Graduate Seminar in Physical Geography:
Watershed Biogeochemistry
Geography 7032 (3 credit hours, graduate)
Spring Semester 2015

**Course Time and Location:**
Tues 2:00 - 4:00
Braunstein 402

**Instructor:** Dr. Ishi Buffam
**Email:** ishi.buffam@uc.edu
**Office:** Rieveschl 731H

**Summary:** In this interdisciplinary seminar course, graduate students will explore the relationship between watershed characteristics (geology, topography, vegetation, land use, climatic context) and the characteristics of freshwater ecosystems. The main focus will be on biogeochemical cycling, i.e. the patterns and processes related to the flow of bio-active elements through terrestrial landscapes and into streams and lakes. As the course develops, we will place emphasis on spatial patterns in watershed characteristics, as well as spatial patterns within stream and lake ecosystems. How much is spatial variation in the terrestrial landscape reflected in spatial variation in the hydroscape? What degree of spatial aggregation is appropriate for scientific study of watershed-stream relationships?

After an introduction by the instructor, the course will revolve around in-class discussions of primary scientific literature, with papers ranging from classic foundational papers, to new publications on the cutting edge of the discipline. All students will be actively involved in selecting papers and will be responsible for leading paper discussions. Thus, the interests of the students will influence the direction of the class over the course of the semester. Each student will also develop, write and present an independent research proposal, based on a knowledge gap that they identify within the course theme.

**Learning Outcomes:** Students successfully completing this course will be able to:

1. Identify the major elements in the historical and current scientific understanding of the relationship between watershed characteristics and surface water biogeochemistry, and identify the type of data/data sources behind these elements.
2. Evaluate the degree of spatial aggregation appropriate for different research questions related to watershed-stream relationships.
3. Critically evaluate the methodologies used in published or proposed watershed biogeochemistry studies, and assess their validity in the study context.
4. Organize and manage a group discussion/critique of a peer-reviewed scientific paper.
5. Develop, write, present and defend a new scientific research proposal.

Expectations: As this is a discussion-based class, your attendance and participation in an informed discussion of each week's papers is expected and makes up the major part of the grade for the class. For the first part of the class, readings have been selected by the instructor, and there will be an assigned presenter. Later in the course, presenters will choose their own articles to present, from within the course theme. For these days, if you are the presenter you are expected to select a few (usually 2) articles on your chosen topic and create a short bibliography (Citations to 5-15 related articles) on the topic for the class to access. They will then upload the papers and bibliography to the Bb site (under Course Documents section, subfolder for your day) at least 7 days prior to class. Following class, you should upload the powerpoint file into the same Bb folder. Readings have been drawn from the scientific literature, mainly from primary sources; these will be available through the course Blackboard site. Students are expected to have carefully read them and reached a fair level of understanding prior to coming to class.

Discussion Questions Prior to Class: By NOON on the day of class, every student (except for the presenter of that day) should email to the instructor a set of three questions specific to the paper(s) being discussed that day. This should include at least one question related to each paper, and the questions should be designed to motivate discussion on the paper, OR should highlight a question that arose/gap noted in the paper.

Discussion Article Selection: For the second half of the course, you will have the opportunity to select articles for the day you lead discussion. The articles need to be run by the course instructor for approval by (at latest) 8 days prior to the class meeting, and posted to the Bb site under “Course Documents” by (at latest) the beginning of class 7 days before your class meeting. A good approach is to select one general review or broad conceptual article, and one more specific research article. They should address, at least in part, the theme of the relationship between watershed characteristics and aquatic biogeochemistry. However, feel free to be creative and explore related topics of interest to you. You can also include articles that take a strong position, as long as at least one of the articles gives enough of the context for the class to be informed consumers of the position piece. You can upload a message on the Bb site with the articles, letting the other students in the class know how you’d like them to approach the articles, which one you’d like them to focus on primarily, and so on.

Discussion Format: The class leader gives a presentation (typically 15-30 minutes) introducing the day’s topic and going through the paper(s). For a powerpoint presentation, about 1 slide per minute is recommended. A typical presentation approach for a research article would be Introduction to the topic (3-4 minutes), Description of the Methodological approach taken (2-3 minutes), Description of the Results and Key Points Made in the article...
are several steps along the way to creating the proposal, with the following timeline:

**Note**, the sample proposal should not be distributed outside of the class.

Keyword definitions. Keywords will be assigned for each class period, typically a week or more beforehand. Each student will be assigned specific word(s) for that day. In order to receive credit for your assignment, a relevant, complete definition of the keyword must be handed in to me prior to noon on the day of class. This can be carried out electronically, via email (ishi.buffam@uc.edu). Sloppy and/or cursory work will not receive credit. During class, each student will also describe the meaning of their keyword in their own words, without the help of notes or visual aids. The instructor will maintain a working document of all the collective keywords on Blackboard as a reference, and as a study guide for the end-of-course terminology quiz.

Proposal: The individual proposal is due April 7 and should be turned in as an MS Word or Adobe pdf document under the Assignments section on the Bb site. As a starting point, you should identify a gap in the knowledge, involving any topic within the general theme of the course – this could be the same topic as you used for your in-class discussion, or it could be something new. It should be substantively distinct from your graduate research project. The proposal will be written with the purpose of seeking funding for a project to fill the identified knowledge gap.

This is an individual project to be completed independently. If you know that you are going to be addressing a similar issue as someone else in the class, you should coordinate with them at the outset and pick different aspects of the main theme to focus on. The format is National Science Foundation (NSF) Division of Environmental Biology pre-proposal format, which has a page limit of 4 pages (single-spaced, Times New Roman 11-point font OR Arial 10-point font, 1” margins all sides) of Project Description including figures; PLUS a single-page Project Summary (up to 500 words). You will also have additional pages of reference list, not included in the page limit. In the Course Documents/Proposal folder, you can find a detailed description of the NSF proposal expectations and format, as well as a sample proposal. Note, the sample proposal should not be distributed outside of this class. There are several steps along the way to creating the proposal, with the following timeline:

2/17: Propose topic to instructor. This could be a few sentences and a follow-up discussion.
2/24: Finalize topic. You may have precisely identified the key knowledge gap your proposal will fill, or it may still be a little vague – that’s ok.
3/3: Annotated bibliography due, along with a clearly identified knowledge gap that you will address with your proposal – we will discuss and help you refine these, in class
3/24: Draft Proposal due – this is a fully written and carefully edited proposal
3/31: Proposal feedback – read and comment on your peer’s proposals, highlighting strengths and weaknesses, and make suggestions for improvement
4/7: Final Proposal due – this is a further refined proposal, incorporating your peer’s suggestions as appropriate to make for the strongest possible proposal
4/14: Presentation of Proposal in class, ca. 20 minute powerpoint including Background, Question/Knowledge Gap, Proposed Methods, Expected Outcomes and Significance of Research

Annotated Bibliography (due 3/3): This assignment is an annotated bibliography of articles or books relevant to your chosen research project. See below for details. For instructions on annotated bibliography see: http://olinuris.library.cornell.edu/ref/research/skill28.htm

To get full credit you will need to:

1. Choose 20 or more unique articles/books, including at least 15 peer-reviewed journal articles, which are relevant to your proposal project.

2. Demonstrate that you have read and understand the main points of the articles by giving a succinct annotated bibliography IN YOUR OWN WORDS.

Let me know if you have any trouble with the logistics of this project, i.e. finding articles. I usually use Web of Knowledge (http://apps.webofknowledge.com), and that will link directly to pdf files of articles. If you are located off-campus, you will have to use VPN (http://www.uc.edu/ucit/internet/offcampus.html) to access this database through UC. Keep in mind, these articles will be useful to you in writing your proposal! The annotated bibliography will be graded on citation format (use the APA format: http://www.apastyle.org/learn/tutorials/basics-tutorial.aspx), completeness (is context described, what are papers about), and appropriateness (are main results of the paper described, and is it clearly relevant to your project theme).

I always find in writing a paper or proposal that it is difficult to select a scope that is not too big and not too small – as a starting point it is helpful to do a literature search. For journal articles I usually use Web of Knowledge with a search of key terms, and make sure that I can find a few dozen relevant-seeming papers on my topic. If there are several hundred, the topic is too broad. If there are less than five or so, the topic may be too narrow – or may just require more digging to get the crucial references. If you find a book or two on your topic, you can add those in the mix. If you find lots of books, pick a more focused (or more current) topic!
**Grading Policy:** The course is graded on a traditional letter scale, with the breakdown of the final grade as follows:

- Paper Presentations (2): 20%
- Paper Questions: 10%
- Active Participation in Discussion: 30%
- Keywords: 5%
- Annotated Bibliography: 5%
- Proposal Presentation: 10%
- Written Proposal: 15%
- End-of-course Quiz: 5%

**Additional Student Responsibility:** Class information and communications will be disseminated online through Blackboard. It is your responsibility to download and read (and print out, if desired) the required readings prior to the beginning of class. Please let me know if you are having trouble with Bb.

**The work you will do in this course is subject to the University of Cincinnati Code of Conduct.** The Code of Conduct is a commitment to the highest degree of ethical integrity in academic conduct, a commitment that, individually and collectively, the students of the University of Cincinnati will not lie, cheat, or plagiarize to gain an academic advantage over fellow students or avoid academic requirements. You will prepare your assignments independently unless otherwise indicated by the instructor. If you are unsure about the rules for a particular assignment, it is your responsibility to ask the instructor. The Student Code of Conduct (SCOC) document can be accessed at: [http://www.uc.edu/conduct/Code_of_Conduct.html](http://www.uc.edu/conduct/Code_of_Conduct.html).

**Special Needs Statement:** If you have any special needs related to your participation in this course – including identified visual, hearing or physical impairments, a communication disorder, and/or a specific learning disability that may influence your performance in this course – please contact me to arrange for reasonable provisions to ensure an equitable opportunity to meet all course requirements. Some accommodations may require prior approval by Disability Services (513-556-6823).
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<th>Date</th>
<th>Class Leader</th>
<th>Topic</th>
<th>Readings/Assignment Due</th>
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<tr>
<td>1/13</td>
<td>T Buffam</td>
<td>1. Introduction, Course Logistics, Syllabus</td>
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<td>1/20</td>
<td>T Buffam</td>
<td>2. Stream chemistry and small watershed approach to studying biogeochemistry</td>
<td>Borrman &amp; Likens 1967, Allan Ch. 4</td>
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<td>1/27</td>
<td>T Mitchell</td>
<td>3. Connectivity between watersheds, floodplains, and streams/stream ecology</td>
<td>Hynes 1975, Allan Ch. 2</td>
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<td>2/10</td>
<td>T Murray</td>
<td>5. What level of spatial specificity is appropriate?</td>
<td>Strayer 2003a, Strayer 2003b</td>
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<td>2/17</td>
<td>T Buffam</td>
<td>6. Nutrient cycling in watersheds, and a Variable Source Area model</td>
<td>Allan Ch. 11 (11.0, 11.1, 11.4 only), Creed 1998; Propose Topic</td>
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<td>2/24</td>
<td>T Mitchell</td>
<td>7. +Midterm Course Eval</td>
<td>Readings; Finalize Proposal Topic</td>
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<td>3/3</td>
<td>T Wise</td>
<td>8. +Discussion of Proposed “Knowledge Gaps”</td>
<td>Readings; Annotated Bibliography</td>
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<td>3/10</td>
<td>T Murray</td>
<td>9.</td>
<td>Readings</td>
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**SPRING BREAK - NO SCHOOL**

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<tr>
<td>3/24</td>
<td>TBD</td>
<td>10.</td>
<td>Draft Proposal Due</td>
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<td>3/31</td>
<td>All Students</td>
<td>11. Discussion and Feedback for all Draft Proposals</td>
<td>Read and Comment all Proposals</td>
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<td>4/7</td>
<td>T Buffam</td>
<td>12. Whole-watershed experiments</td>
<td>Carpenter 1998, Schelker 2012; Final Proposal Due</td>
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<td>4/14</td>
<td>All Students</td>
<td>13. Student Presentations of Proposals</td>
<td>Prepare Proposal Presentation</td>
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<td>4/21</td>
<td>T Buffam</td>
<td>14. Wrap-up, End-of Course Terminology Quiz, and Course Evaluation</td>
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