Date: THURSDAY, October 20, 2016

Time: 3:30-4:45 PM

Place: Buchanan 1930

Speaker: Dr. Terry Smith, Professor Emeritus, Department of Geography, UC Santa Barbara

Title: "The Integration of Slopes and Channels in Equilibrium Landscapes"

Abstract:
Researchers have long realized the importance of the fundamental difference between river channels and un-channeled slopes in fluvial landscapes. A great deal is known about each of these phenomena separately, but precisely how they fit together has long been a puzzle. In this talk I will present the results of the analysis of a relatively simple model that provides some pleasing insights into a solution to this problem. The model describes the erosion of a landmass in a dynamic equilibrium, as first described by G.K.Gilbert in 1877. The analysis of such a landscape leads naturally to a viewpoint in which the boundary between channels and slopes is the key feature. In a truly equilibrium landmass this contour is a simple, closed curve that is determined by the equilibrium balance and by the requirement that the equilibrium landforms be stable. A remarkable property of the contour is that it is characterized by a constant critical flow of water and sediment and a critical slope. This leads immediately to the result that the drainage density is independent of the size and shape of the landmass. The un-channeled slopes are characterized by equilibrium forms that minimize energy flows and that maintain a constant concentration of sediment. The flow environment changes dramatically on the down-flow side of the slope-channel boundary where the only stable forms are river channels. Hence the boundary marks a bifurcation in the solutions to the model, with one emergent solution being the stable channels and the other being unstable overland flows. The solutions for the river channels have the interesting property that they behave like waves propagating across the landscape, intersecting, and forming networks. The channels and slopes form a perfect union at their boundary, so stabilizing the equilibrium landscape.