 2006. Ecohydrology of water limited environments: A scientific vision. *Water Resources Research* 42
- Rodriguez-Iturbe, I., P. D'Odorico, F. Laio, L. Ridolfi, and S. Tamea. 2007. Challenges in humid land ecohydrology: Interactions of water table and unsaturated zone with climate, soil, and vegetation. *Water Resources Research* 43
- Rodriguez-Iturbe, I. 2000. Ecohydrology: A hydrologic perspective of climate-soil-vegetation dynamics. *Water Resources Research* 36:3-9
- Scanlon, T.M. K.K. Caylor, S.A. Levin and I. Rodriguez-Iturbe. 2007. Positive feedbacks promote power law clustering of Kalahari vegetation. *Nature* 449:209-213
- Stallins, J.A. 2006. Geomorphology and ecology: Unifying themes for complex system in biogeomorphology. *Geomorphology* 77:207-216
- Van Hulzen, J.B., J. van Soelen and T.J. Bouma. 2007. Morphological Variation and Habitat Modification are Strongly Correlated for the Autogenic Ecosystem Engineer *Spartina anglica* (common cordgrass). *Estuaries and Coasts* 30:3-11
- Wilcox, B.P., D.D. Breshears and C.D. Allen. 2003. Ecohydrology of a resource-conserving semi-arid woodland: effects of scale and disturbance. *Ecological Monographs* 73:223-239
- Zalewski, M. 2002. Ecohydrology – the use of ecological and hydrological processes for sustainable management of water resources. *Hydrological Sciences* 47:823-831.

PERFORMANCE EVALUATION

Grading Scale:

A	= 100-90	C	= 75-70
B+	= 89-86	D+	= 69-66
B	= 85-80	D	= 65-60
C+	= 79-76	E	<60

Assignments

Discussion Lead and Participation	20%
Synthesis paper and presentation	40% (25% + 15%)
Group experimental design, implementation and manuscript	40%

Notes:

- Class attendance is required.
- Synthesis papers are due **October 7th**. Presentations will be in class the two weeks of September 28th and October 5th.
- Groups of students (n=3-4) will design an experiment of their choosing to test a tractable hypothesis, execute the experiment under the guidance of the instructor and write up the results in journal article format. Grades will be based on instructor (25%) and peer (25%) review. Final manuscripts are due before Dec. 14th.

DISCUSSION LEAD

- Identify two-three papers (primarily from the journal "**Ecohydrology**") of interest to you and thematically linked
- Provide papers to the class 1 week ahead of time – everyone reads them
- Lead a discussion on the papers (objectives, methods, findings, limitations, implications)
- Everyone participates every week

SYNTHESIS PAPER

- Start early(!) A topic area summary of your chosen topic is due to the instructor by September 8th. Focus on topic areas that occupy the overlap between your own research and the central concepts of this course.
- Papers are expected to be ~20-30 pages long.
- Presentation of your research (15-20 minutes) will be required.

GROUP EXPERIMENT AND MANUSCRIPT

- Start early(!) Draft questions, hypotheses and predictions are due October 13th. In addition to "indices of interestingness", consider the tractability of your question.
- What is your experimental design? How many samples will you require?
- A presentation of your findings at the end of class (conference format – 15 mins + 5 for questions) and a manuscript will be your deliverables.

ECOHYDROLOGY COURSE SCHEDULE (FALL 2011)

Week of…	Lecture (1.5 hrs)	Discussion (1.5 hrs)	Due Dates
Aug-26th	Why Ecohydrology?	Course Structure, Expectations	
Sep-2nd	Ecohydrological equilibria and Eagleson's Hypothesis	Instructor: Soil Moisture - A Keystone Variable in Water Limited Ecosystems	
Sep-9th	Arid land ecohydrology	Student: Arid Land Ecohydrology	
Sep-16th	Ecohydrologic imprinting of streamflow at the watershed scale	Student: Ecohydrology of Streamflow	
Sep-23rd	Alternative stable states in desert streams	Student: Ecological Effects on Sediment Stabilization and Export	
Sep-30th	Humid land ecohydrology	Instructor: Ecohydrology of the Okavango - Channel avulsion	
Oct-7th	**CLASS PRESENTATIONS**	**CLASS PRESENTATIONS**	**SYNTHESIS PAPER DUE**
Oct-14th	Humid land ecohydrology	Student: Shallow water table ecohydrology	
Oct-21st	Patterned peatlands: boreal	Student: Patterned peatlands	
Oct-28th	Karst ecohydrology	Student: Biological controls on carbonate dissolution	
Nov-4th	Biogeomorphology	Student: Biological controls on terrain	
Nov-11th		**NO CLASS - HOMECOMING**	
Nov-18th	Ecohydrology and element cycles	Student: Stream nutrient processing	**DRAFT PAPER DUE**
Nov-25th		**NO CLASS - THANKSGIVING**	
Dec-2nd	Biological controls on element cycles: P in the Everglades	Ecohydrology and restoration	
Dec-9th	**CLASS PRESENTATIONS**	**CLASS PRESENTATIONS**	**FINAL PAPER DUE**

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ADDITIONAL INFORMATION

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 Helping Resources:
Students experiencing crisis or personal problems that interfere with their general wellbeing 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.**