Department of Geography
Hong Kong Baptist University

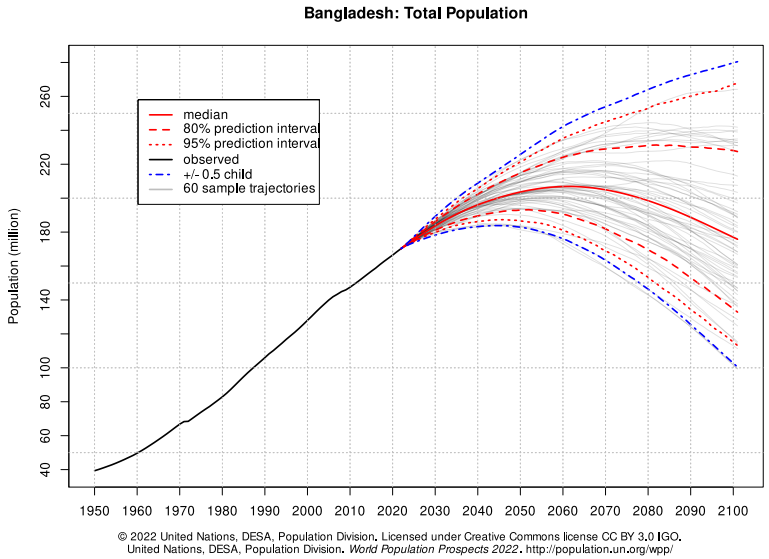
Climate-induced shocks trigger food security risk through crop productivity loss in coastal Bangladesh

Md Abdullah Al Mamun[1,2], Jianfeng Li[1,4], Aihong Cui[1], Raihana Chowdhury[2], Md Lokman Hossain[1,3]

[1]Department of Geography, Hong Kong Baptist University, Hong Kong, China
[2]Department of Food Technology and Nutrition Science, Noakhali Science and Technology University, Noakhali, Bangladesh
[3]Department of Environment Protection Technology, German University Bangladesh, Gazipur, Bangladesh
[4]Department of Geography and Resource Management, The Chinese University of Hong Kong, Hong Kong, China

Presenter : Md Abdullah Al Mamun

- Bangladesh is a country with a population of **over 170 million** and a density of around **1329** individuals Km^2
- The coasts are **32%** of the total area of Bangladesh, Impacted by climate change.



- **Small-scale agriculture in Bangladesh is** sensitive to climate change and climate-induced extreme events.
- **Frequent and intense** drought & wet periods, events are critical factors in the reduction of crop production.

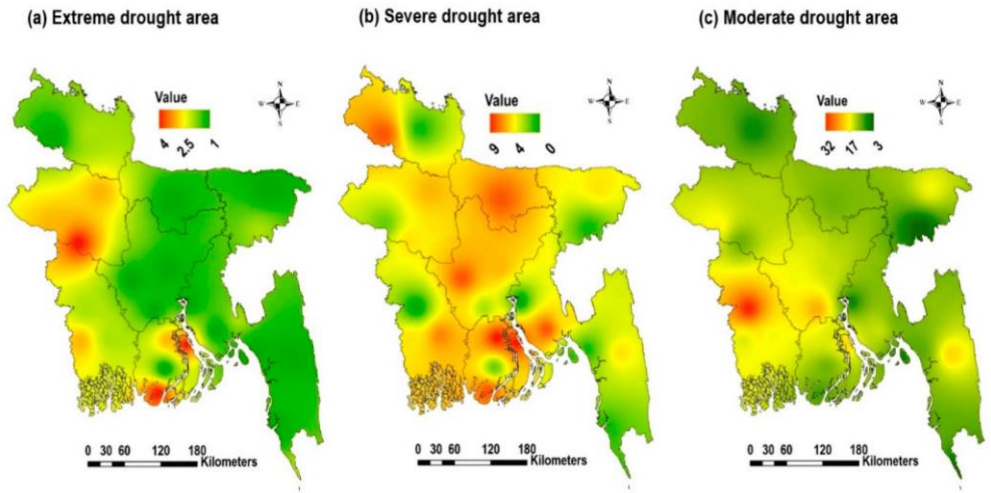
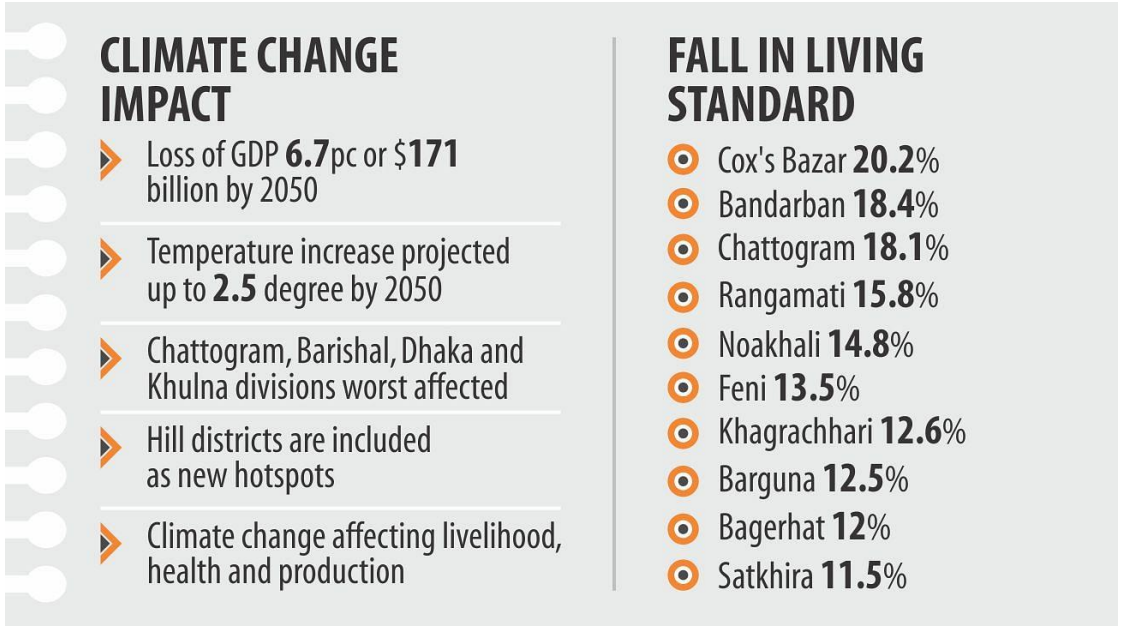


Figure 1: Spatial distribution of droughts from 1981–2015: (a) Extreme; (b) Severe; (c) Moderate severities (Kamruzzaman et al., 2019).

- **Drought** and low **soil water capacity** threaten agriculture and the livelihood of farmers.
- The latest World Food Programme (WFP) report shows that **24%** of the population is food insecure.
- The prevalence of undernutrition is **30% or higher** in countries in Sub-Saharan Africa (SSA), India, **Bangladesh,** and Yemen (Ssentongo et al., 2021). Even undernutrition is spatially distributed at a higher rate in different district levels of Bangladesh (Das et al.,2022).



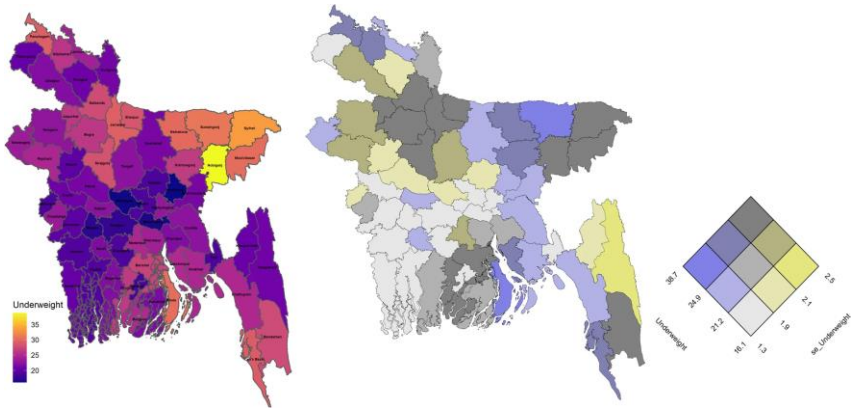


Figure 2: Climate change impact and risk of malnutrition (The daily star 2022; Das et al.,2022)

Research Gaps

1. Climate and hydrology in **drought – wet** research on **small area scale** is rare in Bangladesh.
2. Examining the **agricultural stakeholders' views** on climate risk indicators for **food security** in a local area is difficult; it can sensitize **policy** improvement.

Objectives

To assess the climate change drought-wet effect in the southeastern coastal part of Bangladesh.

Significance

- Assessing **climatic conditions** will help relevant **stakeholders** design projects, programs, and interventions.
- Evaluation of stakeholders' **perceptions** will provide **evidence-based** knowledge.

To assess the climate change drought in the coastal part of Bangladesh

- Introductions
- **Methodology**
- Results
- Discussions

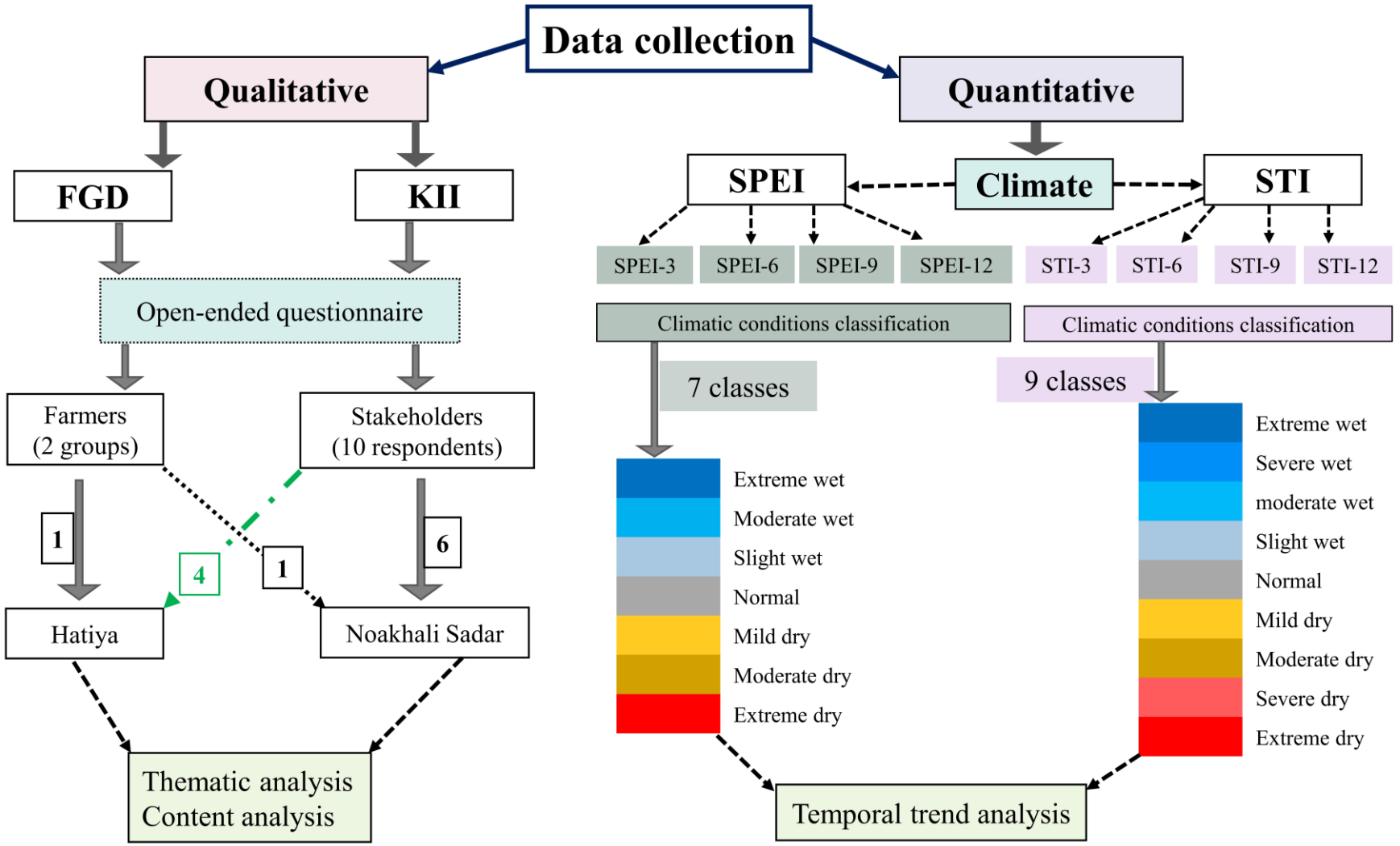


Figure 3: The methodological framework for the study

Introductions

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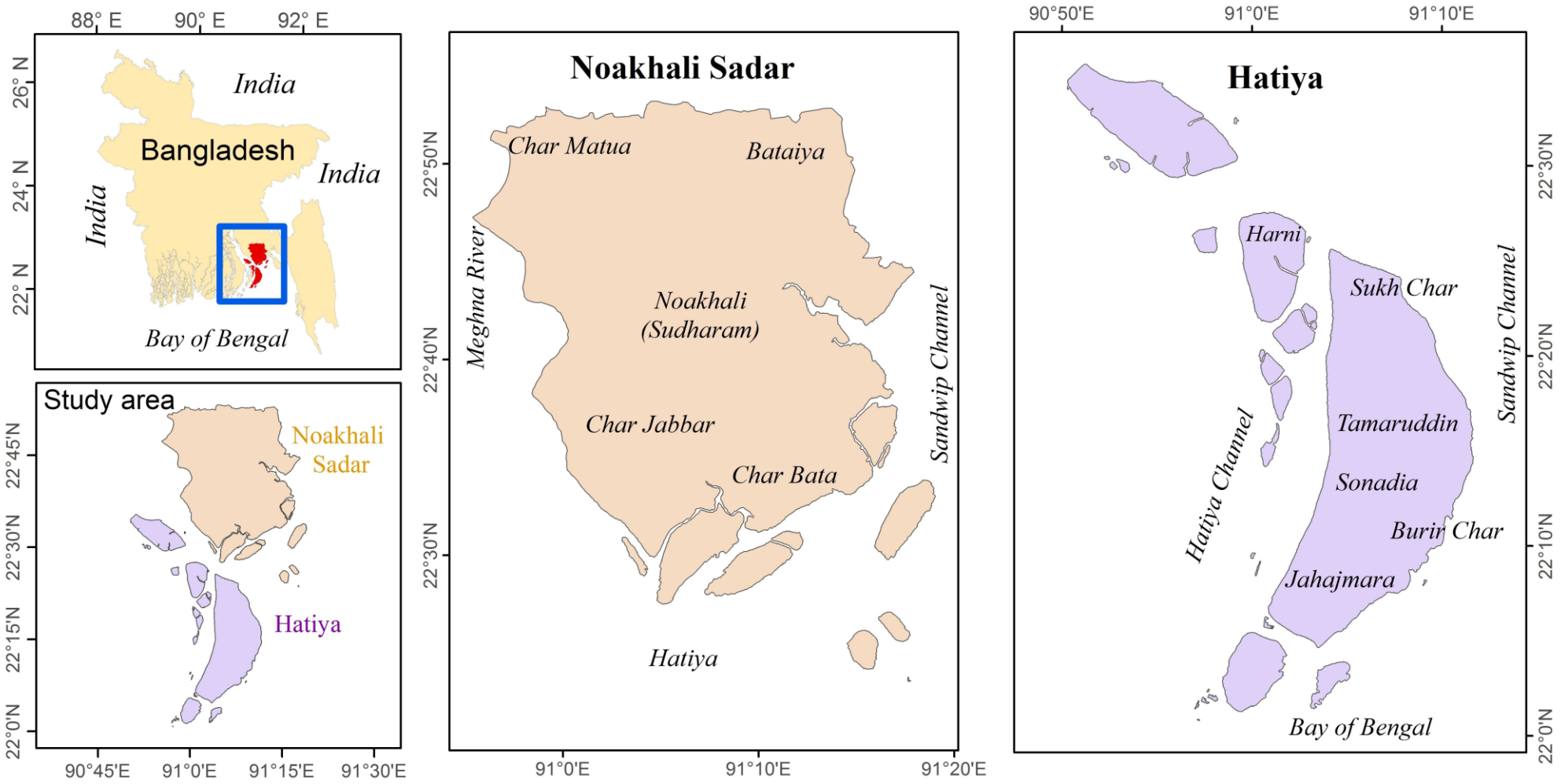

Figure 4: The study area of the coastal district in Bangladesh.

Theme 1 - Climate Change and Traditional Agriculture

Agriculture sector personnel perceived one of the answer -

"***Increasing temperature*** *is the main reason of* ***climate change.*** *Methane gas is produced a lot in soil which influenced climate change. In the rivers and oceans, chemical and waste from various industries and ships are created a layer of oil which hinders the carbon fixation.* ***Groundwater*** *is used for several purpose which contain heavy metals (Arsenic, Chromium) are mixing with atmosphere and effect on climate. Seawater enters into* ***the freshwater reservoir*** *which became useless for agriculture. Industry does not establish waste management plant properly, as a result* ***environment and water bodies*** *are polluted by chemical and other waste. Several pesticides are used in cultivation which hampers necessary microbes and insects and causes for climate change."*

Theme 2 – Climate-Adaptive Agriculture

One of the answer from the **Non-Government Body** described that-

"*Due to less access of timely rainfall and untimely heavy rainfall, farmers are starting to produce plants of fruits and vegetable in tray and coconut shell system. For paddy culture,* ***floating seedbed system*** *is very effective. Farmers are encouraged to* ***use organic fertilizer*** *and to avoid pesticide to maintain nutrition quality in foods. Nim oil, Mahogany oil, Pheromone trap, Lighting trap, Boddo mixture, Fruit bagging etc. techniques were introduced to maintain nutrition level in foods. Guti urea is begun to use by farmer to reduce the loss of urea through water. BRI-72, 62, 47 varieties are saline tolerance have introduced in Hatiya. Bostami rice is given to farmer which has ability to tolerate heat. In case of mango cultivation, gypsum and ash are used in soil and proper irrigation to reduce salinity.* ***Sack method*** *is introduced to cultivate vegetables and fruits in where soil can hold water for long time even at heat weather. Baby watermelon have introduced to cultivate in all the year round especially in rainy season. Vermi compost and Tryco compost are also used in plants which act as both fertilizer and pesticide.****"***

Theme 3 – Food Security

University and Research body personnel expressed one of the answers for theme 4 is that-

"Food especially fruits and vegetables are still now not so much available in Noakhali as because most fruits and vegetables are not growing here. All of them are coming from outside exotic source like Chittagong and north part of Bangladesh. If ***saline tolerant, heat tolerant, saline resistance type variety*** *are introduced which will be best for accessibility of food. People should need to get idea about food utilization to know the nutritional status of food. New variety adaptation and cultivation with nutritional management are progressing in this area day by day. But expensive cost of seed, poor farmer has no own land and pond are barrier for ensuring food security."*

Government body from Agriculture sector personnel perceived one of answer for theme 5 is that-

"Staple foods acceptance is higher in Hatiya Upazila. But the supply of nutritious foods such as fruits, meats etc. are much less. That's why the nutrition status is very low in this area and people are having ***malnutrition problem."***

Table 1. Awareness and utilization of climate-adaptive techniques obtained from content analysis of 2 Focus Group Discussions (FGDs) in Noakhali Sardar and Hatiya sub-districts in coastal Bangladesh.

Name of technique	No. of aware respondents (% of total respondents)	No. of user respondents (% of total respondents)
Rainwater harvest	7 (58)	5 (42)
Use of pheromone trap	6 (50)	3 (25)
Organic fertilizer	8 (67)	6 (50)
Integrated cropping	5 (42)	3 (25)
Drought-tolerant crop cultivation	7 (58)	5 (42)
Application of Sorjon method	3 (25)	2 (17)
Improved seed variety	7 (58)	4 (33)
Irrigation	8 (67)	5 (42)
Mulching	3 (25)	2 (17)

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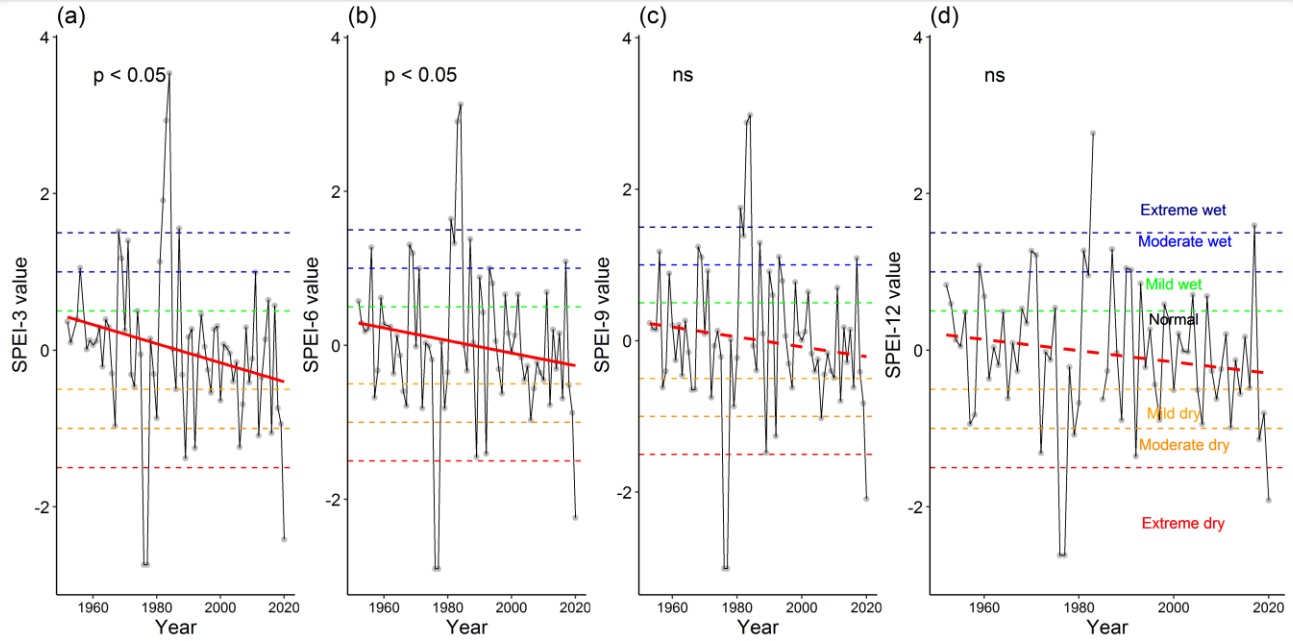

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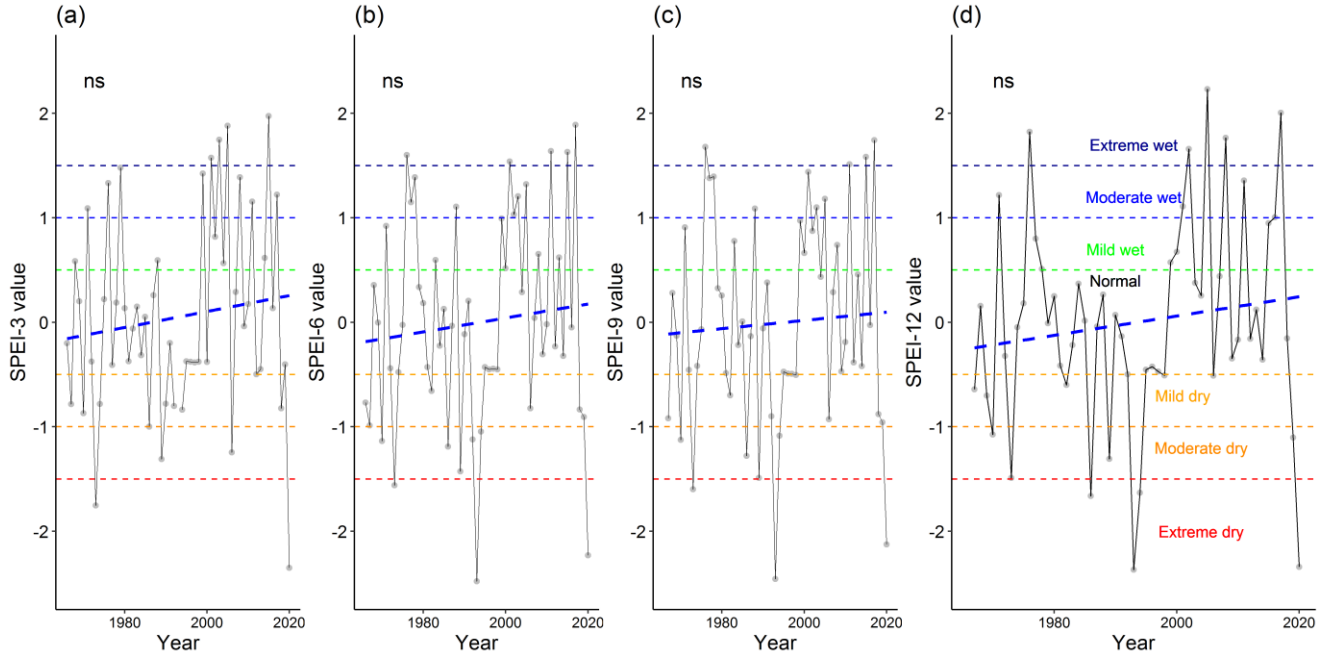

Result Figures 1 and 2: The SPEI index of Maijdiee court and Hatiya weather station with the Kendall trend line for a) SPEI3, b) SPEI6, c) SPEI9, and d) SPEI12 from 1966-2020 for Hatiya and 1952-2019 for Maijdee court weather station.

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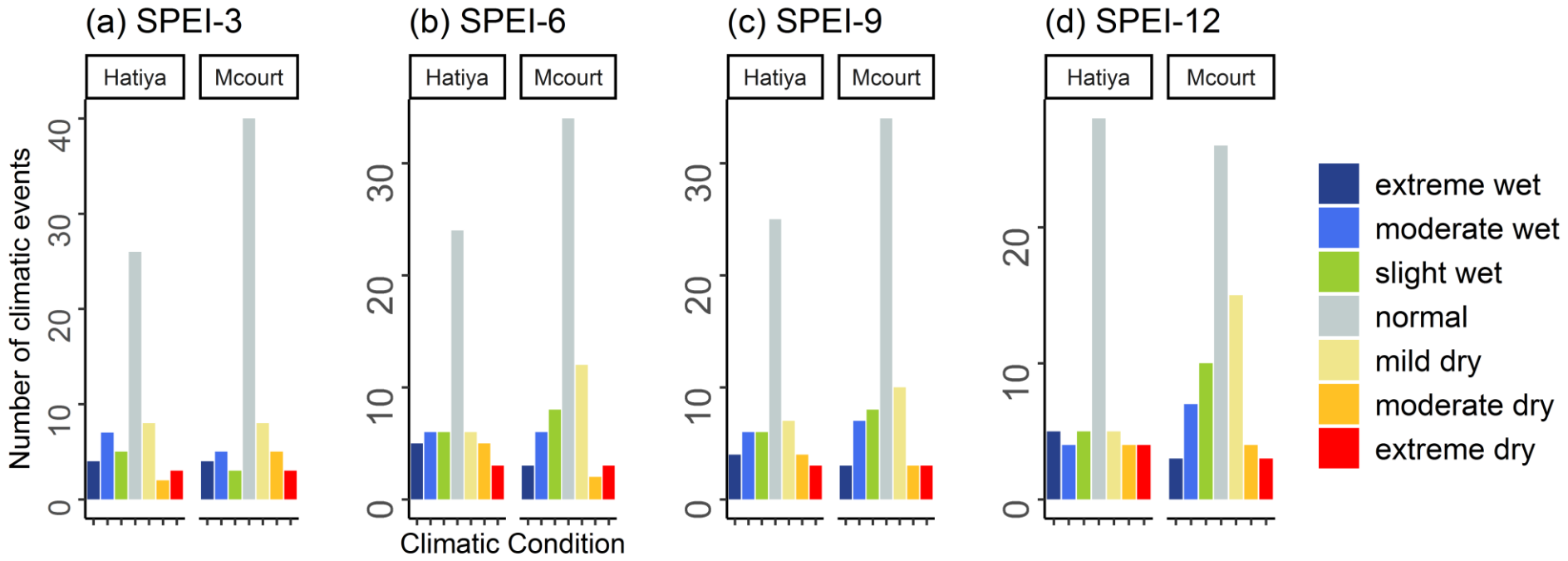

Result Figures 3: The number of the climatic events on the SPEI index of Hatiya and Maijdiee court weather station with the Kendall trend line for a) SPEI3, b) SPEI6, c) SPEI9, and d) SPEI12 from 1966-2020 for Hatiya and 1952-2019 for Maijdee court weather station.

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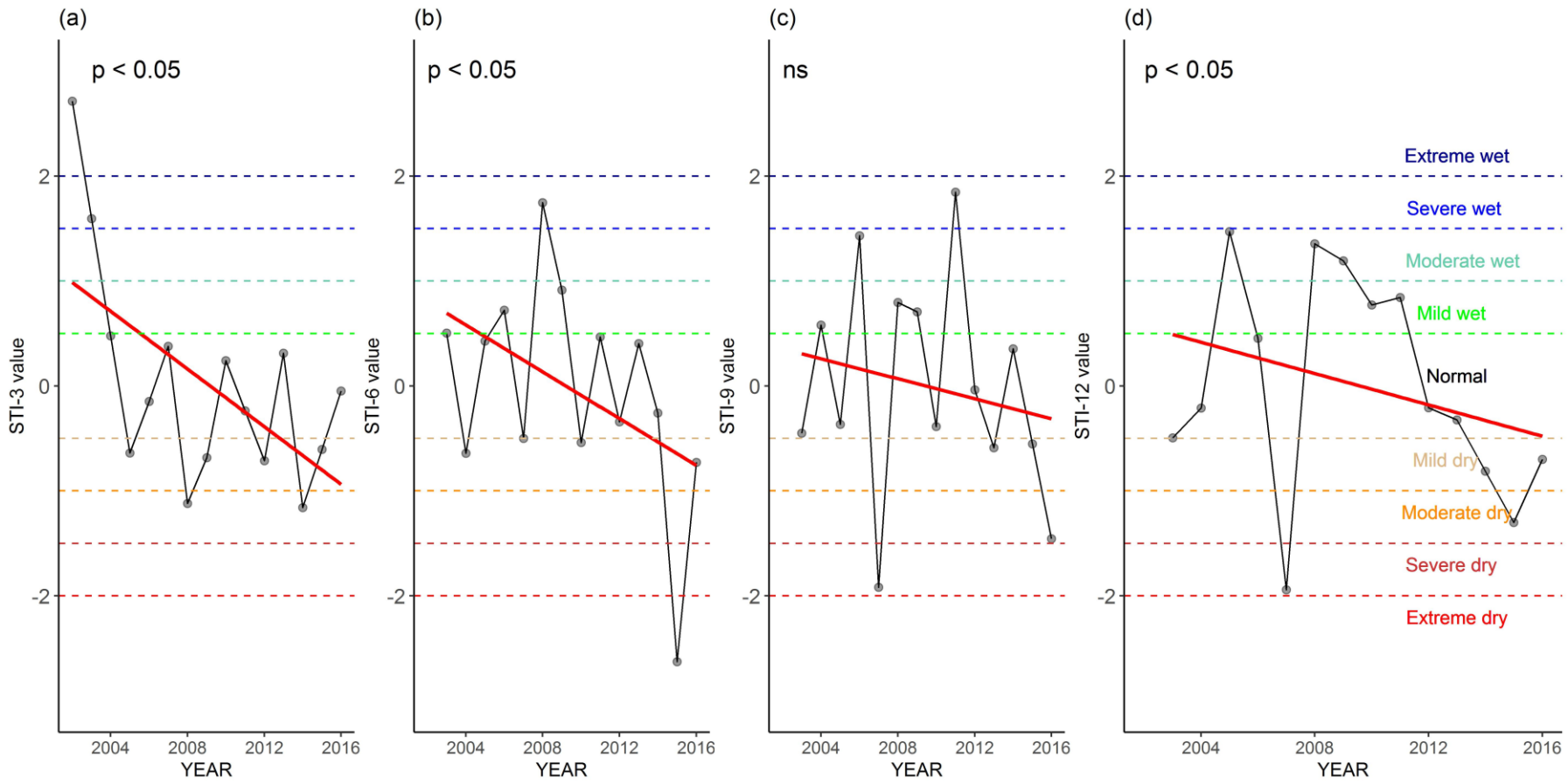

Result Figures 4: The STI index of Hatiya and Maijdiee court weather station with the Kendall trend line for a) STI3, b) STI6, c) STI9, and d) STI12 from 2002-2017 for the weather stations.

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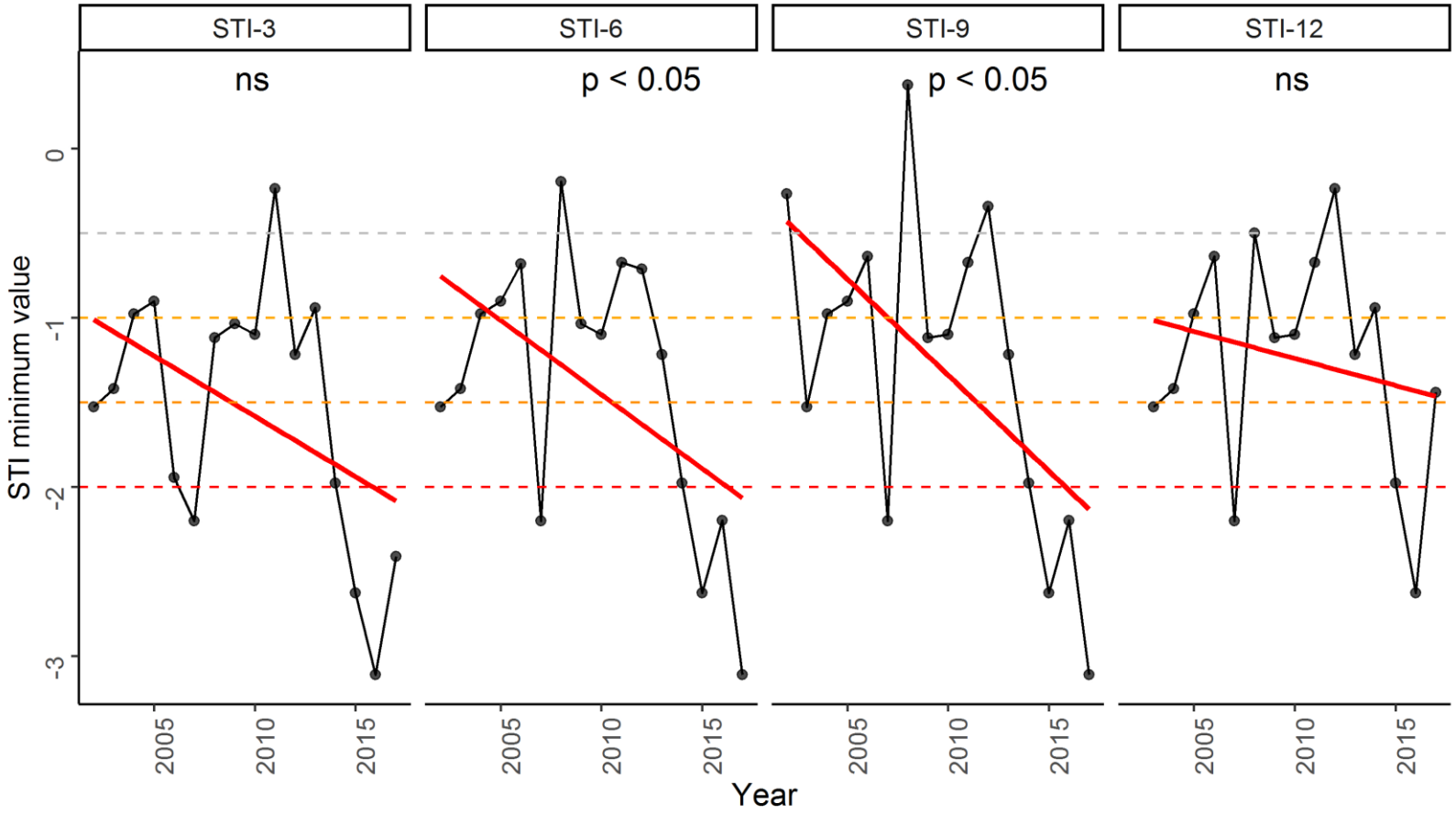

Result Figures 5 : The STI minimum value index of Hatiya and Maijdiee court weather station with the Kendall trend line for a) STI3, b) STI6, c) STI9, and d) STI12 from 2002-2017 for the weather stations.

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- Our analysis found **the rising intensity** of growing season **dry climatic conditions**, suggesting coastal Bangladesh is vulnerable to more **drought-wet** events.
- Empirical studies in **climatic zones** (Rahman et al. 2021), **the west** (Shahid and Behrawan 2008), and **the northwestern** (Das et al. 2017) have similar and more **drought intensity** findings.
- **Droughts** threaten these regions' **livelihoods** (Hoque et al. 2019).
- In this context, the main **stakeholders** recognize the need for crop types that can withstand **heat and drought** for an extended period. The **farmers' statement** acknowledges these difficulties and similar patterns seen in local farmers in different regions of the world (Doll, J. E. et al., 2017; Mkonda, M. Y., and He, X., 2017).

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