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Supplementary Table 1. Description of Hydrogeomorphic Hazard Indicators used in this study

Indicator	Description
Elevation	• Lowland areas may get flooded faster as water flows from high altitude to low regions. Areas located at a higher elevation usually have a lower probability of flooding compared to lowland areas. • In this study, the elevation map was prepared from SRTM DEM 30m resolution and classified data with high and low elevation in ArcGIS 10.8
Slope	• Slope controls the surface runoff and the intensity of water flow that provokes erosion of soil and vertical percolation. • The area having a lower slope is more exposed to flooding. • In the study area, the angle variation in slope ranges from 0˚– 39.31˚.
Drainage density	• It is defined as the ratio of the total length of the watershed channels to the total area of the basin. • Drainage density has a direct relationship with flooding. • The stream network was extracted from SRTM DEM and a drainage density map was developed by applying line density in spatial analyst ArcGIS 10.8
NDVI	• The NDVI is another factor that is a valuable index in assessing vegetation coverage and its outcome on flooding in a basin. • The NDVI normally ranges from -1 to +1. • The NDVI map was prepared from a satellite image of Landsat 8 (OLI).
TWI	• TWI is generally used to measure the effect of topography on runoff generation and the amount of flow accumulation at any position in a river catchment. • High TWI regions have a high vulnerability to flooding and lower TWI regions have lower flood vulnerability.
Rainfall	• Flooding usually occurs after heavy rainfall. • The rainfall distribution map has been prepared from average rainfall through Inverse Distance Weighting (IDW) Interpolation in ArcGIS 10.8
Geology	• Geology of an area is an important criterion, because it amplifies the magnitude of flood events. • Permeable formations favor water infiltration, throughflow and groundwater flow. • The data of study area classified as GLG classes.
Geomorphology	• Geomorphology plays a vital role in management of water resources. • It helps in various types of planning and developmental activities. • The study area is classified into different landforms.
Soil	• Soil has direct impact on flood as they control the amount of water that can infiltrate into soil. • The chance of flood hazard increases with decrease in soil infiltration capacity. • The soil map of study area is classified into its types [primarily Luvisols (lo) and Regosols (Rd)] using ArcGIS 10.8
Storm surge	• Storm Surge indicates the amount of land prone to floods above a particular rise in water • level. • It is calculated using DEM of that area. It is prepared by raster analysis using ArcGIS10.8.
Distance to stream	• Flood hazard is most severe in locations near stream whereas the effect of this parameter reduces with increased distances. • The study area is classified into 5 classes with 250 interval using ArcGIS 10.8.

Supplementary Table 2. Description of Socio-economic Vulnerability Indicators used in this study

Indicator	Description
Population density	• It is defined as the ratio of the total population to the total area of the selected region. • It is a key component of the flood impact assessment process and an indicator of possible threat to human life and health. • A higher likelihood of Flood Vulnerability of any area is directly linked to higher Population density
Female density	• Female density is calculated as the ratio of the total no. of female population to the total area in a specific region. • The lack of mobility of women to access the information and services and cultural restrictions can inhibit the ability of women to adapt to the flood risk and makes them a vulnerable group.
Literacy rate	• The proportion of the adult population aged 15 years and over which is literate, expressed as a percentage of the total population of any area. • A population with higher literacy can react faster and comprehend the nature and severity of a dangerous situation better.
Number of households	• Higher number of households in a flooded area intensifies the risk of infectious diseases spreading post-flooding. • Knowing the number of affected households helps prioritize rescue and medical aid allocation.
LULC	• The LULC maps are used to predict surface runoff characteristics in different land covers and possible catchment areas that impacts flood water volume and direction. • The LULC map was classified into five classes: Crops , vegetation, water bodies, built area, and barren land.
Number of hospitals	• No. of hospitals near floodplains depicts accessibility to vital care for injured or vulnerable populations. • Hospitals can serve as temporary shelters and staging grounds for efficient evacuation during floods
Distance to road	• Roads act as barriers to floodwaters and escape routes, making distance to them critical for judging vulnerability • During flooding, the availability of major roads such as main district roads (MDR), state highways (SH), and national highways (NH) plays an important role, especially in rescue and relief operations.

Supplementary Table 3. Weights assigned to Hydrogeomorphic Hazard Indicators using WO & AHP approaches

Hydrogeomorphic Hazard Indicator	Weighted Overlay Weights	Analytical Hierarchy Process Weights
Elevation	12	19.4
Slope	10	10.8
Drainage density	10	11
NDVI	5	2
TWI	8	5.1
Rainfall	20	26.3
Geology	5	2.4
Geomorphology	5	1.8
Soil	8	5.8
Storm Surge	10	10.8
Distance to stream	7	3.6

Supplementary Table 4. Weights assigned to Socio-Economic Vulnerability Indicators using WO & AHP approaches

Socio-Economic Vulnerability Indicator	Weighted Overlay Weights	Analytical Hierarchy Process Weights
Population Density	25	21.6
Female Density	12	10.4
Literacy rate	8	9
No. of Households	18	19.2
LULC	7	7
No. of Hospitals	15	16.8
Distance to road	15	16

Supplementary Table 5. Pairwise Comparison Matrix of Hydrogeomorphic Hazard Indicators

Indicators	Rainfall	Elevation	Slope	Drainage Density	Storm surge	Soil	TWI	Distance to stream	Geology	Geomor-phology	NDVI
Rainfall	**1.000**	2.000	3.000	3.000	3.000	5.000	5.000	7.000	9.000	9.000	9.000
Elevation	0.500	**1.000**	2.000	3.000	3.000	4.000	4.000	5.000	7.000	7.000	7.000
Slope	0.333	0.500	**1.000**	1.000	1.000	3.000	3.000	4.000	5.000	5.000	5.000
Drainage Density	0.333	0.333	1.000	**1.000**	1.000	2.000	2.000	3.000	5.000	5.000	5.000
Storm surge	0.333	0.333	1.000	1.000	**1.000**	2.000	2.000	4.000	5.000	5.000	5.000
Soil	0.200	0.250	0.333	0.500	0.500	**1.000**	2.000	3.000	4.000	4.000	4.000
TWI	0.200	0.250	0.333	0.500	0.500	0.500	**1.000**	2.000	4.000	4.000	4.000
Distance to river	0.143	0.200	0.250	0.333	0.250	0.333	0.500	**1.000**	2.000	2.000	2.000
Geology	0.111	0.143	0.200	0.200	0.200	0.250	0.250	0.500	**1.000**	2.000	2.000
Geomorphology	0.111	0.143	0.200	0.200	0.200	0.250	0.250	0.500	0.500	**1.000**	1.000
NDVI	0.111	0.143	0.200	0.200	0.200	0.250	0.250	0.500	0.500	0.500	**1.000**

Supplementary Table 6. Normalized Pairwise Comparison Matrix of Hydrogeomorphic Hazard Indicators

Indicators	Rainfall	Elevation	Slope	Drainage Density	Storm surge	Soil	TWI	Distance to stream	Geology	Geomor-phology	NDVI
Rainfall	0.30	0.38	0.32	0.27	0.28	0.27	0.25	0.23	0.21	0.20	0.20
Elevation	0.15	0.19	0.21	0.27	0.28	0.22	0.20	0.16	0.16	0.16	0.16
Slope	0.08	0.09	0.11	0.09	0.09	0.16	0.15	0.13	0.12	0.11	0.11
Drainage Density	0.08	0.06	0.11	0.09	0.09	0.11	0.10	0.10	0.12	0.11	0.11
Storm surge	0.08	0.06	0.11	0.09	0.09	0.11	0.10	0.13	0.12	0.11	0.11
Soil	0.05	0.05	0.04	0.05	0.05	0.05	0.10	0.10	0.09	0.09	0.09
TWI	0.05	0.05	0.04	0.05	0.05	0.03	0.05	0.07	0.09	0.09	0.09
Distance to river	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.03	0.05	0.04	0.04
Geology	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.04	0.04
Geomorphology	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0.02
NDVI	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.02
Critical Weights	0.263	0.194	0.108	0.11	0.108	0.058	0.051	0.036	0.024	0.018	0.02
Weights (%)	**26.3**	**19.4**	**10.8**	**11**	**10.8**	**5.8**	**5.1**	**3.6**	**2.4**	**1.8**	**2**

Supplementary Table 7. Calculation of Consistency Index & Consistency Ratio of Hydrogeomorphic Hazard Indicators

Indicators	Rainfall	Elevation	Slope	Drainage Density	Storm surge	Soil	TWI	Distance to stream	Geology	Geomor-phology	NDVI
Rainfall	0.263	0.391	0.340	0.295	0.303	0.340	0.290	0.232	0.219	0.173	0.164
Elevation	0.132	0.195	0.227	0.295	0.303	0.272	0.232	0.166	0.170	0.134	0.127
Slope	0.088	0.098	0.113	0.098	0.101	0.204	0.174	0.133	0.122	0.096	0.091
Drainage Density	0.088	0.065	0.113	0.098	0.101	0.136	0.116	0.099	0.122	0.096	0.091
Storm surge	0.088	0.065	0.113	0.098	0.101	0.136	0.116	0.133	0.122	0.096	0.091
Soil	0.053	0.049	0.038	0.049	0.051	0.068	0.116	0.099	0.097	0.077	0.073
TWI	0.053	0.049	0.038	0.049	0.051	0.034	0.058	0.066	0.097	0.077	0.073
Distance to river	0.038	0.039	0.028	0.033	0.025	0.023	0.029	0.033	0.049	0.038	0.036
Geology	0.029	0.028	0.023	0.020	0.020	0.017	0.014	0.017	0.024	0.038	0.036
Geomorphology	0.029	0.028	0.023	0.020	0.020	0.017	0.014	0.017	0.012	0.019	0.018
NDVI	0.029	0.028	0.023	0.020	0.020	0.017	0.014	0.017	0.012	0.010	0.018
Weighted Sum	3.009	2.253	1.317	1.125	1.159	0.769	0.644	0.371	0.267	0.217	0.208
Consistency Index	**0.035**										
Consistency Ratio	**0.025 < 0.1** (Hence the calculations are okay)										

Supplementary Table 8. Pairwise Comparison Matrix of Socio-Economic Vulnerability Indicators

Indicators	Population Density	Female Density	Literacy rate	Distance to road	No. of Household	No. of Hospitals	LULC
Population Density	**1**	2.04	2.3	1.33	1.13	1.3	3
Female Density	0.49	**1**	1.13	0.65	0.55	0.64	1.47
Literacy rate	0.43	0.88	**1**	0.58	0.49	0.57	1.31
Distance to road	0.75	1.54	1.73	**1**	0.85	0.98	2.26
No. of Household	0.88	1.82	2.04	1.17	**1**	1.15	2.65
No. of Hospitals	0.77	1.57	1.75	1.02	0.87	**1**	2.31
LULC	0.33	0.68	0.76	0.44	0.38	0.43	**1**

Supplementary Table 9. Normalized Pairwise Comparison Matrix of Socio-Economic Vulnerability Indicators

Indicators	Population Density	Female Density	Literacy rate	Distance to road	No. of Household	No. of Hospitals	LULC
Population Density	0.216	0.216	0.216	0.216	0.216	0.216	0.216
Female Density	0.104	0.104	0.104	0.104	0.104	0.104	0.104
Literacy rate	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Distance to road	0.16	0.16	0.16	0.16	0.16	0.16	0.16
No. of Household	0.192	0.192	0.192	0.192	0.192	0.192	0.192
No. of Hospitals	0.168	0.168	0.168	0.168	0.168	0.168	0.168
LULC	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Critical Weights	0.216	0.104	0.09	0.16	0.192	0.168	0.07
Weights (%)	**21.6**	**10.4**	**9**	**16**	**19.2**	**16.8**	**7**

Supplementary Table 10. Calculation of Consistency Index & Consistency Ratio of Socio-Economic Vulnerability Indicators

Indicators	Population Density	Female Density	Literacy rate	Distance to road	No. of Household	No. of Hospitals	LULC
Population Density	0.106	0.104	0.102	0.104	0.106	0.108	0.103
Female Density	0.093	0.092	0.090	0.093	0.094	0.096	0.092
Literacy rate	0.162	0.160	0.156	0.160	0.163	0.165	0.158
Distance to road	0.190	0.189	0.184	0.187	0.192	0.193	0.186
No. of Household	0.166	0.163	0.158	0.163	0.167	0.168	0.162
No. of Hospitals	0.071	0.071	0.068	0.070	0.073	0.072	0.070
LULC	0.071	0.147	0.164	0.095	0.082	0.093	0.216
Weighted Sum	0.732	0.649	1.124	1.321	1.147	0.496	0.868
Consistency Index	**0.063**						
Consistency Ratio	**0.047 < 0.1** (Hence the calculations are okay)						