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Assignment: Risk-Based Zoning of the August 2024 Flood in Bangladesh

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Risk-Based Zoning of the August 2024 Flood in Bangladesh

1 Introduction

This report analyses the recent flash floods in 2024 that affected the South-Eastern and Eastern districts of Bangladesh. Eleven of the most affected districts were selected in this report. Three different parameters including the number of people affected, the number of people displaced and the area covered by the flood in each district were considered. For each parameter, all of the districts were ranked and were issued an impact score by using the min-max normalisation or Feature Scaling [1] which is shown by Equation 1. The districts were given an impact score based on their likelihood of occurrence using the same method. Both the Relative Impact Score and the Relative Likelihood score were combined to calculate the Risk Matrix as shown in Figure 1.

$$x = a + \frac{(x - x_{\min})}{(x_{max} - x_{min})} \times (b - a) \tag{1}$$

As shown in Fig 1-1, the risk values are divided into four categories ranging from Very High Risk, High Risk, Medium Risk and Low Risk. Finally, each district is assigned their respective risk values and projected on the map by ArcGis software.

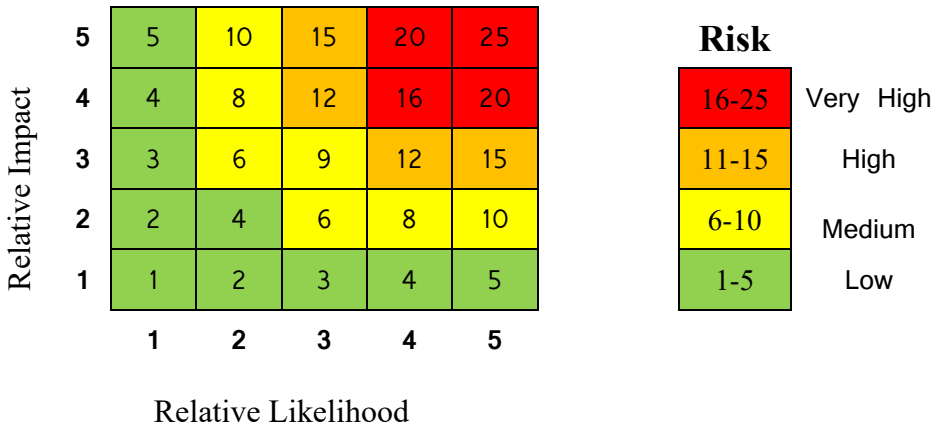

Fig. 1-1 Risk Matrix

2 Risk-Based Zoning Based on People Affected

The risk matrix in Table 2-1 and corresponding risk map Fig. 2-1 provide critical insights into the impact of the August 2024 floods in Bangladesh, highlighting variations in vulnerability across different districts. Noakhali emerges as the most severely affected district, with a risk index of 20, categorizing it in the "Very High" risk zone due to its combination of significant population affected (2,130,000) and high impact and likelihood scores [2]. Similarly, Feni and Lakshmipur follow with "High" risk ratings, as their substantial populations and high likelihood of flood events make them particularly vulnerable.

Table 2-2 Risk index based on people affected

Districts	People Affected	Impact Level (V)	Likelihood (H)	Risk Index (R)
Noakhali	2130000 [3]	5	4	20
Feni	1000000 [4]	3	4	12
Lakshmipur	723,000 [5]	3	4	12
Habiganj	70,240 [6]	2	4	8
Moulivibazar	257,993 [7]	2	3	6
Chattogram	262,400 [8]	2	2	4
Sylhet	66,000 [9]	2	2	4
Cumilla	1060000 [10]	3	1	3
Brahmanbariya	64,829 [8]	1	3	3
Cox's Bazar	148,450 [8]	2	1	2
Khagracchari	123,992 [8]	2	1	2

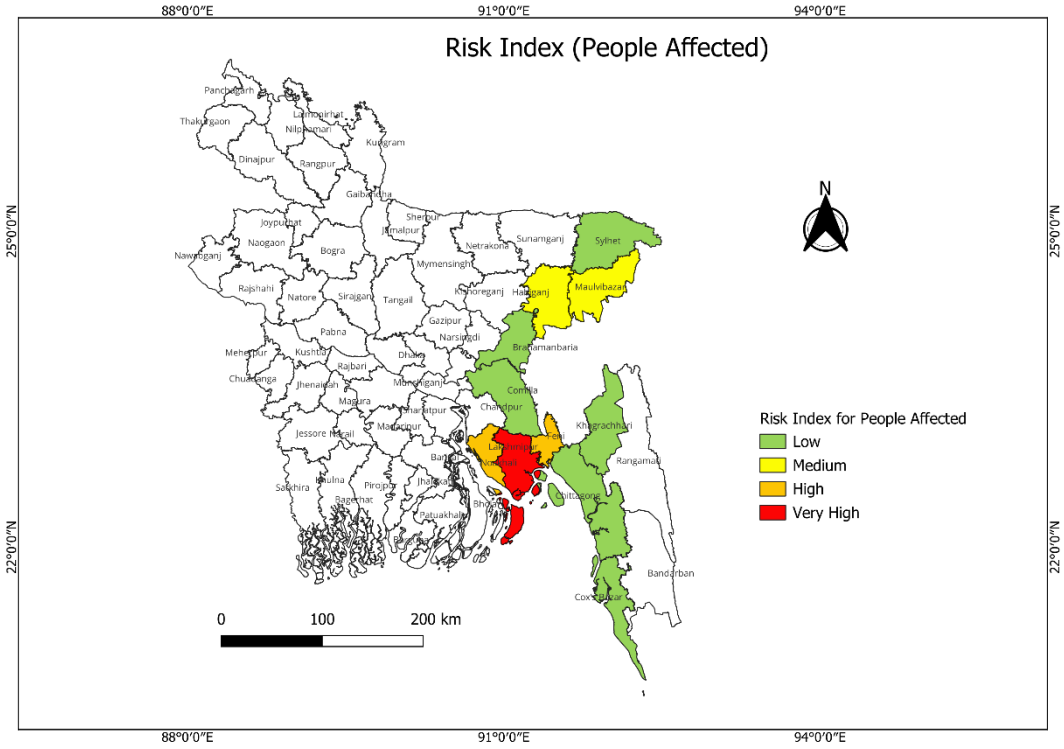

Fig. 2-2 Risk Map for People Affected

On the other hand, districts like Habiganj, Moulvibazar, and Chattogram fall in the "Medium" risk category, reflecting moderate levels of impact and likelihood. Districts such as Sylhet, Cox's Bazar, and Khagrachari, which exhibit lower risk indices, are categorized in the "Low" risk zone

3 Risk-Based Zoning Based on People Displaced

Due to its high number of displaced individuals (205,745) and maximum impact level Feni is identified as the most critically affected district, with a risk index of 20, categorizing it in the "Very High" risk zone as shown in Table 3-1. Noakhali and Lakshmipur are also categorized as "High" risk areas, with risk indices of 12 each, indicating substantial displacement combined with a considerable likelihood of flooding.

Table 3-1 Risk index based on people displaced

Districts	People Displaced	Impact Level	Likelihood (H)	Risk Index (R)
Feni	205,745 [4]	5	4	20
Noakhali	120,493 [3]	3	4	12
Lakshmipur	73,040 [5]	3	4	12

Districts	People Displaced	Impact Level	Likelihood (H)	Risk Index (R)
Habiganj	24000 [11]	2	4	8
Moulvibazar	80,000 [12]	3	3	9
Chattogram	250,000 [13]	5	2	10
Sylhet	4,000 [14]	2	2	4
Brahmanbariya	120 [15]	1	3	3
Cox's Baza	31,000 [16]	2	1	2
Cumilla	14,871 [10]	2	1	2
Khagracchari	8,130	2	1	2

In contrast, districts such as Habiganj, Moulvibazar, and Chattogram fall into the "Medium" risk category. Although they exhibit notable displacement numbers, their lower likelihood or impact levels result in moderate risk indices. Low-risk zones include Sylhet, Brahmanbaria, Cox's Bazar, Cumilla, and Khagrachari, where displacement figures and associated risks are significantly lower.

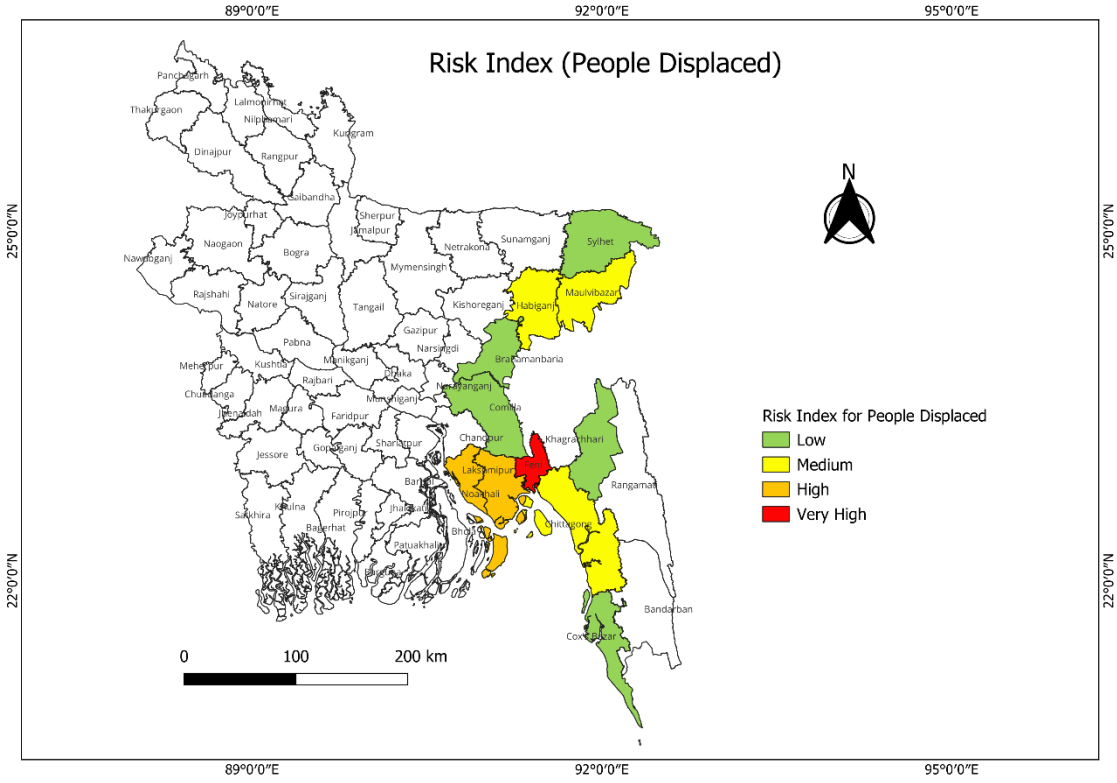

Fig. **3-1** Risk map based on people displaced

4 Risk-Based Zoning Based on Area Covered by the Flood

In the case of the flooded area, feni also rises in the list of highest risk. As Feni is one of the smallest districts in Bangladesh, the percentage of area covered by flood in August 2024 is much higher than of the other districts followed by Lakshmipur, Noakhali and Moulvibazar districts.

Table 4-1 Risk index based on area covered

Districts	Area Flooded (%)	Impact Level	Likelihood (H)	Risk Index (R)
Feni	78 [4]	5	4	20
Lakshmipur	100	5	4	20
Noakhali	92.04	5	4	20
Moulvibazar	60	4	3	12
Habiganj	40 [15]	3	4	12
Chattogram	73 [18]	4	2	8
Sylhet	39.4 [19]	3	2	6
Khagracchari	77.77 [18]	5	1	5
Cumilla	71.5	4	1	4
Cox's Bazar	62.5 [18]	4	1	4
Brahmanbariya	10 [15]	1	3	3

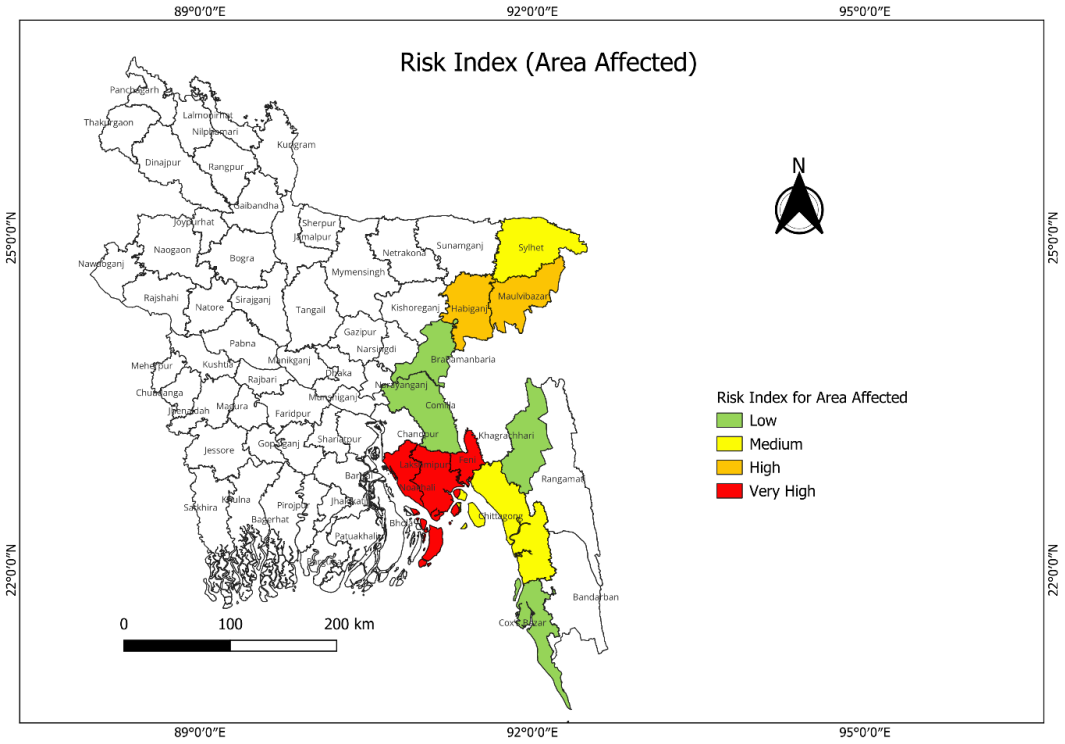

Fig. 4-1 Risk Map for Area Affected

5 Conclusion

6 References

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