AWRA 2011 ANNUAL WATER RESOURCES CONFERENCE
Albuquerque, New Mexico
November 7-10, 2011

QUANTIFYING THE SPATIAL STRUCTURE OF A LARGE GRAVEL-COBBLE RIVER

Josh Wyrick*, Greg Pasternack, Paul Bratovitch, Tom Johnson, Duane Massa

ABSTRACT: A common practice in geomorphology involves delineating channel features at a specific scale and then characterizing their attributes, including hydraulics. Morphological units (MU) represent distinct local form-process associations at the 1-10 W scale that, once identified, are independent of the flow regime and can be used as the basic unit for stratifying other hydrodynamic and ecohydraulic characteristics of the river. However, most definitions of riverine landform patterns at the MU scale are subjective by nature, because no framework for objective delineation of landforms based purely on topography exists yet. They also do not account for lateral variability in MUs. This research addressed two questions: (1) can 2D (depth-averaged) hydrodynamic model results be used for identifying and classifying spatially distributed MUs at the sub-width spatial scale and (2) can such identified MUs have statistically significant spatial associations amongst themselves at the river and reach scales. A high-resolution digital elevation model of the ~37.5-km Lower Yuba River, CA was used along with hydrological observations to perform 1-m resolution 2D modeling using SRH-2D. Depth and velocity outputs for different flows were then converted to rasters and used to classify MUs below the perennial minimum flow stage, between that and the bankfull stage, and above bankfull. At this scale of MU mapping, eight in-channel units (riffle, glide, pool, etc.) and six bankfull bar units (lateral bar, medial bar, etc.) were identified across seven distinct reaches. Statistical testing confirmed that the delineated MUs were spatially organized in a coherent, nonrandom pattern. Pools dominate in the confined reaches, while glides and riffles dominate in the wider, meandering reaches. Longitudinally, pools and chutes have the least uniform distributions, while the glides and slackwater are the most uniform. The average longitudinal spacing for riffles and pools are 3.4 and 4.8 W, respectively, with some reach-scale variations. Riffles tend to exhibit high adjacency to riffle-transition, chute, and run units, while pools show adjacencies to glides, runs, and slackwater. Overall, the results from this study illustrate that geomorphically meaningful MUs can be objectively identified using 2D hydraulic models, and then these can be employed to assess landform-dependent ecological functions.

* Post-doc researcher, Department of Land, Air, and Water Resources, University of California, Davis, One Shields Ave, Davis, CA 95616 USA, Phone: 609-220-5585, Fax: 530-752-1552, Email: jwyrick@ucdavis.edu