CLIMATE CHANGE IN URBAN AREAS: BANGLADESH CASE STUDY

2018

Key Stage 3 Geography (ages 12-14)
England and Wales: Year 8/9 and Northern Ireland: Year 9/10

(Republic of Ireland: Junior Cycle, 2nd/3rd year and Scotland: S2/S3)

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Overview

Time frame: approximately two hours, plus homework.

This resource is part of a programme of research carried out at the University of Manchester on climate change resilience, vulnerability and adaptation, led by Dr Joanne Jordan. This project examined the role of land tenure in influencing climate change impacts and in turn how land tenure can influence strategies for enhancing climate resilience in Dhaka.

The aim of this resource is to engage learners in the impacts of climate change on low-income people in Dhaka. The resource focuses on the experience of three residents of Duaripara informal settlement in Dhaka, with their experiences of living with flooding, waterlogging, drainage congestion, and heat stress being portrayed through three films.

At the end of the resource you will find homework suggestions to further extend learners understanding of the effects of climate change on low-income people in Dhaka.

Project engagement

To support in the success of the project, it would be greatly appreciated if your students submit their homework, along with completing a short survey (maximum of 5-10 minutes). For further details on how students can submit their work please refer to the homework suggestions on pages 8 and 9.

For all teachers that use this resource it would be greatly appreciated if you were to complete the online form (maximum of 1 minute) so we can record all schools that use the material provided in this resource http://bit.ly/GDIpotgansurvey1.

As a token of appreciation, the project will make donations to the Education Support Partnership, a charity providing mental health support services to those working in education in the UK, and Suas Education Development, which provides one-to-one literacy mentoring to disadvantaged children in Ireland.

Resources included in this pack

- Lesson objectives
- Resources
- Key terms
- Suggested classroom activities
- Homework ideas
- Background information for teachers
- Further reading and information for teachers

Lesson objectives

1. To explore the effects of climate change in Bangladesh.
2. To understand how the effects of climate change impact the lives of low-income people in Bangladesh.

2

Your 'big question'

How are the lives of low-income people affected by climate change in Bangladesh?

???

How to use this resource

- Print or share resources 2-4 with students to allow them to explore the area of study.
- Watch the videos with students to provide insight into the experiences of climate change for low-income people.
- Undertake all or some of the suggested classroom and homework activities.
- Complete the teacher survey http://bit.ly/GDIpotgansurvey1 (see p.2).
- Encourage students to complete the survey and submit their homework http://bit.ly/GDIpotgansurvey2 (see pp.8-9).

Please note: This resource is based on research and therefore technical language has been used throughout to support learners access to academic geographical vocabulary. A glossary has been included to support learners, however teachers may wish to pre-teach or provide further resources to aid understanding.

Lesson resources

Resource 1

Three residents of Duaripara informal settlement in North-west Dhaka share their experiences of living with climate change. The film series explores how the climate effects Rohima, Sufia and Nasrul and their families, their reasons for settling in Duaripara and their hopes for the future.

- Living on the frontlines of climate change: A migrant's story (5 minutes) http://bit.ly/GDIpotganMigrant
- Living on the frontlines of climate change: A mother's story (5 minutes) http://bit.ly/GDIpotganMother
- Living on the frontlines of climate change: A rickshaw wallah's story (4 minutes) http://bit.ly/GDIpotganDriver)

Resource 2A | Background information on Duaripara informal settlement (see resource 2B for definitions of key terms)

Total households: 13,000 to 14,000 households.

Average household size: 4.09 persons.

Topography: Mixed elevation, with low-lying land in the West and the North (see Figure 2).

Climate risk: More than 4 out of 5 dwellers experience severe heat stress and almost 2 out of 5 face severe flooding, waterlogging, or drainage congestion in the monsoon season.

Average asset index: Sub-index 1: 0.81 - this means on average most of the dwellers have a source of water, latrine, and gas. Sub-index 2: 0.37 - this means that most dwellers do not own all of the following assets: source of cooking fuel, electric fan, air conditioner, fridge, mobile, and so on, as values are closer to 0. So, if they would like to move out of being vulnerable to climate change, they need to have better access to some of these assets

Residency status (average length of time living in Duaripara)**:** 11.37 years.

Land ownership (land that dwelling is built on)**:** Private (96.27%), government (2.55%), non-government (0.39%), do not know (0.59), Waqf (0.20).

Type of housing structure: Tin shed/kacha (58.04%), semi-pucca (35.49%), pucca (5.88%), tong ghor (0.39%), jhupri (0.20%).

House ownership: Rent (89.22%), own (7.25%), rent free (3.33%), own, but still paying (mortgage/loan) (0.20%).

Average house rent (excluding water and electricity): 2547.29 tk./month (£21.77; €25.99) 26.42 tk per ft^2 (£0.22; €0.27)

Eviction threat: 25.69% of households are currently experiencing the threat of eviction and 21.37% have in the past in Duaripara. Major evictions occurred in 2008 and 2015.

Average size of dwelling: 11.25 x 8.99 foot (100.92 ft^2).

Source of drinking water: Tap (100%).

Latrine facilities: Sanitary (water sealed) (82.75%), pit (12.94%), hanged/katcha (4.31%).

Source: Jordan (2018) Urban climate resilience survey. Unpublished raw data.

Figure 1 | Location map of Duaripara informal settlement

Note: You can download a high-resolution version http://bit.ly/GDIpotganDPmap1
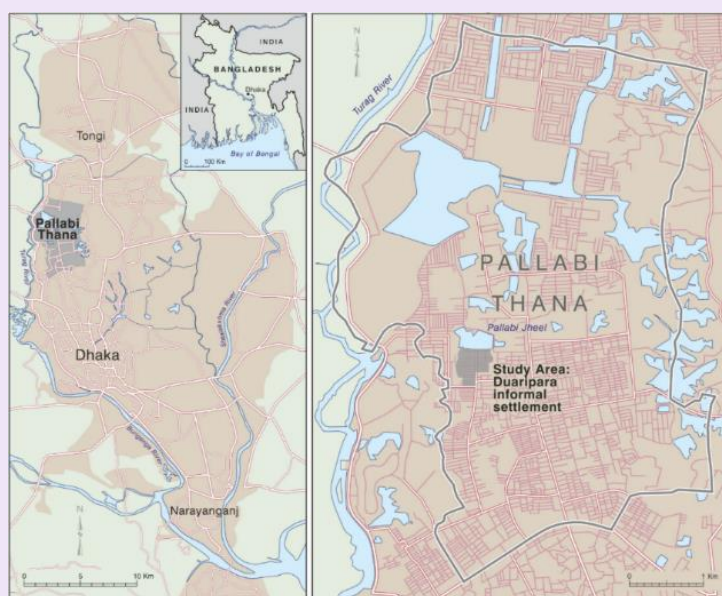
Resource 2B | Key terms

Asset index: Assets are different types of goods that people have access to (e.g., house). A different way to measure poverty beyond just income, is counting the number and the quality of assets that people have. The more assets they have, and the more they can build up over time, the higher their levels of well-being (and lower chances of falling into poverty). So, the aim of an asset index is to try and collapse different kinds of assets, to form one number. This number is scaled between 0 and 1. With 0 being that the person owns very little assets and 1 being (s)he owns the highest that can be owned. These calculations are all relative i.e. compares only across the selected sample of informal dwellers.

Bangladeshi taka: When the study was carried out 1 British pound = 117 Bangladeshi taka and 1 Euro = 98 Bangladeshi taka.

Climate change: A change in the earth's climate that can be identified by changes in the average and/or the variability of its properties, and that lasts for typically decades or longer. (IPCC, 2012).

Flood: Occurs when a stream or other body of water overflows beyond its capacity, or water builds up over areas not normally submerged (IPCC, 2014a).

Heat stress: People can experience considerable heat stress when temperature and humidity are high. It can be dangerous to human health, make it difficult to work, and increase poverty.

Jhupri: Housing structure made from cheap materials like straw, bamboo, grass, leaves and polythene sheets. It has a ceiling of less than 4 foot (BBS, 2015, 19).

Katcha: Housing structure with its roof and walls made of bamboo, jute, sticks, leaves and/or straw. The floor is made of mud or soil (BBS, 2015, 19).

Informal settlement: [Often] have poor housing and are developed on land that is occupied illegally with high levels of overcrowding, [with a inadequate or a lack of] provision for safe water, sanitation, drainage, paved roads, and basic services (IPCC, 2014a, 1768).

Latrine: A toilet or a facility used as toilet.

Monsoon: The rainy season, from June to September in Bangladesh.

Pucca: Housing structure with roof and wall made of bricks and mortar (BBS, 2015, 19).

Semi-pucca: Housing structure of normal height and has walls made of bricks. The roof is made of any materials other than cement/concrete (BBS, 2015, 19).

Tin shed: Housing structure of normal height and its roof made of corrugated/plain tin sheets. Wall is not made form bricks (BBS, 2015, 19).

Tong ghor: House on a water body in low-lying land.

Waqf: A donation made by a Muslim to a religious, educational, or charitable cause.

Resource 3 | Explore Duaripara informal settlement

You can view the project photographs (http://bit.ly/GDIpotganDphotos) and the community map drawn with residents of Duaripara (see Figure 2) to learn more about the area.

Figure 2 | Duaripara map

Note: You can download a high-resolution version http://bit.ly/GDIpotganDPmap2
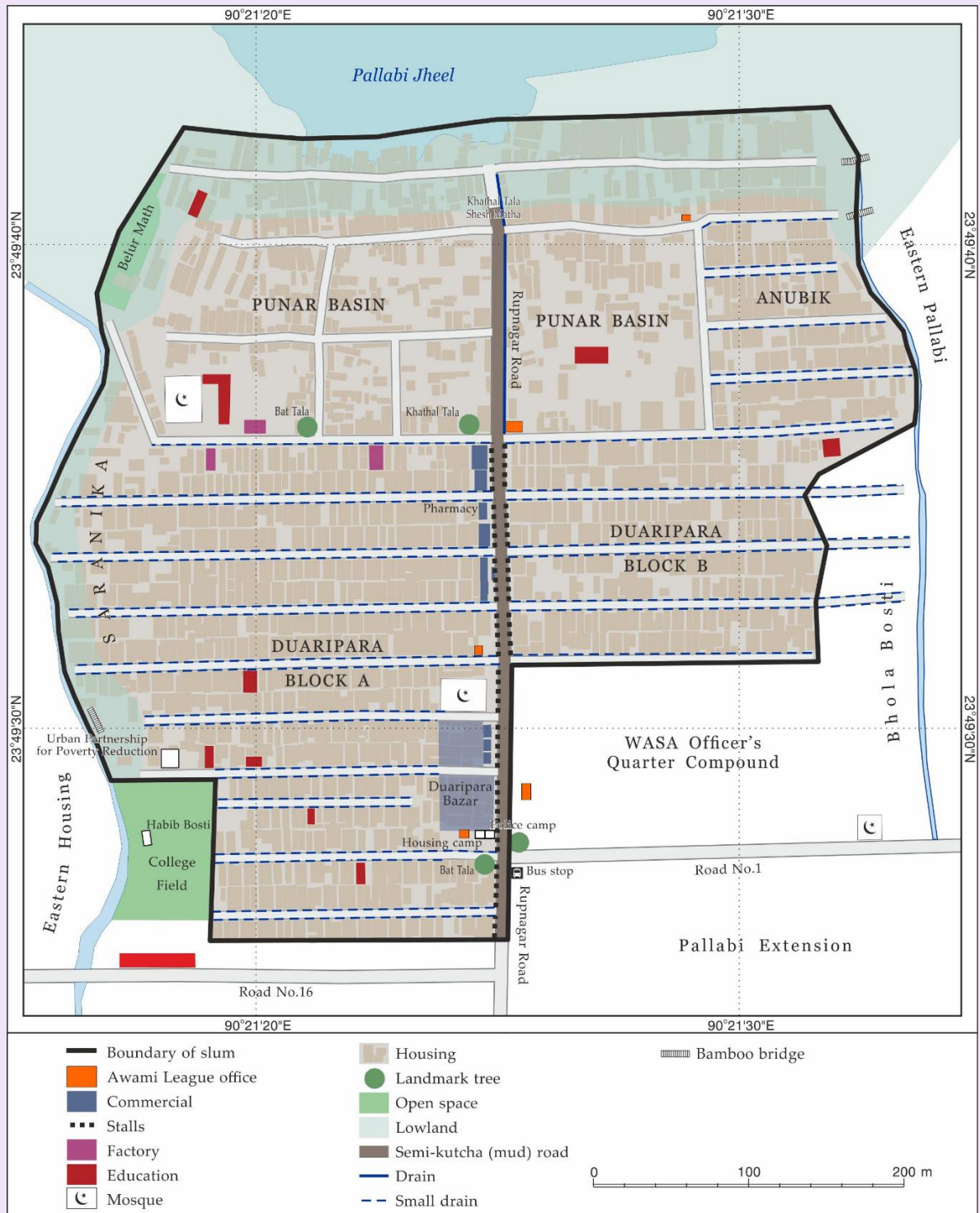
Resource 4A | Bangladesh country information (see resource 4B for definitions of key terms)

- Population (2017): 164.67 million
- Population density (2017): 1265 persons per km^2 ([compared to 270.3 persons per km^2 in the UK, 2015](#))
- Urban population (% of total population, 2017): 34.3%
- Urban population growth rate (average annual %, 2017): 3.6%
- Capital city (Dhaka) population (2017): 17.59 million
- Income per capita (2017): US$1207.9 per year
- Poverty rate: 31.5%
- Total CO^2 emissions (2017): 73.2 million tonnes
- CO^2 emissions per person (2017): 0.5 tonnes ([compared to 7.1802 million tonnes per person in the UK, 2011](#))

Over the last ten years Bangladesh has made impressive gains in key human development indicators. According to the 2008 United Nations Development Programme Human Development Index Statistical Update, Bangladesh ranks 147th among 179 countries with a Human Development Index score of 0.524, placing it among countries considered to have achieved medium human development. But even as Bangladesh has taken these considerable steps towards reducing poverty, many challenges remain. More than 63 million people live below the poverty line. The constant threat of shocks – natural, political, or economic - the uncertain impact of globalisation, and an increasingly competitive international trade environment slow down economic growth. In addition, structural changes in rural Bangladesh have encouraged rapid economic migration. This increases urban poverty, creates a lack of reliable work and leads to congestion and limited shelter in urban areas. Bangladesh therefore faces considerable challenges to sustain and build on the achievements of the last decade, and to remain on track to meet its targets under Sustainable Development Goals.

Source: [UNDP](#); [UN data](#)

Resource 4B | Key terms

Economic migration: Movement from one area to another to find better paid work.

Human development index: Measures a countries level of development based on achievement in three key dimensions: health, education, and standard of living. The HDI is measured between 0 to 1, with 1 being the highest level of human development.

Population density: Average number of people per square km.

Population growth rate: Average rate of change in the size of the population.

Poverty: A condition characterised by a lack of basic human needs, including food, safe drinking water, and shelter (United Nations, 1998).

Poverty line: Minimum level of income that is viewed as adequate in a particular country.

Sustainable development goals: Global goals set by the United Nations to make our planet fair, healthy and sustainable by 2030 (e.g., no poverty, climate action, and quality education).

Suggested activities

Group activity (approximate time frame 20 minutes, plus 5 minutes for extension activity)

For each film, the class discusses (see resource 1):

1. What are the living conditions like in Duaripara?
2. Why did Rohima, Sufia and Nasrul decide to settle there?
3. Why is the monsoon season such a major issue for people that live in Duaripara?
4. In what ways have Rohima, Sufia and Nasrul witnessed climate change?
5. What do the stories from Rohima, Sufia and Nasrul tell us about the impacts of climate change on low-income people? **Extension**: Categorise the impacts of climate change into social, economic and environmental.
6. Why are Rohima, Sufia and Nasrul desperate to see their children or grandchildren leave Duaripara?

Individual activity (approximate time frame 20 minutes)

1. List the effects of climate change that are already being experienced in Bangladesh.
2. Explain why residents of Duaripara are vulnerable to the effects of climate change.

Stretch and challenge (approximate time frame 25 minutes)

1. To what extent does poverty worsen the impacts of climate change for residents of Duaripara?

Reflection (approximate time frame 10 minutes)

1. What do you think is the biggest effect of climate change for residents in Duaripara? Why?
2. Could you survive in the conditions experienced by Rohima, Sufia and Nasrul and their families? If so, how? If not, why?
3. How do your actions contribute to climate change? How could you change your behaviour to reduce your greenhouse gas emissions?

Homework suggestions

All students are asked to submit their homework and complete a short survey (maximum of 5-10 minutes) via the web links below. All students that participate in this exercise will be entered into a free prize draw with the chance to win a £40.00 Ticketmaster voucher.

Any homework submitted, and information gathered from the survey will be used solely for the purpose of this research. The information generated will be confidential, there will be no identifying information on the data. If you require further information, please contact Dr Joanne Jordan joanne.jordan@manchester.ac.uk.

1. Design a home that would help low-income people deal with the effects of climate change. Submit your design and complete a short survey (5-10 minutes) via this link http://bit.ly/GDIpotgansurvey2

    Here is an example for inspiration:
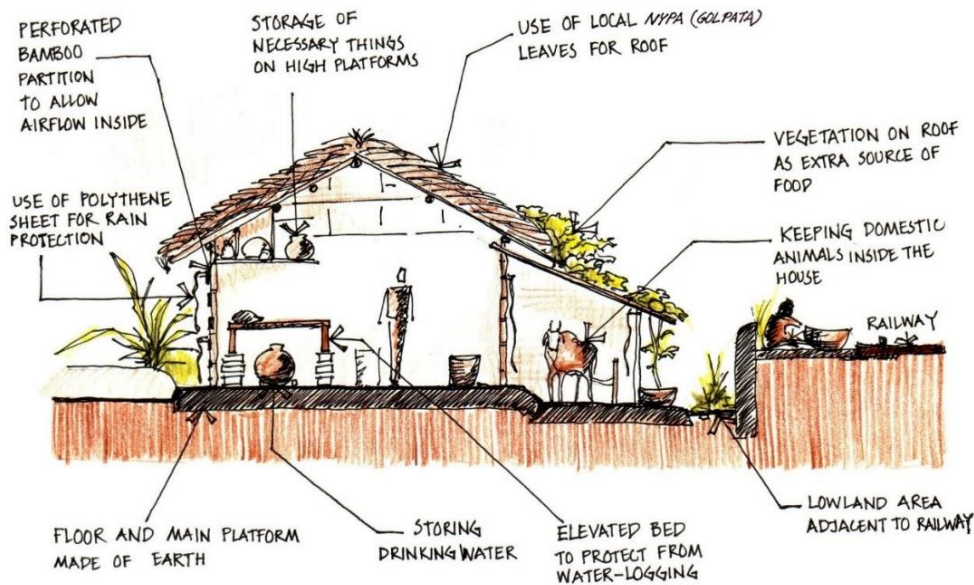
Source: Haque et al. (2014), 123

2. Make a pledge to act on climate change - set yourself three goals to help tackle climate change. Register your pledges and complete a short survey (5-10 minutes) via this link http://bit.ly/GDIpotgansurvey2

Here are some examples for inspiration:

- Walk, cycle or use public transport more.
- Turn of the light when it is not needed.
- Start a 'watt watchers group' at your school. Students patrol the halls reducing energy waste by turning off lights and computers and leaving tickets for those left on.
- Encourage your school to participate in Meet Free Monday (view on http://bit.ly/GDIpotganMFM).
- Recycle more and reduce your consumption, for example use a reusable water bottle.
- Eat seasonal produce more.
- Try and eat less meat (particularly beef).
- Reduce your use of water.
- Share your experiences of making more climate friendly choices with your family and friends and encourage them to make a pledge, too.

3. Design a campaign poster or TV advert to raise awareness of the effects of climate change for Bangladesh. Submit your poster or TV advert design and complete a short survey (5-10 minutes) via this link http://bit.ly/GDIpotgansurvey2

Here are some examples of other videos from this project for inspiration:

The Lived Experience of Climate Change: A Story of One Piece of Land in Dhaka
- Trailer (watch on http://bit.ly/GDIpotganTrailer).
- Documentary with English subtitles (watch on http://bit.ly/GDIpotganDocEng).

Background information for teachers

Global impacts of climate change

Climate change is now widely recognised as one of the greatest challenges facing humanity. The Intergovernmental Panel on Climate Change has authoritatively predicted the likelihood of increased temperatures, changes in patterns of precipitation, sea level rise and an increase in extreme weather and climate events, with potentially devastating impacts on livelihoods, food security, water supply, and health and well-being (IPCC, 2014b).

But people will not all face this challenge in the same way, as the impacts of climate change are unevenly distributed. Low-income people are already affected disproportionately, many of the projected impacts of climate change will reinforce and perpetuate poverty, increasing vulnerability. Hallegatte and Rozenberg's (2017) recent study estimates that up to 122 million additional people could be in extreme poverty in 2030 due to climate change.

Climate change in an urbanising world

Globally, more people live in urban areas than rural areas. 54% of the world's population lived in urban areas in 2014, by 2050 this is expected to increase to 66% (UN DESA Population Division, 2014). Most of the growth in the world's population up to 2050 will be in urban areas in what are currently low- and middle-income countries (Revi et al., 2014). Much of the key and emerging global climate risks are concentrated in urban areas (Revi et al., 2014). Given the rising levels of urbanisation, an increasing proportion of the world's population will be vulnerable to the impacts of climate change in urban areas (de Sherbinion et al., 2007).

Low-income people are most at risk to climate change because they cannot afford housing in areas less vulnerable to climate risks, and there is a lack of government investment to protect at risk areas. About one in seven people in the world live in poor quality, overcrowded and insecure housing, often in low-lying areas, and mostly in informal settlements with irregular land tenure lacking adequate drainage and basic infrastructure and services (McGranahan et al., 2007; Moser and Stein, 2011; UN-Habitat, 2011). Much of the climate risk in urban areas is concentrated in these settlements (Revi et al., 2014).

How climate change affects Bangladesh

Bangladesh in South Asia is characterised by high temperatures, heavy rainfall and high humidity. Climate change creates major risks for Bangladesh; however the main aspects of its vulnerability are mostly contextual. The physical, social and economic conditions of Bangladesh are related to its status as one of the most vulnerable countries globally to climate change (Huq and Ayers, 2008). Bangladesh is a low-lying deltaic country, with 80% of the land

floodplain. Two-thirds of Bangladesh is less than 5 metres above sea level. Annually 30% of the country is normally flooded, in extreme years this can rise to 70% (Agrawala et al., 2003). The sediment loads brought by three Himalayan rivers, coupled with a negligible flow gradient, which increases drainage congestion exacerbate the extent of flooding (Agrawala et al., 2003).

Future climate change in Bangladesh is predicted to result in increasing temperatures (likely to be associated with an increase in extreme temperatures); greater monsoon precipitation; droughts; increased vulnerability to cyclone and storm surges; and higher mean sea level levels, which will cause more coastal inundation, salinisation, coastal erosion and are likely to compound the enhanced storm surges expected to result from cyclones with higher intensity.

Living on the frontlines of climate change in Dhaka

Dhaka, the capital city of Bangladesh is one of the world's fastest growing megacities. Its population is likely to increase from over 17 million to 20 million by 2020 (Ahmed et al, 2012). There has been a major increase in the number of informal settlements in Dhaka in recent decades, around 40% of its population are now estimated to live in informal settlements.

Dhaka has hot, humid summers, short, mild winters and heavy rainfall during the monsoon season. It is primarily exposed to floods, waterlogging, overstretched drainage systems, and heat stress. The melting of glaciers and snow in the Himalaya and increasing rainfall will increase the frequency of flooding in Bangladesh. Dhaka is recognised as one of the top 20 cities for both population and asset exposure to coastal flooding in both the current and 2070 rankings (Hanson et al., 2011). Drainage congestion and waterlogging is due to river floods and extreme rainfall during the monsoon is already causing serious impacts. Dhaka is also exposed to 'heat island' problems because temperatures in the city are higher than in the surrounding areas (Alam and Rabbani, 2007)

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Climate change affects people in different ways in Dhaka:

- Human deaths, illness (including psychological stress), and injury
- Damage or destruction of properties and public infrastructure
- Displacement
- Risk of food insecurity
- Wastewater and sanitation systems will be increasingly overburdened
- Contamination of water sources
- More prone to losing time from school
- Loss of livelihood options and/or disruption or limitation of income earning opportunities

Further reading for teachers

IPCC (2014) Summary for policymakers. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

Revi, A., D.E. Satterthwaite, F. Aragón-Durand, J. Corfee-Morlot, R.B.R. Kiunsi, M. Pelling, D.C. Roberts, and W. Solecki (2014) Urban areas. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

[Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 535-612.

Further information

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To learn more about the project:

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