Supplementary Materials

Topic: **'Urban Flood Vulnerability Assessment In Freetown, Sierra Leone: AHP Approach'**

Table S1. LULC CHANGE OF FREETOWN_2001,2010 TO 2022 USING MODIS CLASSIFICATION

LULC CHANGE OF FREETOWN_2001,2010 TO 2022 USING MODIS CLASSIFICATION												
Year	Evergreen Needleleaf Forest	Evergreen Broadleaf Forest	Mixed Forest	Woody Savannas	Savannas	Grasslands	Permanent Wetlands	Croplands	Urban Built Lands	Cropland Mosaic	Barren	Water Bodies
2001 (Area_Sq_km)	0.6	96.07	0.48	117.12	237.16	2.16	120.48	7.73	74.88	32.65	0.88	5.86
2010 (Area_Sq_km)	0.2	122.6	0	121.5	262.6	10.9	73.2	10.4	80.7	7.9	0.3	5.9
2020 (Area_Sq_km)	0	72.9	0	131.6	266.3	30.6	67.9	11.8	97.1	10.9	1.2	5.9

Table S2. Pair-wise comparison of 9 × 9 decision matrix

Pair-wise comparison of 9 × 9 decision matrix									
Class	Rainfall	Slope	LULC	Drainage Density	Distance to Road	TWI	Distance to River	NDVI	Elevation
Rainfall	1	6	4	2	5	2	3	3	5
Slope	1/6	1	2	3	3	3	4	4	3
LULC	1/4	1/2	1	2	2	2	3	3	4
Drainage Density	1/2	1/3	1/2	1	1	2	2	1	3
Distance to Road	1/5	1/3	1/2	1	1	1	3	2	2
TWI	1/2	1/3	1/2	1/2	1	1	2	1	3

Distance to River	1/3	1/4	1/3	1/2	1/3	1/2	1	2	3
NDVI	1/3	1/4	1/3	1	1/2	1	1/2	1	1/2
Elevation	1/5	1/3	1/4	1/3	1/2	1/3	1/3	2	1
Total	2.99	1.95	1.48	1.00	0.90	0.86	0.63	0.67	0.44

Table S3. Weights of sub-classes using AHP comparison matrix

SI No	Parameter	Unit	Sub Classes	Vulnerabilty	Rank
1	Rainfall	m	2260-2300	Very Low	1
			2310-2480	Low	2
			2490-2530	Moderate	3
			2540-2580	High	4
			2590-2660	Very High	5
2	NDVI	Level	Water	Very High	5
			Built Up Area	High	4
			Barren Land	Moderate	3
			Grassland	Low	2
			Vegetation	Very Low	1
3	Elevation	m	13-80.294	Very High	1
			80.296-216.65	High	2
			216.66-363.76	Moderate	3
			363.77-525.54	Low	4
			525.25-902	Very Low	5
4	Drainage Density	m/km	0-0.432	Very Low	1
			0.433-0.935	Low	2
			0.936-1.58	Moderate	3
			1.59-2.52	High	4
			2.53-4.59	Very High	5
5	TWI	level	2985-6014	Very Low	1
			6015-7908	Low	2
			7909-10,56	Moderate	3
			1057-1397	High	4
			1398-223	Very High	5
6	Land Use Land Cover Change (LULC)	Level	Built Up Area	Very High	5
			Bare Land	High	4
			Vegetation	Moderate	3
			Cropland	Low	2
			Vegetation	Very Low	1
7	Distance to River	m	0-0.00776	Very High	5
			0.00776-0.04536	High	4
			0.04527-0.1056	Moderate	3
			0.1057-0.1271	Low	2
			0.1272-0.1522	Very Low	1
8	Slope	degree	0-4.974	Very High	5
			4.975-11.37	High	4
			11.38-18.47	Moderate	3
			18.48-26.29	Low	2
			26.3-60.4	Very Low	1
9	Distance to Road	m	0-0.00219	Very High	5
			0.00219-0.00694	High	4
			0.00694-0.01279	Moderate	3
			0.01279-0.01949	Low	2
			0.01949-0.03106	Very Low	1

Table S4 Normalized Pair-wise comparison										
Class	Rainfall	NDVI	Elevation	Drainage Density	TWI	LULC	Distance to River	Slope	Distance to Road	Priority Weight
Rainfall	0.334	4.478	11.364	2.000	2.326	2.703	4.762	3.077	5.556	0.27
NDVI	0.111	1.493	1.136	1.000	1.163	0.225	0.794	0.128	0.556	0.18
Elevation	0.111	1.493	1.136	1.000	1.163	0.225	0.794	0.128	0.556	0.14
Drainage Density	0.167	1.493	6.818	1.000	2.326	0.338	3.175	0.171	1.111	0.09
TWI	0.167	1.493	6.818	0.500	1.163	0.338	3.175	0.171	1.111	0.08
LULC	0.084	4.478	9.091	2.000	2.326	0.676	4.762	0.256	2.222	0.08
Distance to River	0.111	2.985	6.818	0.500	0.581	0.225	1.587	0.128	0.370	0.06
Slope	0.056	5.970	6.818	3.000	3.488	1.351	6.349	0.513	3.333	0.06
Distance to Road	0.067	2.985	4.545	1.000	1.163	0.338	4.762	0.171	1.111	0.04
									∑=	1.00

Table S5. Pair-wise comparison matrix scale and Random index for AHP

Pair-wise comparison matrix scale and Random index for AHP (Saaty 1980)	
Numerical rating	Verbal judgments of preferences
9	Extremely preferred
8	Very strongly to extremely
7	Very strongly preferred
6	Strongly to very strongly
5	Strongly preferred
4	Moderately to strongly
3	Moderately preferred
2	Equally to moderately
1	Equally preferred
Random Index (RI)	
Number of criteria	1 2 3 4 5 6 7 8 9 10 11
Random Index	0 0 0.58 0.9 1.12 1.24 1.32 1.41 1.45 1.49 1.51

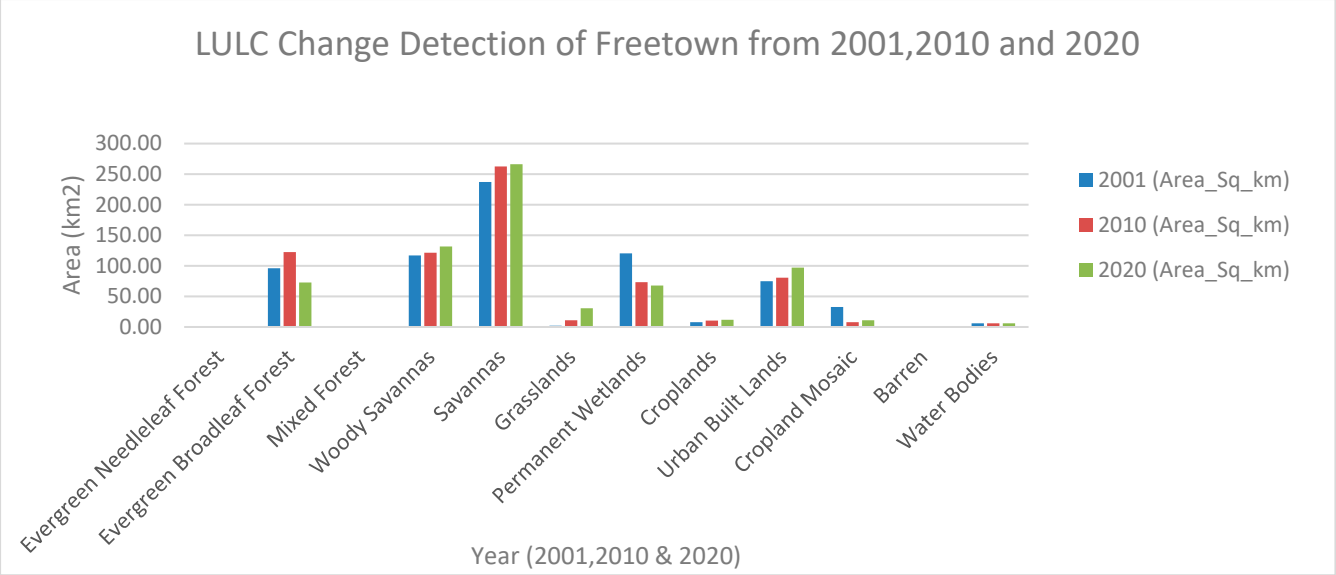

Figure S1. LULC Change Détection of Freetown from 2001,2010 and 2020