



A global analysis of human habitation on river deltas

Douglas Edmonds (1), Rebecca Caldwell (1), Sarah Baumgardner (2), Chris Paola (3), Samapriya Roy (4), Amelia Nelson (1), and Jaap Nienhuis (5)

(1) Department of Geological Sciences, Indiana University, Bloomington, IN, United States, (2) Chevron Corporation, Houston, TX, United States, (3) Department of Earth Sciences, University of Minnesota, Minneapolis, MN, United States, (4) Department of Geography, Indiana University, Bloomington, IN, United States, (5) Department of Earth and Environmental Sciences, Tulane University, New Orleans, LA, USA

River deltas are ideal sites for human habitation because of their fertile floodplains, easy access to the ocean, and abundant land. But anthropogenic and natural processes are causing deltas to sink, which increases the probability of coastal flooding and human exposure to risk. The full extent of the risk posed to humans is unclear because the number of people living on river deltas is unknown. Towards this end we mapped the locations and areas of all deltas in the world ($n=1813$). Using *Google Earth* we identified all river mouths (≥ 50 m wide) on marine coastlines that are also connected to an upstream catchment. Rivers that split into two or more active or relict distributary channels, end in a depositional protrusion from the shoreline, or do both, are defined as deltas. The depositional protrusion and distributary channel network define the geomorphic area of each delta. We mark the position of the delta apex at the first bifurcation, or for a single channel delta at the intersection of the regional shoreline and the main channel. We mark three lateral extents, one on either side of the main channel at the maximum displacement of the depositional protrusion or the distributary network, and one on the most basinward position of the delta. We define delta area as the convex hull around these extent points and the delta apex. For each delta area polygon we extract elevation from the Shuttle Radar Topography Mission dataset and population count in years 2000, 2005, 2010, 2015, and 2020 from Gridded Population of the World, version 4. In total, deltas cover 0.56% of the total area of the world yet contain 4.1% of the world's population. The population on deltas has grown from 237 million in 2000 to projected values of 322 million in 2020. Deltaic population is growing at 1.59% per year, which outpaces the world growth rate of 1.11%. Additionally, population density is increasing with time from 322 people per km² in year 2000 to projected values of 422 people per km² in 2020. Of the 300 million people currently living on deltas, roughly 69% live below 10 meters elevation in the so-called low elevation coastal zone that is particularly susceptible to coastal flooding. Interestingly, the population in the low elevation coastal zone is unevenly distributed. The largest number of people, approximately 24%, live between 4 and 6 m elevation. This elevation range is also more densely populated at 580 people per km², which is nearly 12 times the global mean of 47 people per km². We consider these estimates to be a minimum given that we define delta area from the geomorphic footprint.