BIO 464/564: Stream and Watershed Ecology

Lecture (Wimberley 210): MWF 8:50 – 9:45 am

Instructor:
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Course Purpose and Goals:
During successful participation in and completion of this course, the student will:

- Develop critical thinking and quantitative problem solving abilities to understand the dynamics of fluvial ecosystems and their watersheds
- Understand how water is transported through watersheds
- Understand biological transformations of energy and matter through fluvial ecosystems
- Understand the abiotic and biotic factors that control fluvial ecosystem structure and process rates
- Develop computational tools to evaluate and compare hydrologic and geomorphologic responses to anthropogenic watershed transformations
- Expand personal and interpersonal skills in scientific communication through active involvement in learning about fluvial ecosystems including group activities that focus on analysis, investigation, and reporting results
- Understand and objectively discuss primary research literature pertaining to fluvial ecosystems

Required Materials:

- Allan, J. D. and Castillo, M. M. 2007. Stream Ecology – Structure and Function of Running Waters, Second Edition. Springer, New York, New York.
- Hauer, F. R. and Lamberti, G. A. 2007. Methods in Stream Ecology, Second Edition. Academic Press, New York, New York.

Website:
The website (on Desire2Learn [D2L]) is where you will find class notes, reading assignments, the most up to date copy of this syllabus, your current grade, and other important information and documents. It is vital you check the website regularly. I highly recommend you print the notes, put them in a binder, and bring them to class.

Grading:
Below is a current list of items that will be graded. The instructor reserves the right to make modifications to this list. The grading scale used in this class is also listed below.

Item	Points
Midterm Exams (2)	200
Final Exam (1)	150
RCC Quiz	20
Data Sets (6)	120
Talking Points (18)	100
Presentation (1)	100
Participation	40
Total	730

OR

Item	Points
Midterm Exams (2)	200
Final Exam (0)	
RCC Quiz	20
Data Sets (6)	120
Talking Points (18)	100
Presentation (1)	100
Participation	40
Total	580

Grade	%
A	92-100
AB	88-91
B	81-87
BC	77-80
C	67-76
D	55-66
F	<54

Exams and RCC Quiz:
All three exams will be take-home exams and answers must be typed. The final exam will be optional. Take the final if you want the opportunity to improve your grade or do not take the final if you are satisfied you're your grade at that time.

Students are encouraged to use any materials they wish to answer the questions on the take-home exams, however, students must work independently and all answers must be in your own words and references used must be cited within the answer they were used. A bibliography must also be attached to the exam. Exams are due by 11:59pm in the D2L dropbox on the due date. This should go without saying, but plagiarism will not be tolerated and will result in a zero on the exam. Word-for-word copying from references, even if cited, is still considered plagiarism. Occasional use of cited quotes is allowed. If you have questions, please ask.

Without question, the River Continuum Concept (RCC) is the guiding paradigm in the field of stream ecology. To facilitate learning in this class it is important that all students be familiar with the ideas presented in the RCC from the beginning. All students should thoughtfully read the paper by Vannote et al. (1980) and on the third day of class there will be a quiz on the basic ideas presented in the paper.

Reading Assignments and Talking Points:
Almost every week students will lead classroom discussions on papers that are relevant to the topics covered in class. Each undergraduate student will only need to lead one discussion. The papers were picked to either add extra details or to provide additional topics related to the lecture. The general ideas given in the papers are fair game on the exams. Therefore, all students should read all the papers. The student assigned to a particular paper will be expected to summarize the paper to the class in 10 minutes (it is expected that shorter papers will be more thoroughly summarized) and then lead the class in a discussion of the paper for another 5 minutes. In addition, the assigned student should write down a list of ~5 discussion questions and distribute them to me and the other students on the day of discussion (these substitute for talking points).

At the end of each class period that includes a discussion of a reading assignment, each student shall hand in a typed "talking points" page. A talking points page should consist of 4-5 bulleted items per article. The bulleted items could be questions that arose during the reading, criticism of ideas/techniques presented in the reading, tangential thoughts related to an idea in the paper, etc. Talking points are designed to promote critical thinking and facilitate discussion among the class. Each talking point needs to be only long enough for your use in discussion, but it must be at least one (complete) sentence long and they **must be typed** (these have to be completed before you come to class). A total of 18 talking points, i.e., responses to 18 articles, will be graded. The first 17 articles are worth 5 pts each for 85 pts, and the 18th article is worth 15 pts. Talking points are worth a total of 100 points.

Data Sets:
Throughout the semester students will individually work with data collected during actual ecosystem related studies. The data sets will be related to the concepts presented in lecture (i.e., an application of the concepts). The purpose of these exercises are to: a) see how ecosystem concepts have been applied to actual ecological questions; and b) gain practice in processing, graphing, and analyzing ecosystem data. For each data set assignment students will upload into the D2L dropbox: 1) a MS Word file containing answers to questions and required graphs; and 2) MS Excel file containing all calculations. Assignments are due by 11:59pm on the due date. Late submissions will be penalized 20% per day. Seven data sets will be analyzed (6 @ 20 points each for a total of 120 points).

Saturday Field Day:
On Saturday, April 8th we will be conducting a physical/chemical/biological survey on a local stream reach. We will meet in the football stadium parking lot at 8:00 a.m. and car pool to the survey site. We will work through the morning, take a lunch break and finish the survey around 2:30 p.m. We will travel back to campus to store and record samples and to stow gear. We will finish between 4:30 – 5:00 p.m. Please make arrangements now with your employer and family to attend this field trip. The quality of your involvement in the field will be factored into the class participation portion of your grade. Also, the data collected on this trip will be analyzed as a graded data set.

Student Presentations:
The presentations will consist of the student groups (random, 4-5 students) presenting the lecture for the day on a topic related to human impacts on some aspect of stream ecology. The presentations must be approximately 45 minutes in length with 10 minutes for questions. Everyone in the group must be part of the oral presentation and everyone must use visual aids (e.g., PowerPoint slides). Presentations will be scored by classmates and by the instructor. Grades will be assigned using the classmate (25% weight) and instructor (75% weight) scores. Each student will be expected to evaluate all presentations. Additional details will be provided later. Potential topics: Climate change, Nutrient pollution and eutrophication, Urbanization, Dams and dam removal, Non-nutrient pollution, and Invasive species.

Class Participation
Although it is just 5.5 – 7% of your final grade, I consider participation to be necessary in this upper division class. So to do well on the participation portion of the course you will need to (1) be in attendance and on time to lecture, (2) engage in the literature discussions, (3) ask questions, and (4) be engaged on the field day.

Students with disabilities
UWL policies concerning students with disabilities will be observed. Any student with a documented disability (e.g., ADHD, autism spectrum disorder, acquired brain injury, PTSD, physical, sensory, psychological, or learning disability) who needs to arrange reasonable accommodations must contact the instructor and the ACCESS Center office (165 Murphy, 785-6900) at the beginning of the semester. Students who are currently using the ACCESS Center will have a copy of a contract that verifies they are qualified students with disabilities who have documentation on file in the ACCESS Center office. It is the student's responsibility to communicate their needs with the instructor in a timely manner. For more information about the ACCESS center, refer to their website at: https://www.uwlax.edu/access-center/

Return of Graded Work
Generally, I return work that requires individual feedback within 14 days from the date the work was due (usually much faster). I will notify you if I am unable to grade the work within the 14-day timeframe, and will identify a revised return date. If you submit work after the due date, it may not be returned within 14 days. Your graded coursework will be returned in compliance with FERPA regulations, such as in class, during my office hours, or via the course management system through which only you will have access to your grades. Final exams will not be returned, but you may come to my office to see your graded exam after the final exam scores are posted.

Student Evaluation of Instruction (SEI)
UWL conducts student evaluations electronically. Approximately 2 weeks prior to the conclusion of a course, you will receive an email at your EagleApps address directing you to complete an evaluation for each of your courses. In-class time will be provided for students to complete the evaluation in class. Electronic reminders will be sent if you do not complete the evaluation. The evaluation will include numerical ratings and, depending on the department, may provide options for comments. The university takes student feedback very seriously and the

information gathered from student evaluations is more valuable when a larger percentage of students complete the evaluation. Please be especially mindful to complete the surveys.

Academic Dishonesty

Strict adherence to UWL policies will be maintained, consult the student handbook (http://www.uwlax.edu/student-life/student-resources/student-handbook/) for full details. What is academic dishonesty? Here is the official UWL definition:

Academic misconduct is an act in which a student:

a) Seeks to claim credit for the work or efforts of another without authorization or citation;
b) Uses unauthorized materials or fabricated data in any academic exercise;
c) Forges or falsifies academic documents or records;
d) Intentionally impedes or damages the academic work of others;
e) Engages in conduct aimed at making false representation of a student's academic performance; or
f) Assists other students in any of these acts.

General Advice for Success:

In Biology 464/564, you will be expected to learn and understand numerous scientific concepts and terms which may be entirely new to you. Because we will cover many topic areas, you will need to study on a regular basis. The best ways to help your grade:

- Attend every lecture
- Take copious notes, but focus on the meaning
- Form study groups
- Actively read the textbook
- After lecture, read the books/papers again, and use it to fill in your notes
- Learn as you go; study an hour and a half a day for five days rather than cramming the material all in one day
- Do all the assignments. Think about what you are doing
- Do not procrastinate
- Finally, speak up in class when you do not understand, because if you are lost, fellow students are probably also confused. Questions are highly encouraged

Tentative Class Schedule:

Date		Day	Topic	Data Sets	Exams
Jan.	23	M	Introduction		
	25	W	Streamflow and Hydrology		
	27	F	Streamflow and Hydrology		*RCC Quiz*
	30	M	Streamflow and Hydrology	*Rivers of the World DS Due*	
Feb.	1	W	*Student-Led Literature Discussion*		
	3	F	Fluvial Geomorphology		
	6	M	Fluvial Geomorphology		
	8	W	Streamwater Chemistry	*Streamflow DS Due*	
	10	F	Streamwater Chemistry		
	13	M	*Student-Led Literature Discussion*		
	15	W	Physical Environment		
	17	F	Physical Environment	*Hubbard Brook DS Due*	
	20	M	Physical Environment		
	22	W	*Student-Led Literature Discussion*		
	24	F	*Exam 1*		*Exam 1 handed out*
	27	M	Primary Producers		
Mar.	1	W	Primary Producers		
	3	F	Detrital Energy Sources		*Exam 1 due*
	6	M	*Student-Led Literature Discussion*		
	8	W	Detrital Energy Sources		
	10	F	*Student-Led Literature Discussion*		
	13	M	Spring Break – No Class		
	15	W	Spring Break – No Class		
	17	F	Spring Break – No Class		
	20	M	Lotic Communities		
	22	W	Lotic Communities		
	24	F	*Student-Led Literature Discussion*		
	27	M	Trophic Relationships		
	29	W	Trophic Relationships		
	31	F	Trophic Relationships		
Apr.	3	M	*Student-Led Literature Discussion*		
	5	W	Group Work		
	7	F	Nutrient Dynamics	*Stream P Fertilization DS Due*	
	8	Sat	Field Trip		
	10	M	*Exam 2*		*Exam 2 handed out*
	12	W	Nutrient Dynamics		
	14	F	Nutrient Dynamics		
	17	M	Stream Metabolism		*Exam 2 due*
	19	W	Stream Metabolism		
	21	F	*Student-Led Literature Discussion*	*Field Trip DS Due*	
	24	M	Fish/Wildlife Harvesting	(Kenna, Nate, Owen, Mitch R.)	
	26	W	Climate Change	(Matt, Lexi, Courtney, Marissa)	
	28	F	MRRC – No Class	*Stream Metabolism DS Due*	*Final Exam handed out*
May	1	M	Invasive Species	(Mitch M., Ryan, Cody, Emily)	
	3	W	Nutrient Pollution	(Shania, Maggie, Dustin)	
	5	F	Urbanization	(Rachel, Cory, Courtney, Skylar)	
	9	Tu			*Final Exam Due (2:15pm)*

Reading Assignments

Date	Reading Assignments	Responsible Student
2/1	Belmar et al. (2013)	Matt Hlina
	Hatt et al. (2004)	Dustin McHenry
	Ward and Stanford (1983)	Nate Heili
2/13	Argerich et al. (2013)	Cody Bahr
	Bernot et al. (2016)	Marissa Despins
	Junk et al. (1989)	Kenna Breckner
2/22	Krider et al. (2013)	Courtney Swanson
	Steuer et al. (2009)	Ryan Bunting
	Frissell et al. (1986)	Skylar Schoh
3/6	Cardinale (2011)	Brian Thome
	Cotton et al. (2006)	Mitchell Reis
3/10	Rosemond et al. (2015)	Emily Healy
	Wallace et al. (2015)	Cory Reinen
3/24	Hildebrand et al. (1999)	Owen Henriksen
	Power (1990)	Courtney Purcell
	Zeug and Winemiller (2008)	Margaret Knight
4/3	Dudley et al. (1990)	Elexius Passante
	Riley et al. (2008)	Rachel Larson
4/21	Ensign and Doyle (2005)	----
	Evans-White and Lamberti (2006)	Shania Leask
	Whiles et al. (2013)	Mitch McCloskey

Reading Assignment Citations

Argerich, A., S. L. Johnson, S. D. Sebestyen, C. C. Rhoades, E. Greathouse, J. D. Knoepp, M. B. Adams, G. E. Likens, J. L. Campbell, W. H. McDowell, F. N. Scatena, and G. G. Ice. 2013. Trends in stream nitrogen concentrations for forested reference catchments across the USA. Environmental Research Letters 8:014039.

Belmar, O., J. Velasco, C. Gutiérrez-Cánovas, A. Mellado-Díaz, A. Millán, and P. J. Wood. 2013. The influence of natural flow regimes on macroinvertebrate assemblages in a semiarid Mediterranean basin. Ecohydrology 6:363-379.

Bernot, M. J., J. C. Becker, J. Doll, and T. E. Lauer. 2016. A national reconnaissance of trace organic compounds (TOCs) in United States lotic ecosystems. Science of The Total Environment 572:422-433.

Cardinale, B. J. 2011. Biodiversity improves water quality through niche partitioning. Nature 472:86-89.

Cotton, J. A., G. Wharton, J. A. B. Bass, C. M. Heppell, and R. S. Wotton. 2006. The effects of seasonal changes to in-stream vegetation cover on patterns of flow and accumulation of sediment. Geomorphology 77:320-334.

Dudley, T. L., C. M. Dantonio, and S. D. Cooper. 1990. Mechanisms and consequences of interspecific competition between two stream insects. Journal of Animal Ecology 59:849-866.

Ensign, S. H., and M. W. Doyle. 2005. In-channel transient storage and associated nutrient retention: Evidence from experimental manipulations. Limnology and Oceanography 50:1740-1751.

Evans-White, M. A., and G. A. Lamberti. 2006. Stoichiometry of consumer-driven nutrient recycling across nutrient regimes in streams. Ecology Letters 9:1186-1197.

Frissell, C. A., W. J. Liss, C. E. Warren, and M. D. Hurley. 1986. A hierarchical framework for stream habitat classification: viewing streams in a watershed context. Environmental Management 10:199-214.

Hatt, B. E., T. D. Fletcher, C. J. Walsh, and S. L. Taylor. 2004. The influence of urban density and drainage infrastructure on the concentrations and loads of pollutants in small streams. Environmental Management 34:112-124.

Hilderbrand, G. V., T. A. Hanley, C. T. Robbins, and C. C. Schwartz. 1999. Role of brown bears (Ursus arctos) in the flow of marine nitrogen into a terrestrial ecosystem. Oecologia 121: 546-550.

Junk, W. J., P. B. Bayley, and R. E. Sparks. 1989. The flood pulse concept in river-floodplain systems. Proceedings of the International Large River Symposium. Canadian Special Publications of Fisheries and Aquatic Sciences 106:110-127.

Krider, L. A., J. A. Magner, J. Perry, B. Vondracek, and L. C. Ferrington. 2013. Air-water temperature relationships in the trout streams of southeastern Minnesota's carbonate-sandstone landscape. Journal of the American Water Resources Association 49:896-907.

Power, M. E. 1990. Effects of fish in river food webs. Science 250:811-814.

Riley, L. A., M. F. Dybdahl, and R. O. Hall Jr. 2008. Invasive species impact: asymmetric interactions between invasive and endemic freshwater snails. Journal of the North American Benthological Society 27:509-520.

Rosemond, A. D., J. P. Benstead, P. M. Bumpers, V. Gulis, J. S. Kominoski, D. W. P. Manning, K. Suberkropp, and J. B. Wallace. 2015. Experimental nutrient additions accelerate terrestrial carbon loss from stream ecosystems. Science 347:1142-1145.

Steuer, J. J., J. D. Bales, and E. M. P. Giddings. 2009. Relationship of stream ecological conditions to simulated hydraulic metrics across a gradient of basin urbanization. Journal of the North American Benthological Society 28:955-976.

Vannote, R. L., G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. E. Cushing. 1980. The river continuum concept. Canadian Journal of Fisheries and Aquatic Sciences 37:130-137.

Wallace, J. B., S. L. Eggert, J. L. Meyer, and J. R. Webster. 2015. Stream invertebrate productivity linked to forest subsidies: 37 stream-years of reference and experimental data. Ecology 96:1213-1228.

Ward, J. V., and J. A. Stanford 1983. The serial discontinuity concept of lotic ecosystems. Pages 29-42 in I. T.D. Fontaine and S. M. Bartell (editors). Dynamics of Lotic Ecosystems. Ann Arbor Science Publishers, Ann Arbor.

Whiles, M. R., R. O. Hall, W. K. Dodds, P. Verburg, A. D. Huryn, C. M. Pringle, K. R. Lips, S. S. Kilham, C. Colón-Gaud, A. T. Rugenski, S. Peterson, and S. Connelly. 2013. Disease-driven amphibian declines alter ecosystem processes in a tropical stream. Ecosystems 16:146-157.

Zeug, S. C., and K. O. Winemiller. 2008. Evidence supporting the importance of terrestrial carbon in a large-river food web. Ecology 89:1733-1743.