

GIS and DEM analysis of large-scale human land modification in western Tokyo

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Large-scale land modification for constructing broad residential areas was conducted in the Tama Hills of western Tokyo during the late 20th century, to cope with a rapid population increase in the Tokyo Metropolitan area. The Tama Hills originally consisted of strongly dissected hilly lands with short steep slopes, underlain by Pleistocene unconsolidated sediments. A common method of the land modification is levelling hills and filling valleys to provide relatively flat areas suitable for housing. Two sets of 10-m DEMs showing the topography of the Tama area in the mid 1980s and late 1990s were constructed using detailed vector contour data and aerial photogrammetry. GIS analyses of the DEMs permit quantitative evaluation of topographic changes due to the human land modification. The magnitude of land modification was significantly large if land slope was originally gentler than 15 degrees, suggesting that steeper areas were unsuitable for land modification using bulldozers and trucks. The total volume of hill levelling is slightly larger than that of valley filling, probably reflecting enhanced sediment erosion on bare lands which appeared widely during the land modification. Detailed volumetric and spatial analysis of the levelling and filling provided some insights into major sediment transportation routes during the land modification. For example, simple land modification with sediment transfer from a ridge to an adjacent valley was rather limited, and sediment transfer between distant areas was more frequent.