Geomorphic classification for arid ephemeral streams using channel geometry and basin characteristics

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Abstract. Understanding of arid channel characteristics is limited and many stream classifications do not adequately describe ephemeral streams, warranting development of more precise terminology to discuss their physical attributes and classification. In addition to development of a geomorphic classification system, we examine relationships between basin characteristics and channel geometry that will indicate where specific ephemeral stream types might occur, as well as the hydrologic implications for riparian vegetation and ecosystem sensitivity. Our conceptual model includes five geomorphic ephemeral stream types; 1) braided washes, 2) incised alluvium, 3) bedrock with alluvium, 4) bedrock, and 5) piedmont headwater channels. Preliminary watershed classification and cluster analysis of the U.S. Sonoran Desert was conducted using NHD 10-digit Hydrologic Unit Codes (HUCs), PRISM precipitation data, state geologic survey lithology, and data derived from 30m DEMs (i.e., drainage area, hillslope, elevation). Eighty-six reaches were surveyed on the U.S. Army Yuma Proving Ground in southwestern Arizona, representing the five stream types within three watershed categories. Following delineation of local watershed characteristics for each reach using 5m DEMs, preliminary statistical analyses including one-way ANOVAs and contrast comparisons were used to examine individual correlations and significant relationships among stream type, basin and channel characteristics. Statistically significant differences ($P<0.001$) exist between stream type and i) width/depth ratios and ii) stream gradient. Median grain size was significantly different among the three HUC types, with implications for available water and plant uptake. Stream types fall into groups when drainage area is plotted against width/depth ratio and stream gradient. Multivariate statistics and cluster analysis will be used to examine complex relationships among a continuous spectrum of all variables to test the conceptual stream classification. Following verification and any necessary modifications of the stream classification, the model will be tested on 15 reaches surveyed on Barry M. Goldwater Air Force Range in southwestern Arizona.

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