Appendix 3: Determination of flood-risk areas

In order to map areas that are prone to flooding, we followed the guidelines of the Indonesian National Agency for Disaster Management (Badan Nasional Penanggulangan Bencana / BNPB), which requires two main input datasets, namely (1) a digital elevation model (DEM) and (2) the river flow network. We used the 3 arc-second (≈ 90 m) void-filled, open-access DEM "Hydrological Data and Maps Based on Shuttle Elevation Derivatives at Multiple Scales" (HydroSHEDS) developed by the Conservation Science Program of the World Wildlife Fund For Nature (Lehner et al. 2008). This DEM presents a combination of the Shuttle Radar Topography Mission (SRTM-3) and the void-filled digital terrain elevation data (DTED®-1) (Lehner 2013). The river network is based on the corresponding vector layer from the Indonesian Geospatial Information Agency (Badan Informasi Geospasial / BIG 2017) digitally available for Jambi Province at the scales of 1:250,000 and 1:50,000. Building on these two datasets, we determined a flooding probability by combining the slope gradient, distance from the rivers and the modified topographic index (TI_m) :

$$TI_m = ln\left[\frac{a_d^n}{\tan(\beta)}\right]$$

where a_d is the local upslope contributing area per unit contour length; tan(β) is the local slope gradient; n is an exponent ($0.016x^{0.46}$) and x is the spatial resolution of the DEM (Manfreda et al. 2011; Manfreda et al. 2014). The TI_m was developed to delineate the exposure to flooding events on the basis of the basin topography (Manfreda et al. 2011). Eventually, an area was defined as flood-prone when (1) the distance to the river was < 300 m, (2) the slope gradient < 15% and (3) TI_m exceeded a threshold τ, which was set to $\tau = 10.89n + 2.282$ (based on BNPB 2016), and constitutes an area that equals or exceeds 0.2 % annual chance to be flooded (Holmes Jr. and Dinicola, 2010).

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