DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL MANGEMENT

University of Waterloo
Fall 2019

COURSE OUTLINE

COURSE: Geography 201 – Fluvial Geomorphology
Lectures: Tues & Thurs W STC 0040 2:30 – 3:50 PM

INSTRUCTOR: Dr. M. Stone
Room 112 – ENV1
Office Hours: Wed (1:00 - 3:00 PM)

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Course Description:
Fluvial geomorphology is the scientific study of river landforms and the processes that create them. A working knowledge of fluvial geomorphology has important practical environmental science and management applications and is relevant to many other fields of environmental enquiry such as environmental engineering, watershed planning, source water protection, forestry and risk management.

This course will examine a range of physical and chemical processes that create micro and macro-scale landforms over a range of spatial and temporal scales. Implications of these processes for environmental management in the context of environmental change will be considered.

Course Goals:

- To provide an understanding of fundamental earth surface processes that create fluvial landforms
- To understand the relevance of fluvial geomorphology to other fields of environmental enquiry i.e. environmental engineering, planning, soil science, hydrology, sediment transport, water quality, water resources management.

Required Text: Charlton, R. 2008 Fundamentals of Fluvial Geomorphology. Routledge. 234 p.

Evaluation:	2 Quizzes - Drop lowest grade	30%
	3 Labs @ 10% each	30%
	Final	40%

Class Schedule

Sept 5 **Course Introduction (Chapter 1)**
Why study rivers?

Sept 10 **The Fluvial System (Chapter 2)**
Inputs, outputs and storage
Types of systems
Fluvial system variables
Feedback and thresholds
Spatial and temporal scales
Concept of equilibrium
Feedback, thresholds and equilibrium – Southern Rockies case study

Sept 12 **Drainage basin characteristics**

Sept 17 **Film: Rivers of Destiny**

Sept 19 **Flow regime (Chapter 3)**
Flow generation and hydrological pathways
Hill slope hydrology
Storm hydrograph and drainage basin response
Measurement of flow in streams
Lab 1 Drainage basin characteristics and river discharge

Sept 24 **Flow regime (Chapter 3)**
Floods
Bankfull discharge
Flood magnitude and frequency
Regional flood frequency curves

Sept 26 **Sediment sources (Chapter 4)**
Weathering and mass wasting processes

Oct 1 **Sediment sources (Chapter 4)**
Hillslope erosion
Rain splash and sheet wash erosion
Rills and gullying
Monitoring rates of erosion
Soil erosion models

Oct 3 **Large scale sediment transfer (Chapter 5)**
Sediment transfer
    Sediment transfer from hillslopes
    Modes of sediment transport in rivers
Sediment Yield
    Sediment storage and delivery ratio
Controls on sediment yield
Lab 2 Sediment transport processes

Oct 8 **Large scale sediment transfer (Chapter 5)**
Coarse sediment transfer and yield
Sediment budgets
Human activity and sediment yields

Oct 10 **Quiz 1**

Oct 15 **No class - Reading Week**

Oct 17 **No class- Reading Week**

Oct 22 **Flow in channels (Chapter 6)**
Flow in river channels
- Driving and resisting forces
- Channel parameters
- Flow velocity and variations

Concept of flow continuity

Oct 24 **Flow in channels (Chapter 6)**
Flow, channel and boundary resistance
Flow behavior
- Subcritical, critical and supercritical flow
- Laminar and turbulent flow
- Boundary layer
- Bed shear stress

Oct 29 **Erosion, transport and deposition processes (Chapter 7)**
Concept of stream power
- Work, energy and stream power

Erosion in bedrock channels
Erosion in alluvial channels

Oct 31 **Erosion, transport and deposition processes (Chapter 7)**
Sediment entrainment and transport
Bedload Transport
Suspended load transport
Sediment supply and transport rates
Depositional environments

Nov 5 **Channel form and behavior (Chapter 8)**
Controls on channel adjustment and form
- Driving variables
- Sediment regime
- Stream power vs sediment supply

Boundary conditions
Channel adjustments

Nov 7 **Channel form and behavior (Chapter 8)**
Hydraulic geometry relationships
Channel geomorphic units
Floodplain morphology

Nov 12 **Channel form and behavior (Chapter 8)**

Alluvial channel form
- Straight and meandering channels
- Braided channels
- Anabranching channels
- Anastamosing channels

Mixed bedrock and alluvial channels

Nov 14 **System response to change (Chapter 9)**

Nature of change
- Allogenic vs autogenic
- Types of disturbance
- System response

Sensitivity to change

Functional Flows

Nov 19 **Quiz 2**

Nov 21 **System response to change (Chapter 9)**

Response to fluvial systems to change
- Extreme floods
- Wildfire
- Human activity
- Tectonics and base level change

Lab 3 River channel change

Nov 26 **River Impoundment**

Nov 28 **Managing River Channels (Chapter 10)**

Traditional Engineering Techniques

Channelization and flow regulation techniques

Environmental degradation

Note:

The labs will be assigned on Sept 19, Oct 3 and Nov 21. They will be introduced in class by the instructor. Completed labs will be due in class one week after they have been assigned. The penalty for late submission is a reduction of 10 %/day.

Supplementary References

Allen, P. A., 1997, Earth surface processes: Oxford, U.K., Blackwell Science, 404 p.

Birkeland, P.W., 1999, Soils and geomorphology (3rd edition): New York, Oxford University Press, 430 p.

Bland, W., and Rolls, D., 1998, Weathering: New York, Oxford University Press, 271 p.

Bloom, A.L., 1998, Geomorphology (3rd ed.): Englewood Cliffs, New Jersey, Prentice-Hall, 482 p.

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Carroll, D., 1970, Rock weathering: New York, Plenum, 203 p.

Carson, M.A., and Kirkby, M.J., 1972, Hillslope form and process: London, Cambridge University Press, 475 p.

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Coates, D. R., and Vitek, J. D. (eds.), 1980, Thresholds in geomorphology: London, Allen and Unwin, p.

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Gordon N.D. et al 2004 Stream hydrology: An introduction for ecologists. Wiley 429 p.

Gregory, K. J., 1977, River channel change: New York, John Wiley and Sons, 450.

Gregory, K.J., and Walling, D.E., 1973, Drainage basin form and process: New York, John Wiley and Sons, 456 p.

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Leopold, L. B., 1994, A view of the river: Cambridge, Massachusetts, Harvard University Press, 298 p.

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Morisawa, M., 1985, Rivers: New York, Longman, 222 p.

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Ritter, D. F., Kochel, R. C., and Miller, J. R., 1995, Process geomorphology (3rd Ed.): Dubuque, Iowa, William C. Brown, 546 p.

Rosgen, D. 1994. Applied river morphology. Wildland Hydrology,

Schumm, S.A., 1977, The fluvial system: New York, John Wiley and Sons, 338 p.

Selby, M.J., 1985, Earth's changing surface: Oxford, Oxford University Press, 607 p.

Small, R.J., and Clarke, M.J., 1982, Slopes and weathering: London, Cambridge University Press, 112 p.

Sparks, B.W., 1986, Geomorphology (3rd ed.): London, Longman, 561 p.

Sugden, D.E., and John, B.S., 1976, Glaciers and landscape: New York, John Wiley and Sons, 376 p.

Plagiarism is defined as taking "intellectual property," such as words, drawings, photos, or artwork, etc., written or created by others, and passing it off as your own. When you submit a report or assignment with your name on it, it is assumed that you are the author of everything in the assignment except for those materials that are specifically identified as coming from other sources. Therefore, if you include sentences, photos, drawings or figures from other sources in a work report or lab report, the complete reference must be cited. This applies in particular to any material cut-and-pasted from the internet or any other electronic source. Failure to cite the source completely is plagiarism, an academic infraction with serious consequences under *University of Waterloo Policy 71*.

Academic Integrity: To create and promote a culture of academic integrity, the behaviour of all members of the University of Waterloo is based on honesty, trust, fairness, respect and responsibility.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, http://www.adm.uwaterloo.ca/infosec/policies/policy70.html

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline, http://www.adm.uwaterloo.ca/infosec/Policies/policy71.html

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals, http://www.adm.uwaterloo.ca/infosec/Policies/policy72.html