**Flood risk transfer as a consequence of climate change and infrastructure modifications along the San Francisquito Creek, California**

**Katherine A. Serafin1, Jeffrey R. Koseff2, Jack W. Baker2, Jenny Suckale3**

1Department of Geography, University of Florida, 3141 Turlington Hall, 330 Newell Drive, Gainesville, Florida, 32611, USA. E-mail: kserafin@ufl.edu

2Department of Civil and Environmental Engineering, Stanford University, 473 Via Ortega, Stanford, California, 94305, USA

3Department of Geophysics, Stanford University, 397 Panama Mall, Stanford, California, 94305, USA

**Abstract**

Communities across the nation are grappling with how to mitigate flooding along urban rivers with aging infrastructure and uncertain changes in climate. Here, we study how climate change and planned infrastructure modifications alter the probability of flood initiation for communities along the San Francisquito Creek, California. We develop a hybrid modeling approach to combine millions of synthetic simulations of upstream river discharge and downstream coastal water levels with the Hydrologic Engineering Center’s River Analysis System (HEC-RAS) flow model to produce along-river water levels. We model synthetic joint climate conditions for current and increased river discharge and sea level. The synthetic joint climate conditions are used as boundary conditions for multiple river configurations to evaluate how changes to the climate and infrastructure alter the probability of flood initiation.

Our model demonstrates clearly that the amplification of the physical driver, such as river discharge or sea level, does not match the amplification of along-river flood initiation. Thus, the practice of using extreme water levels as proxies for flood hazard potentials may not fully capture the frequency of flood initiation. Furthermore, we show that the deterministic focus on one design event for planning purposes may create blind spots to the risks posed by both less frequent and more frequent events. While the planned infrastructure modifications reduce the total flood risk, which is defined as the overall probability of flood initiation anywhere along river, they also redistribute the remaining risk from affluent communities to less affluent communities downstream. This flood risk transfer is exacerbated by unmanaged sedimentation and a continued increase in the variance of precipitation due to climate change. We contend that the San Francisquito Creek holds valuable lessons for the management of other urban rivers that could help identify potential unintended consequences at early stages of planning.