

# Sediment Budgets and Fluvial Geomorphology Fundamentals

March 6 - 10, 2017

## Objectives

The objectives of this course are to provide the participant with the background required for theoretical understanding and practical application of watershed and fluvial sediment processes including sediment budgets and fluvial geomorphology.

Topics will include fundamentals of fluvial geomorphology, sediment transport basics, channel stability concepts, bank stability concepts, hydraulic and hydrologic concepts, channel forming discharge, regime and hydraulic geometry relationships, channel classification and channel evolution models, data collection and assessment techniques, geomorphic assessments, sediment budgets, and case/studies.

## Instructors:

David Biedenharn, PhD, PE

James Selegean, PhD, PE, PH

Travis Dahl, PE

Calvin Creech, PhD, PE

Monday, 6 Mar.:

## Introduction and Fundamentals of Fluvial Geomorphology

8:30 – 9:15 a.m. - **INTRODUCTION (Creech)**

9:15 – 10:45 a.m.

### **1.1 Lecture: Fundamentals of Fluvial Geomorphology (Biedenharn)**

General overview of basic concepts of fluvial geomorphology. The river as a system, dynamic nature of rivers, complexity, thresholds, and time and space scales or river processes.

10:45 – 11:00 a.m. - Break

11:00 – 12:30 p.m.

### **1.2 Lecture: Sediment Transport Basics (Selegan)**

Incipient motion, bedforms, and sediment transport.

12:30 – 2:00 p.m. - LUNCH

2:00 – 3:30 p.m.

### **1.3 Lecture: Channel Stability Concepts (Selegan)**

Lane's Balance of geomorphic variables, concept of dynamic equilibrium, system and local instability.

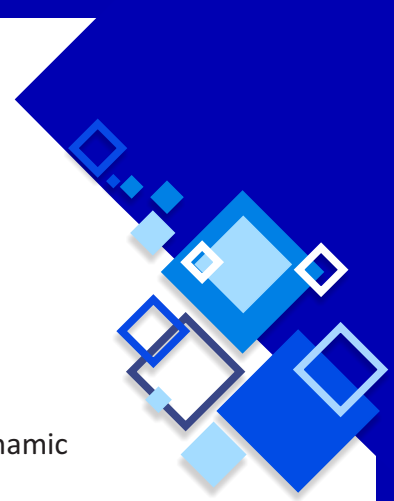
3:30 – 3:45 p.m. - Break

3:45 – 5:00 p.m.

### **1.4 Workshop: Channel Stability Workshop (Dahl)**

Students will apply concepts from Lane's diagram to predict river responses to local or system events.

5:00 – 5:30 p.m. - **Review Workshop 1.4 (Dahl)**



Tuesday, 7 Mar.:

## Fluvial Geomorphology Continued

8:30 – 10:00 a.m.

### **2.1 Lecture: Hydraulic and Hydrologic Concepts (Dahl)**

Basic hydraulic and hydrologic concepts related to river mechanics and sediment transport.

10:00 – 10:15 a.m. - Break

10:15 – 11:15 a.m.

### **2.2 Lecture: Bank Stability Concepts (Creech)**

Pfankuch and Bank Erosion Hazard Index rapid assessments.

11:15 – 12:15 p.m.

### **2.3 Lecture: Channel Forming Discharge (Selegan)**

Bankfull discharge, effective discharge, recurrence intervals.

12:15 - 2:00 p.m. - LUNCH

2:00 - 3:30 p.m.

### **2.4 Lecture: Regime and Hydraulic Geometry Relationships (Biedenharn)**

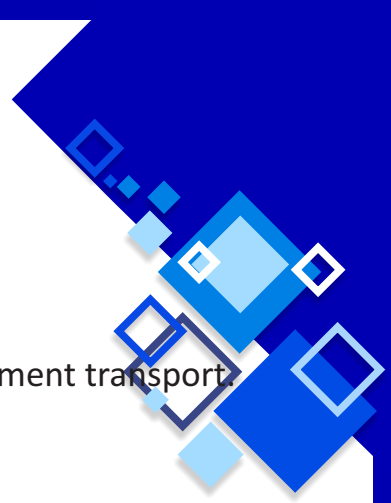
Relationships between hydraulic geometry and hydraulic regime. Power relationships, dimensionless parameters, hydraulic geometry curves, and watershed scaling

3:30 – 3:45 p.m. - Break

3:45 - 5:00 p.m.

### **2.5 Lecture: Channel Classification and Channel Evolution Models (Biedenharn)**

Overview of common channel classification systems and channel evolution models. Use of these conceptual models and classifications to gain insight into the evolving geomorphology of a river system will also be discussed.



Wednesday, 8 Mar.:

## Data Collection and Assessment Techniques

8:30 – 9:00 a.m. - **Review of Previous Day**

9:00 – 10:15 a.m.

### **3.1 Lecture: Sediment Data (Selegan)**

Overview of types of sediment data and collection techniques. Topics include measured suspended sediment data, bed load data, bed material sampling, and sediment surrogates.

10:15 - 10:30 a.m. - Break

10:30 - 12:00 p.m.

### **3.2 Lecture: Sediment Data continued (Selegan)**

Overview of types of sediment data and collection techniques. Topics include measured suspended sediment data, bed load data, bed material sampling, and sediment surrogates.

12:00 - 2:00 p.m. - LUNCH

2:00 - 3:30 p.m.

### **3.3 Lecture: Specific Gage Records (Biedenharn)**

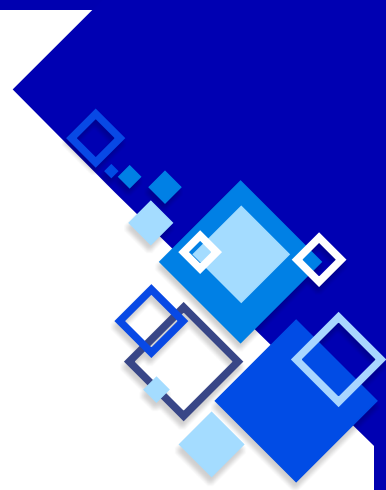
Creation and analysis of specific gage records will be covered for the purposes of investigating changing geomorphologic regimes.

3:30 – 3:45 p.m. - Break

3:45 - 5:00 p.m.

### **3.4 Lecture: Comparative Surveys (Dahl)**

The use of repeated surveys to examine changing river morphology. Data types to be discussed include bathymetric surveys, aerial photography, and LIDAR.



Thursday, 9 Mar.:

Data Collection continued and Sediment Budgets

8:30 – 9:00 a.m. - **Review of Previous Day**

9:00 – 10:15 a.m.

**4.1 Lecture: Geomorphic Assessments (Biedenharn)**

The creation geomorphic assessments to help project future trends in the river.

Discussion of data requirements and field techniques.

10:15 - 10:30 a.m. - Break

10:30 - 12:00 p.m.

**4.2 Lecture: Field Investigations and Preparations (Selegean)**

Discussion of what to do before and during a field investigation. Common data sources and field techniques will be reviewed.

12:00 - 2:00 p.m. - LUNCH

2:00 - 3:00 p.m.

**4.3 Lecture: Sediment Budget Overview (Dahl)**

Overview of sediment budgets. Sources, pathways, and sinks concept.

3:00 – 4:00 p.m.

**4.4 Lecture: Sediment Budget Development (Biedenharn/Dahl)**

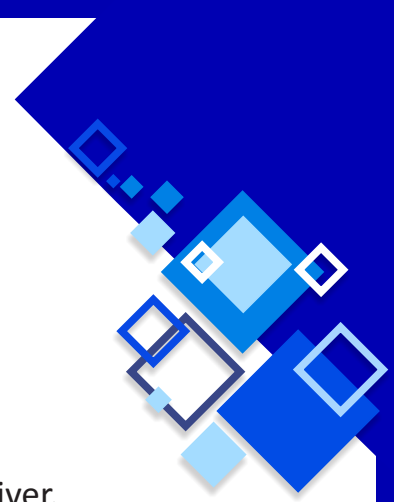
Methods used to develop sediment budgets. Geomorphic assessments. Sediment Impact Analysis Methods (SIAM). The use of watershed models (SWAT, GSSHA, HEC-HMS) and 1D hydraulic models (e.g. HEC-RAS) for sediment budget development.

4:00 – 4:15 p.m. - Break

4:15 - 5:15 p.m.

**4.4 Lecture: Sediment Budget Development continued (Biedenharn/Dahl)**

Methods used to develop sediment budgets. Geomorphic assessments. Sediment Impact Analysis Methods (SIAM). The use of watershed models (SWAT, GSSHA, HEC-HMS) and 1D hydraulic models (e.g. HEC-RAS) for sediment budget development.



Friday, 10 Mar.:

## Sediment Budgets continued

8:30 – 9:00 a.m. - Review of Previous Day

9:00 – 10:30 a.m.

### **5.1 Workshop: Sediment Budget Development (Dahl)**

Students will create a sediment budget for the Battle Creek River and discuss what additional data might be needed or desirable.

10:30 - 10:45 a.m. - Break

10:45 - 11:45 p.m.

### **5.2 Lecture: Case Study: Rio São Francisco (Creech)**

Case study of the sediment budget of the São Francisco basin. Including modeling approaches, field investigations, and the impacts of anthropogenic changes to the sediment budget over time.

11:45 – 12:15 p.m. - **Final Comments and Discussion (All)**

12:15 – 2:00 p.m. - LUNCH

2:00 – 5:30 p.m. - **Field Trip (optional) (All Instructors)**

Students and instructors will tour an experimental watershed maintained by the Universidade de Brasília. Instructors will discuss field techniques, observations about the sites, and answer questions.

