Landscape organization and bio-physical transport

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High resolution topography (1m LIDAR) offers new opportunities for hydrologic research. Of special interest is the long-standing problem of exploring linkages between the underlying physical processes that sculpture the landscape and the statistical signature and organized patterns they imprint on it. If these linkages are understood and quantified they can be useful in guiding field work, e.g, by suggesting physically-distinct regimes from statistically-distinct regimes; in improving modeling, e.g., by suggesting what transport laws might apply in different parts of the watershed; in providing detailed information for hypothesis testing; and in allowing prediction in ungauged basins.

Here we report results along three main directions: (1) explicit and objective extraction of river networks from LIDAR data, to replace the current implicit methods that use threshold area or slope-area threshold relationships requiring field work, (2) quantifying the horizontal organization of hillslope drainage paths and river networks and the vertical organization of hillslopes and valleys with implications for water and sediment transport, and (3) exploring stream organization for upscaling biomass from a point to a stream reach by combining local dimensionless relationships with geomorphic scaling laws. All of the above are discussed in the light of improving hydrologic and biophysical predictions by detailed knowledge of topography and space-time rainfall.