

**GEOGRAPHY 5395 – PROBLEMS IN APPLIED
GEOGRAPHY: FLUVIAL PROCESSES
SOUTHWEST TEXAS STATE UNIVERSITY, FALL 2001
*“I am haunted by waters” – Norman Mclean***

Instructor: Mark A. Fonstad

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Office Hours: 3:00pm – 4:00pm Mondays and Wednesdays or by appointment

Class Time: 6:30pm – 9:15pm Wednesdays

Classroom: Evans Liberal Arts (ELA) Building, Room 316

Course Line Number: 218994

COURSE DESCRIPTION

This course is designed to consider a selected topic relating to applied geography. Emphasis on the practical application of geographic tools, with individual or group participation in a specific project. Course topics may vary depending on student and faculty interests and may apply to any of the three graduate tracks: physical-environmental, land area development and management, or cartography. Repeatable for up to six hours.

Fluvial processes (along with weathering) are probably the single most important geographic process operating on the earth's physical landscape. Stream channels and the water and sediment they carry are major natural hazards as well as major natural resources. They are highly variable from one place to another. This course outlines the fundamental mechanics of fluvial channels with an emphasis on quantitative geographic evaluation of the processes. The course emphasizes natural scientific perspectives, but it includes linkages to ecology, engineering, resource management, and policy. The course provides knowledge and analytical skills useful to scientists, planners, engineers, public decision-makers, and informed laypersons. Part of the course activities will be the standard teaching and learning expectable in a graduate level instructional course related to knowledge and skills. In addition, participants will be involved in active river research using a variety of tools and methods in popular use today.

COURSE OBJECTIVES

The purpose of this course is to familiarize students with contemporary river research. Topics covered include the physical principles of river geomorphology, hydraulics, and hydrology, the distribution of fluvial forces, sediment transport mechanics, channel change, the nature of floods, basin hydrology, prediction of river dynamics, and effects of human societies on rivers. In addition, course participants will be introduced to a suite of methodologic tools for the observation and analysis of rivers.

COURSE ACTIVITIES

The seminar will meet once a week on Wednesday evenings from 6:30 – 9:15 pm in Room 316 of Evans Liberal Arts Building. There will be occasional field trips and a modest literature review. Most class periods will have the following components:

- 1) Lecture – A 1 ½ presentation of basic information and ideas related to the current topic, with an emphasis on fundamentals and methods.
- 2) Either A) Methods or B) Discussion. For methods, the remainder of the period will be devoted to hands-on use of river-related tools such as flow-modeling software, spreadsheets for flood frequency analysis, or basin hydrology analysis via GIS software. For discussion, the remainder of the period will be devoted to discussion of the basis and implications of modern or classical research literature on the current topic.
- 3) Time for discussion of out-of-class student research projects

COURSE MATERIALS

Readings for this class will be from the textbook, Fluvial Forms and Processes: A New Perspective (1998) by David Knighton. A few additional papers placed on file in the departmental library will round out the class readings. Also, *A Manual for Writers of Term Papers, Theses, and Dissertations* (Chicago Guides to Writing, Editing, and Publishing) by Kate L. Turabian (6th edition) is the department style manual used by all students--undergraduate, master's, and Ph.D. I will use this style manual when assessing assignments and papers.

EVALUATION AND GRADING POLICIES

There is no final exam for this course. The primary component of student evaluation will be a small research project in which the student demonstrates his or her competence in the design and execution of river research. Such a project may include one or more than one of the following general topics: field research, remote sensing or GIS-related spatial analysis, quantitative data analysis, critical literature review, or an alternative agreed upon between the student and the instructor. Additionally, the student will report this research in a short class presentation. There is a maximum of 500 points for all of the assignments, projects exams, and participation activities for this class. The basis for grading will be as follows: 15% (75 points) for a 2-page research proposal, 15% (75 points) for class presentation, 10% (50 points) for class participation, 25% (125 points) for small class assignments (due a week after they are started in class), and 35% (175 points) for the completed research project. Because each student has an entire week to finish the small class assignments, there will be no make ups past this period except under extraordinary circumstances.

STUDENTS WITH DISABILITIES

Students having special needs/disabilities that require accommodations for successful completion of this course must notify both SWT's Office of Disability Services and the course instructor by no later than the end of the first week of classes. Failure of the student to do so may result in the necessary accommodations not being made.

POSTING OF GRADES

In accordance with university regulations, grades will not be posted.

ATTENDANCE POLICY

Nonattendance may significantly affect your grade in this course.

OUTLINE OF TOPICS FOR THE SEMESTER

<u>Week</u>	<u>Date</u>	<u>Topics</u>
1	August 29	Overview, simple physics of river flow (1), “roughness”, METHOD: WinXSPRO software Reading for week 2: Knighton 1-8, 96-118
2	September 5	Research project discussion, physics of river flow (2), “step-backwater” techniques, METHOD: HEC-RAS Reading for week 3: Knighton 96-141
3	September 12	Fluvial forces, sediment erosion, transport, and deposition METHOD: Sediment measurement in the lab & field Readings for week 4: Knighton 155-187
4	September 19	Channel Morphology I: hydraulic geometry, thresholds, allometric change, equilibrium vs. nonequilibrium systems No methods or discussion this week. No additional readings for next week.
5	September 26	Channel Morphology II: conceptual and quantitative models of channel change: regime, physically-based, extremal, stochastic. No methods or discussion this week. Readings for week 6: Phillips 1991
6	October 3	Channel Morphology III: channel patterns, switching behavior, Einstein’s meandering paper, quantitative analysis of patterns, cellular automata and braiding DISCUSSION: Phillips’s article Readings for week 7: Knighton 9-64
7	October 10	Basins and Networks I: network topology and landscape evolution No methods or discussion this week Readings for week 8: Knighton 65-95
8	October 17	Basins and Networks II: hydrology and sediment yield METHOD: Arcview CRWR-Prepro and HEC-HMS Readings for week 9: Maidment’s GIS and hydrologic modeling chapter

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| 9 | October 24 | Basins and Networks III: GIS and hydrologic modeling, remote sensing of basin hydrologic information
METHOD: Aspinall and Fonstad's Arcview watershed analysis software
Readings for week 10: Baker, 1994 |
| 10 | October 31 | Floods: Types and causes of floods, flood hydroclimatology, remote flood analysis, Canadian R flood
DISCUSSION: Baker's angry paper
Readings for week 11: Graf, 2001 |
| 11 | November 7 | No Class (I'm away at Geological Society of America Meetings in Boston) |
| 12 | November 14 | Effects of Humans: dams, channelization, land cover change, physical integrity, contaminant transport, river restoration
DISCUSSION: Graf's paper
Readings for week 12: Knox, 1987; Graf, 1983 |
| 13 | November 21 | No class (Thanksgiving break) |
| 14 | November 28 | Effects of Climate and Land Cover Change: difficulties in cause and effect, policy implications, the research frontier
DISCUSSION: Knox vs. Graf's paper
Readings for week 14: Winterbottom & Gilvear, 1997 |
| 15 | December 5 | Student Presentations |
| 15 | December 12 | (Final Exam Time, 6:30-9:00 pm). Student Projects Due |

ABOUT THE INSTRUCTOR

The instructor is Mark A. Fonstad, assistant professor of geography. He is a specialist in fluvial geomorphology, water resources, and the spatial analysis of river systems. Mark received his Ph.D. in Geography from Arizona State University where he researched mountain fluvial systems and the prediction of channel change. For the past year, Mark has been a post-doc at Montana State University's Mountain Research Center where he oversaw research on channel morphology, basin hydrology, and the remote sensing of rivers in Yellowstone National Park.