Course Outline
Applied River Geomorphology and Biotechnical Engineering for Fisheries Biologists

American Fisheries Society Annual Meeting
St. Louis, Missouri
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Instructor: Steve Gough, Little River Research & Design, St. Louis

1. **Introduction** – 60 minutes
   a. Overview of workshop content, class discussion to review background and interests of participants.
   b. Holistic perspective: Watersheds and streams as parts of a system, including brief regional case-studies. Structural integrity of fluvial systems, basic hydraulic geometry.

2. **Hydrology and landscapes** – 20 minutes
   a. Watershed hydrology.
   b. Flow return periods, intro to bankfull flow concepts.
   c. Regional differences in soils and geology.
   d. Effects of landuse on flow regime in natural and urbanized watersheds, flow regime changes caused by watershed/channel modification.
   e. Flow regime case studies, rural and urbanized watersheds.

3. **Fluvial process -- Hydraulics and sediment transport –** 75 minutes
   a. Discharge and continuity.
   b. Stream power, specific energy, and shear stress approaches. Regional variations and influence on stream power. Flow energy, critical velocity and depth, Froude number (using STREAMLAB). Relationship between shear stress and bed material particle size. Use of pebble counts or visual estimation. Field examples of relationship between bed materials and stream power.
   c. Flow over structures. Effects of riffles.
   d. Distribution of energy along the long profile. Flow regimes. Distribution of velocity in a cross-section. Shear stress/stream power and bed material size.

4. **Channel adjustment and pattern.** – 120 minutes
   a. Equilibrium and channel form and process. The balance between hydraulic forces and channel margin strength. Balance in sediment transport.
   b. Bankfull flow. Use of natural channel form in channel design.
      i. Dominant discharge theory and bankfull flow.
      ii. Bankfull flow determination, Money Creek, Mackinaw River, Illinois.

iii. Bankfull discharge and channel geometry as analysis and design tools, determination of bankfull flow at gage sites. Two-stage channels in habitat design and enhancement.

c. Vegetation and channel morphology.
d. Channel gradient and bed/bank materials.
e. Pattern: Review of channelization effects. Partitioning of energy along the long-profile. River's ability to adjust grade through meandering.
f. Stream morphology adjustment to disturbance, with case studies.
   i. Dredged ditches in the Mackinaw River watershed, Illinois.
   ii. Linn Creek, Missouri: Effects of gravel mining on the long profile.
   iii. Spring Creek, the Ozark Plateau, Missouri. Effects of vegetation on bank strength. Use of time-series aerial photos to diagnose stream behavior. Adjustment of pattern, cross section, and bankfull floodplain.
   iv. St. Louis Urban: Vago Park instability diagnosis. Midland Creek, Maryland Heights, Missouri.
      (1) Incision. Hydrologic and morphological changes in an urban stream; grade stability and use of long profile surveys; treatment, including grade control structures and bioengineered streambank protection.
g. Adapting management to regional differences in geomorphology.
h. Model stream session

5. Applied Stream Management 30 minutes

a. Local vs. systemic processes -- understanding a reach's place in its watershed. Treating local and systemic problems. Geologic and manmade project limits and geomorphic controls.
b. Manageability of stream problems. Realistic approaches.
c. Diagnostic methods -- bed and bank materials, changes in flow regime, use of vegetation as a diagnostic tool. Use of bankfull channel indicators and cross-sections. Time-series aerial photographs. Understanding and analyzing long-profile surveys. Identifying stability thresholds.
d. Diagnostic case study, Midland Creek, Vago Park.
e. Applying holistic approaches along with traditional engineering. Constraints in urban areas. Changes in policy, legal framework to enable holistic assessment and management, acceptance of natural vegetation.
f. Model stream session

6. Biotechnical methods and civil engineering 120 minutes

a. Civil engineering and biotechnical methods.
b. Introduction and fundamentals.
   i. Multiple purposes of biotechnical approaches.
   ii. Limiting factors, e.g. shade and season
   iii. Influence on hydraulics vs. that of "hard" structures.
   iv. Characteristics of suitable plant taxa
c. Tree revetments, cribwalls, brush layering, and other methods.
d. Grade control structures and other riprap-based methods.