

Flood hazard in Afghanistan is intensified both by natural and socioeconomic factors

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Table S1. Calculation of relative importance weightage (RIW) for level 2 decision indicators used for the FHI index map a) Stream frequency, b) drainage density, c) Basin relief, d) Drainage texture, e) Infiltration number, f) Compactness coefficient.

a) Stream frequency							
Decision indicators	0.002 - 0.005	0.005 - 0.006	0.006 - 0.008	0.008 - 0.009	0.009- 0.01	EEV	RIW
0.002- 0.005	1	1/2	1/2	1/3	1/3	0.488	0.085
0.005- 0.006	2	1	1/2	1/2	1/3	0.699	0.121
0.006- 0.008	2	2	1	1/2	1/3	0.922	0.160
0.008 - 0.009	3	2	2	1	1/2	1.431	0.248
0.009 - 0.01	3	3	3	2	1	2.221	0.385
b) Drainage Density							
Decision indicators	0.01 - 0.04	0.04 - 0.07	0.07 - 0.09	0.09 - 0.11	0.11 - 0.15	EEV	RIW
0.01 - 0.04	1	1/2	1/3	1/3	1/4	0.43	0.071
0.04- 0.07	2	1	1/2	1/3	1/3	0.64	0.108
0.07 - 0.09	3	2	1	1/2	1/3	1.00	0.167
0.09 - 0.11	3	3	2	1	1/2	1.55	0.260
0.11 - 0.15	4	3	3	2	1	2.35	0.394
c) Basin Relief (in km)							
Decision indicators	0.4 - 1.3	1.3- 2.6	2.6 - 3.9	3.9 - 5.4	5.4 - 7.1	EEV	RIW
0.4 - 1.3	1	1/2	1/3	1/5	1/5	0.37	0.06
1.3- 2.6	2	1	1/2	1/3	1/3	0.64	0.10
2.6 - 3.9	3	2	1	1/2	1/3	1.00	0.16
3.9 - 5.4	5	3	2	1	1/2	1.72	0.28
5.4 - 7.1	5	3	3	2	1	2.46	0.40
d) Drainage Texture							
Decision indicators	0.02 - 0.05	0.05 - 0.08	0.08 - 0.1	0.1 - 0.14	0.14 - 0.18	EEV	RIW
0.02 - 0.05	1	1/2	1/3	1/3	1/4	0.43	0.07
0.05 - 0.08	2	1	1/2	1/3	1/3	0.64	0.11
0.08 - 0.1	3	2	1	1/2	1/2	1.08	0.18
0.1 - 0.14	3	3	2	1	1/2	1.55	0.26
0.14 - 0.18	4	3	2	2	1	2.17	0.37

e) Infiltration Number							
Decision indicators	0.00003 – 0.0005	0.0005 – 0.0007	0.0007 – 0.0008	0.0008 – 0.0010	0.0010 – 0.0014	EEV	RIW
0.00003 - 0.0005	1	1/2	1/2	1/2	1/3	0.53	0.10
0.0005 - 0.0007	2	1	1/2	1/2	1/2	0.76	0.14
0.0007 - 0.0008	2	2	1	1/2	1/2	1.00	0.18
0.0008 - 0.0010	2	2	2	1	1/2	1.32	0.24
0.0010- 0.0014	3	2	2	2	1	1.89	0.34
f) Compactness Coefficient							
Decision indicators	2.2 - 2.3	2.3 - 2.5	2.5 - 2.9	2.9 - 3.5	3.5 - 4.4	EEV	RIW
2.2 - 2.3	1	2	2	3	4	1.86	0.38
2.3 - 2.5	1/2	1	2	3	3	1.32	0.27
2.5 - 2.9	1/2	1/2	1	2	3	0.84	0.17
2.9 - 3.5	1/3	1/3	1/2	1	2	0.49	0.10
3.5 - 4.4	1/4	1/3	1/3	1/2	1	0.34	0.07

Table S2. Calculation of relative importance weightage (RIW) for level 2 decision indicators for the FHI index map a) Circulatory ratio, b) Elongation ratio, c) Ruggedness number, d) Bifurcation Ratio, e) Length of overland flow, f) Form factor

a) Circulatory Ratio							
Decision indicators	0.05 - 0.08	0.08 - 0.10	0.10- 0.14	0.14- 0.16	0.16 - 0.20	EEV	RIW
0.05 - 0.08	1	1/2	1/3	1/4	1/5	0.38	0.06
0.08 - 0.10	2	1	1/2	1/3	1/4	0.61	0.10
0.10- 0.14	3	2	1	1/2	1/3	1.00	0.16
0.14- 0.16	4	3	2	1	1/2	1.64	0.26
0.16- 0.20	5	4	3	2	1	2.61	0.42
b) Elongation Ratio							
Decision indicators	0.02 - 0.03	0.03 - 0.05	0.05- 0.06	0.06 - 0.07	0.07 - 0.16	EEV	RIW
0.02- 0.03	1	2	2	3	5	2.27	0.39
0.03- 0.05	1/2	1	2	2	3	1.43	0.24
0.05- 0.06	1/2	1/2	1	2	3	1.08	0.18
0.06- 0.07	1/3	1/2	1/2	1	2	0.70	0.12
0.07 - 0.16	1/5	1/3	1/3	1/2	1	0.41	0.07
c) Ruggedness number							
Decision indicators	0.02 - 0.12	0.12 - 0.21	0.21 - 0.32	0.32 - 0.44	0.44 - 0.62	EEV	RIW
0.02 - 0.12	1	1/2	1/2	1/3	1/3	0.49	0.09
0.12 - 0.21	2	1	1/2	1/2	1/3	0.70	0.12
0.21 - 0.32	2	2	1	1/2	1/2	1.00	0.18
0.32 - 0.44	3	2	2	1	1/2	1.43	0.25
0.44 - 0.62	3	3	2	2	1	2.05	0.36
d) Bifurcation Ratio							
Decision indicators	1.12 - 1.59	1.59 - 2.06	2.061 - 2.837	2.83 - 4.56	4.56 - 7.70	EEV	RIW

1.12 - 1.594	1	1/2	1/3	1/4	1/5	0.452	0.056
1.594 - 2.061	2	1	1/2	1/3	1/4	0.760	0.094
2.061 - 2.837	3	2	1	1/2	1/3	1.316	0.163
2.837 - 4.562	4	3	2	1	1/2	2.213	0.275
4.562 - 7.70	5	4	3	2	1	3.310	0.411
e) Length of overland flow							
Decision indicators	3.20 - 4.91	4.91 - 5.99	5.99- 7.83	7.83- 12.110	12.11 - 30.74	EEV	RIW
3.20 - 4.91	1	2	3	5	5	2.72	0.43
4.91 - 5.99	1/2	1	2	3	4	1.64	0.26
5.99 - 7.83	1/3	1/2	1	3	3	1.08	0.17
7.83- 12.11	1/5	1/3	1/3	1	3	0.58	0.09
12.11- 30.74	1/5	1/4	1/3	1/3	1	0.35	0.06
f) Form factor							
Decision indicators	0.11 - 0.17	0.17 - 0.28	0.28 - 0.49	0.49 - 0.76	0.76 - 1.64	EEV	RIW
0.11 - 0.17	1	1/2	1/2	1/3	1/3	0.49	0.09
0.17 - 0.28	2	1	1/2	1/2	1/3	0.70	0.12
0.28 - 0.49	2	2	1	1/2	1/2	1.00	0.18
0.49 - 0.76	3	2	2	1	1/2	1.43	0.25
0.76 - 1.64	3	3	2	2	1	2.05	0.36

15 Table S3. Calculation of relative importance weightage (RIW) for level 2 decision indicators of Precipitation (mm) for the FHI index.

Decision indicators	3-14	15-28	29-45	46-67	68-98	EEV	RIW
3-14	1	1/2	1/2	1/3	1/4	0.461	0.076
15-28	2	1	1/2	1/3	1/4	0.608	0.101
29-45	2	2	1	1/2	1/3	0.922	0.153
46-67	3	3	2	1	1/2	1.552	0.257
68-98	4	4	3	2	1	2.491	0.413

20 Table S4. Calculation of relative importance weightage (RIW) for level 2 decision indicators for the FVI index map flood vulnerability of the Afghanistan region (a) population density, (b) Rural population density, (d) Literacy rate, (e) Female literacy, f) Basic health centres

a) Population density							
Decision indicators	4-17	17-44	44-106	106-247	247-1074	EEV	RIW
4-17	1	1/2	1/3	1/5	1/7	0.34	0.05
17-44	2	1	1/2	1/3	1/4	0.61	0.09
44-106	3	2	1	1/2	1/3	1.00	0.15
106-247	5	3	2	1	1/2	1.72	0.27
247-1074	7	4	3	2	1	2.79	0.43
b) Rural population density							
Decision indicators	3-17	18-34	35-62	63-119	120-246	EEV	RIW
3-17	1	1/2	1/2	1/3	1/3	0.49	0.09

18-34	2	1	1/2	1/2	1/3	0.70	0.12
35-62	2	2	1	1/2	1/2	1.00	0.18
63-119	3	2	2	1	1/2	1.43	0.25
120-246	3	3	2	2	1	2.05	0.36
c) Literacy rate							
Decision indicators	15.8 - 19.9	20.0 - 28.1	28.2 - 33.4	33.5 - 39.3	39.4 - 55.3	EEV	RIW
15.8 - 19.9	1	2	4	5	7	3.09	0.45
20.0 - 28.1	1/2	1	2	4	6	1.89	0.28
28.2 - 33.4	1/4	1/2	1	2	4	1.00	0.15
33.5 - 39.3	1/5	1/4	1/2	1	3	0.60	0.09
39.4 - 55.3	1/7	1/6	1/4	1/3	1	0.29	0.04
d) Female literacy							
Decision indicators	1.5 - 3.8	3.8 - 6.9	6.9 - 16.1	16.1 - 21.6	21.6 - 40.9	EEV	(RIW
1.5 - 3.8	1	2	3	3	5	2.46	0.40
3.8 - 6.9	1/2	1	2	3	4	1.64	0.27
6.9 - 16.1	1/3	1/2	1	2	3	1.00	0.16
16.1 - 21.6	1/3	1/3	1/2	1	2	0.64	0.11
21.6 - 40.9	1/5	1/4	1/3	1/2	1	0.38	0.06
e) Basic health centres facilities							
Decision indicators	19.0 - 36.0	36.1 - 52.0	52.1 - 70.0	70.1 - 84.0	84.1 - 133.0	EEV	RIW
19.0 - 36.0	1	3	3	5	5	2.95	0.46
36.1 - 52.0	1/3	1	2	3	3	1.43	0.22
52.1 - 70.0	1/3	1/2	1	2	3	1.00	0.16
70.1 - 84.0	1/5	1/3	1/2	1	2	0.58	0.09
84.1 - 133.0	1/5	1/3	1/3	1/2	1	0.41	0.06

Table S5. Calculation of relative importance weightage (RIW) for level 2 decision indicators for the FVI index map flood vulnerability of the Afghanistan region: a) Safe drinking water, b) Distance to the nearest drivable road, c) Cultivated Area, d) Poverty rate, e) Unemployment rate

a) Safe drinking water							
Decision indicators	9.6 - 23.5	23.5 - 39.4	39.4 - 55.6	55.6 - 68.5	68.5 - 93.7	EEV	RIW
9.6 - 29.7	1	2	3	3	4	2.35	0.40
29.8 - 49.1	1/2	1	2	2	3	1.43	0.24
49.2 - 62.6	1/3	1/2	1	2	2	0.92	0.16
62.7 - 77.5	1/3	1/2	1/2	1	2	0.70	0.12
77.6 - 93.7	1/4	1/3	1/2	1/2	1	0.46	0.08
b) Distance to the nearest drivable road							
Decision indicators	0.1 - 1.7	1.7 - 3.5	3.5 - 6.7	6.7 - 10.9	10.9 - 24.9	EEV	RIW
0.1 - 1.7	1	1/2	1/3	1/5	1/7	0.34	0.05
1.7 - 3.5	2	1	1/2	1/4	1/6	0.53	0.08
3.5 - 6.7	3	2	1	1/2	1/3	1.00	0.15
6.7 - 10.9	5	4	2	1	1/3	1.68	0.25
10.9 - 24.9	7	6	3	3	1	3.28	0.48

c) Cultivated Area							
Decision indicators	0.8 - 4.2	4.2 - 8.2	8.2 - 18.9	18.9 - 33.4	33.4 - 51.6	EEV	RIW
0.8 - 4.2	1	1/2	1/3	1/5	1/7	0.34	0.05
4.2 - 8.2	2	1	1/2	1/3	1/5	0.58	0.09
8.2 - 18.9	3	2	1	1/3	1/3	0.92	0.14
18.9 - 33.4	5	3	3	1	1/3	1.72	0.26
33.4 - 51.6	7	5	3	3	1	3.16	0.47
d) Poverty rate							
Decision indicators	12.8 - 34.3	34.4 - 50.7	50.8 - 61.8	61.9 - 76.5	76.6 - 90.2	EEV	RIW
12.8 - 34.3	1	1/3	1/5	1/7	1/7	0.27	0.04
34.4 - 50.7	3	1	1/3	1/4	1/5	0.55	0.08
50.8 - 61.8	5	3	1	1/3	1/4	1.05	0.15
61.9 - 76.5	7	4	3	1	1/2	2.11	0.30
76.6 - 90.2	7	5	4	2	1	3.09	0.44
e) Unemployment rate							
Decision indicators	10.6 - 13.8	13.8 - 18.3	18.3 - 25.3	25.3 - 33.3	33.3 - 46.4	EEV	RIW
10.6 - 13.8	1	1/2	1/2	1/3	1/3	0.49	0.09
13.8 - 18.3	2	1	1/2	1/2	1/3	0.70	0.12
18.3 - 25.3	2	2	1	1/2	1/2	1.00	0.18
25.3 - 33.3	3	2	2	1	1/2	1.43	0.25
33.3 - 46.4	3	3	2	2	1	2.05	0.36

Table S6. Landuse and Land cover AHP calculation Land Use and Land Cover: Calculation of relative importance weightage (RIW) for level 2 decision indicators

Decision indicators	Urban or Built Up	Cultivated Land	Water Body / Marshland	Forest or shrub	Barren or Sand cover	Permanent Snow	EEV	RIW
Urban or Built Up	1	2	3	5	7	7	3.37	0.39
Cultivated Land	1/2	1	3	5	7	7	2.68	0.31
Water Body or Marshland	1/3	1/3	1	2	2	2	0.98	0.11
Forest or shrub	1/5	1/5	1/2	1	2	2	0.66	0.08
Barren or Sand cover	1/7	2/7	1/2	1/2	1	2	0.52	0.06
Permanent Snow	1/7	1/7	1/2	1/2	1/2	1	0.37	0.04

30 Table S7. Saaty's scale of preference

Intensity importance	Definition
1	Equal importance

3	Moderate importance
5	Strong importance
7	Very strong or Demonstrated importance
9	Extreme importance
2,4,6,8	Intermediate values
Reciprocals	Inverse comparison

Table S8. Saaty's Random index values

Number of criteria	Random consistency index
1	0
2	0
3	0.58
4	0.89
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49
11	1.51
12	1.54
13	1.56
14	1.57
15	1.59
16	1.60

35 Table S9: Summary table of governing factors characterizing flood risks zones at subbasin/province level.

Flood Risk Zones	Very High	High	Moderate	Low
Covered Area (%)	24	22	26	28
Corresponding subbasin	1, 2, 3, 4, 6, 7, 10,15, 16, 18, 21	5, 8, 9, 11, 12, 23, 25, 27, 28, 30, 40	13, 14, 17,19, 20, 22, 21, 32, 39, 44, 46, 48, 49	24, 26, 33, 34, 35, 36, 37, 38,41, 42, 43, 47,
Corresponding River basins	Amu and Kabul River basin	Kabul, Northern and Harirud-Morghab	Northern and Hilmand	Hilmand and Harirud-Morghab
Hydro-morphometry governing indicators	high stream frequency, circular basins, higher precipitation, low	longer overland flow paths and significant basin relief within areas with lower	higher drainage density, shorter overland flow, and	higher drainage density, lower overland flow and

	compact basin and higher infiltration number	drainage density and infiltration numbers	higher infiltration numbers	higher infiltration number
Socio-economic governing indicators	high population density, significant land use changes, better access to safe drinking water and high poverty rates	Areas with higher population density, including rural populations, better access to safe drinking water, and lower literacy rates	higher rural and overall population density, closer proximity to drivable roads, significant land use changes, and lower female literacy rates	Literate rate, closer to accessible road and lower population density