River Sediment Dynamics Short Course

Tuesdays and Thursdays in October 2020 – 2 pm to 5 pm

Outline

This remotely taught short course covers the fluvial processes responsible for erosion, transport and deposition of sediment within rivers, providing a fundamental understanding of how sediment dynamics drive channel formation, adjustment and evolution. The course also deals with how sediment dynamics can be investigated and accounted for in the contexts of practical river management and restoration.

During this course, students will learn about:

(1) the physics of sediment erosion, transport and deposition,
(2) interactions between fluvial processes, sediment movement and channel form,
(3) the roles of plants and animals in influencing sediment dynamics and channel form,
(4) practical methods to predict and model sediment transport using spreadsheets, one-dimensional, and two-dimensional models
(5) how knowledge of sediment dynamics can inform sustainable river management and, especially, river restoration

Students will undertake hands-on practical work to learn how to use different types of sediment transport software and we will use case-studies to learn how to select the sediment analysis and tool appropriate for application in different river management and restoration contexts and projects.

Instructors

Dr Colin Thorne is Chair of Physical Geography at the University of Nottingham, UK. He earned his BSc and PhD in Environmental Sciences at the University of East Anglia under the supervision of Dr Richard Hey and his early professional career was mentored by Dr Daryl Simons and Dr Stanley A. Schumm at Colorado State University. In a career spanning five decades, Colin has researched and taught not only at

Nottingham and CSU, but also London University, Canterbury University (New Zealand), the USDA National Sedimentation Laboratory, US Army Waterways Experiment Station and NOAA Fisheries (Santa Rosa, CA). His research on fluvial geomorphology, sediment transport, and river restoration extends from upland, gravel-bed rivers to large, lowland, sand-bed rivers. Colin's contribution to knowledge has been recognized by professional organizations ranging from the American Society of Civil Engineers to the Royal Geographical Society of London. He currently divides his time between the UK and PNW.

Steve Winter is a hydrologist and geomorphologist with a focus on wetlands, streams, and rivers in Washington, Oregon, and California. He has over 20 years of experience in managing projects ranging from small scale investigations to some of the largest restoration efforts in Puget Sound. His particular focus of understanding is the interplay between physical and ecological processes working to achieve ecological restoration goals. Steve has extensive hydrologic and hydraulic modeling experience in support of restoration design efforts in complex areas including road crossings, outlet channels to connect off channel habitats, large wood design, and development of sediment budgets for estuary restoration projects. Steve also has experience with wetland science and policy at the federal, state and local levels. His knowledge of ecosystem restoration design and management has presented opportunities for plan development, specification and cost estimates on a multiple stream, estuary and nearshore restoration projects, working with contractors, and overseeing construction.

Mason Lacy is a water resources engineer with Environmental Science Associates (ESA) and Recreation Engineering & Planning (REP) in Bend, OR whose work focuses on river restoration design and analysis. He earned his BSc in Civil Engineering from the University of Colorado and his Masters in Water Resources Engineering from Arizona State University. His graduate studies focused on fluvial processes and hydraulic modeling. Mason has been involved in many river engineering projects including dam removals, fish passage, and stream simulation culverts. He is a licensed Professional Engineer in the states of Oregon, Washington, and Colorado. In his free time, Mason enjoys immersing himself in the fluvial environment, literally - in a whitewater kayak.

Short Course Schedule

Week 1

6 October

2:00 – 2:15 Welcome and introductions

Module 1 – Sediment Transport Processes

2:15 – 2:45 1.1 Significance of sediment dynamics – *Colin Thorne*

2:45 – 3:00 Questions and Answers

3:00 – 3:30 1.2 Initiation of motion and sediment transport mechanics – *Colin Thorne*

3:30 – 3:45 Break

3:45 – 4:00 Q&A

4:00 – 4:30 Class exercise 1 – Initiation of motion identification – *Colin Thorne*

4:30 – 5:00 Discussion and preparation for next session

8 October

Module 2 – Sediment Transport Prediction

2:00 – 2:30 Feedback on Class Exercise 1 – *Colin Thorne*

2:30 – 3:00 2.1 History of sediment transport prediction – Colin Thorne

3:00 – 3:15 Q&A

3:15 – 3:30 Break

3:30 – 4:00 2.2 Practical sediment transport prediction – *Steve Winter*

4:00 – 4:15 Q&A

4:15 – 5:00 Class exercise 2 – Spreadsheet-based sediment transport prediction – *Steve Winter*

Week 2

13 October

Module 3 –The Influence of Biology on Sediment Dynamics

2:00 – 2:30 Feedback on class exercise 2 – *Steve Winter*

2:30 – 3:00 3.1 Life in the river: multiple players, complex effects, big impacts – *Colin Thorne*

3:00 – 3:15 Q & A

3:15 – 3:30 Break

3:30 – 4:00 3.2 Partnering with nature's river restorers – *Colin Thorne*

4:00 – 4:15 Q&A

4:15 – 4:30 Class exercise 3: Interactions between physical and biological processes – *Colin Thorne*

4:30 – 5:00 3.3 Understanding morphological complexity: Stream Evolution Triangle – *Colin Thorne*

15 October

Module 4 – Channel Sediment Dynamics, Stable Channel Design, and Channel Changes

2:00 – 2:15 Feedback on Class Exercise 3 – *Colin Thorne*

2:15 – 2:45 4.1 Stable channel design _____ – *Brian Bledsoe?*

2:45 – 3:00 Q&A

3:00 – 3:15 Break

3:15 – 4:15 Class exercise 4: Stable Channel Design using NCHRP Research Report 853 – *BB*

4:15 – 4:45 4.2 Sediment imbalance: degradation and aggradation – *Colin Thorne*

4:45 – 5:00 Q&A

Week 3

20 October

Module 5 – 1-D Modelling of Sediment Dynamics and Channel Changes

2:00 – 2:30	Feedback on Class Exercise 4 – *Brian Bledsoe?*
2:30 – 3:00	5.1 Modelling sediment dynamics in 1-Dimension – *Steve Winter*
3:00 – 3:30	Q&A
3:30 – 3:45	Break
3:45 – 4:45	Class exercise 5: Using HEC-RAS 5 to model sediment dynamics – *Steve Winter*
4:45 – 5:00	1-D sediment modeling homework assignments

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2:00 – 2:45	Class exercise 5 and Homework – Feedback and discussion – *Steve Winter*
2:45 – 3:15	5.2 Case Study applications of 1-D sediment transport models – *Steve Winter*
3:15 – 3:30	Q&A
3:30 – 3:45	Break
3:45 – 17:00	1-D Modeling - Class discussion and feedback

Week 4

27 October

Module 6 – 2-D Modelling Sediment Dynamics and Channel Changes

2:00 – 2:30	6.1 Modelling sediment dynamics in 2-Dimensions – *Mason Lacy*
2:30 – 2:45	Q&A
2:45 – 3:30	Class exercise 6: Modelling sediment dynamics in 2-dimensions - *Mason Lacy*
3:30 – 3:45	Break

3:45 – 4:15 6.2 Case Study application(s) of Modelling sediment transport in 2-D – *Mason Lacy*

4:15 – 4:30 Q&A

4:30 – 5:00 2-D sediment modeling homework assignments

29 October

Module 7 –Sediment Dynamics and Stage 0 River Restoration

2:00 – 2:45 Class exercise 6 and Homework – Feedback and discussion – *Mason Lacey*

2:45 – 3:15 7.1 Thinking outside the channel and risk-based approach to restoration – *Colin Thorne*

3:15 – 3:30 Q&A

3:30 – 3:45 Break

3:45 – 4:15 Class exercise 7: Restoration Site evaluation – *Colin Thorne*

4:15 – 4:45 7.2 Wrap-up: Accounting for sediment dynamics in river restoration – *Colin Thorne*

4:45 – 5:00 Closing remarks, short course evaluation and end of Short Course