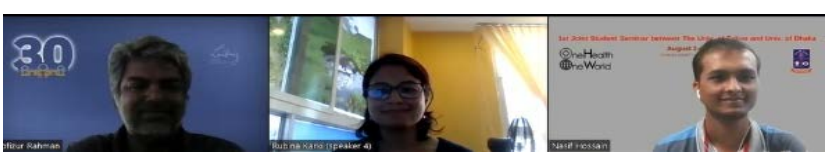
1st Joint Student Seminar between The University of Tokyo, Japan and University of Dhaka, Bangladesh

August 3rd and 4th, 2022
ONLINE

OneHealth
OneWorld



The 1st Joint Student Seminar between The University of Tokyo And University of Dhaka

3-4 August 2022

Co-Organized by

One Health One World (OHOW),
Institute of Industrial Science, The University of Tokyo, Japan

&

Dept. of Disaster Science and Climate Resilience,
Dhaka University, Bangladesh

Supported by Takeuchi laboratory

Organizing Members

Prof. Dr. A.S.M. Maksud Kamal (Dhaka Univ., Bangladesh)
Prof. Wataru Takeuchi (IIS, UTokyo, Japan)
Prof. Dr. Md. Iqbal Kabir (CCHPU, Dhaka Univ., Bangladesh)
Prof. Masahiro Hashizume (SIH, UTokyo, Japan)

1st Joint Student Seminar between Univ. of Tokyo and Univ. of Dhaka

August 3 -4, 2022

ONLINE (ZOOM)

17:00-20:00 (JST), 15:00-18:00 (BST)

Organized by

One Health One World (OHOW), The University of Tokyo, Japan

&

University of Dhaka, Bangladesh

Introduction

The 1st Joint Student Seminar topic will be on one health and one world which is a comprehensive science of human and animal health, and the global environment in addition to public health and civil engineering related research.

Objective

Sharing research information and friendships to improve presentation skills between University of Tokyo and University of Dha

Seminar Themes

The seminar will include invited lectures by professors and poster presentations by students in different fields, such as stem cells and infectious disease, transportation and human mobility, structural and geotechnical engineering for human safety, ecology environment impact of human public health, climate change and green recovery, remote sensing and GIS etc...

Important Dates

***July* 4, 2022:**
Deadline for abstract submission

August 1, 2022:
Deadline for poster submission

Organizing Members

Prof. Dr. A.S.M.Maksud Kamal (Dhaka Univ., Bangladesh)
Prof. Wataru Takeuchi (IIS,UTokyo, Japan)
Prof Dr. Md. Iqbal Kabir (CCHPU, Dhaka Univ., Bangladesh)
Prof. MasahiroHashizume(SIH, UTokyo, Japan)

Registration

Please visit OHOW website
Online registration
https:// ohow.iis.u-tokyo.ac.jp/

Contact us

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PREFACE

In the context of urban safety and environmental management, the concept “One Health, One World (OHOW)” has been recognized as a comprehensive science to manage disease outbreaks related to animals. To protect human health, animal lives and ecosystems, interdisciplinary research preventing infectious diseases is essential. Against this backdrop, the One Health, One World (OHOW) Collaboration Research Organization of the University of Tokyo collaborated with the University of Dhaka to arrange the 1st Joint Student Seminar on “One Health, One World”. Lectures by invited professors and posters by students on disaster and infectious disease, transportation and human mobility, structural and geotechnical engineering for human safety, environment and ecology, climate change, public health issues, and green recovery, remote sensing and GIS, etc. were presented at the seminar to share research information and promote friendship between the two universities as well as improve presentation skills of the students. The special lectures featured public health that illustrated climate change and infectious diseases in Bangladesh. These lectures mapped climate change-induced public-health hazards in Bangladesh and the role of the University of Dhaka in reducing the vulnerability of the at-risk community, and climate-resilient health system. There were several presentations on monitoring ecosystems, the impact of climate change on vector-borne diseases like dengue fever while public health-related researches in Bangladesh like – assessing the community’s willingness to pay for improved public healthcare facilities in the hazard-prone coastal areas, effects on the health of the ultra-poor and poor community in the aftermath of floods, nexus between disaster and infectious diseases, etc. were on the focus of the seminar. The critical analysis of the financial efficacy of tiger conservation projects in Bangladesh addressed the need for making the animal health situation transparent which requires a sound legislative basis for national investments in this regard. I sincerely appreciate and would like to thank OHOW, the University of Tokyo for collaborating and cooperation with the University of Dhaka in arranging this seminar, and the invited lecturers and student presenters for sharing their valuable and informative findings with us. The Department of Disaster Science and Climate Resilience (DSCR) was the focal point of the seminar from the University of Dhaka. This seminar was the first step toward forming a new academic research base studying human and animal health and their surrounding environment as a single field for both universities. I hope it will encourage advanced research on OHOW and other relevant fields to predict and respond to probable future dynamic risks faced by humans, animals, and the ecosystems around them.

Dr. A.S. M. Maksud Kamal
Professor, Department of Disaster Science and Climate Resilience (DSCR) &
Pro Vice-Chancellor, University of Dhaka

PREFACE

It is our great pleasure to announce that One Health One World Initiative (OHOW) held the 1st Joint Student Seminar in webinar form on August 3 (Wed) and 4 (Thu), 2022 as the first collaboration with the University of Dhaka. We are thankful for Prof. Masahiro Hashizume (International Health), Graduate School of Medicine, Prof. Dr. Iqbal Kabir (Epidemiology and Climate Change), Ministry of Health and Family Welfare (MoHFW), Bangladesh, Associate Professor Go Minami (Supramolecular Materials Design) and Prof. Dr. ASM Maksud Kamal (Disaster Management), University of Dhaka, Bangladesh, gave invited lectures.

There were a total of 34 presentations by students: 26 from Bangladesh, mainly from Dhaka University and North South University, a leading private university in Bangladesh; 2 from India; and 6 from Japan. Of the 34 presentations, 21 were by female students, which was impressive. Despite the short presentation time of only 8 minutes, they all made excellent presentations that could be easily understood by the audience from other fields.

Specifically, the presentations included an assessment of the impact of climate change on Neglected Tropical Diseases (NTDs), a research study on conflicts between humans and wildlife such as Bengal tigers, an analysis of the relationship between worsening air pollution from traffic and construction sources and health hazards in Dhaka City, an analysis of the material flow and the impact of climate change on EV vehicles, and a study on the impact of climate change on the environment and the environment on the development of EV vehicles. Study on Material Flow and Life Cycle Assessment for EVs, Measurement of Mangrove and Sea Level Change in the Bay of Bengal Using Satellite Remote Sensing, Monitoring of Marine Pollution in the Brahmaputra River and Bay of Bengal by Plastic Waste, Analysis of Relationship between Climate Change and Mental Illness in Japan, Microbiome and Genome in River Sediments, and Microbiome and genome analysis in sediments, studies on the historical evolution of ecosystem conservation and ecosystem services in Bangladesh, and methods for assessing the health of buried structures using ground penetrating radar (GPR) in Japan were among the topics discussed.

In addition to understanding the various risks that society faces from humans, animals, and the global environment covered by One Health One World, meaningful discussions were held to develop related academic fields in a comprehensive and coordinated manner in order to respond to these issues.

Professor, Institute of Industrial Science

Director general, One Health and One World Initiative

The University of Tokyo, Japan

Wataru TAKEUCHI

CONTENTS

The 1st Joint Student Seminar between Univ. of Tokyo and Univ. of Dhaka on August 3-4, 2022

ZOOM

DAY1

	Time Bangladesh upper Japan lower	name	affiliation	title
3rd August 2022				
Opening ceremony	14:00-14:05 17:00-17:05	Chairman: Prof. Dr. A S M Maksud Kamal, University of Dhaka, Prof. Wataru Takeuchi, The University of Tokyo		
Special Lecture	14:05-14:35 17:05-17:35	-Climate, climate change and infectious diseases in Bangladesh- Prof. Masahiro Hashizume, MD Ph.D. Department of Global Health Policy Graduate School of Medicine, UTokyo		
1	14:35-14:43 17:35-17:43	Quazi Nazmus Sakib	Univ. of Dhaka	Impact of climate change on dengue: A systematic review
2	14:43-14:51 17:43-17:51	Ibrahim Abdullah Mannan	North South Univ.	A critical analysis of financial efficacy on tiger conservation projects in Bangladesh
3	14:51-14:59 17:51-17:59	Sabera Sultana	UTokyo	Associations between lifestyle behaviors and diabetes in South Asian countries
4	14:59-15:07 17:59-18:07	Rubina Karki	BRAC Univ,	Community perception about climate change: Investigating experiences of Himalayan communities involved in the tourism industry
5	15:07-15:15 18:07-18:15	Humayra Rahman	North South Univ.	Chemistry and source of ions and metals in fine particulate matters over Dhaka City: A Preliminary study
6	15:15-15:23 18:15-18:23	Nipa Jahan	North South Univ.	The prospects of urban mining to achieve a circular economy in Bangladesh
7	15:23-15:31 18:23-18:31	Maliha Islam Proma	North South Univ.	Understanding the recycling and management process of end-of-life passenger vehicles in Dholaikhal, Bangladesh: A material flow perspective
8	15:31-15:39 18:31-18:39	Md. Habibur Rahman Habib	Univ. of Dhaka	Satellite-based time series analysis of sea level in the Bay of Bengal from 1871 to 2010 for climate applications
BREAK	15:39-15:50 18:39-18:50	Break		
Special lecture	15:50-16:20 18:50-19:20	Climate resilient health system: post pandemic challenges and opportunities for public health Prof (Dr) Iqbal Kabir, Prof of Epidemiology, Climate Change and health promotion unit, MoHFW		
9	16:20-16:28 19:20-19:28	Tasnim Jabin Jui	Univ. of Dhaka	Assessment of community's willingness to pay (WTP) for improved public healthcare facilities in the coastal hazard-prone areas of Bangladesh
10	16:28-16:36 19:28-19:36	Sara Binte Rashid	North South Univ.	Sources and contribution of water soluble compositions on the formation of secondary inorganic aerosol over Dhaka city.
11	16:36-16:44 19:36-19:44	Ummay Ayesha Mim	North South Univ.	Diurnal variations and Respiratory Deposition Dose

				flux of aerosol and reactive gases over Dhaka City
12	16:44-16:52 19:44-19:52	Lin Szu Yu	UTokyo	Ambient temperature and nervous system disease mortality in Japan from 2010 to 2019: A time-stratified case-crossover analysis
13	16:52-17:00 19:52-20:00	Israt Nur Jannatul Raim	North South Univ.	Receptor modelling and human Respiratory Deposition Dose in Dhaka City.
14	17:00-17:08 20:00-20:08	Mashrur Hafiz Turjo	North South Univ.	Unraveling the global flow of single-use plastic packaging
15	17:16-17:24 20:16-20:24	Nayeema Talukder Ema	Univ. of Dhaka	Microbiome profiling and functional analysis of the Buriganga River sediment in Dhaka, Bangladesh, using whole-genome metagenomics
Comments/ Closing	17:24-17:35 20:24-20:35	Chairman: Prof. Dr. A S M Maksud Kamal, University of Dhaka, Prof. Wataru Takeuchi, The University of Tokyo		

DAY 2

	Time Bangladesh upper Japan lower	name	affiliation	title
4th August 2022				
Opening	14:00-14:05 17:00-17:05	Chairman: Prof. Dr. A S M Maksud Kamal, University of Dhaka, Prof. Wataru Takeuchi, The University of Tokyo		
Special Lecture	14:05-14:35 17:05-17:35	Toward the realization of chemical sensors that can be used by anyone, anywhere Associate Prof. Tsuyoshi Minami, PhD, Institute of Industrial Science, UTokyo		
1	14:35-14:43 17:35-17:43	Adrita Choudhury Tithi	North South Univ.	Historical analysis of selected ecosystem functions in the co-managed forest protected areas and bio-diverse non-co-managed forest areas of Bangladesh using MODIS remotely sensed data
2	14:43-14:51 17:43-17:51	Feifan Huang	UTokyo	Spatio-temporal changes of ambient NO2 during COVID-19 lockdowns in China
3	14:51-14:59 17:51-17:59	Md. Shahoriar Sarker	Univ. of Dhaka	Time series horizontal surface displacement and seismicity scenario in and around Sagaing fault for the last 20 years
4	14:59-15:07 17:59-18:07	So Fumiyama	UTokyo	Estimation of nighttime light distribution in an urban area for urban environmental assessment
5	15:07-15:15 18:07-18:15	Aishia Fyruz Aishi	Univ. of Dhaka	Time-series analysis of landcover dynamics and their relation with coastline migration along Kuakata coast, Bangladesh using remote sensing techniques
6	15:15-15:23 18:15-18:23	Shunsuke Iwai	UTokyo	Highly accurate real-time estimation of void thickness inside concrete by spectral analysis pattern matching of GPR signal
7	15:23-15:31 18:23-18:31	Anika Samm-A	Univ. of Dhaka	Earthquake and rainfall induced landslide hazard assessment of Kutupalong Rohingya Camp using meteorological and geological Information
8	15:31-15:39 18:31-18:39	Shuto Yotsumoto	UTokyo	Estimation of subsurface pipes using 3D radar images

9	15:39-15:47 18:39-18:47	Naharin Zannat	Univ. of Dhaka	Ambient seismic noise levels in the Bengal Basin, Bangladesh
Break	15:47-16:00 18:47-19:00	Break		
Special lecture	16:00-16:30 19:00-19:30	Climate changes induced public-health hazard mapping in Bangladesh and role of the University of Dhaka in reducing the vulnerability Professor Dr. A S M Maksud Kamal, Dhaka University		
10	16:30-16:38 19:30-19:38	Lamia Mahzabin	North South Univ.	Hazard index and potential cancer risk of heavy metals in the groundwater of Bangladesh
11	16:38-16:46 19:38-19:46	Md. Shahriar Kabir Shakil	Univ. of Dhaka	Exploration of gut microbiome in irritable bowel syndrome patients in Bangladesh using whole genome metagenomic analysis
12	16:46-16:54 19:46-19:54	Shirajum Munira Dewan	Univ. of Dhaka	The aftermath of the flood crisis on the ultra-poor and poor community of Bangladesh: Effects on health, nutrition and economy of the disaster affected population
13	16:54-17:02 19:54-20:02	Ayesha Ershad	North South Univ.	Qualitative assessment on earthquake preparedness among academics, ministries and private institutions
14	17:02-17:10 20:02-20:10	Md. Anwer Hossain	Univ. of Dhaka	Riverbank erosion and local adaptation: the context of char areas in Bangladesh
15	17:10-17:18 20:10-20:18	Tisha Chakma	Univ. of Dhaka	Nexus between disaster and infectious diseases: Experience from recent flood in Bangladesh
16	17:18-17:26 20:18-20:26	Ravindra Kumar Kushwaha	CSJM Univ., Kanpur (INDIA)	Utilities of smart cities services for blinds persons in India: The educational perspectives
17	17:26-17:34 20:26-20:34	Tasnim Binte Masud	North South Univ.	Territorial agglomeration in Dholaikhal: A material flow analysis perspective
18	17:34-17:42 20:34-20:42	Spencer Mark Mondol	Univ. of Dhaka	Whole genome analysis of multidrug-resistant Providencia stuartii isolated from burn patients: The emergence of blaNDM-1 conferring complete resistance to carbapenems
19	17:42-17:50 20:42-20:50	Rubinur Choudhury	Cooachbehar Panchanan Barma Univ.	A Study of ecological biodiversity in Dudhia of Darjeeling district, West Bengal
Comments/ Closing	17:50-18:00 20:50-21:00	Chairman: Prof. Dr. A S M Maksud Kamal, University of Dhaka, Prof. Wataru Takeuchi, The University of Tokyo		

SPECIAL LECTURE

Climate, climate change and infectious diseases in Bangladesh

Masahiro HASHIZUME

School of International Health,
The University of Tokyo

1st Joint Student Seminar between the Univ. of Tokyo and Univ. of Dhaka
3 August 2022

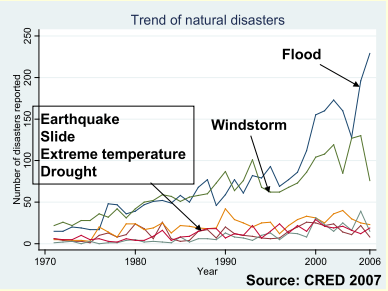
Structure

1. Effects of flooding on cholera incidence
   (episode analysis)
2. Association with climatic factors
   (time-series analysis)
3. Indian Ocean Dipole and cholera
4. Dengue fever and river levels

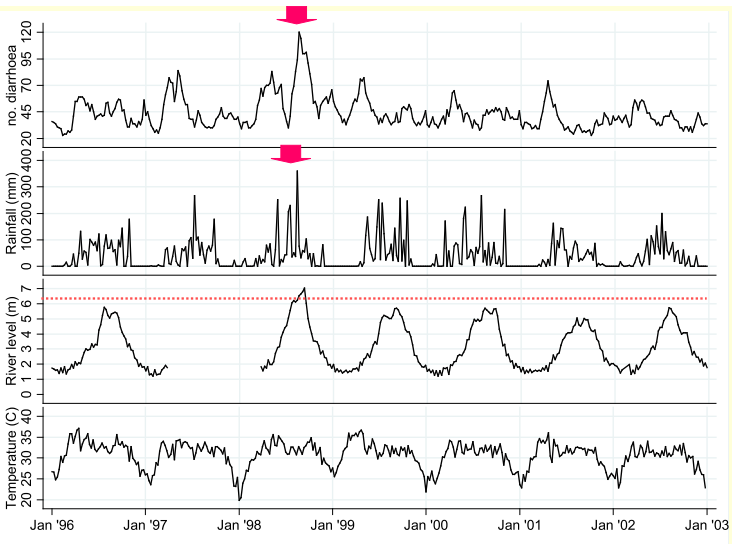
1. Effects of flood on cholera incidence

Background

- Floods are the most frequent natural disasters affecting over 2.5 billion people during the last 30 years (Centre for Research on the Epidemiology of Disasters 2007).
- Floods have tended to intensify, and this trend could increase with climate change (Easterling et al. 2000; Milly et al. 2002).



Source: CRED 2007



Hashizume et al. *Journal of Water and Health* 2008;6:323-32.

Methods

Data (January 1996~December 2001)

- **Hospital surveillance: International Centre for Diarrhoeal Disease Research, Bangladesh in Dhaka**
  - Weekly counts of patients with diarrhoea (2% sample)
  - Individual information
    - Sex, age, socio-economic status, hygiene&sanitation practices and pathogen identified by microbiological examinations
- **Meteorological data in Dhaka**
  - Weekly rainfall
  - Weekly average of daily maximum temperature
- **River level data (Brigonga river in Dhaka)**
  - Weekly average of daily maximum river level

Definitions and statistical analysis (episode analysis)

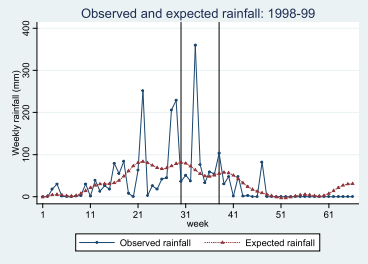
- **Flood period**: river level exceeded danger level (weeks 30~38, 1998)
- **Post-flood period**: up to 6 months after the flood (week 39, 1998~week 14, 1999)
- **Outcome measure**: The ratio of the observed against expected number of cases
- **Expected number of patients**: season-specific average over the two preceding (1996-97) and subsequent (2000-01) years using Poisson generalised linear models.

$$\log[E(Y)] = \alpha + \text{time(Fourier, 6 harmonics/year)}$$

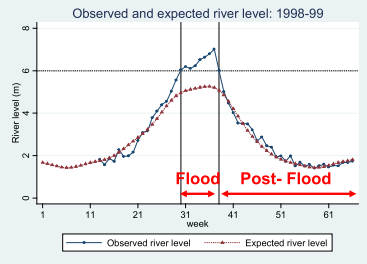
where *E*(Y): the expected weekly count of patients, Fourier: Fourier terms

Results

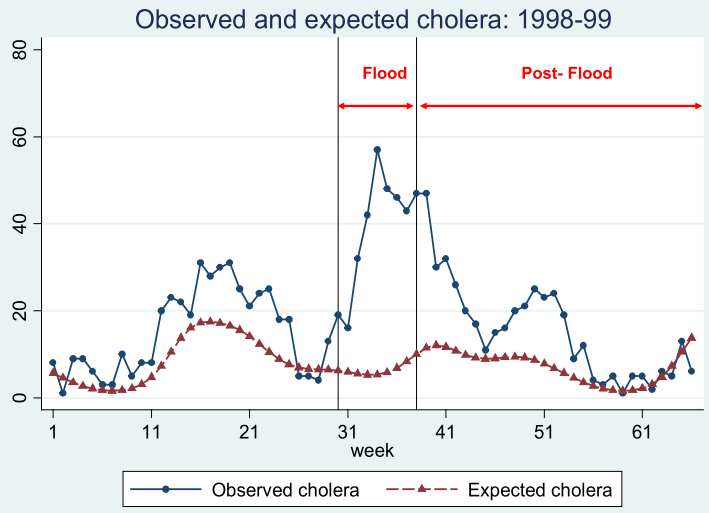
Rainfall



River level



Observed and expected rainfall and river level in 1998-99. The vertical line shows the period of flood (weeks 30 to 38, 1998).



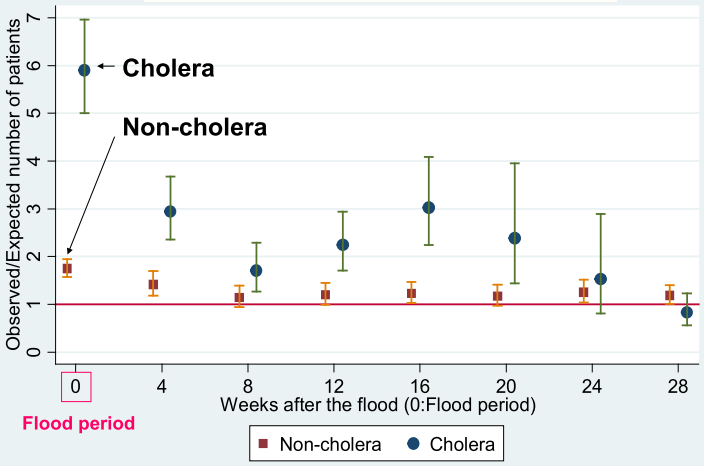
Excess risk of cholera

	Flood period					Post-flood period				
	Observed	Expected	O/E	95% CI	*p*-value*	Observed	Expected	O/E	95% CI	*p*-value*
Total	350	59.3	5.9	(5.0, 7.0)	-	422	199.1	2.1	(1.9, 2.4)	-
Drinking water source										
Tube well	108	22.9	4.7	(3.6, 6.2)	0.05	260	97.2	2.7	(2.3, 3.1)	<0.001
Tap water	241	36.1	6.7	(5.4, 8.2)		162	100.8	1.6	(1.3, 1.9)	
Distance to water source										
More than 5m	228	38.4	5.9	(4.8, 7.3)	0.95	303	141.6	2.1	(1.9, 2.5)	0.82
5m or less	122	20.8	5.9	(4.4, 7.8)		118	56.8	2.1	(1.7, 2.6)	
Type of toilet										
Unsanitary	136	24.5	5.6	(4.3, 7.2)	0.55	266	100.9	2.6	(2.3, 3.1)	<0.001
Sanitary	214	34.8	6.1	(5.0, 7.6)		156	98.2	1.6	(1.3, 1.9)	

The expected values of diarrhoea patients were adjusted by season (Fourier terms up to 6 harmonic).

*Test for heterogeneity

Duration of excess risk



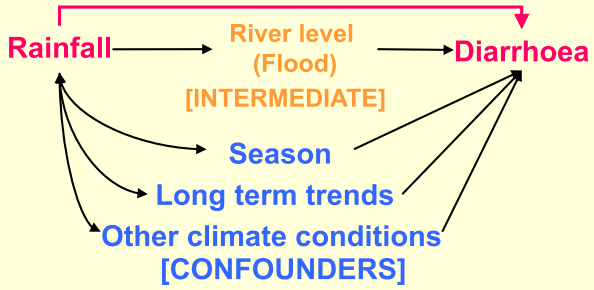
Summary findings

--- flood and cholera ---

1. **Incidence of diarrhoea was higher than expected during the flood (O/E=5.9 during the flood).**
2. **Excess risk of cholera persisted up to 20 weeks after the end of the flood.**
3. **Nearly everyone was vulnerable during the flood, while people in lower hygiene and sanitation status were specially vulnerable in the post-flood period.**

2. Association with climatic factors

Conceptual framework



Models for rainfall

(time-series analysis)

Model 1: rainfall over lags 0−16 weeks:

$log[E(Y)] = NS(rain_{0-16}, 3\ df) + (confounders)$

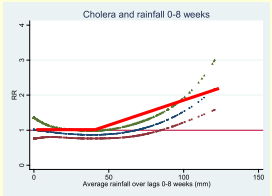
Model 2: rainfall over lags 0−8 and 9−16 weeks:

$log[E(Y)] = NS(rain_{0-8}, 3\ df) + NS(rain_{9-16}, 3\ df) + (confounders)$

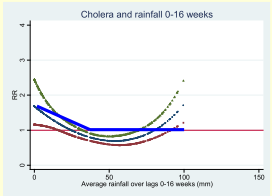
$(confounders) = \alpha + time(Fourier, 6\ harmonics/year) + i.year + i.holiday + NS(temp_{0-4}, 3\ df)$

Rainfall and cholera in Bangladesh

Lag 0-8 weeks



Lag 0-16 weeks



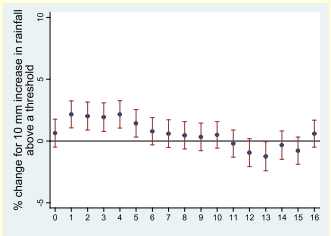
	Lag (week)	Cut-points	% increase (/10mm)	95% CI
High rain	0-8	45 mm	14.4	(10.1, 18.9)
Low rain	0-16	45 mm	23.9	(10.7, 38.6)

Hashizume *et al. Epidemiology* 2008;19:103-10.

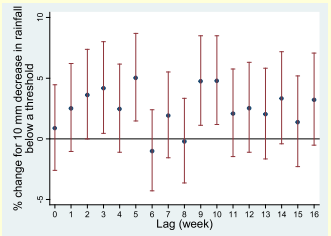
Lag structures

(distributed lag model)

High rainfall

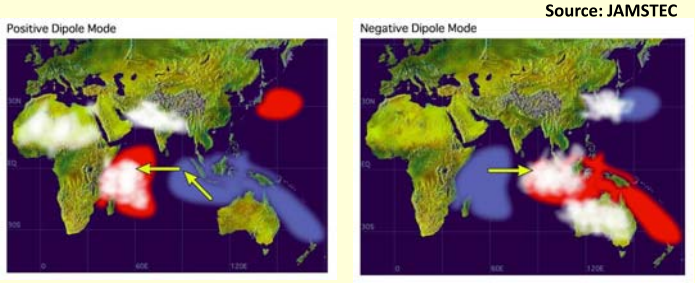


Low rainfall



3. Indian Ocean Dipole

Source: JAMSTEC

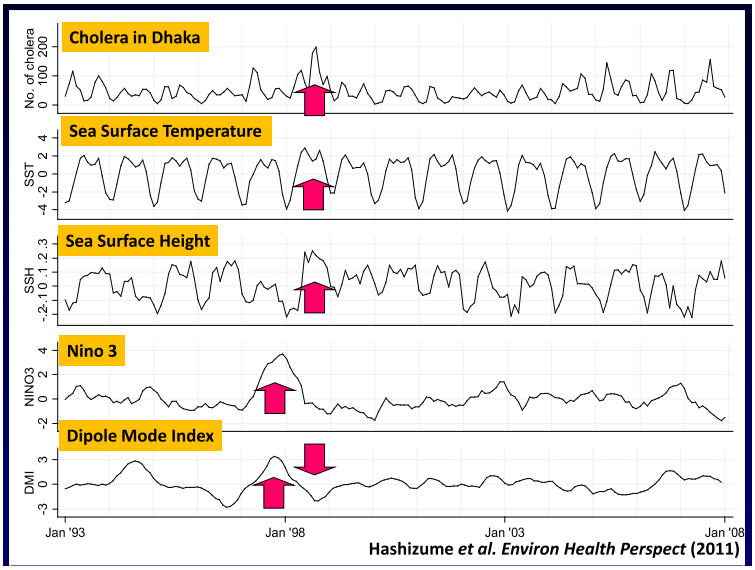


- The IOD characterizes the sea surface temperature (SST) anomaly during this event
- A negative IOD is associated with positive sea level anomaly in the Bay of Bengal.
- A positive IOD increases Indian monsoon rainfall

potential for flooding & outbreaks of cholera in Bangladesh

Statistical analysis

- $log[E(Y)] = \alpha + NS(DMI_{0\text{-}3}, 3\ df) + NS(DMI_{4\text{-}7}, 3\ df) + NS(DMI_{8\text{-}11}, 3\ df) + NS(NINO3_{0\text{-}3}, 3\ df) + NS(NINO3_{4\text{-}7}, 3\ df) + NS(NINO3_{8\text{-}11}, 3\ df) + i.month + i.year + AR_1$
- *E(Y)* : expected monthly case count,
- NS: natural cubic spline function,
- $DMI_{0\text{-}3}$ and $NINO3_{0\text{-}3}$: average DMI and NINO3 at lag 0-3 months,
- *i.month* : indicator variables for the month,
- *i.year* : indicator variables for the year,
- *AR1* : a first-order autoregressive term.
- Generalized linear negative binomial regression controlling for autocorrelation



Hashizume *et al. Environ Health Perspect* (2011)

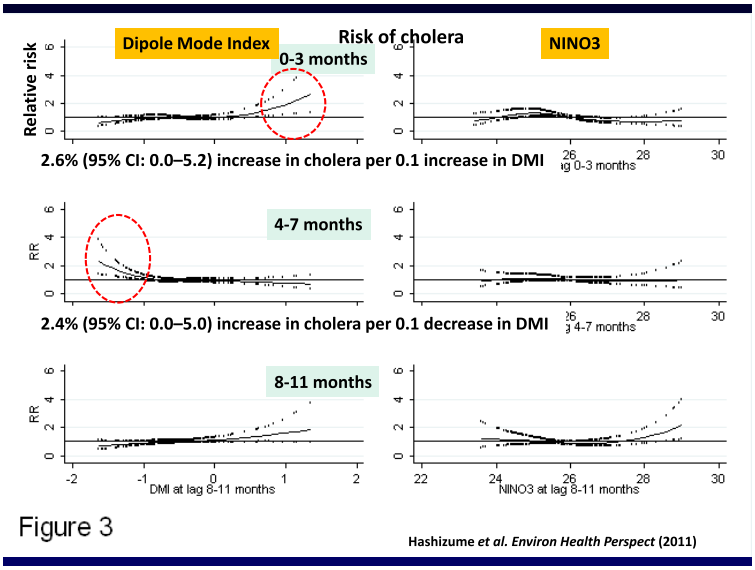
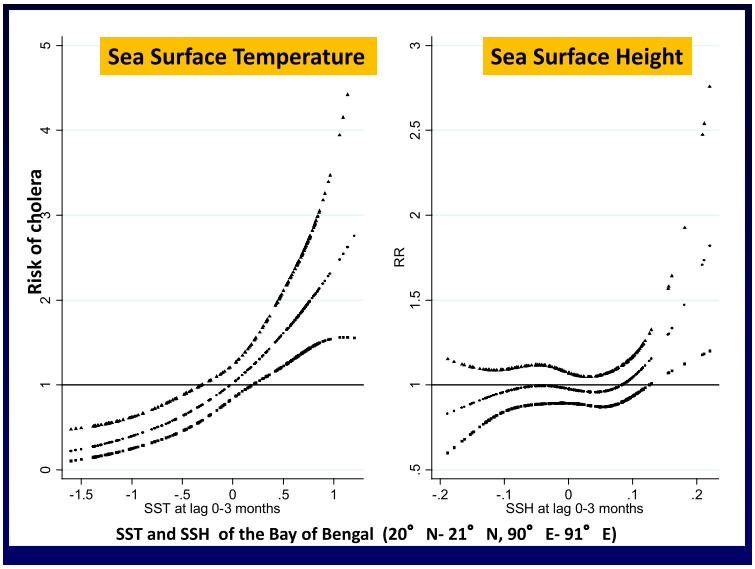


Figure 3

Hashizume *et al. Environ Health Perspect* (2011)



SST and SSH of the Bay of Bengal (20° N- 21° N, 90° E- 91° E)

Summary

- The number of cholera cases in Dhaka increases with positive DMI at short-lag (0-3 months) and negative DMI at intermediate lag (4-7 months).
- SST and SSH in the BoB are associated with cholera incidence in Dhaka.
- IOD could improve accuracy of the climate-based prediction of cholera.

4. Dengue fever and river levels

Design: Retrospective time-series study

Outcome: Weekly number of dengue cases of 11 hospitals in Dhaka

Exposure: Average river levels in Dhaka

Confounders: rainfall, temperature, season, long-term trends

Period: 2005 – 2009

Hashizume M, et. al., *BMC Infect Dis.* 2012;12:98

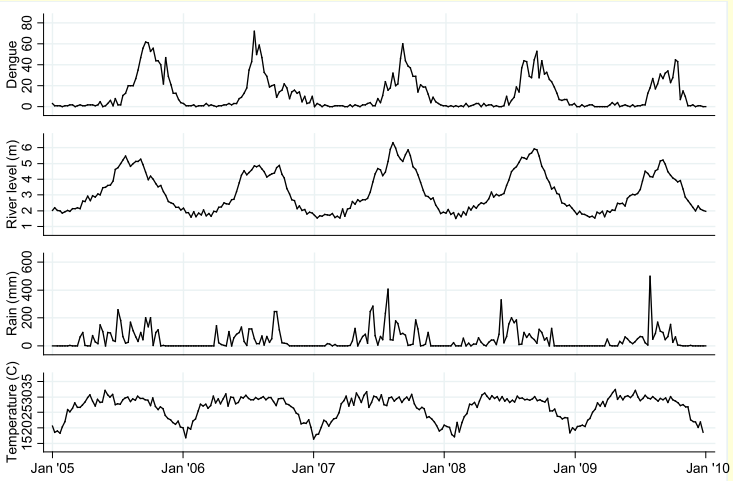


Figure 2

Hashizume M, et. al., *BMC Infect Dis.* 2012;12:98

Statistical analysis

$$log[E(Y)] = \alpha + NS(river_{0\text{-}5}, 3\ df) + NS(river_{6\text{-}19}, 3\ df) + NS(temp_{0\text{-}5}, 3\ df) + NS(temp_{6\text{-}19}, 3\ df) + NS(rain_{0\text{-}5}, 3\ df) + NS(rain_{6\text{-}19}, 3\ df) + time(Fourier, 5\ harmonics/year) + i.year + AR1$$

- Generalized linear Poisson regression
- *E(Y)* : expected weekly case count,
- NS: natural cubic spline function,
- $river_{0\text{-}5}$, $temp_{0\text{-}5}$ and $rain_{0\text{-}5}$: average river level, temperature and rainfall at lag of 0-5 weeks, respectively
- *Fourier* : Fourier (trigonometric) terms
- *i.year* : indicator variables for the year,
- *AR1* : a first-order autoregressive term.

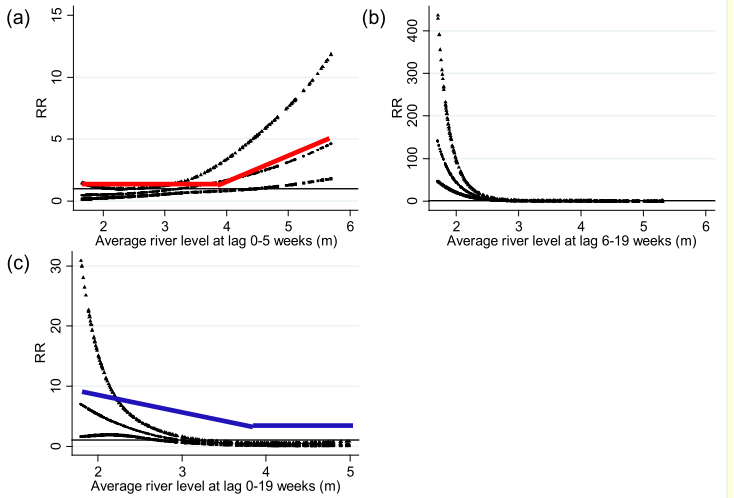


Figure 3

Hashizume M, et. al., *BMC Infect Dis.* 2012;12:98

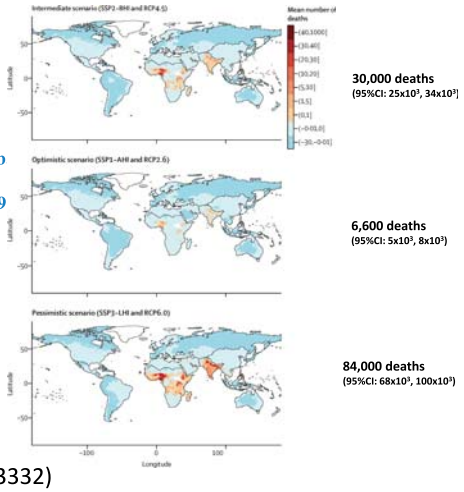
Results

High river level effects

6.9% (95 % CI: 3.2, 10.7) increase in dengue hospitalizations for each 0.1 metre **increase** above a threshold (3.9 metres) for the average river level over lags of **0–5 weeks**.

Low river level effects

29.6 % (95 % CI: 19.8, 40.2) increase in dengue hospitalizations for a 0.1 metre **decrease** below the same threshold of the average river level over lags of **0–19 weeks**.



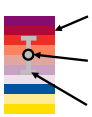
GCM-ensemble estimates of glob mean temperature-attributable enteric infection deaths in 2080-9 by 0.5° ×0.5° grids

GCM=general circulation model
SSP=shared socioeconomic pathway
BHI=baseline health investment
AHI=additional health investment
LHI=lowered health investment
RCP=representative concentration pathway

Bangladesh: 1000 (-1333; 3332)

Chua PLC, Huber V, Ng CFS, Seposo X, Madaniyazi L, Hales S, Woodward A, Hashizume M. *Lancet Planetary Health.* 2021;5(7), e436-e445.

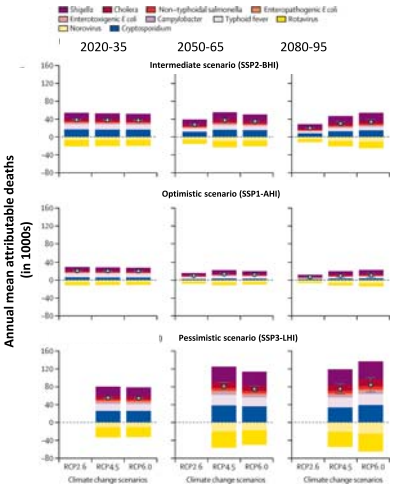
GCM-ensemble estimates of mean global temperature-attributable enteric infection deaths



Pathogen-specific mean number of deaths

Overall mean number of deaths

95% empirical confidence intervals



Chua PLC, Huber V, Ng CFS, Seposo X, Madaniyazi L, Hales S, Woodward A, Hashizume M. *Lancet Planetary Health*. 2021;5(7), e436-e445.

Acknowledgements

London School
Ben Armstrong
Shakoor Hajat
Paul Wilkinson

Univ. East Anglia
Paul Hunter

ICDDR,B
ASG Faruque
Kim Streatfield
Md Yunus

Research Institute for Humanity and Nature
Kazuhiko Moji

Kyoto Univ.
Taiichi Hayashi

Tsukuba Univ.
Yukiko Wagatsuma

The Univ. Tokyo
Paul Lester Chua

Climate Resilient Health System: Post pandemic challenges and opportunities for public health

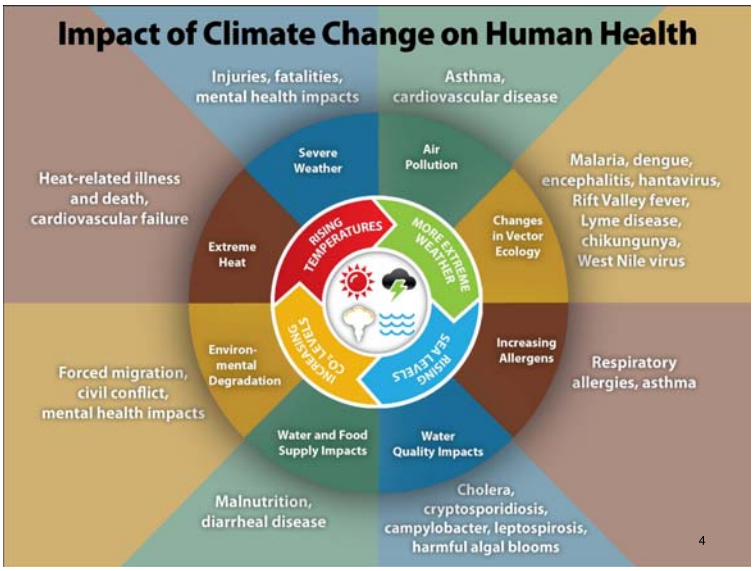
Prof Dr Iqbal Kabir
MBBS, MPH, PhD (Australia)
Coordinator, CCHPU, HSD, Ministry of Health and Family Welfare
Former Professor & Head of the Dept. Epidemiology, NIPSOM
Former Director (Planning & Research), DGHS

Extreme events!
SIDR, AILA…The Innocent Victims of Bangladesh

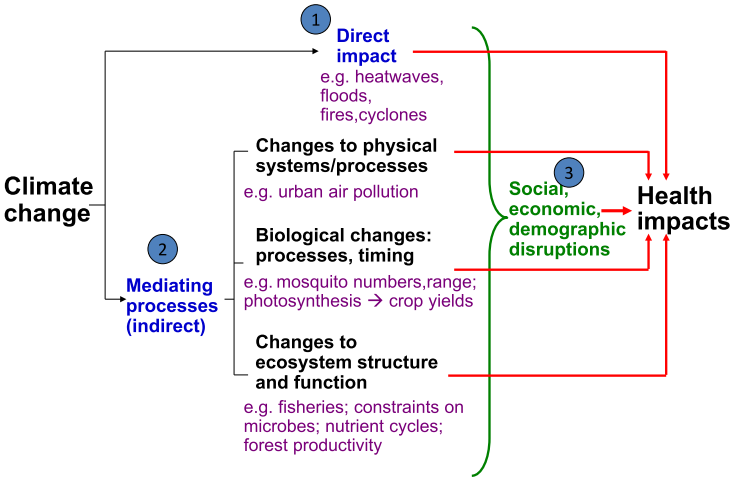
Climate Change, Livelihood, Health…???

Two Important Perspectives of climate change and health

- Health risks are influenced by <u>both</u> 'natural climate variability' and by '(human-induced) climate change'
- Climate change typically acts in concert with other environmental changes



Climate Change and Health: Pathways



Some of the largest disease burdens are climate-sensitive

Each year:

- Undernutrition kills 3.5 million.
- Diarrhoea kills 2.2 million.
- Malaria kills 900,000.
- Extreme weather events kill 60,000.

WHO estimates that the climate change that has occurred since the 1970s already kills over 140,000 per year.

Global community has given clear direction

- UNFCCC, Article 1, paragraph (1) states need to minimize adverse effects on "*natural and managed ecosystems or on the operation of socio-economic systems or on* ***human health and welfare***" .

- World Health Assembly Resolution WHA/61.R19, and Executive Board Resolution EB124.R5, request WHO to ***develop capacity to assess the risks from climate change for human health and to implement effective response measures***, and support countries through ***Awareness raising, Partnerships, Evidence, and health system strengthening***.

Health is directly linked with Food, Water, Shelter and Livelihood crisis in extreme events of climate change

Women and Children are the most vulnerable group

Climate sensitive diseases indicators :

- Water-borne diseases (e.g. Diarrhoea, cholera, Hepatitis, Enteric fever etc)
- Air borne diseases (e.g. ARI, Pneumonia, Bronchial asthma, COPD, Flu like syndrome
- Vector-borne diseases (Dengue, Chikungunya, malaria)
- Malnutrition (e.g. Severe Acute Malnutrition (SAM), Moderate Acute Malnutrition (MAM)
- Injuries
- Skin Diseases
- Psycho-social stress
- Post Traumatic Stress Disorder (After any natural disaster)
- Drowning
- Snake bite
- Non-Communicable diseases: Hypertension, Diabetes,
- Reproductive Health: Eclampsia, Pre-Eclampsia, Menstrual Hygiene Management: Urinary Tract Infection, SRH, Infertility
- Carcinoma: Cervical Carcinoma, Lung Carcinoma, Skin Carcinoma, Breast and other carcinomas

Pandemic effect on CCH

- In 2020, COVID-19 added a new and unwelcome dimension to weather, climate and water-related hazards, with wide-ranging combined impacts on human health and well-being.
- Mobility restrictions, economic downturns and disruptions to the agricultural sector exacerbated the effects of extreme weather and climate events along the entire food supply chain, elevating levels of food insecurity and slowing the delivery of humanitarian assistance.
- The pandemic also disrupted weather observations and complicated disaster risk reduction efforts.

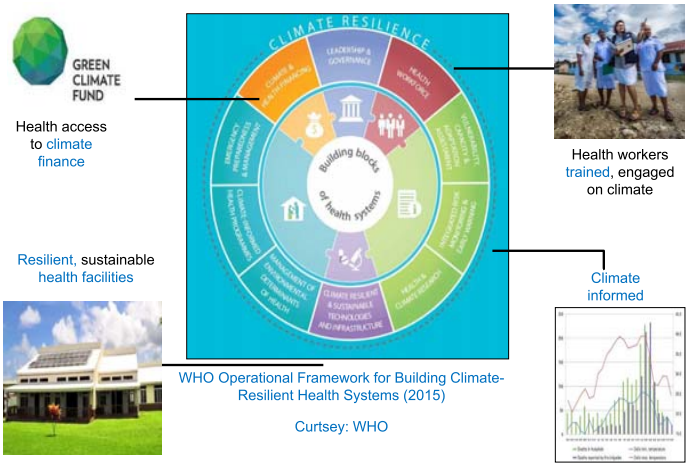
WMO report

- **Extreme weather and COVID-19 combined in a double blow:** compiled by the World Meteorological Organization (WMO)
- 2020 was one of the three warmest years on record, despite a cooling La Niña event. The global average temperature was about 1.2° Celsius above the pre-industrial (1850-1900) level. The six years since 2015 have been the warmest on record. 2011-2020 was the warmest decade on record.
- More than 50 million people were doubly hit in 2020 by climate-related disasters (floods, droughts and storms) and by the COVID-19 pandemic

Extreme weather and COVID-19 combined in a double blow for Public Health

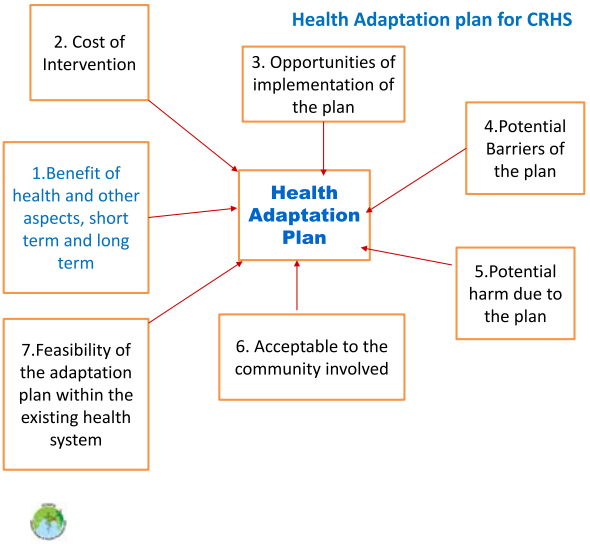
- A 50 bedded Primary health care centre (Upazila Health Complex) destroyed in a district of Bangladesh due to flood and river erosion in 2020.

Strengthen Climate Resilient Health *System*



Post Pandemic Lessons and opportunities for enhancing CRHS

- The current global recession caused by the COVID-19 pandemic may make it challenging to enact the policies needed for mitigation, it also presents opportunities to set the economy on a greener path by boosting investment in green and resilient public health infrastructure, thus supporting GDP and healthy employment during the recovery phase.
- Adaptation policies aimed at enhancing resilience to a changing climate, such as investing in disaster-proof health infrastructure and early warning systems, risk sharing through local level planning, and the development of social safety nets, can limit the impact of weather-related shocks and help building a climate resilient health system.



Let's start NOW!

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Thank you

The 1st Joint Student Seminar between Univ. of Tokyo and Univ. of Dhaka

Aug. 4, 2022

Toward the realization of chemical sensors that can be used by anyone, anywhere

Tsuyoshi Minami

INSTITUTE OF INDUSTRIAL SCIENCE, THE UNIVERSITY OF TOKYO

MINAMI Research Group

PI : Assoc. Prof. Tsuyoshi Minami

Research assistant professor, PhD Candidates (JSPS DC1×2), Technical staff, and a JSPS researcher (short term): Total 20 members

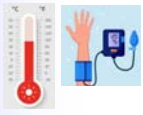
What is "Sensor"?

What is sensor?

- Analyte
- Receptor (Detection portion)
- Reporter (Transducer)
- Output signal

What is types of sensor?

Physical sensor: Heat, Pressure



- ・Artificial receptor ⇒Chemical sensor
- ・Biogenic material ⇒Biosensor

Chemical information is significantly related to our daily life.

However, chemical sensors are not realized in contrast to physical sensors in general life.

What is "Chemical Sensor"?

Defined by the official journal for the International Union of Pure and Applied Chemistry (IUPAC)

Chemical sensor is *"a device that transforms chemical information, ranging from the concentration of a specific sample component to total composition analysis, into an analytically useful signal".* F. Ingman et al., Pure Appl. Chem 1991, 63, 1247.

- Analyte → Biomarkers (for diagnosis), Toxic species (for environment assessment), Taste components (for food analysis), etc.
- Receptor
- Reporter → Evaluation items for chemical sensors ☆Sensitivity ☆Selectivity ☆Response speed ☆Stability
- Output signal → Optical, electrochemical, electric, mass sensitive, magnetic, thermometric, radiations, etc.

Easy-to-use chemical sensors are very important.

How Can We Detect Molecular Information?

Conventional methods: **Large analytical instruments**

Gas Chromatography-Mass spectrometry (*ca.* 110,000 US$)

Atomic absorption spectrometry (*ca.* 70,000 US$)

Liquid Chromatograph - Mass Spectrometry (*ca.* 700,000 US$)

- ✔High sensitivity
- ✖Large size
- ✖Complicated process
- ✖Long-time measurement

Toward real-world applications

Requirements for chemical sensors

- ✓ Small-sized device
- ✓ Recording system without using large apparatuses
- ✓ Qualitative and quantitative detectability

Representative easy-to-use chemical sensors

Paper-based sensors

D. Citterio et al., *Anal. Bioanal. Chem.* **2018**, *410*, 2305.

- Inexpensive, lightweight, and easy-to-store
- Single-use, portable and safely disposable
- User-friendly and rapid detection
- Possibility of multi-step assays in a compact device
- Requiring small volumes of sample and assay reagents

Progress of paper-based sensor

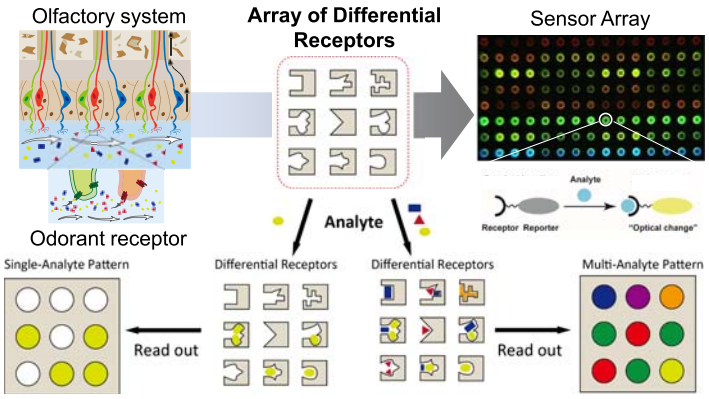
pH test paper (since 1664)

Urine dipstick (since 1950s)

Human chorionic gonadotropin (Pregnancy kit, since 1988)

Conventional paper-based sensors are capable of detecting **an only single analyte**, **whereas quantitative multi-component analysis is required in real-world scenarios**.

Sensor Array System for Pattern Recognition

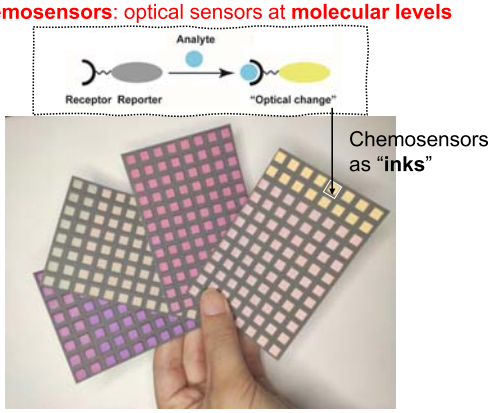


Suslick et al., *Nature* **2000**, 406; E. V. Anslyn et al., *Angew. Chem. Int. Ed.* **2001**, *40*, 3118;
T. Minami et al., *J. Am. Chem. Soc.* **2013**, *135*, 15238; T. Minami et al., *Coord. Chem. Rev.* **2021**, *429*, 213607.

Sensor arrays can qualitatively and quantitatively discriminate invisible chemical species by combination with computational methods.

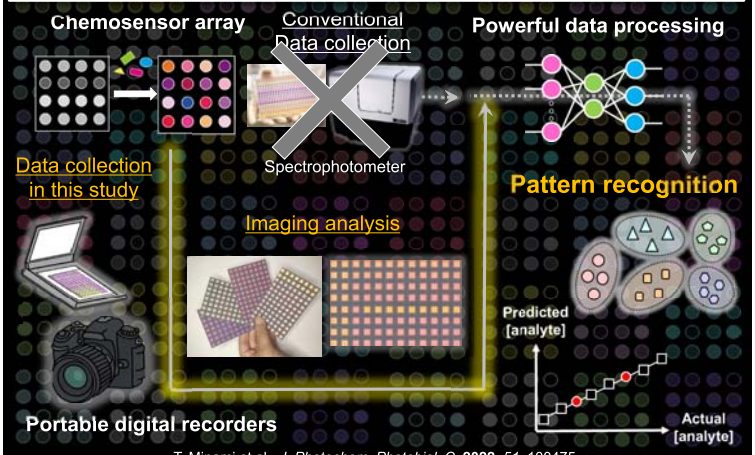
Toward Realization of Easy-to-Use Sensor

Chemosensors: optical sensors at **molecular levels**



Paper-based chemosensor array is a disposable analytical tool that can be fabricated by using **office printers**.

Aim: **Realization of chemical sensors that can be used by anyone, anywhere**



T. Minami et al., *J. Photochem. Photobiol. C*, **2022**, *51*, 100475 .

Sensing Applications

☆Saccharide detection for food analysis

96-Well Microtiter Plate Made of Paper: A Printed Chemosensor Array for Quantitative Detection of Saccharides

Anal. Chem. **2021**, *93*, 1179 (Top 10% article, Clarivate Analytics).

☆Oxyanion detection for environmental assessment

A Printed Paper-Based Anion Sensor Array for Multi-Analyte Classification: Application to On-Site Quantification of Glyphosate

ChemPlusChem **2021**, *86*, 798

☆Simultaneous categorization of multi-groups

Printed 384-Well Microtiter Plate on Paper for Fluorescent Chemosensor Array in Food Analysis

Chem. Asian J. **2022**, *in press.*

Acknowledgements

Financial Support

CREST (2020-)

Aquatic Functional Materials

Scientific Research on Innovative Areas (2020-)

Scientific Research (B) (2021-)

Challenging Exploratory Research (2020-2022)

4 August, 2022

CLIMATE CHANGE INDUCED PUBLIC-HEALTH HAZARD MAPPING IN BANGLADESH AND ROLE OF THE UNIVERSITY OF DHAKA IN REDUCING THE VULNERABILITY

Dr. A S M Maksud Kamal
Professor, Department of Disaster Science and Climate Resilience

Introduction

- With significant economic growth over the last 50 years, reduction in poverty, self-sufficiency in food production, infrastructure development, digital and mobile technologies (e.g. access to mobile telephones, high-speed internet) and collective social changes, Bangladesh is now much more resilient to natural disasters.
- Natural hazards and associated disasters have been intensified due to climate change, unsustainable development, rapid urbanization and population growth, particularly in the Global South, including Bangladesh.

Climate-Health Nexus

- The impact of climate change on human health and well-being can be manifested through different pathways and can be categorized as being direct or indirect, mediated through complex biophysical and social dynamics.
- The direct effects of climate change that have been observed in Bangladesh include morbidity and mortality due to heat stress, cyclones, floods, droughts and other weather extremes at different spatio-temporal scales.

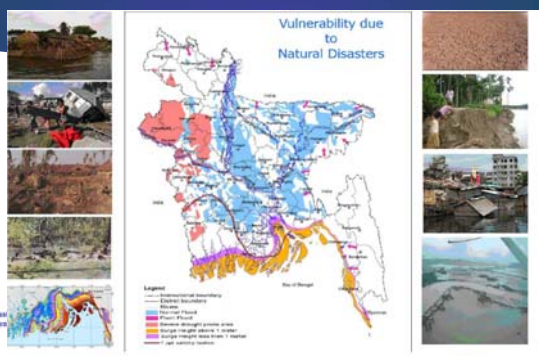
University of Dhaka

- The University of Dhaka is the oldest and largest University in the Country consisting of 96 entities of Departments and Institutes, as well as 172 constituents and affiliated colleges
- We have 11 faculties and 56 research centers and bureaus

Entities involved in Climate Change and public health studies

- Institute and Department engaged in public health research: Department of Disaster Science and Climate Resilience, Department of Geography and Environment, Department of Population Sciences, Department of Microbiology, Department of Biochemistry, Department of Fisheries, Institute of Health Economics, Institute of Nutrition and Food sciences, Department of Pharmacy, Institute of Vulnerability Studies and Disaster Management,

Climate-induced Natural Events



Public health research

7

- Disease mapping in Bangladesh
- Trends and Determinants of Common Non-communicable Diseases in Bangladesh
- HIV Infection and Multidrug-Resistant Tuberculosis: A Systematic Review and Meta-analysis

Epidemiology/Diseases

- Role of Parental Education on Reduction of Prevalence of Childhood Undernutrition in Bangladesh
- Association of Low-Birth Weight with Malnutrition in Children under Five Years in Bangladesh

Nutrition

- Prevalence, pattern and sociodemographic differentials in smokeless tobacco consumption in Bangladesh
- Media and education play a tremendous role in mounting AIDS awareness among married couples in Bangladesh

Community Health

Disaster Management

- Change-point and Spatio-temporal Analysis of Climate Data in Bangladesh
- Coping strategies with floods in Bangladesh: an empirical study

Machine Learning/Bioinformatics

- Machine Learning Approaches Reveal that Number of Tests does not Matter to Predict Global COVID-19 Confirmed Cases
- Advanced correlation grid: Analysis and visualisation of functional connectivity among multiple spike trains

Maternal and Child Health

- Identifying Factors Influencing Contraceptive Use in Bangladesh
- Trends and determinants of perinatal mortality in Bangladesh
- Association of Low-Birth Weight with Malnutrition in Children under Five Years in Bangladesh

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Climate Change and Health crisis

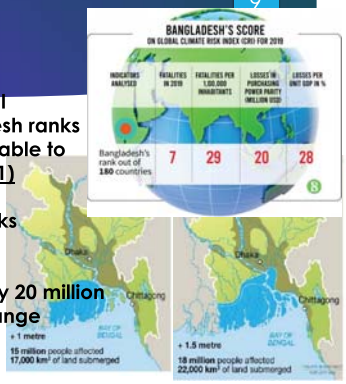
8

Department of Disaster Science and Climate Resilience

Climate Risk Index

9

- Despite producing only 0.56% of the global emissions changing our climate, Bangladesh ranks seventh on the list of countries most vulnerable to climate devastation, (Germanwatch's 2021)
- UNICEF's Children's Climate Risk Index ranks Bangladesh 15 out of 163 countries.
- One in three children in Bangladesh, nearly 20 million children in total, are victims of climate change



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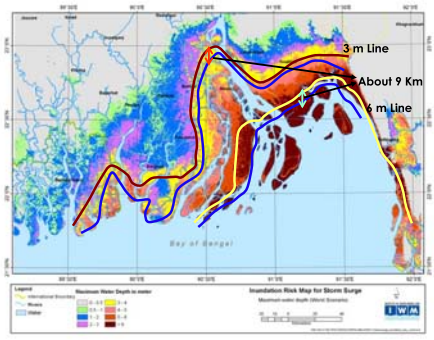
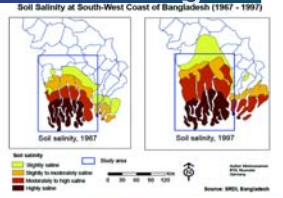
Impact of Climate Change in Coastal region

10



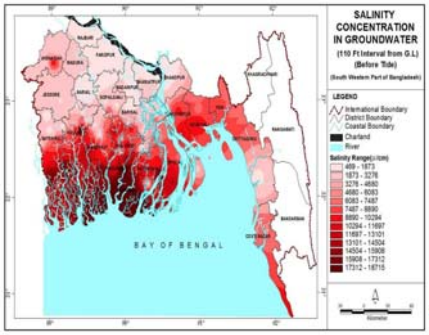


Crop	% in yield reduction based on different soil salinity (EC in dS/m)		
	0%	10%	25%
Onion	1.2	1.8	2.8
Beans	1.0	1.5	2.3
Potato	1.7	2.5	3.8
Sweet potato	1.5	2.4	3.8
Carrot	1.0	1.7	2.8
Radish	1.2	2.0	3.1
Pepper	1.5	2.2	3.3

Source: FAO, 2011

Drinking Water Vulnerability

11



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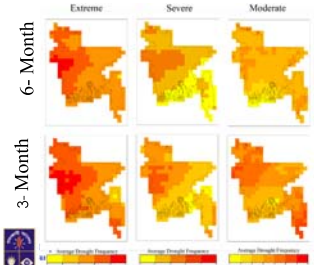
Impact of 1.5° and 2°C temperature rise on the drought in Bangladesh using CMIP6 climate models

12

Drought Frequency Changes

Compared to Reference Level



Reference Period (1975 - 2014)

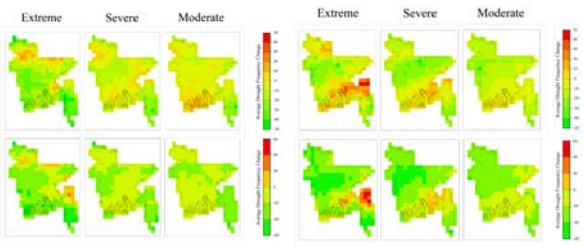
Near Future (2020 – 2059)

Impact of 1.5° and 2°C temperature rise on the drought in Bangladesh using CMIP6 climate models

13

Drought Frequency Changes: SSP 126 model

- Occurrence frequency of droughts was found to decrease in the drought-prone western region up to -50% and increase in the east up to 50 to 70%, which would make droughts more homogeneously distributed over the country



Near Future (2020 – 2059) | Far Future (2060 – 2099)

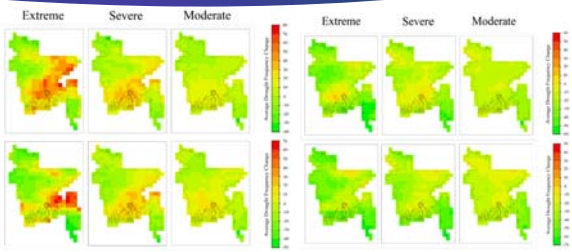
Department of Disaster Science and Climate Resilience

Impact of 1.5° and 2°C temperature rise on the drought in Bangladesh using CMIP6 climate models

14

Drought Frequency Changes: SSP 119 model

- Comparison of drought scenarios for SSP119 and SSP126 revealed a 0.5°C more temperature rise can cause an increase in extreme droughts by 30% in the central-eastern region.



Near Future (2020 – 2059) | Far Future (2060 – 2099)

Department of Disaster Science and Climate Resilience

Wet Bulb Global Temperature (WBGT) in Bangladesh

15

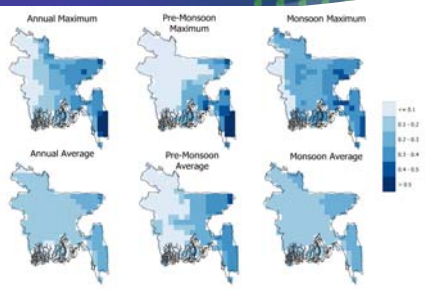
- WBGT is a measure of the heat stress in direct sunlight.
- It is a type of apparent temperature used to estimate the effect on humans
- Takes into account: temperature, humidity, wind speed, solar radiation
- Found to be increasing due to climatic changes with catastrophic impacts on public health, human and labours activities, and environmental sustainability.

Department of Disaster Science and Climate Resilience

Rate of change in average and maximum WBGT in Bangladesh (1979 to 2021)

16

The results from this study can be utilized to prepare for adaptation and lessen the effects of climate change on disease and mortality, especially given the huge number of marginally poor people working in construction and agriculture and being exposed to excessive heat in the country



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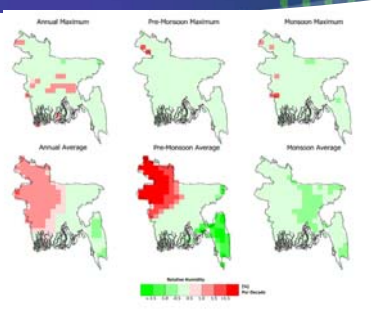
Rate of change in relative humidity

17

Rate of change in average and maximum Relative Humidity in Bangladesh (1979 to present)



Department of Disaster Science and Climate Resilience

Climate Change and Public health hazards in Bangladesh

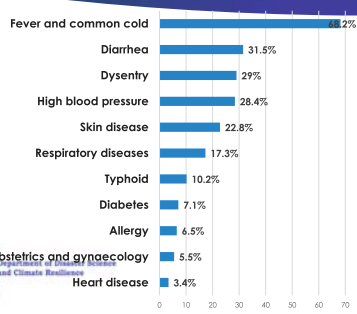
18

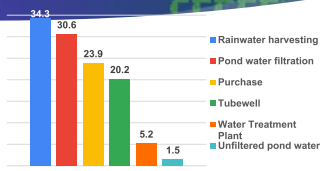
- Infectious diseases
- Psycho-social effects
- Displacement
- Damage to healthcare infrastructure
- Disruption of public health services
- Transformation of ecosystems
- Social dislocation
- Loss of jobs and livelihoods
- Economic crisis
- Increased heat-related mortality and morbidity
- Higher occurrence of drought-related dysentery and diarrhea because most safe water sources have dried out

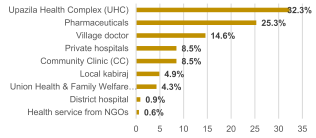
Department of Disaster Science and Climate Resilience

Health issues and Relevant Factors

19







Willingness to Pay for Health Services in Disaster Prone coastal area

20

		Percentage (%)	Total
Households willing to pay	Willing a offered bid	58.8	**82.6%**
	Willing to pay less than offered bid	23.8	
Households unwilling to pay	Consider it to be government's responsibility	15.9	**17.4%**
	Consider the program to be uneffective	1.5	

Estimated mean WTP $\mu = -\frac{\alpha}{\beta}$

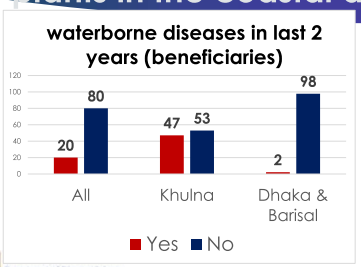
= Tk 60 per visit (approximately)

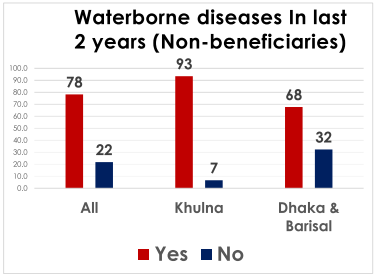
Significantly influencing factors

- Offered bid
- Monthly household income
- Age
- Gender
- Availability of drinking water

GoB interventions through water treatment plants in the coastal areas of Bangladesh

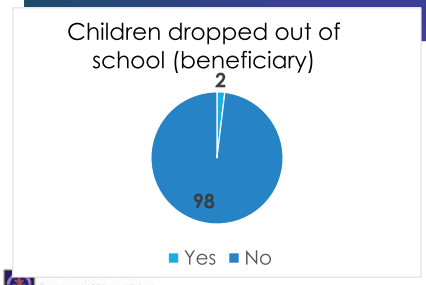
21

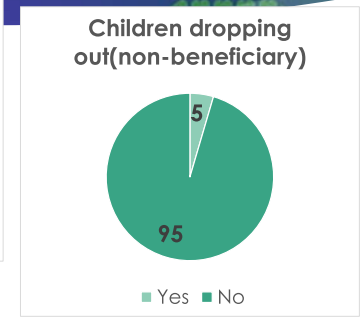




Social impacts of GoB interventions through water treatment plants in the coastal areas

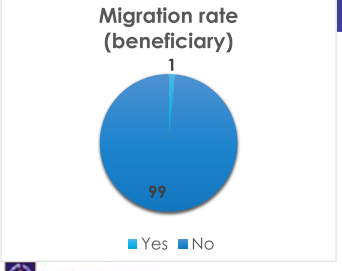
22

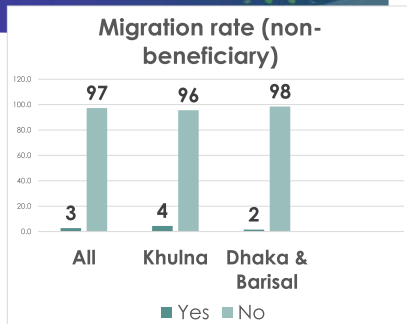




Social impacts of GoB interventions through water treatment plants in the coastal areas

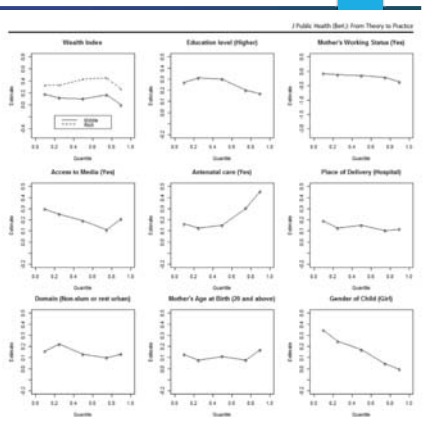
23





Urban Children (under 5) Health Status

Place of residence (Domain), mother's age at birth, gender of the child, wealth index, education and working status of the mother, access to media, antenatal care, and place of delivery were found to have a significant association with the malnutrition of children of urban areas of Bangladesh



Government Initiatives

- The Government of Bangladesh has a number of measures already in place, efforts that have been complemented by local interventions. Evidence to take robust health policy decisions related to climate change is limited and scattered, while there is a lack of multidisciplinary research efforts.
- Considering these limitations, generating and summarizing scientific evidence is vital for informing a resilient health system against future public health concerns in climate vulnerable countries such as Bangladesh and in other low-income regions.

Concluding Remarks

- Bangladesh is a hot spot for the study of climate change-induced public health
- Deeper understanding of public health
- Further Collaboration and cooperation
- Student exchange
- Joint research

STUDENTS PRESENTATIONS

IMPACT OF CLIMATE CHANGE ON DENGUE: A SYSTEMATIC REVIEW

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Key Words: *Climate change, dengue transmission, projection, meteorological factors.*

1. BACKGROUND

The number of dengue cases reported worldwide have increased more than 8 folds over the last two decades. A number of climatic factors have potentially contributed in raising the global dengue incidence. This study aims to review the ecology and environmental impact on dengue transmission, its global variability and tries to provide future projection of Dengue globally.

2. METHODOLOGY

This study reviewed peer-reviewed journal articles which assessed the effect of climate change on dengue transmission. A systematic search was conducted using electronic databases PubMed, Google Scholar and ScienceDirect. The studies considered were published from February 2011 to May 2022 and written in English. A total of 29 out of 35 articles were reviewed.

Figure: Dengue patients in a hospital ward.

3. FINDINGS

Most of the selected studies showed that multiple meteorological factors including temperature, humidity, wind velocity, precipitation and rainfall influence dengue transmission, geographical region at risk and seasonal time window for dengue epidemic. Rainfall and temperature are the major factors that increase the exposure of dengue by raising the birth rate of Aedes vector mosquitoes. As temperature is expected to rise further in future due to climate change, dengue incidence will rapidly increase, with the increase in vector capacity (VC), the vector's ability to spread the disease. Overall, majority of the projections regarding the effect of global warming on dengue fever found significant positive relationship among temperature (up to a certain threshold), dengue transmission rate and the size of the area prone to a dengue epidemic.

Table: Country-wise climatic effect on dengue.

Country	Impact on dengue
Malaysia	An increasing risk of dengue outbreak in future.
China	Number of days per year suitable for dengue transmission will increase by 20 days in 2080.
Mexico	40% increase in dengue incidence by 2080.
Bangladesh	40-fold increase in dengue cases by the end of 21st century with an assumed increase in temperature of 3.3°C.

4. CONCLUSION

This review suggests that the transmission of dengue is dependent on temperature, humidity, wind speed and direction (speed, height), air density, precipitation and barometric pressure which impacts the timing and magnitude of dengue transmission. Dengue incidence rapidly increases due to the increase in rainfall and temperature. Lastly, the results support impact of climate change as main risk factor for dengue outbreak.

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[1]. Naish, S., Dale, P., Mackenzie, J. S., McBride, J., Mengersen, K., & Tong, S. 14(1) (2014) 1-14.

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[3]. Li, C., Lu, Y., Liu, J., & Wu, X. 622 (2018) 493-501.

[4]. Williams, C. R., Mincham, G., Faddy, H., Viennet, E., Ritchie, S. A., & Harley, D. 144(14) (2016) 3091-3100.

[5]. Banu, S., Hu, W., Guo, Y., Hurst, C., & Tong, S. 63 (2014) 137-142.

1st Joint Student Seminar between University of Tokyo and University of Dhaka

Theme: Ecology and Environmental Impact of Human Public Health

IMPACT OF CLIMATE CHANGE ON DENGUE: A SYSTEMATIC REVIEW

Presenter: Quazi Nazmus Sakib

Co- authors: M.I. Hassan, A.S. Moitree, N.J. Marin, M.S. Hasan

Institute of Health Economics, University of Dhaka

CONTENTS AND SEQUENCE

BACKGROUND AND OBJECTIVE

- The number of Dengue cases have increased more than 8 folds over the last two decades worldwide.
- A number of climatic factors have potentially contributed in raising the global dengue incidence.
- This study aims to review the ecology and environmental impact on dengue transmission, its global variability and tries to provide future projection of Dengue globally.

METHODOLOGY

- A systematic search was conducted using electronic databases which include PubMed, Google Scholar and ScienceDirect.
- The studies considered were published from February 2011 to May 2022 and written in English.
- A total of 29 out of 35 articles were reviewed.

FINDINGS

1. Multiple meteorological factors including temperature, humidity, wind velocity, precipitation and rainfall influence dengue transmission.

2. Rainfall and temperature are the major factors that increase the exposure of dengue by raising the birth rate of Aedes vector mosquitoes.

3. As the Earth will continue to warm, this will increase dengue vector's ability to spread the disease. As a result, dengue incidence will rapidly rise.
4. Overall, majority of the projections regarding the effect of global warming on dengue fever found significant positive relationship between temperature (up to a certain threshold) and dengue transmission rate.

Projections

Country	Impact on dengue
Malaysia	An increasing risk of dengue outbreak in future.
China	Number of days per year suitable for dengue transmission will increase by 20 days in 2080.
Mexico	40% increase in dengue incidence by 2080.
Bangladesh	40-fold increase in dengue cases by the end of 21st century with an assumed increase in temperature of 3.3°C.

Table: Country-wise climatic effect on dengue.

CONCLUSION & RECOMMENDATION

- This review suggests that the transmission of dengue is dependent on temperature, humidity, wind speed and direction (speed, height), air density, precipitation and barometric pressure which impacts the timing and magnitude of dengue transmission
- The results support impact of climate change as a risk factor for dengue outbreak.
- Dengue incidence rapidly increases due to the increase in rainfall and temperature.

REFERENCES

[1]. Naish, S., Dale, P., Mackenzie, J. S., McBride, J., Mengersen, K., & Tong, S. 14(1) (2014) 1-14.

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[5]. Banu, S., Hu, W., Guo, Y., Hurst, C., & Tong, S. 63 (2014) 137-142.

Thank You

A CRITICAL ANALYSIS OF FINANCIAL EFFICACY ON TIGER CONSERVATION PROJECTS IN BANGLADESH

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***Keywords**: Tiger conservation; conservation finance; budget allocation; tiger population; Bengal tiger.*

INTRODUCTION:

Bangladesh as one of the TRCs failed to increase the tiger population despite investing much funds. Critical review of the funded projects' outcomes compared to India and Nepal.

METHODOLOGY:

Six specific tiger conservation projects implemented in Bangladesh, India and Nepal were selected to analyze Allocated fund distributions were segmented into five groups:

- Capacity Building
- Planning Policy and Reports
- Infrastructural Development,
- Tiger-Human Conflict (THC) reduction
- Direct Initiatives

RESULTS:

In results, India and Nepal spent respectively 48.84% & 46.20% of their budget on on-field activities and less on planning purposes.

India and Nepal also developed a sustainable funding mechanism to reduce their dependency on donor agencies.

Table 1. Comparison of funding allocation and tiger population among India, Nepal, and Bangladesh

Parameters	India (2011-2022)	Nepal (2016-2020)	Bangladesh (2018-2027)
Total Estimated Budget (USD)	2,119,840,000	3,290,000	11,450,000
Capacity Building (%)	1.99	35.95	22.57
Tiger-Human Conflict (%)	48.01		8.95
Policy and Report Planning (%)		17.85	40.08
Direct Initiatives (%)	48.84	46.20	4.28
Infrastructure (%)	1.16	*Lump sump*	0.00
Unallocated (%)	0.00	0.00	24.12
Current Estimated Tiger Population	2967	235	114

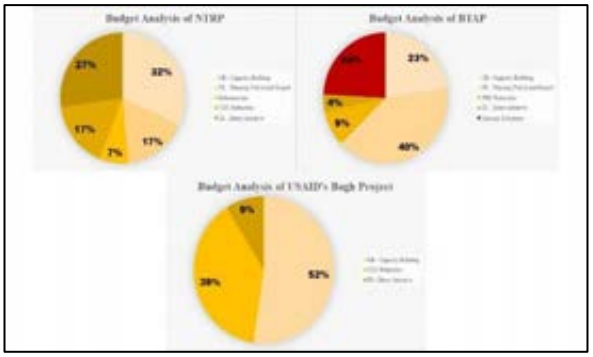


Figure 1. Graphical Representation of the projects' analyzed in Bangladesh.

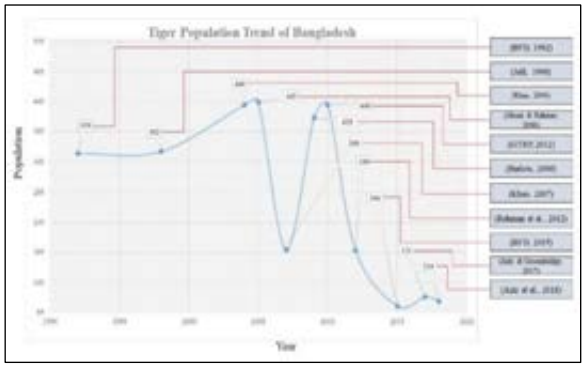


Figure 2. A summary of tiger population in Bangladesh 1992 – 2018

In contrast, Bangladesh spent the majority of their fund on planning purposes (40.08%) and from 2012 to 2018 The population dropped from 199 to 114. Bangladesh also has major lack of funding and, due to not having financial planning.

CONCLUSION:

It is recommended that Bangladesh needs to develop a sustainable long-term funding mechanism for tiger protection. Collaborating financially with different governmental bodies can establish a new monetary reserve for tiger conservation. In the future tiger conservation initiatives in Bangladesh should address more on-field direct action. The series of actions taken will execute the plans and enhance the effectiveness resulting in increased tiger population and an appropriate habitat for the species.

Presentation on

A CRITICAL ANALYSIS OF FINANCIAL EFFICACY ON TIGER CONSERVATION PROJECTS IN BANGLADESH

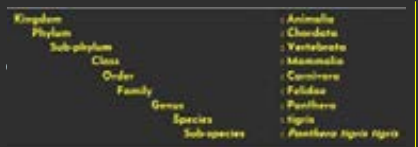
Authors: I. Mannan, M. Sujauddin, and M.S.I. Sohel.

Are we really saving the tigers?

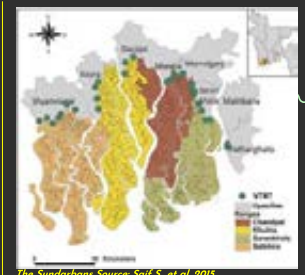
Introduction

- The Bengal Tiger is a Global Concern
- 13 Tiger Range Countries committed to double the tiger population by 2022
- Bangladesh failed to increase the tiger population despite much monetary investments

Methodology:
Targeted Species and Study Area



Taxonomical classification of the Bengal tiger



The Sundarbans Source: Saif S, et al. 2015

Methodology

Sl no.	Name ofthe Paper	Type of Document	Published Year	Organization
1	Bangladesh Tiger Action Plan (2009-2017)	Action Plan	2009	Bangladesh Forest Department
2	National Tiger Recovery Program of Bangladesh 2017-2022	Action Plan	2016	Bangladesh Forest Department, The World Bank
3	Bangladesh Tiger Action Plan (2018-2027)	Action Plan	2018	Bangladesh Forest Department
4	Status of Tigers in Sundarbans 2018	Report	2019	Bangladesh Forest Department
5	Wildlife Without Borders - Rhinoceros and Tiger Conservation Fund (Project BAGH)	Report	2012	United States Fish and Wildlife Services
6	Tiger Action Plan in Nepal (2016-2020)	Action Plan	2016	Govt. of Nepal
7	NATIONAL TIGER ACTION PLAN INDIA 2011-2022	Action Plan	2011	India's National Tiger Conservation Authority

Content Analysis

1. Capacity Building

Major activity: Communal Engagement, Raising Awareness, Research facility

2. Planning Policy and Reports

Major Activity: Guidelines, Rules, International steps.

3. Infrastructural Establishments

Major Activity: Office, HQs, Remuneration

4. Tiger-Human Conflict (THC) Reduction

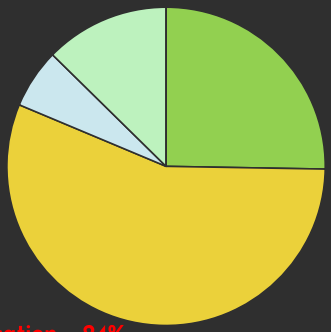
Major Activity: FTRT, VTRT, Compensations

5. Direct initiatives to Control Tiger Population

Major Activity: Implications of plans and On-field measures

Bangladesh Tiger Action Plan (2018-2027)

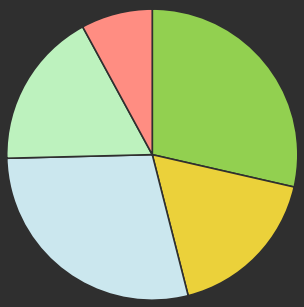
- Capacity Building - 23%
- Planning Reports - 40%
- Direct Actions - 4%
- THC Reduction - 9%
- Infrastructural - 0%



Missing Allocation - 24%

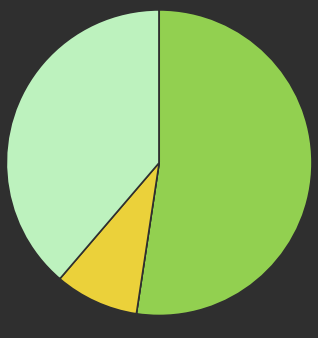
National Tiger Action Plan (2017-2022)

- Capacity Building - 32%
- Planning Reports - 17%
- Direct Actions - 27%
- THC Reduction - 17%
- Infrastructural - 7%

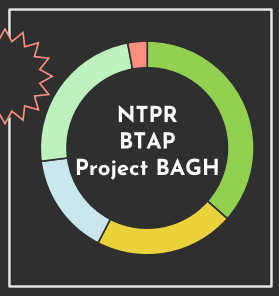


Project BAGH (2012)

- Capacity Building - 52%
- Planning Reports - 0%
- Direct Actions - 9%
- THC Reduction - 39%
- Infrastructural - 0%

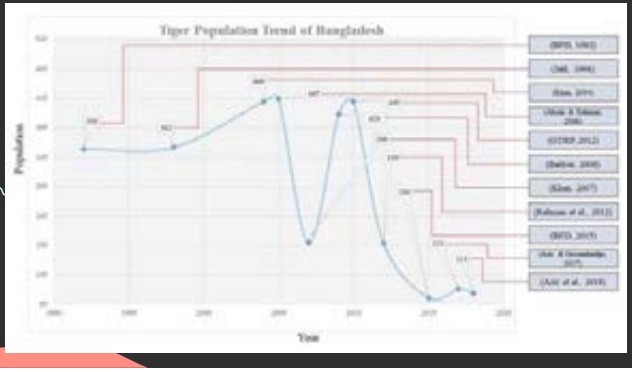


Final Cummilative Analysis



- Capacity Building - 36.50%
- Planning Reports - 21.10%
- Direct Actions - 15.41%
- THC Reduction - 24.06%
- Infrastructural - 2.93%

Tiger Population Status



A Short Comparison

Parameters	India (2011-2022)	Nepal (2016-2020)	Bangladesh (2018-2027)
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Infrastructure (%)	1.16	Lump sump	0.00
Unallocated (%)	0.00	0.00	24.12
Current Estimated Tiger Population	2967	235	114

A Way Forward....

Things to keep in mind

- Population growth was not satifactory
- No Sustaianable Financial Model
- 24.12 % of the budget allocation was missing
- Less focus on implimentation
- Inefficient training staffs

Neighboring Countries

- More effective financial allocations
- Revenue Generation Model
- More investment on direct initiatives
- Improved tiger population
- Effective Co-managment

"Bengal tigers can get locally extinct within the next 5-10 years"

– (Rahman et al.)

THANK YOU!

The Floor is Open for Questions

ASSOCIATIONS BETWEEN LIFESTYLE BEHAVIORS AND DIABETES IN SOUTH ASIAN COUNTRIES

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Correspond to S. SULTANA (suravi.here@gmail.com)

BACKGROUND

South Asian people are at a higher risk of developing diabetes at an earlier age and a lower body mass index. However, responses to lifestyle behaviors in relation to developing diabetes among the South Asian population have been studied less.

OBJECTIVES

To examine the associations between lifestyle (LS) behaviors and diabetes among South Asian countries. This will help us to understand the influence of multiple LS risk factors on diabetes when they are present simultaneously.

METHODS

My study population is World Bank South Asian countries including Afghanistan, Bangladesh, Nepal, Sri Lanka and Bhutan. But here I used only Afghanistan dataset for primary demonstration of my objectives. I used the 2018 WHO STEP survey data. This is a household-level cross-sectional survey. Participants were 18-69 years old. Pregnant women were excluded from this study. The analysis sample size was 3302. The outcome variable of my study was diabetes defined by WHO as fasting plasma glucose (FPG) ≥ 126 mg/dl [1]. Exposure variables were LS risk factors including fruit and vegetable intake (5 servings/ day), intake of processed food that are high in salt, eating out habit, physical inactivity (< 75 minutes of vigorous activity/ week) [2], daily sitting time (< 10 hours), use of tobacco and alcohol. Modified Poisson regression was used to produce the risk ratios (RR) with 95% (CI). The results were adjusted for age, sex, education, place of residence (urban/ rural), abdominal obesity (waist circumference ≥ 94 cm for men and ≥ 80 cm for women) and hypertension (systolic ≥ 140 mm Hg and diastolic ≥ 90 mm Hg) status [3].

RESULTS

13.6% of Afghan adults had diabetes. The prevalence of diabetes among the adult population under the age of 40 years old was 9% whereas the prevalence was around 19% among the population with the age 40 years or above. The distribution of LS risk factors is shown in figure 1.

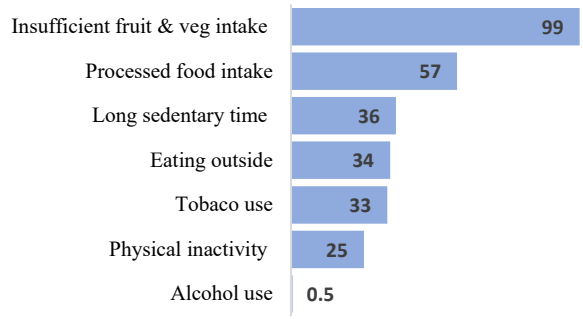

Figure 1: Prevalence of unhealthy lifestyle behaviors among Afghan adults.

In the unadjusted model, alcohol use [RR 2.98 (95% CI 1.66-5.36)], physical inactivity [RR 1.66 (95% CI 1.4-1.97)], tobacco use [RR 1.27 (95%CI 1.06-1.51)] and long sedentary time [RR 1.33 (95% CI 1.07-1.65)] were positively associated with the risk of diabetes.
In the adjusted model, use of alcohol [RR 2.17 (95% CI 1.09-4.32)], physical inactivity [RR 1.45 (95% CI 1.25-1.84)] and eating out habits [RR 1.37 (95% CI 1.14-1.66)] were found to increase the risk of diabetes. However, the use of tobacco also showed a positive association [RR 1.13 (95% CI 0.92-1.39)] although it was not significant.

CONCLUSION

Among the selected lifestyle behaviors, use of alcohol, physical inactivity, and eating out habits were positively associated with the risk of diabetes among Afghan adults.

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COMMUNITY PERCEPTION ABOUT CLIMATE CHANGE: INVESTIGATING EXPERIENCES OF HIMALAYAN COMMUNITIES INVOLVED IN THE TOURISM INDUSTRY

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[2]Assistant Director, Post Graduate Programs in Disaster Management, BRAC University, Dhaka, Bangladesh,
Correspond to Rubina Karki (rubina.karki.nepali@gmail.com)

Keywords: *Climate change, Tourism, Himalayan region, Manang, Nepal*

INTRODUCTION

There occurs a close relationship between tourism and climate, where the former is highly dependent on the latter [1]. Local perspectives play a crucial role in improving our understanding of climate change by refocusing attention on empirical studies that contemporary science frequently overlooks [2]. The present research assesses the perception of the local people regarding their understanding and impacts of climate change on their tourism-dependent livelihood in villages in the Himalayan district, Manang, of Nepal. This exploratory case study employs a content analytic technique to investigate data obtained from focus group discussions (FGDs), semi-structured interviews, and questionnaire surveys in 17 settlements in the Manang district. A total of 107 respondents were involved in the study. The research was done in 2021.

FINDINGS

The local people perceived the climate in their villages has been changing with perceived increased summer and winter temperature, decreased snowfall and snow coverage, and reduced or erratic rainfall. These changes are perceived to positively influence the tourism economy. They also believe that indirect influences such as better hotel facilities, road transportation, and repaired trekking trails in recent years may have had a positive impact on tourism-dependent livelihood. The research recommends taking actions where perceptions of future impacts of climate change are evident.

Figure 1. Map of Study Area

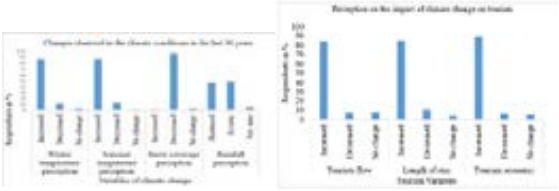

Figure 2. Data Collected

CONCLUSION

The local people perceived that the climate in their villages has been changing with perceived increased summer and winter temperature, decreased snowfall and snow coverage, and reduced or erratic rainfall. These changes are perceived to positively influence the tourism economy. The research recommends taking actions where perceptions of future impacts of climate change are evident.

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COMMUNITY PERCEPTION ABOUT CLIMATE CHANGE: INVESTIGATING EXPERIENCES OF HIMALAYAN COMMUNITIES INVOLVED IN THE TOURISM INDUSTRY

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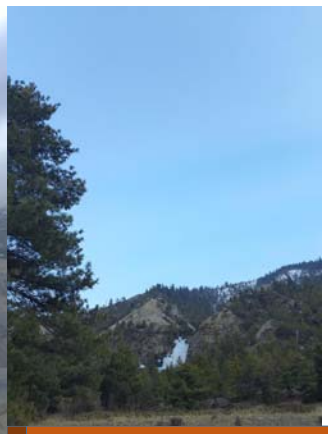


Presentation Outline

- Introductory Concepts
- Research Scopes
- Context
- Research Design
- Data Collection and Analysis
  - ✓ Community Perception about Climate Change
  - ✓ Long-term Impacts of Climate Change on Tourism: As Predicted by the Communities
- Major Findings
- Conclusion

Key Literature

Introductory Concepts

Focus 1
Climate Change

Focus 2
Tourism

Community Perception about Climate Change and its Impact on Tourism

My Research

- Nature-based tourism activities that occur in the Himalayan region are found to be highly climate sensitive (Rayamajhi, 2012)
- Local perceptions play an important role to understand climate change better, through redirecting the focus towards empirical investigations that often might be overlooked by the modern science (Kloprogge & Van der, 2006)

Research Scopes

- Documenting the perception of the local people, focused on tourism to comprehend their knowledge about the impacts of climate change through the employment of participatory planning approaches
- Only fewer studies specifically assess the impacts of climate change on the tourism industry by the inclusion of tourism stakeholders (Hein et al, 2009)

Research Questions and Objectives

Research Scopes

Research Question 1: How do the local communities of the Manang villages involved in the tourism industry perceive climate change?

Objectives

- To explore the understanding of local people about climate change and their perception regarding different climatic factors
- To investigate how the local people built their understanding about the climate change variabilities in their region

Research Question 2: What are the community perceptions regarding the impacts of climate change on tourism industry?

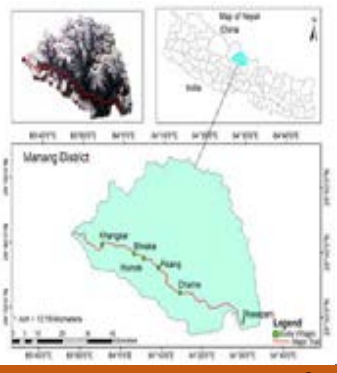
Objectives

- To understand the relation between climatic factors and tourism industry in the Manang villages
- To explore the prediction of the local people regarding the future impact of climate change on tourism industry

Manang District and Study Villages

- Located in the Northwestern part of Himalayan region of Nepal, 270km north-west of Kathmandu
- Carried out in the Manang villages of Chame Municipality of Manang
- located at latitude 28°40'22.80" North and longitude 84°10'45.84"East
- Annapurna Circuit Trekking
- **Stakeholders of the Study: HOTEL OWNERS**

Context



Methodology

Data Collection

Primary Data Collection

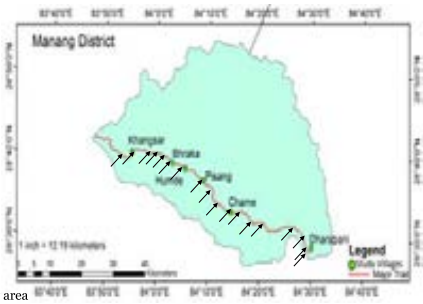
- Field observation
- Questionnaire survey
- Focus group discussion
- Semi-structured interview, and
- Literature review of the secondary data to understand the relevant materials for the study
- Carried out within 17 villages that follows the route to Tilicho Lake from the start of Manang District
- **Total Hotels in the study area: 112**
- **Total Respondents: 107**

Research Design

Research Design

Study Area

- **Dharapani**
- **Bagarchhap**
- **Danaque**
- **Timang**
- **Syarkhu**
- **Koto**
- **Nar Manang**
- **Chame**
- **Talekhu**
- **Dhukkurpokhari,**
- **Pisang**
- **Humde**
- **Bhraka**
- **Manang**
- **Tanki Manang**
- **Siri Kharka**
- **Khangshar (including Tilicho Base Camp)**



- The study took place in 17 villages in total and the study area in this research started from Dharapani to Tilcho Base Camp from an altitude of 1800masl to 4200masl

Methodology

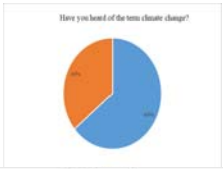
Secondary Data Collection

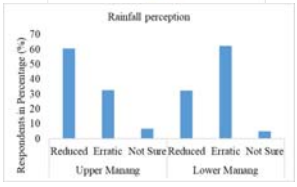
- Collected from the published relevant journals, magazine articles, books, websites, thesis reports, official records, etc.

Data Analysis

- Qualitative data analyzed using content analysis method
- Obtained data and collected information were analyzed using Microsoft Excel (2016) for the interpretation of result: pie charts, bar diagrams

Research Design



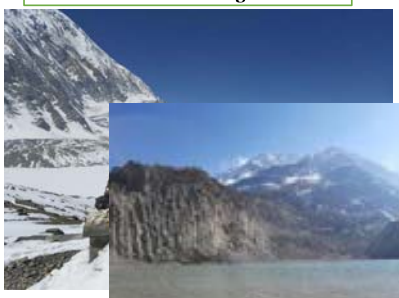


Data Collection and Analysis

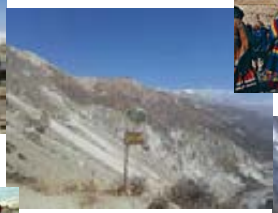
Community Perception about Climate Change

Tourism Peak Season:
October-November
April-May

Tourism Destinations:
Tilicho Lake, Thorung la Pass, cultural festivals, villages

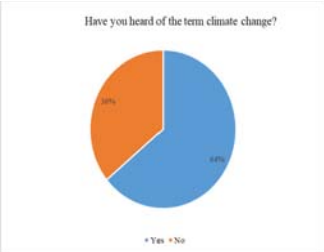


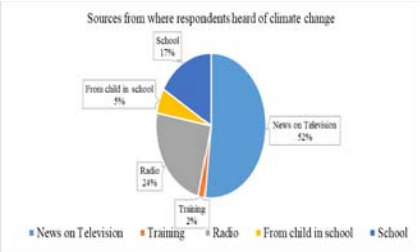
Community Perception about Climate Change

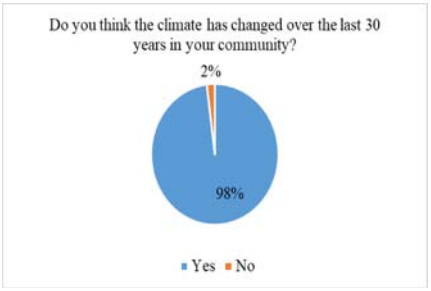


Data Collection and Analysis

Familiarity with Climate Change





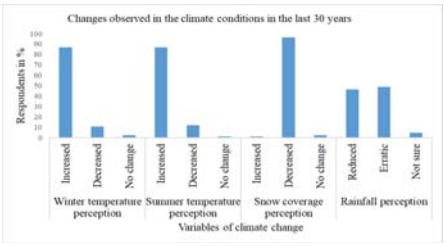


- More than half of the respondents had an idea about climate change
- In most of the cases, the respondents got ideas from news on electronic media. All the respondents have televisions and radios at their residences
- Almost every respondent has noticed the changes in climatic variables in his/her village over last 30years
- Less amount of snowfall and snow coverage, erratic or reduced rainfall, increased summer and winter temperature are some indications that are observed by the locals

Long-term Impacts of Climate Change on the Tourism Industry: As Predicted by the Communities

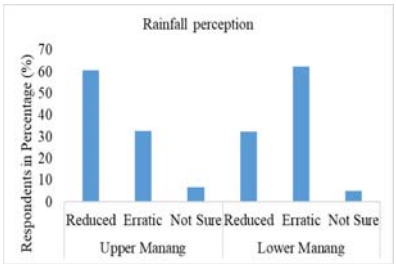
Data Collection and Analysis

Changes Observed in the Climate in the Last 30 Years



- More than 86.9% of the respondents perceived that there has been an increase in the winter temperature in the past 30 years
- More than 86.9% of the respondents have noticed an increase in the summer temperature
- Majority of the respondents (96.4%) have witnessed the decrease in the average snow fall coverage
- More than 46.4% of the respondents believed that the rainfall occurrence has reduced in the last 30 years, however 48.8% of them believe that it became more erratic

Data Collection and Analysis



- More than 60.5% of the respondents in the upper Manang area found that the amount of rain fall has decreased
- Almost one third of the respondents from the Lower Manang valley identified that the rate of rainfall has decreased while most respondents found that the seasonal pattern of rainfall has become erratic

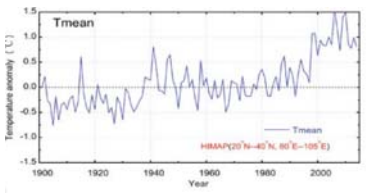
Upper Manang: Pisang-Khangsar (3100-4200masl)
Lower Manang: Dharapani-Pisang (1800-3100masl)

One of the respondents from the Tilicho Base Camp shares his experience as:

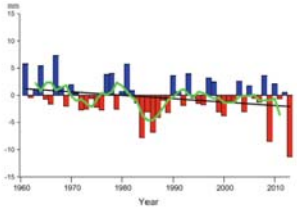
'I feel that the snow fall rate is massively decreasing at the base camp...now I notice that the snow coverage of the surrounding mountains has decreased. The whole mountains used to be covered in snow, but now, half of it or more usually does not get snow cover even in the peak time' (Respondent No. 12)

Data Collection and Analysis

Climate Change Indicators Secondary Dataset for Hindu-Kush Himalayan Region

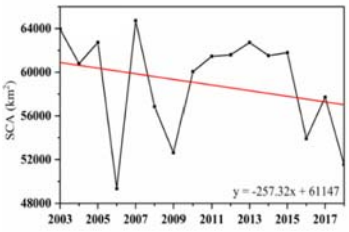


Annual mean temperature series for the Himalayan Region between 1901 and 2014 (Ren et al. 2017)



The regional average annual precipitation series between 1961 and 2013 (Krishnan & Shrestha, 2019)

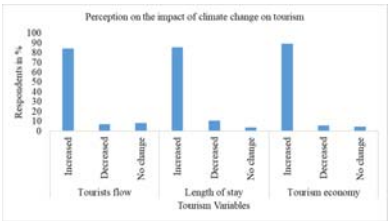
Data Collection and Analysis

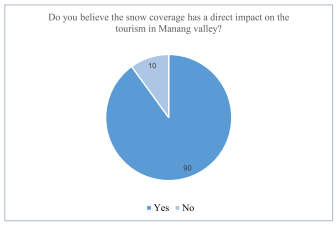


Snow coverage persistency in the Hindu-Kush Himalayas between 2003 and 2018 (Khadka et al. 2020)

- Chaudhary and Bawa (2011) have found that local perceptions are often consistent with scientific observations
- The local perception of climate change in the study region have been guided by extensive knowledge thus, their perception conformed information obtained from scientific data (Chaudhary et. al, 2011)

Community Perception of the Impact of Climate Change on Tourism

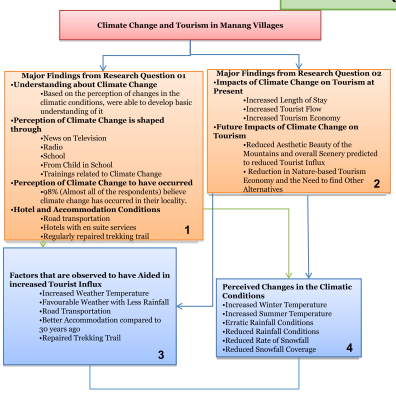




Long Term Impacts of Climate Change on Tourism

Factors that have aided the Tourism in the Recent Years

Factors	Road Transportation	Better hotel facilities	Repaired Trekking Trail	Increased seasonal temperature	Favourable weather with less rainfall	Rank
Road Transportation						2
Better hotel facilities	Road Transportation					5
Repaired Trekking Trail	Road Transportation	Repaired Trekking Trail				4
Increased seasonal temperature	Increased seasonal temperature	Increased seasonal temperature	Increased seasonal temperature			1
Favourable weather with less rainfall	Road Transportation	Favourable weather with less rainfall	Favourable weather with less rainfall	Increased seasonal temperature		3



Perception about Climate Change: A Foundation to Start with

Climate Change is not the only Contributing Factor to Increased Tourist Influx

Climate Change is more of a Bane in the Long Run for the Tourism Industry in Manang

Resorting to Other Types Tourist Attractions: Changing Tourism Patterns

Suggestions by the Stakeholders to Secure their Tourism-based Professions

- Shifting to other types of tourism
- Promotion of Adventure Tourism
- Building Better Transport Infrastructure
- Increasing Tourist Entry Fee

- The perception of the local people stemmed from their source of information about climate change
- The local people in Manang villages are aware of the impacts of climate change to their livelihood, **they are deemed to be more beneficial than disadvantageous**
- Climate variables as the apparent consequences of climate change in the study area, however, actions to combat these issues in the regions have not been prioritized yet

- The influence of climate change on tourism: Mostly Positive
- Indirect factors to tourism
- Long term impact: **Negative**
- **Alternative sources** to tourism
- This research **highlights the need to associate tourism with climate change** in the context of Himalayan communities where the impact of climate change has already been observed at present conditions and thus, the research contributes more to the spectrum of gathering information about local perceptions which could be utilized in related processes

Recommendation

- There is a need to propose adaptation measures for the tourism industry for managing the impacts of climate change
- Involvement of local people for future developmental projects in the region
- Working on the sensitization of local communities through context-specific approach
- Focusing on more than just one sector of tourism in the region

THANK YOU!

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CHEMISTRY AND SOURCE OF IONS AND METALS IN FINE PARTICULATE MATTERS OVER DHAKA CITY: A PRELIMANARY STUDY

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***Keywords**: ions, metals, IC, ICP-MS, aerosol, sources, $PM_{2.5}$*

1. INTRODUCTION

$PM_{2.5}$ are particulate matters that have an aerodynamic diameter of less than 2.5 micrometers. $PM_{2.5}$ significantly degrades the air quality and can be detrimental to the health.

2. OBJECTIVE

To characterize the sources of fine particulate matters over Dhaka city, focusing on the concentration of ions and metals of $PM_{2.5}$.

3. METHODS

$PM_{2.5}$ samples were collected on a cellulose filter paper using a low volume air sampler on a 24 h basis for 10 days at the rooftop of the North South University. For the analysis of ions, the filters were ultrasonically extracted. After filtration, the extracted samples were analyzed for five cations (Na+, K+, NH4+, Ca2+ and Mg2+) and anions (F-, Br-, NO2-, NO3- and $SO4^{2-}$) using an ion chromatograph. For the analysis of metals, the filters were extracted in 10 ml of ultrapure nitric acid and hydrogen peroxide mixtures for 40 minutes using a microwave digestion system. After filtration, the extracted samples were analyzed for 12 metals (As, Cd, Co, Cr, Cu, Ni, Pb, Zn, Mn, Fe, Se, and V) using an inductively coupled plasma mass spectrometer.

4. RESULTS AND DISCUSSION

The daily average found for cadmium in our sample of nine days is 6.19 ng/m^3. The highest concentration of cadmium is 21.3 ng/m^3. On the 28th of March (day 4), the value exceeds the WHO air quality guideline for cadmium of 5 ng/m3 (WHO, 2000).

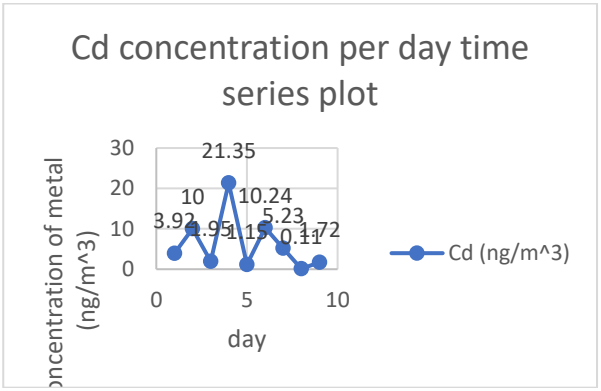

Figure 1. Cadmium concentration per-day time series plot

5. CONCLUSION

Concentration of Cd in $PM_{2.5}$ was found to exceed the WHO air quality guideline for cadmium of 5 ng/m3 recommended to prevent any further increases in cadmium levels in agricultural soils (WHO, 2000). Air mass back trajectory was done which indicated that some of the particulate matters are originated from India, and Pakistan, but most are coming from the Bay of Bengal. This can help us determine the transboundary pollution effect.

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Chemistry and source of ions and metals in fine particulate matters over Dhaka City: A Preliminary study

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INTRODUCTION

- PM 2.5 are particulate matters that have an aerodynamic diameter of less than 2.5 micrometers.
- PM2.5 significantly degrades the air quality and can be detrimental to the health.
- The ever-growing development and anthropogenic activities in Dhaka have caused the air quality to deteriorate.

OBJECTIVE

To characterize the sources of fine particulate matters over Dhaka city, focusing on the concentration of ions and metals of $PM_{2.5}$.

METHODS

• $PM_{2.5}$ samples were collected on a cellulose filter paper the rooftop using a low volume air sampler (MCZ - Model LVS1, Germany) with a flow rate of 2.3 m^3/h on the 24 h basis for 10 days at the rooftop of the North South University.

• Analysis of ions: The filters were ultrasonically extracted in 10 ml of ultrapure water for 30 minutes.

• After filtration, the extracted samples were analyzed for five cations (Na+, K+, NH4+, Ca2+ and Mg2+) and anions (F-, Br-, NO2-, NO3- and $SO4^{2-}$ and anions using an ion chromatograph (Dionex ICS-1600, Thermo Scientific, USA).

• Analysis of metal: The filters were extracted in 10 ml of ultrapure nitric acid and hydrogen peroxide mixtures for 40 minutes using a microwave digestion system (StartD, Milestone, Italy).

• After filtration, the extracted samples were analyzed for 12 metals (As, Cd, Co, Cr, Cu, Ni, Pb, Zn, Mn, Fe, Se, and V) using an inductively Coupled plasma mass spectrometer (NexION 2000, Perkin Elmer, USA).

STUDY AREA MAP

Figure 1

FINDINGS

Concentration of metals (ng/m3) [Table: 1.1]

Ions	Mean	Min	Max
Ca2+	98.5±323	0.367	1073
Cl-	42.4±139	0.149	462
F-	7.28±23.9	0.0439	79.4
K+	50.1±164	0.145	544
Mg2+	8.76±28.7	0.0407	95.4
Na+	37.9±124	0.182	412
NH4	73.3±240	0.111	797
NO3-	61.7±202	0.152	671
SO4	412±1352	0.556	4490

Concentration of ions (µg/m3) [Table 1.2]

Metal	Mean	Min	Max
As	3.29±1.87	1.31	6.89
Cd	6.18±6.38	0.107	21.3
Co	0.591±0.149	0.306	0.814
Cr	33.9±20.3	17.2	76.7
Cu	22.3±24.8	0	80.4
Fe	476±258	76.5	919
Mn	98.6±117	11.1	344
Ni	18.4±15.2	7.47	60.9
Pb	227±186	15.5	572
Se	2.22±0.658	1.19	3.45
V	5.61±4.25	1.37	12.9
Zn	882±1079	71.9	3645

FINDINGS (continued)

- The daily average concentration of lead (Pb) for our samples of nine days is 227 ng/m³. The highest concentration of lead is 572 ng/m³ on the 30th of March (Table 1.1 and Figure 2). Both the values are sufficiently below the recommended exposure limit (50000 ng/m³ over 8-hours) set by the National Institute for Occupational Safety and Health (NIOSH).
- The daily average found for cadmium in our sample of nine days is 6.19 ng/m³. The highest concentration of cadmium is 21.3 ng/m³.
- On the 28th of March (day 4), both the values exceed the WHO air quality guideline for cadmium of 5 ng/m3 recommended to prevent any further increases in cadmium levels in agricultural soils (WHO, 2000).

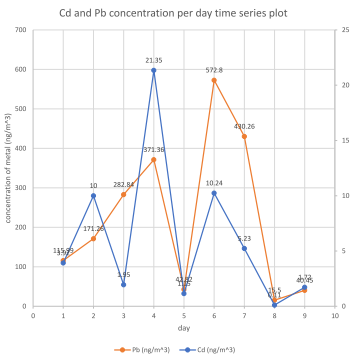

Figure 2: Daily concentration of Cd and Pb

SOURCES
Air Mass
Backward
Trajectory

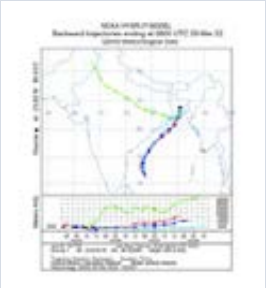

Figure 3.1: 29th March 2022, 72 hours trajectory

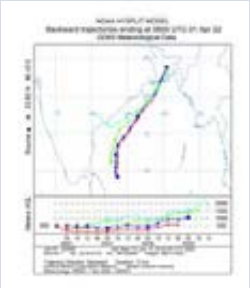

Figure 3.2: 1st April 2022, 72 hours trajectory

CONCLUSION

- Concentration of Cd in $PM_{2.5}$ was found to exceed the WHO air quality guideline for cadmium of 5 ng/m3 recommended to prevent any further increases in cadmium levels in agricultural soils (WHO, 2000).
- As the air mass backward trajectory indicates, some of particulate matters are originated from India, and Pakistan, but most are coming from the Bay of Bengal.

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THE PROSPECTS OF URBAN MINING TO ACHIEVE A CIRCULAR ECONOMY IN BANGLADESH

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***Keywords**: Urban miming, Material Flow Analysis (MFA), Metal recycling.*

1. BACKGROUND AND RATIONAL

The world is running out of valuable minerals and resources, as well as having severe environmental consequences. To address these issues, decoupling natural resources and environmental impacts is required. One of the efficient means to achieve resource decoupling is urban mining. No mainstream research in urban mining has been done in Bangladesh. Therefore, this study is important for Bangladesh since there are still knowledge gaps among the relevant stakeholders. Moreover, urban mining maximizes the economic value of waste streams generated from urban setups by putting a significant contribution to the planning and designing of sustainable cities with the consistent goal of ensuring sustainable development goals.

2. OBJECTIVES AND METHODOLOGY

This study focused on the five prominent metals such as steel, aluminum, copper, lead, and zinc in the FY2020-21 to quantify the inflows, outflows, loss, and export perspectives utilizing the concept of material flow analysis in the greater Dhaka area. Moreover, an extensive field survey from March to October 2021 has been conducted to collect data.

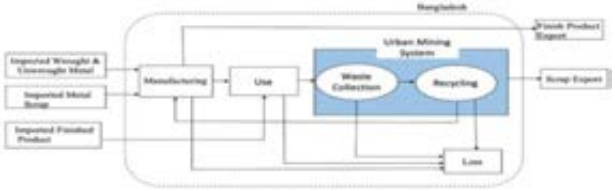

Figure 1. A typical MFA of a metal industry and system boundary of urban metal mining In Bangladesh.

3. RESULTS

In the (FY) 2020-21, the lion's share (50%) of metal scrap was from steel followed by 26% from aluminum, 12% from copper, 7% from lead, and 5% from zinc. The amount of total collected steel waste was 9,99,970 MT and a considerable amount of scraps (1,05,296 MT, 13%) went to the natural environment of Bangladesh as a loss while 59,998 MT (6%) of the collected scraps were exported. In the case of copper, 40% of the total demand (44,555 MT) was met through imports. Interestingly, the remaining 60% (66612 MT) came directly from urban mining in FY 2020-21 which had a trade value of USD 369M.

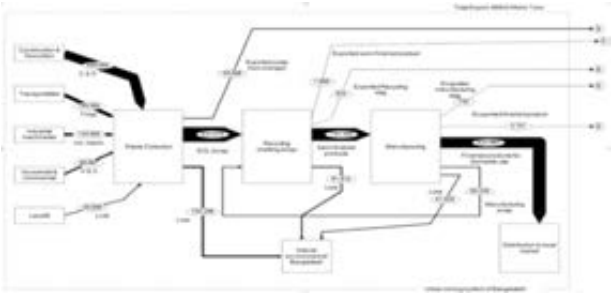

Figure 2. The complete flow of materials of urban mining of steel through collection, recycling, and manufacturing processes.

Figure 3. Money flow of steel urban mining among the stakeholders.

4. CONCLUSIONS

The generation of metal wastes would increase in the near future, necessitating the involvement of more stakeholders. However, effective resource recovery implies a strong framework for both stakeholders and preservation of natural resources.

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The prospects of urban mining to achieve a circular economy in Bangladesh

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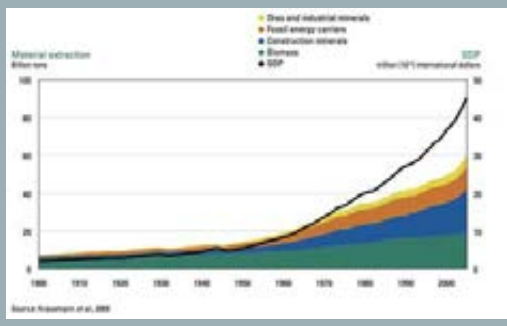
Resource consumption in the age of Anthropocene

In the The 20th century the extraction of

- Construction minerals grew by factor 34
- Ore and minerals by a factor of 27
- Fossil fuels by a factor of 12
- Biomass by a factor of 3.6

Environmental impacts

- Over-exploitation
- Climate change
- Pollution
- Land-use change
- Loss of biodiversity



Global material extraction in billion tons, 1900–2000

Urban mining for a better environmental sustainability

Cossu and Williams (2015) stated that "urban mining should refer to the exploitation of anthropogenic stocks"; the authors further add, "the term is widely used for describing almost any sort of material recycling."

The phases of urban mining start with

I. Prospecting or investigating the relevant areas of urban mines, then

ii. Quantifying the stock, and ultimately evaluating the extraction possibilities

Concept of recovery, recycling, and extraction of resources from waste. (Cossu and Williams, 2015)

Circular economy and UM to achieve CE

Urban mining is closely linked to the notion of circular economy, as it is seen as the most effective approach for reshaping the existing linear economy into a circular economy.

A way to shift from a linear to a circular economic paradigm.

Urban mining breaks the traditional linear economy of take, make, dispose, and aims of decoupling of growth from the consumption of finite resources.

Global example

India

Netherlands

China

Srilanka

Italy

Brazil

Necessity of conducting urban mining study in Bangladesh

- To address the knowledge gap
- To ensure long-term environmental sustainability
- To conserve the non-renewable resources

Limitations of the study

- Lack of secondary data
- Stakeholders are not clear
- Lack of cooperation
- Data quality
- Safety

Study Objectives

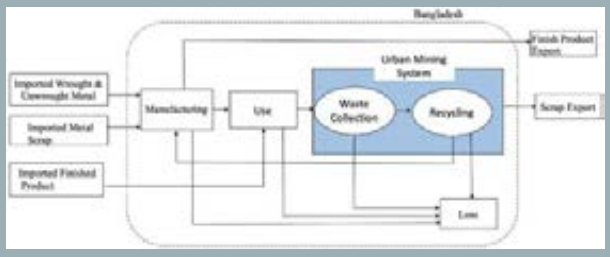
General Objective

The general objective of the thesis was to capture the qualitative and quantitative picture of the five prominent metals (from consumption and economic perspectives) flowing/circulating within the geographical boundary of Bangladesh.

Specific Objectives

1. To identify the **qualitative picture** of the steel, aluminum, copper, lead, and zinc from an urban mining perspective.
2. To identify the **quantitative picture** of at least one metal including the **amount of waste, recycling, manufacturing, and export perspectives.**
3. To identify the **characteristics of stakeholders**
4. To know what an urban mining system looks like and **key activities within the system**.
5. To evaluate how urban mining can contribute to fulfilling the **major metal demands** in Bangladesh.
6. To know the **historical trends and current scenario** of urban miners in Bangladesh
7. To determine the **challenges and opportunities** of urban mining in Bangladesh.

Conceptual framework



A typical MFA of a metal industry and system boundary of urban metal mining In Bangladesh

Estimation of flows for steel MFA

Mass Balance

Input (DE)= output + Export + Loss

Input flows

Total input (DE) ----------(W)

Some coefficient value were used from field survey to calculate each flow

Construction and Demolition (C&D) waste = W* 50% ---------- (1)

Transportation waste = W*20%---------- (2)

Industrial machineries = W*15%---------- (3)

Household and commercial waste = W* 10% ---------- (4)

Landfill waste = W* 5% ---------- (5)

Process flows

Waste collection process = Total input (DE) ---------- (W)

Flow of materials through the waste collection process =
Domestically collected scrap= Scrap to recycling + Loss + Exported scrap

Recycling process = (W)- (Es + L) ---------- (R)
Flow of materials through recycling process=
Recyclable Scrap from waste collection= Exported slag + Exported semi finished product + Semi finished product flow to manf.+ loss

Manufacturing process = (R)- (Esfp +Es +L) ----------(M)
Flow of materials from manufacturing process=
semi finished product from recycling= manufacturing scrap to recycling + Exported slag + exported finished product+ finished product flow to distribution + loss

Output flow

Distribution flow to the local market = (M)- (Msr +Es +Efp +L) ---------- (6)

Loss flows

Loss flow from waste collection process = W* 13%---------- (7)
Loss flow from recycling process = (R)* 11%---------- (8)
Loss flow from manufacturing process = (M)* 7%---------- (9)

Export flows

Exported EOL scrap flow from waste collection process = W * 6%---------- (11)

Exported slag flow from recycling process = R * (0.1) %---------- (12)

Exported semi-finished product from recycling process = R * (0.2) % ---------- (13)

Exported slag from manufacturing process = M * (0.1) % ---------- (14)

Exported finished product from manufacturing process = M * (0.5) % ---------- (15)

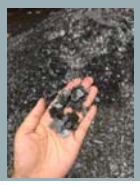
Results

Qualitative analysis of urban mining of Steel

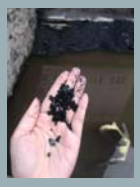
1. Waste collection
2. Melting shop
3. Induction furnace
4. Semi-finished product
5. Rolling mill
6. Finished product

Results

Qualitative analysis of urban mining of Steel



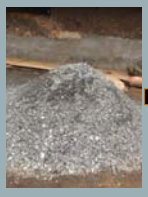
The export value for slag generated from the induction furnace is BDT 35-40k/ton



Slag generated from manufacturing
Has higher export value

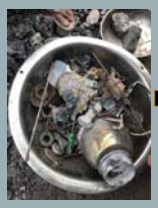
Results

Qualitative analysis of urban mining of Steel



Slag generated from induction furnace

Waste pickers
BDT 5k-6k salary
Work 9am-5pm



Collected scrap
BDT 20/kg

Melting shop

Qualitative analysis of urban mining of Steel

Stakeholder analysis

Stakeholders		Definition
1.Primary waste collectors	Scavenger/waste pickers/Tokai	Collects and gathers recyclable discarded metal waste through physical selection from landfills and dumping stations. Daily income BDT200-250.
	Moylawala	Collects recyclable metal waste through physical separation discarded from households. In the urban areas, they generally work under the city corporation distributes in different zones. Their daily income is around BDT250-350.
	Bhangariwala/Feriwala	Mostly found in village areas. They roam around to buy old and unused metal products in exchange of money, pickles, caramel bar (kotkoti), gram flour crisps (chanachur), etc. Their daily income is around BDT500-500.
	Small shop's collector	Hired by small scrap shops. According to the weight of collected metal scrap, Wages are given daily or monthly. Their daily income is around BDT500-600.

Stakeholder analysis

2. Secondary waste collectors	Small shop/ miniature	Shops made with bamboo, wood, straw, tin as roof. There are generally 2-5 men works in a shop. They informally dismantle and separate the mix metals. Their monthly income varies from BDT15,000-50,000.
	Mid-sized shop	Generally, shop owners are financially well off. Shops are made with brick. There are 5-10 people work under the shop and their monthly income is around BDT1,00,000-1,50,000.

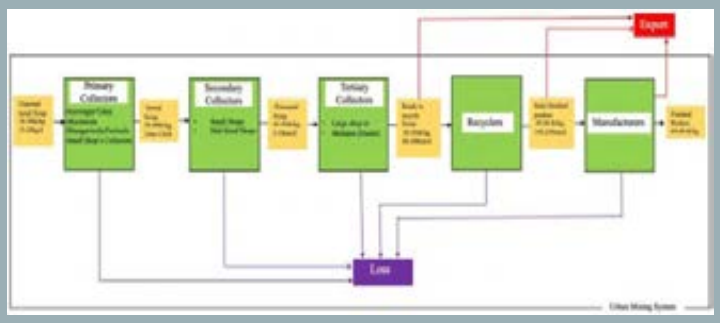
Stakeholder analysis

3. Tertiary waste collectors	Large shop/ Mohajon	Locally known as "Mohajons" are the person who work as middle man to send the metal scraps from scrap shops to the melting shops/ recycling mills. They are generally the dealers and without them scraps cannot be sent to the melting shops directly. Some of them own large shops having 10-15 workers or some of them has only an office area to make the deals. They are also responsible for exporting the scraps. Although there are thousands of "Mohajons" in the urban mining sector, this thesis paper only considered those who are closely linked to the melting shops and scrap export. Their monthly income varies between BDT5,00,000-6,00,000.

Stakeholder analysis

4. Melting shop/Recycling mills and factories	**Recyclers**	In melting shops, scrap go through the induction furnace. The output is semi-finished products or billet. Some mill has only induction furnace without any rolling mills. Whereas the big mills have both of them. There are around 50-1,000 employees in a mill. Their daily melting capacity varies from 150-250 ton.
5.Manufacturing industry	**Manufacturers**	The semi-finished products (billets) are sent to the manufacturing industries. The output is rebar, rod, angle, I & H beam. The industries are generally massive. There are only 40 manufacturing industries all over the country. There are around 1,000-15,000 employees in an industry. Their daily production capacity is 200- 5,000 ton.

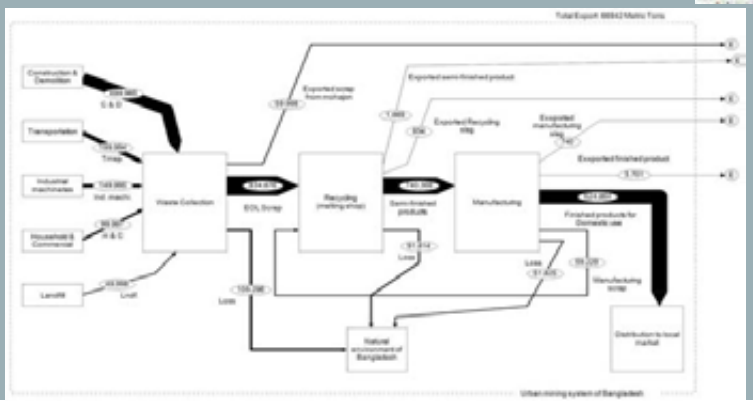
Quantitative analysis of the stakeholders for UM of Steel



Money flow of steel urban mining

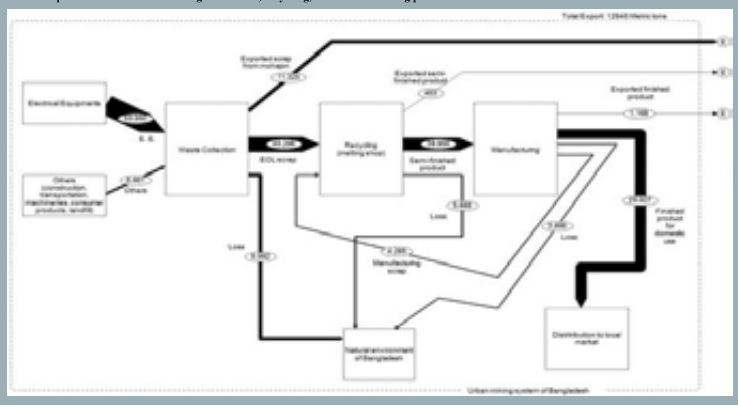
Material flow analysis of urban mining of steel in FY 2020-21

The complete flow of materials through collection, recycling, and manufacturing process



Material flow analysis of urban mining of steel in FY 2020-21

The complete flow of materials through collection, recycling, and manufacturing process



Contribution of urban mining in the steel industry

Ship Breaking and the Steel Industry in Bangladesh
A Material Flow Perspective

Steel	Net Wt. (MT)	Percentage	Trade Value ($)	Data Source	Fiscal Year
Imported scrap	30,95,187	26%	$114,22,03,454 (114m)	UN Comtrade	2020-21
Urban mining (DE)	9,99,970	24%	$36,90,14,598 (369m)	Field survey	2020-21
SBI (Ship Breaking Industry)	61,42,735	50 %	$226,68,26,894 (226m)	Assumption Based on (Sujauddin et al., 2016)	2020-21
Total Import	92,37,922	76%	$345,43,66,997 (345m)	Imported scrap + SBI	2020-21

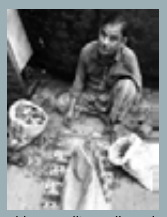
Contribution of urban mining in the copper industry

Steel	Net Wt. (MT)	Percentage	Trade Value ($)	Data Source	Fiscal Year
Imported scrap	11,665	10%	$114,22,03,454 (114m)	UN Comtrade	2020-21
Urban mining (DE)	66,612	60%	$36,90,14,598 (369m)	Field survey	2020-21
SBI (Ship Breaking Industry)	32,890	30 %	$226,68,26,894 (226m)	Assumption Based on (Ruma et al., 2019)	2020-21
Total Import	44,555	40%	$345,43,66,997 (345m)	Imported scrap + SBI	2020-21

Social aspects of urban miners in Bangladesh

- Trend showing the number of people dealing with urban mining in Bangladesh from 1981 to 2021.
- Percentage of people associated with scrap business
- Percentages approximate length of time in urban mining business in Bangladesh
- Estimated income of urban mining shops according to their shop size.
- Percentages of urban miners and daily wages in taka based on their gender
- Health hazards urban miners face
- The comparison of increase in steel price/kg and daily wages of urban miners in 1980 and 2021.

Thank you



A 55 years old man selling collected mix EOL scrap metals in Midford, Dhaka

UNDERSTANDING THE RECYCLING AND MANAGEMENT PROCESS OF END-OF-LIFE PASSENGER VEHICLES IN DHOLAIKHAL, BANGLADESH: A MATERIAL FLOW PERSPECTIVE

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***Keywords**: End-of-life vehicles (ELVs), Material flow analysis (MFA), Vehicle dismantling, Waste management, Recycling*

1. BACKGROUND & RATIONALE OF STUDY

The automobile industry of Bangladesh is a growing sector. The growth in vehicle ownership, especially passenger vehicles, has led to an increase in end-of-life vehicles (ELVs) in Bangladesh. ELVs are a large source of hazardous wastes, creating a heavy environmental burden if mismanaged [1]. ELVs generate around 5% of industrial wastes worldwide [2].

Bangladesh has yet to formulate a proper ELV management policy so there is no formal way to dispose ELVs. However, there is a robust informal sector to process ELVs. Dholaikhal, an informal mini motor industrial zone in Dhaka, is the biggest secondhand car parts market in Bangladesh, employing up to 30,000 people in hundreds of small stores that reuse, recycle, refurbish and sell all kinds of vehicle parts [3].

Due to a lack of ELV legislation, many recyclable materials are landfilled, and non-metallic hazardous wastes are illegally openly dumped. Therefore, the ELV recycling and management process in Dholaikhal is unsustainable and needs to be formalized in order for improvement. To facilitate decision-making and policy formulation, the vehicular scrap recycling in Dholaikhal needs to be inspected and assessed.

2. OBJECTIVES AND METHODOLOGY

This study inspects the state of vehicular scrap recycling in Dholaikhal. As most ELVs in Bangladesh are passenger vehicles, this study focuses on end-of-life passenger vehicles (ELPVs). To identify and understand the flows and processes of ELPVs, this study provides the first-ever material flow analysis of ELPVs in Dholaikhal, conducted during the Fiscal Year (FY) 2018. This study reveals the previously unclear rate of ELPVs reusing, re-manufacturing and recycling in Dholaikhal, and illustrates the manual ELV dismantling process through field observation. A comparison between the recycling techniques of Dholaikhal and Japan is also provided, emphasizing on the non-metallic scrap streams of ELVs. Since, there are no studies on how ELVs are managed in Dholaikhal and no secondary data or official records of its ELV flows, this study is fundamentally based on field investigation and mass balance method for flow quantification.

3. REPRESENTATION OF THE RESULTS

In FY2018, 75,600 pieces of ELPV parts were imported, 26,460 pieces of ELPV engines were collected from domestic in-use vehicles, and 28,080 reusable parts were recovered from domestic ELPVs. These parts are almost entirely reused, refurbished, recycled or collected by scrap collectors leaving no stock behind in Dholaikhal. As seen in Figure 1, only 359 pieces of scrap, less than 1% of the total input, was landfilled while as much as 5,631 non-metallic scraps were recycled outside of Dholaikhal through processes shown in Figure 2.

The vehicle dismantling process in Bangladesh is a complete manual process using simple hand tools. Only the scrap glass, textile and leather parts are landfilled. All other parts including plastic, rubber and tire are recycled eventually. Landfilled parts hold only 3-4% by weight of ELPVs, meaning 96% to 97% is reused, remanufactured and recycled.

Meanwhile in Japan, based on the principle of a sound material-cycle society and prioritization of the cyclical use of resources, the 'ELV Recycling Act' was passed in 2005, which allowed Japan to reuse, recycle and recover approximately 99 % of ELVs by weight, leaving only 1% residue to be landfilled [4]. On the other hand, despite no financial or technological support and managing ELVs with manual dismantling process sees 96% to 97% of ELVs reused, remanufactured and recycled by the informal sectors of Bangladesh.

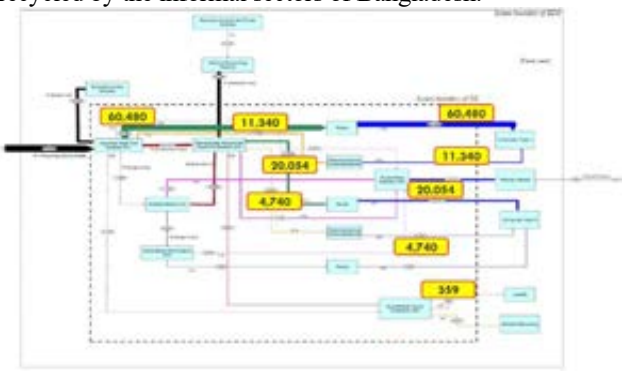

Figure 1. Process and flows of ELPVs in Dholaikhal

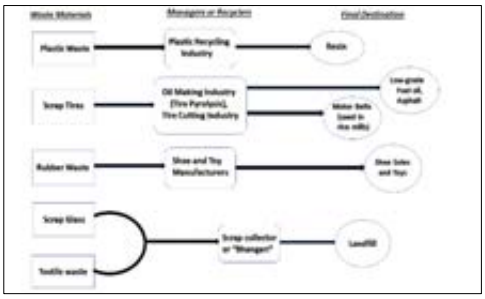

Figure 2. Recycling of non-metallic scraps of ELPVs

4. CONCLUSIONS

Considering Dholaikhal as an important entity in the future manufacturing process of automobiles, government should formalize and regulate this informal sector with specific legislations. In policy and decision-making process, ELVs should be perceived as valuable resources, while special emphasis given to better sorting of materials for high level recycling rates. It is hoped this study gives insights to facilitate better performance of ELV management with a view to a sustainable automobile industry in Bangladesh.

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Poster presentation

UNDERSTANDING THE RECYCLING PROCESS OF END-OF-LIFE PASSENGER VEHICLES IN *DHOLAIKHAL*: A MATERIAL FLOW ANALYSIS PERSPECTIVE

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End-of-life Vehicles (ELVs)

A vehicle that has reached to its end of the 'product lifecycle'

An object that has fulfilled its assigned purpose or not functional and useful to its owner

An output that doesn't have any purpose or an owner

End-of-life Vehicles (ELVs)

Automobile industry of Bangladesh

Due to having complex structure and varied composition, processing of ELVs is very difficult since, they cannot be managed by simple disposal systems

Thus demanding fast growing and effective waste flow management for resource conservation, circular economy and sustainable development

- According to BRTA data, , the number of passenger vehicles registration in particular has increased at a rate of 5.43% from 2011-2020
- Vehicles are not manufactured yet in Bangladesh. The automotive industry of Bangladesh is entirely import dependent
- In recent years, the sharp increase in vehicle ownership has led to a rapid increase in the amount of car wastes produced and ELVs in Bangladesh
- Although, Bangladesh recently has drafted "Automobile Industry Development Policy, 2020", the automobile scraping or ELVs management policy is still to be formulated
- Therefore, there are no formalized ways to manage and dispose end- of-life vehicles properly in Bangladesh

Dholaikhal : A heaven of all magicians

Dholaikhal : A heaven of all magicians

Dholaikhal, one of the biggest secondhand car parts markets in Bangladesh located in Old Dhaka, has been reducing this burden through reusing, remanufacturing and recycling of scrap car parts since 1960

It is an ***informal mini motor industrial zone*** offering from nuts and bolts to chassis, from every engine parts to suspensions, from windshield to doors and any small or big parts of vehicles in its jam-packed tin-shed stores situated in footpaths, road islands and even railings

The entire transportation sector of Bangladesh is dependent on the second-hand motor vehicle parts sold here

However, the management system of ELVs is not driven by specific ELV directives, national policy or legislations which is why the recycling practice in *Dholaikhal* is neither well-established nor sustainable

Types of vehicles, dealers and consumers of the vehicle segment in *Dholaikhal*

Vehicle Types	Dealer Types	Consumer Types
Pessenger Vehicles	Imported Used part dealers (A)	Type 1
	Importers (B)	Type 1 and A
	Domestically Recovered part dealers (C)	Type 2
	Used Engine Spare part dealers (D)	Type 2
	Scrap Car dealers (X)	C
	Engine Disassembers (Y)	D
Bus, truck, pickup	Imported Used part dealers (E)	Type 3
	Importers (F)	Type 3
	Used Engine spare part dealers (G)	Type 4
	Domestically Recovered part dealers (H)	Type 4
	Disassemblers (W)	G
Passenger vehicles and bus, truck, pick ups	Metal scrap collector	Melting Industry
	Non-metal scrap collector	Recyclers outside of Dholaikhal
Non-vehicular Segments		

Objectives

To conduct the very first MFA of end-of-life passenger vehicles (ELPVs) in 'Dholaikhal' during FY 2018 to identify the processes and flows of End-of-life Passenger Vehicles in Dholaikhal

To evaluate the dismantling process (step-by-step) of End-of-life Passenger Vehicles

To identify the current status of reuse, remanufacture and recycling rate of End-of-life Passenger vehicles in *Dholaikhal*

To illustrate the recycling and management process of non-metallic scraps of the End-of-life Passenger Vehicles in Bangladesh (Qualitative scenario only)

Methodological framework

Extensive field survey was conducted

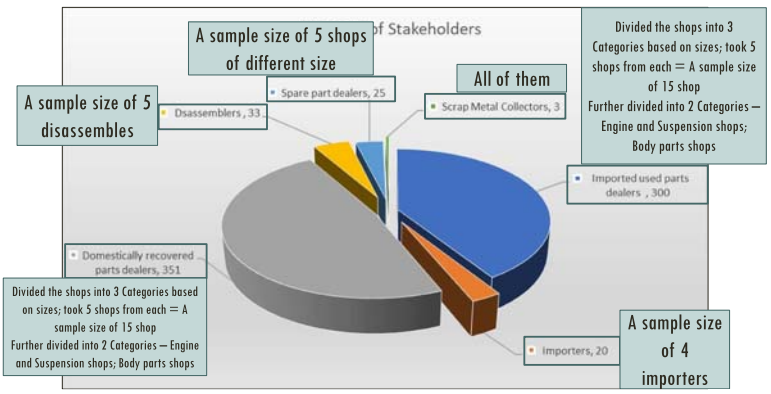
1st Phase
A pilot field survey during March to June 2021 to identify the process and flows of *Dholaikhal*

2nd Phase
A massive in-depth field survey was conducted for the quantification of the flows

3rd Phase
A thorough observation on the vehicle dismantling centers located in 'Kajla' and 'Uttara' areas to capture the full step-by-step process of the dismantling

4th Phase
Several surveys were conducted both in and out of *Dholaikhal* system boundary to obtain only the qualitative picture of the management system of Non-metallic parts of ELPVs

Sample selection

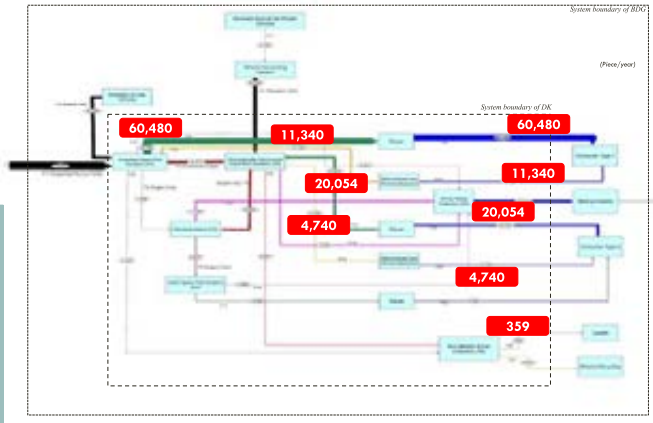


Calculations & Estimations

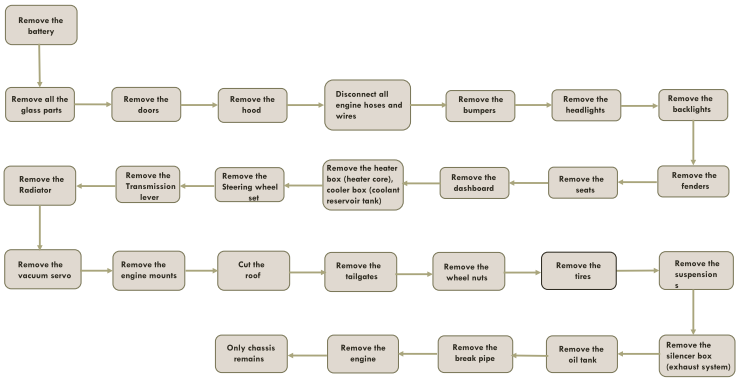
Flow Category	Flow Number	Flow Details	Data sources	Calculation	Assumptions
Import flow	F28	Expected amount of recycled scrap from Dholaikhal	NA	Unquantified due to time limitation	NA
Waste flows	F21	Amount of non-metal scrap generated from IU collected by DP	Field survey	Total mixed scrap from domestic dealers * 40%	Total non-metal waste percentage (Static & non-metal scrap (SU) = 40%
	F26	Amount of scrap to landfill	Field survey	Total non-metal waste generation*0%	only glass and textile wastes dispose into landfill
	F27	Amount of scrap to further material recycling outside of Dholaikhal	Field survey	Total non-metal waste generation - F26	No assumption was made for this flow
	F22	No. of unnecessary recovered reusable parts sold to Consumer U	Field survey	F21 + F12	All collected scraps goes to melting industry for recycling
	F23	No. of domestically recovered re-fabricated/remanufactured parts sold to Consumer U	Field survey	F22 + F23	There is no stock in Dholaikhal
	F25	No. of ELVs, engine spare parts sold to Consumer U	Field survey	F25 + F27	There is no stock in Dholaikhal

Findings

MFA of ELPVs in *Dholaikhal*



Step-by-step end-of-life passenger sedan vehicle dismantling process of Bangladesh

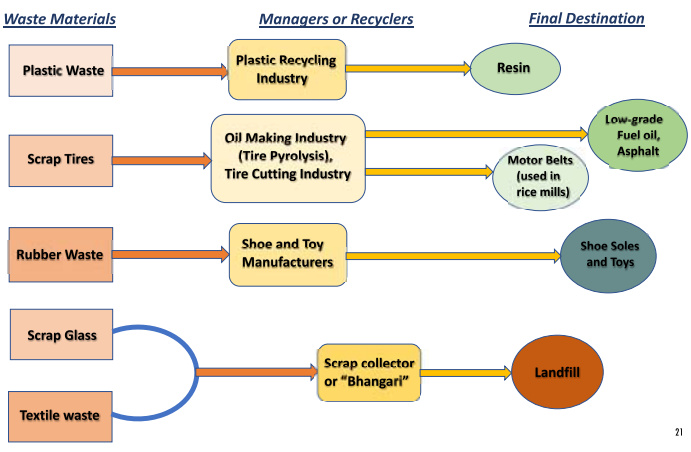


Part Category, Material type, treatment type and wight (%) of an end-of-life passenger vehicle (ELPV) after dismantling process

Part Category	Material Type	Treatment Type	Weight (%)
Glass parts	Glass	Landfilled	3%
Doors	Metal	Reuse (depending on the condition) or Recycle	NA
Hoods	Metal	Reuse (depending on the condition) or Recycle	NA
Engine and Engine Parts	Metal	Reuse (depending on the condition), Remanufacture or Recycle	20-25%
Bumpers	Metal	Reuse (depending on the condition) or Recycle	NA
Headlights, Backlights	Plastic	Reuse (depending on the condition) or Recycle	1%
Transmission lever	Metal, plastic, wood	Reuse (depending on the condition), Remanufacture or Recycle	NA
Steering wheel	Metal, plastic, rubber	Reuse or Recycle	NA
Dashboard	Plastic	Reuse or Recycle	7%
seats	Textile, leather, wood	Reuse or Landfilled	2%
Fenders	Metal	Reuse or Recycle	NA
Vacuum servo	Metal	Reuse or Recycle	NA
Roof	Metal	Recycle	NA
Tailgate	Metal	Recycle	NA
Wheel and wheel nuts	Metal	Reuse or Recycle	NA
Suspension and Chassis	Metal mostly	Reuse or Recycle	25%
Silencer box	Metal	Reuse or Recycle	NA
Break pipe	Metal, Rubber	Reuse or Recycle	NA
Scews, nuts and bolts	Metal	Reuse or Recycle	NA
Tires and other Rubbers	Rubber	Reuse or Recycle	5-7%

Approximately 3-4% of the end-of-life passenger vehicles goes to landfill while approximately, 96% to 97% was destined for reuse, remanufacture and recycle

A qualitative scenario of the management and recycling process of the non-metallic scraps of ELPVs in Bangladesh



Recommendations

Formalize' this sector with financial support and incentives under the supervision of an executive and managerial body with imposed obligations

'Regulate' this informal sector with specific legislations with a focus on limiting unmanaged flows of materials

Establish a policy with specific targets

Concepts like Recycling fees, Rewards, and Subsidies, Extended producer responsibility (EPR), design for environment should be integrated

Thanks

SATELLITE-BASED TIME SERIES ANALYSIS OF SEA LEVEL IN THE BAY OF BENGAL FROM 1871 TO 2010 FOR CLIMATE PROJECTIONS

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***Keywords**: Satellite data; R programming; Sea surface height; Bay of Bengal*

BACKGROUND

The Bay of Bengal, a northern extended arm of the In dian Ocean, is located between latitudes 5'N and 22'N and longitudes 80'E and 100'E (Fig. 1).

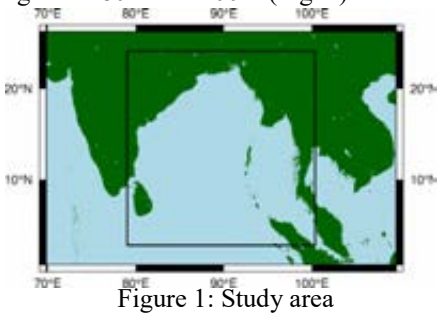

Figure 1: Study area

OBJECTIVES OF THE STUDY

- To determine sea surface height and make projections for the future.

METARIALA AND METHODS

R programming was used to extract the satellite-based sea surface height (m) data for the Bay of Bengal fro m the Asia Pacific Data Research Center (APDRC) o ver the period of January 1871 to December 2010.

RESULTS AND DISCUSSION

The mean annual data for the Bay of Bengal's sea surf ace height (m) from January 1871 to December 2010 was extracted from monthly satellite data using R pro gramming and is displayed below (Fig. 2). According to the trend-line figure, the sea surface height (m) of the Bay of Bengal has been increasing during the last 140 years (Fig. 3).

Average annual sea surface height (m) in the Bay of Bengal from January 1871 to December 2010

Year	ssh	Year	ssh	Year	ssh	Year	ssh
1871	0.4643995	1906	0.4504902	1941	0.4995905	1976	0.5174531
1872	0.4307028	1907	0.451401	1942	0.5009703	1977	0.5174722
1873	0.4379476	1908	0.448369	1943	0.5016222	1978	0.5174062
1874	0.4251244	1909	0.4505607	1944	0.5019025	1979	0.5179462
1875	0.4230165	1910	0.4534815	1945	0.5028813	1980	0.5169655
1876	0.4239209	1911	0.4534154	1946	0.5048943	1981	0.5172798
1877	0.435506	1912	0.4544956	1947	0.5054886	1982	0.5190426
1878	0.4497065	1913	0.4571499	1948	0.5055813	1983	0.5199698
1879	0.4575583	1914	0.459112	1949	0.5051663	1984	0.5198241
1880	0.4624139	1915	0.4616274	1950	0.505692	1985	0.5195872
1881	0.4681291	1916	0.4625608	1951	0.5067705	1986	0.5168647
1882	0.467056	1917	0.4632137	1952	0.507583	1987	0.5137386
1883	0.4613352	1918	0.4659647	1953	0.5083882	1988	0.5121354
1884	0.4554667	1919	0.4688296	1954	0.50924	1989	0.5115203
1885	0.4522009	1920	0.4711457	1955	0.5091712	1990	0.5111232
1886	0.4507597	1921	0.471328	1956	0.5089388	1991	0.5098353
1887	0.4507184	1922	0.4727566	1957	0.508886	1992	0.5094091
1888	0.4470698	1923	0.4731562	1958	0.5097525	1993	0.5113748
1889	0.4480262	1924	0.4756147	1959	0.5098939	1994	0.511946
1890	0.4450877	1925	0.4782018	1960	0.5099885	1995	0.5079282
1891	0.4423222	1926	0.4788272	1961	0.5106368	1996	0.5089437
1892	0.4419395	1927	0.4806339	1962	0.5107884	1997	0.5053115
1893	0.4417978	1928	0.4834733	1963	0.5114068	1998	0.5065142
1894	0.4439587	1929	0.4864378	1964	0.5116675	1999	0.5100723
1895	0.4425096	1930	0.4879418	1965	0.5109132	2000	0.511531
1896	0.4455602	1931	0.4894323	1966	0.5116249	2001	0.5167513
1897	0.4466752	1932	0.4897068	1967	0.5122176	2002	0.5235219
1898	0.4460247	1933	0.4909989	1968	0.5122858	2003	0.5267264
1899	0.4459176	1934	0.492711	1969	0.5117953	2004	0.5279717
1900	0.4491132	1935	0.4926603	1970	0.5122745	2005	0.530913
1901	0.4512573	1936	0.4925012	1971	0.5139595	2006	0.5275049
1902	0.4516972	1937	0.493377	1972	0.514595	2007	0.5316464
1903	0.4514264	1938	0.4948545	1973	0.513916	2008	0.5439138
1904	0.4511015	1939	0.4961226	1974	0.5150551	2009	0.5402604
1905	0.4507294	1940	0.497885	1975	0.5165212	2010	0.5731205

Figure 2: Average annual sea surface height (m) in the Bay of Bengal

The correlation coefficient between the year and sea surface height, according to the correlation study's findings, is 0.8774, or very nearly 1. This demonstrates the strong correlation between the two variables (Fig. 4).

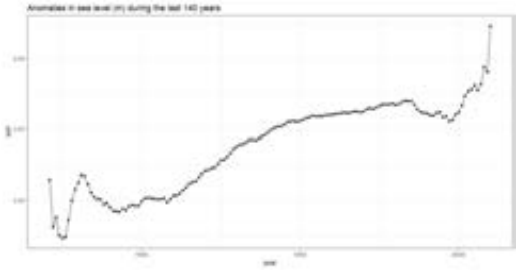

Figure 3: Satellite observations show a consistent average sea level gradually accelerating in the Bay of Bengal since 1871.

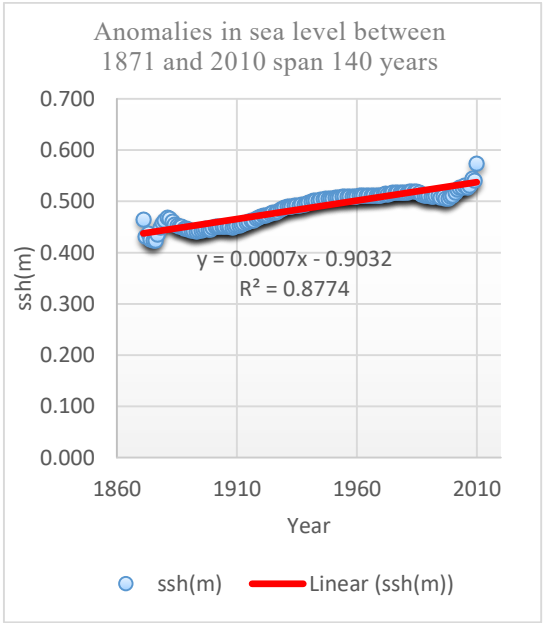

Figure 4: Sea level anomalies in the Bay of Bengal

CONCLUSIONS

The linear regression equation allows us to quickly calculate the future sea surface height required for climate projections.

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Warrick, R.A., Azizul Hoq Bhuiya, A.K., Mitchell, W.M., Murty, T.S. and Rasheed, K.B.S., 1996. Sea-level Changes in the Bay of Bengal. In *The Implications of Climate and Sea–Level Change for Bangladesh* (pp. 97-142). Springer, Dordrecht.

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1st Joint Student Seminar between
the University of Tokyo and the University of Dhaka
August 3-4, 2022
17.00-20.00(JST), 14.00-17.00(BST)

Presentation on

Satellite-based time series analysis of sea level in the Bay of Bengal from 1871 to 2010 for climate projections

Keywords: Satellite data; R programming; Sea surface height; Bay of Bengal

Presented By :
Md. Habibur Rahman Habib
B.S. and M.S. (1st Batch)
Department of Oceanography
University of Dhaka

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Contents

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1. Introduction

- Mean sea level is an average surface level of one or more among Earth's coastal bodies of water from which heights such as elevation may be measured.
- Although sea level rise varies significantly by place, it is not uniform. Global sea level trends and relative sea level trends are different measurements. The sea surface is not changing at the same rate at all points around the globe.
- Sea level rise at specific locations may be more or less than the global average due to many local factors: subsidence, ocean currents, variations in land height, tectonic movement, sediment load, melting of glaciers, ice caps & ice sheets, and/or groundwater extraction.
- Sea level rise is expected to have a variety of effects, particularly on coastal systems. These effects include: increased high tide and storm surge flooding; increase in the loss of property and coastal habitats; effects on agriculture and aquaculture due to deteriorating soil and water quality; increased coastal erosion; increased coastal inundation; changes to the quality of surface water; and changes to the properties of groundwater.
- Objectives of the study:

➢ To determine the sea level (m) span of 140 years in the Bay of Bengal and make climate projections for the future.

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2. Study area: Bay of Bengal

- The Bay of Bengal, a northern extended arm of the Indian Ocean.
- Located between latitudes 5'N and 22'N and longitudes 80'E and 100'E (Fig. 1).

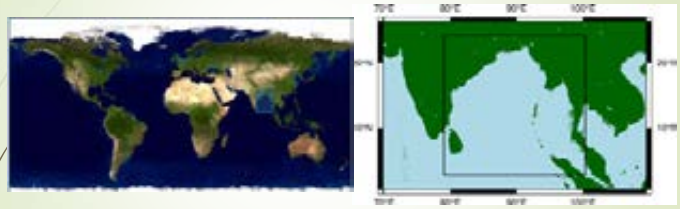

Fig. 1. Study area

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3. Materials and methods

Location: Bay of Bengal
Data: Satellite-based monthly sea surface height (m) data
Data sources: Asia Pacific Data Research Center (APDRC)
Time-series: Over the span of 140 years from January 1871 to December 2010.
Data extracted by: R programming
Analysis: Regression & correlation

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4. Results and discussion

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- On average, the level of elevation in Bangladesh hovers around 30 feet (appro. 9m) above sea level. The lowest point of elevation is along the southern border of Bangladesh where the country touches the waters of the Bay of Bengal.
- According to this study, the sea surface height increased by 15 cm between 1871 and 2010, with the lowest value (0.423 meters) and highest value (0.573 meters) occurring in 1875 and 2010, respectively (Table 1).

Table 1: Average annual sea surface height (m) in the Bay of Bengal from January 1871 to December 2010

Year	ssh	Year	ssh	Year	ssh	Year	ssh
1871	0.4640995	1906	0.4504902	1941	0.4995905	1976	0.5174331
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- According to the trend-line figure, the sea surface height (m) of the Bay of Bengal has been increasing during the last 140 years (Fig. 2).
- The correlation coefficient between the time of the year and sea surface height, according to the correlation study's findings, is 0.8774, or very nearly 1. This demonstrates the strong correlation between the two variables (Fig. 3).

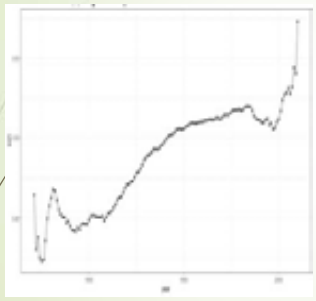

Figure 2: Satellite observations show a consistent average sea level gradually accelerating in the Bay of Bengal since 1871.

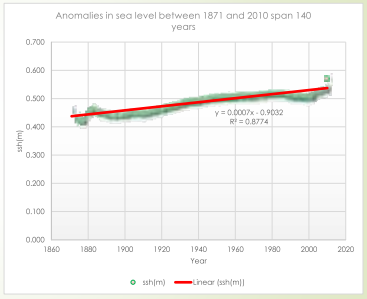

Figure 3: Sea level anomalies in the Bay of Bengal

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5. Conclusions

- Therefore, low-lying areas in the Bay of Bengal's adjacent countries will be quite vulnerable.
- Asia has the biggest population at danger from rising sea levels due to countries like Bangladesh, China, India, Indonesia, and Vietnam having highly dense coastal populations (McLeman, 2018).
- The future sea surface height needed for climate forecasts may be rapidly determined using the linear regression equation (y = 0.0007x - 0.9032).
- This study may also serve as a point for more complex studies on possible climate projections.

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ASSESSMENT OF COMMUNITY'S WILLINGNESS TO PAY (WTP) FOR IMPROVED PUBLIC HEALTHCARE FACILITIES IN THE COASTAL AREAS OF BANGLADESH

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***Keywords**: Willingness to Pay (WTP), Public healthcare facilities, Contingent valuation, Community participation, Coastal community at risk*

BACKGROUND

In the coastal districts of Bangladesh, several diseases and health issues prevail that are aggravated by multiple natural hazards. Death and injuries occur during cyclone, Storm surge, and coastal flood. Besides, salinity intrusion, inadequate safe drinking water and proper sanitation are the other problems that result in unsafe health conditions and deteriorate healthcare provision. The healthcare service provided in Bangladesh is mostly dependent on the government for finance, service delivery system and overall management policies [1]. To improve the service quality and overall facilities of the public healthcare system, increased fund is required. It is necessary to assess the preference of the patients' and community people receiving healthcare from public facilities about contributing to health financing for the development of their services. It is therefore essential to assess which attributes in the health system the affected communities prefer to improve and how much they are willing to share the economic burden of the improvement. Evaluating suitable healthcare financing and service delivery scheme requires economic valuation of healthcare and health outcome. This research aimed to explore the prevailing health issues among the community people, insufficiency of public health services and assess the affected communities' preference about a financial contribution for improving healthcare services.

METHODOLOGY

The contingent valuation method (CVM) has been used to estimate aggregate willingness to pay for improved healthcare services. 328 randomly sampled households of Shyamnagar upazila of Satkhira district of Bangladesh were surveyed applying the payment card approach of contingent valuation to realize the households' willingness to pay. A binary logistic regression model was applied to find out factors influencing the variation in willingness to pay and the mean willingness to pay additional money for healthcare improvement was obtained using a probit model. Aggregate willingness to pay for improved healthcare services was estimated for the number of patients visiting Upazila Health Complex (UHC) of Shyamnagar annually.

RESULT

The people in the study area were found to widely suffer from diarrhea, dysentery, high blood pressure, and skin diseases among many other diseases. Although 32.3% of respondents preferred UHC as the primary source for healthcare seeking, several problems are reported to exist at the UHC which hinders quality healthcare provision. Unavailability of doctors, staff and medicines were the most mentioned problems. In addition to addressing these problems, improvement of the UHC's WASH facilities was strongly suggested by the respondents.

Table 1. Distribution of households based on their choices to pay

		Percentage (%)	Total
Households willing to pay	Willing a offered bid	58.8	**82.6%**
	Willing to pay less than offered bid	23.8	
Households unwilling to pay	Consider it as government's responsibility	15.9	**17.4%**
	Consider the program to be ineffective	1.5	

The annual mean WTP for improved public healthcare was estimated to be approximately Tk 60. After deducting the 17.4% protest zeros, the estimated revenue equivalent to the aggregate WTP was found to be approximately Tk 2840000 annually from Shyamnagar.

CONCLUSIONS

Access to safe drinking water is a common problem found in the study area contributing to a high percentage of waterborne diseases. The willingness to pay of individual households was influenced by socio-economic factors mostly. The outcome of this study suggests that by ensuring the availability of doctors and staff, sufficient and good quality medicines, improved WASH facilities, specialized diagnostic equipment in the Upazila Health Complexes by the government, a considerable amount of funds can be raised through public support.

REFERENCES

[1] Islam, A. (2014). Health System in Bangladesh: Challenges and Opportunities. American Journal of Health Research, 2(6), 366.

1st Joint Student Seminar between University of Tokyo and University of Dhaka

Presentation on

Assessment of Community's Willingness to Pay (WTP) for Improved Public Healthcare Facilities in the Coastal Hazard-prone Areas of Bangladesh

Presented by

Tasnim Jabin Jui

Department of Disaster Science and Climate Resilience

University of Dhaka

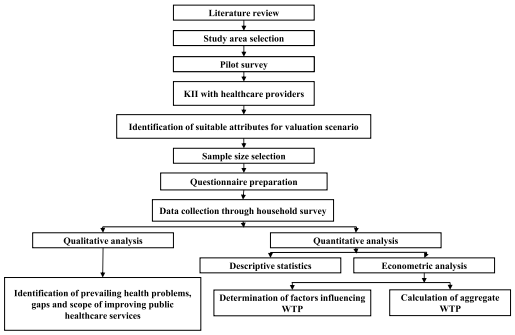
Background

- Insufficient public healthcare facilities
- Healthcare in coastal remote region
- Need for community participation in financing
- Valuation of healthcare for adopting suitable health financing scheme and health policy.
- Application of Contingent Valuation Method (CVM) for healthcare services.

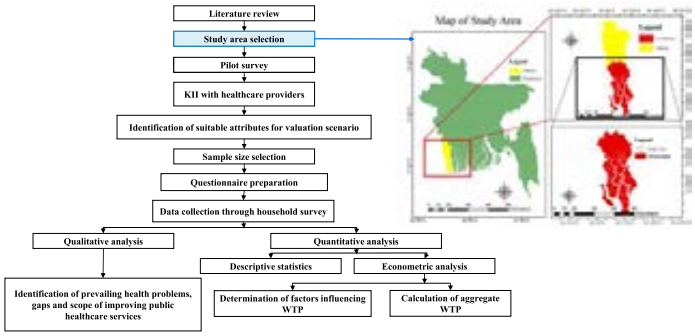
Research Objectives

1. Identifying the prevailing health issues in the coastal districts.
2. Analyzing community's interest in co-financing for improved public healthcare.
3. Determining the variation of willingness to pay among the natural hazard-affected and non-affected households.
4. Estimating the aggregate willingness to pay of the communities for healthcare facilities improvement.

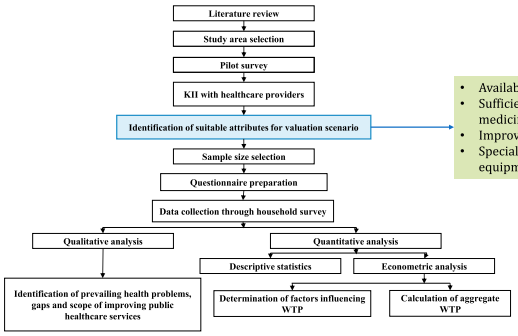
Methodological Framework



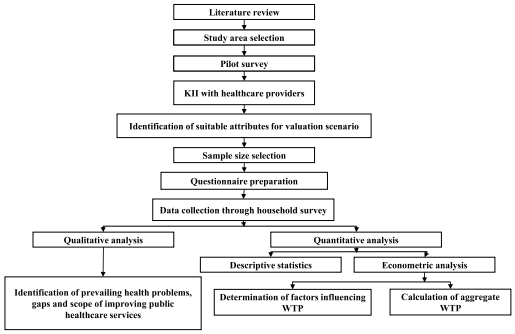
Methodological Framework



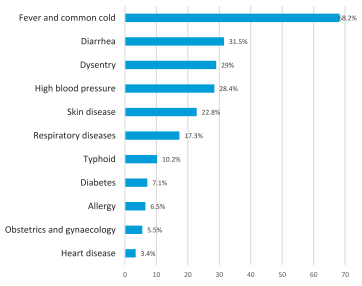
Methodological Framework



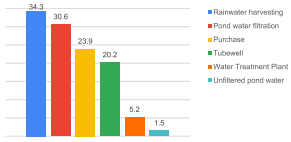
Methodological Framework



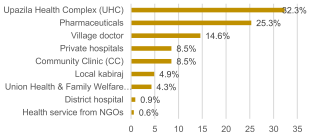
Result



1. Prevailing Health Issues



2. Sources of Drinking Water



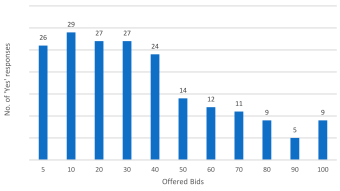
3. Primary choice for seeking healthcare

Result

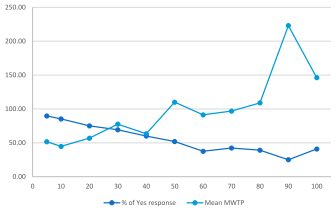
Reasons for not preferring UHC

Mentioned problems faced by the households	N	Percentage (%)
Doctors are not always available	82	51.2
UHC is very far away	74	46.3
Medicines are unavailable	71	44.4
Complexity of getting treatment and medicines	62	38.8
Specialized diagnostic services are not available	36	22.5
Consulting at pharmaceuticals is sufficient	33	20.6
Private hospitals provide better care	24	15.0
Village doctor or local kabiraz is convenient	8	5.0
Unhygienic condition of UHC	4	2.5

Result



4. Frequency distribution of Yes responses for offered Bids



5. Mean MWTP and % of Yes response per bid

Result

Table: Logit model estimates of the factors influencing WTP

					[95% Conf. Interval]	
RESPONSE	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**Lower**	**Upper**
BID	-0.0324***	0.0048	-6.71	0.000	-0.0419	-0.0229
M1000	0.0272**	0.0119	2.29	0.022	0.0039	0.0506
AGE	-0.0194**	0.0096	-2.02	0.044	-0.0383	-0.0006
GENDER	-1.0658***	0.3000	-3.55	0.000	-1.6537	-0.4779
HEALTH	-0.0248	0.3369	-0.07	0.941	-0.6850	0.6355
DAMAGE	0.3947	0.3299	1.20	0.232	-0.2519	1.0413
DW	0.8411***	0.3045	2.76	0.006	0.2443	1.4379
_cons	2.6259	0.7202	3.65	0.000	1.2143	4.0376

*** and ** indicate coefficients of variables with significance levels of 1% and 5% respectively

Significantly influencing factors

- Offered bid
- Monthly household income
- Age
- Gender
- Availability of drinking water

Result

Table: Estimates of the probit parameters

					[95% Conf. Interval]	
RESPONSE	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**Lower**	**Upper**
BID	-0.0285 (β)	0.0044	-6.49	0.000	-0.0372	-0.0199
_cons	1.700 (α)	0.2440	6.97	0.000	1.2221	2.1787
LR chi^2 (1)	48.53					
Prob>chi^2	0.0000					

Estimated mean WTP $\mu = -\frac{\alpha}{\beta}$

= Tk 60 per visit (approximately)

Result

		Percentage (%)	Total
Households willing to pay	Willing a offered bid	58.8	**82.6%**
	Willing to pay less than offered bid	23.8	
Households unwilling to pay	Consider it to be government's responsibility	15.9	**17.4%**
	Consider the program to be uneffective	1.5	

Annual number of outdoor patient in UHC = 57707
Deducing 17.4%,
Expected number of households having valid responses = 47666

Annual Aggregate WTP= Tk 2840000 (Approximately)

Significance

- High prevalence of waterborne diseases associated with inaccessibility to safe drinking water.
- Major influence of socio-economic factors over households willingness to pay. Experience of hazard impact did not influence it significantly.
- Scope of generating Tk 2840000 (approx.) revenue if government can ensure
  - Availability of doctors and staff
  - Sufficient and good quality medicines
  - Improved WASH facilities
  - Specialized diagnostic equipment

Thank You

Sources and contribution of water soluble compositions on the formation of secondary inorganic aerosol over Dhaka City

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Keywords: *Aerosol, SIA, marine aerosol, water soluble*

Objectives:

Secondary aerosol plays a significant role to degrade the local scale air quality. Thus, this study aims to measure the water soluble components in PM_{10} and the meteorological processes involve to transform the chemical into aerosol phase.

Methods:

The PM_{10} samples of aerosols were collected at the rooftop of North South University during March 2022 on 24 h basis using a High Volume Sampler (TEI-108NL, Thermo, India) for 10 consecutive days in quartz fibre filters. The filters were extracted and the extracted samples were analysed for cations and anions using an ion chromatograph (Dionex ICS-1600, Thermo Scientific, USA).

Figure 1: Map of the sampling location.

Results:

The result showed that most of the aerosols emitted from anthropogenic sources and the predominant soluble fractions of aerosol are sulphate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-), sodium (Na^+), calcium (Ca^{2+}), magnesium (Mg^{2+}) and potassium (K+) respectively. Ammonium (NH_4^+) also shows a value of 0.83 µg/m^3. The ionic compositions which play a significant role to process the secondary inorganic aerosol (SIA) are SO_4^{2-}, NO_3^- and NH_4^+.

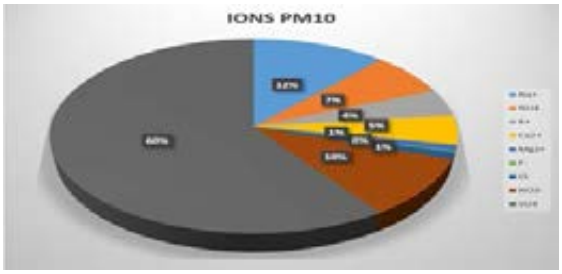

Figure 2: Concentration of PM_{10} ions in percentage.

Figure 3: Enrichment factors of the ions.

Conclusions:

This study will help us to understand the adverse effects of PM_{10} aerosols and it will also help us to find out some recommendations in order to reduce the impacts.

References:

[1] Taylor, Abundance of Chemical Elements in the Continental Crust: A New Table, Geochim. Cosmochim. Acta 28 (8), 1273–1285, 1964. Norazman et al.
[2] Khan MF et al. Comprehensive assessment of $PM_{2.5}$ physicochemical properties during the Southeast Asia dry season (south-west monsoon). J. Geophys. Res., *121 (24)* 14589-14611, 2016.

Sources and contribution of water soluble compositions on the formation of secondary inorganic aerosol over Dhaka City

Sara Binte Rashid[1], Md Firoz Khan[1], Karabi Farhana Biswas[1], Mohammad Moniruzzaman[2], Muhammad Nurul Huda[3], Md. Aftab Ali Shaikh[2,4]

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1. Introduction

Sources of Air pollutants

Secondary aerosols contribute a lot in deteriorating the ambient of air and degrade its quality by forming haze or reducing visibility, cloud seeding, radiative forcing or cloud albedo, acid rain. It also impacts on human health and environment particularly on the vegetation or agriculture farming. Secondary aerosols are basically the mixture of components form from the primary air pollutants through various reactions or physical process. The pollutants are emitted from a number of different sources (Norazman et al. 2021). It is known to all that Dhaka city has the record of having the worst air quality that consequences heavily on the public health. So, this study aims to identify the influence of potential factors, mainly water soluble ions in aerosol particles, through the formation of secondary aerosol pollutants over this polluted mega city in the Bangladesh as well as South Asian region. These aerosols are not only degrading the environment but also posing risks for human health e.g. respiratory airways disparity, cardiovascular diseases, brain damage such as dementia, cancer risk to the important organs such as liver, kidney, etc. However, the respiratory related diseases as well as cardiovascular problems are of great concern due to the exposure of air pollutants.

Health hazards due to air pollution

2. Objectives

(a) To determine the water soluble components in PM_{10} over Dhaka city

(b) To know the process involves to transform the chemical into aerosol phase.

3. Methods

A brief campaign of aerosol sampling has been made at the rooftop of North South University during March 2022

PM_{10} samples have been collected on 24 hours basis for 10 consecutive days

A High Volume Sampler (TEI-108NL, Thermo, India) has been employed to collect the filter samples

The filters were extracted with 20 ml of ultrapure water for 30 minutes using an ultrasonic water bath.

The extracted samples were analyzed for cations and anions

An ion chromatograph (Dionex ICS-1600, Thermo Scientific, USA) was used for the chemical analysis.

Wind vector and air mass trajectory has been demonstrated by GrADS and HYSPLIT

Figure 1: A flow diagram of the methods

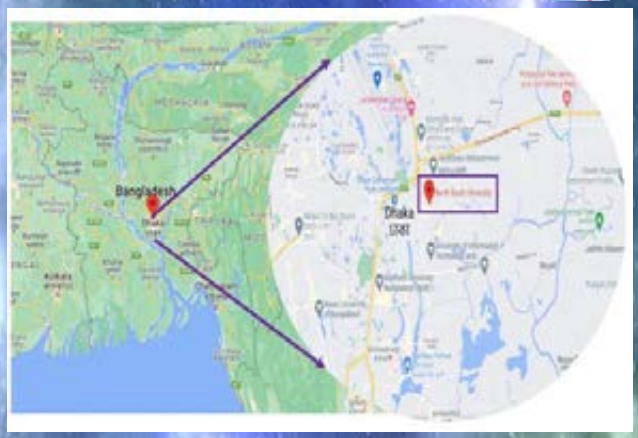

Figure 2: Location of the study area

4. Results and Discussions

- The results show that the predominant soluble fractions of aerosol are sulphate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-), sodium (Na^+), calcium (Ca^{2+}), magnesium (Mg^{2+}) and potassium (K^+), respectively.
- Ammonium (NH_4^+) also shows a value of 0.83 µg/m^3. The ionic compositions which play a significant role to process the secondary inorganic aerosol (SIA) are SO_4^{2-}, NO_3^- and NH_4^+.
- As the concentrations of the ions are relatively higher over Dhaka compared to the several other Asian Cities, SIA influences largely to alter local air quality over Dhaka.
- Tracing of K^+ indicates the biomass burning sources and Na^+/Cl^- are signatures for marine aerosol contributing to the aerosol pollution over Dhaka City.
- Figure 7 shows the enrichment factors of the ions. The blue colour shows if the value is less than 1 then the source is seawater. The orange colour shows if the value is less than 1 then the source is soil. But for both of the cases >1 means the sources are anthropogenic.

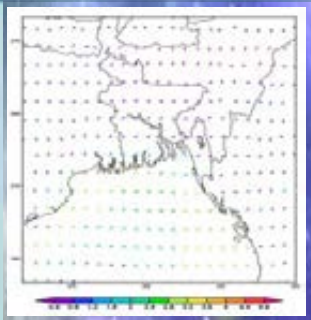

Figure 3: Wind Circulation by GrADS

Figure 4: Backward Trajectory for transport of air mass by HYSPLIT

Table1. Correlation among the ions in PM10

	Na^+	NH_4^+	K^+	Ca^{2+}	Mg^{2+}	F^-	Cl^-	NO_3^-	SO_4^{2-}
Na^+	1	-0.11	0.58	0.65	0.76	0.53	0.68	0.80	0.68
NH_4^+		1	0.35	0.06	-0.43	-0.31	-0.48	-0.36	0.56
K^+			1	0.56	0.63	0.68	0.6	0.65	0.7
Ca^{2+}				1	0.58	0.48	0.5	0.61	0.46
Mg^{2+}					1	0.81	0.96	0.91	0.35
F^-						1	0.91	0.91	0.3
Cl^-							1	0.95	0.3
NO_3^-								1	0.45
SO_4^{2-}									1

Figure 5: Concentrations of ions in PM_{10}

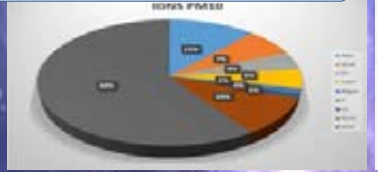

Figure 6: Ions in PM_{10} (%)

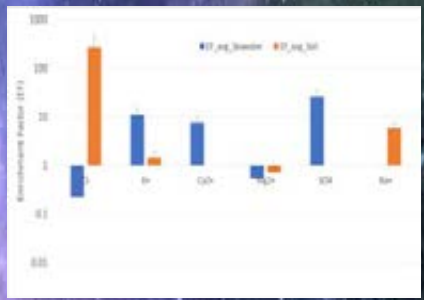

Figure 7: Enrichment Factor (EF)

5. Conclusion

- The amount of SO_4^{2-} is the highest among all the ions in PM_{10}.
- The sources of the ions in PM_{10} are mostly anthropogenic sources. Trace of biomass burning has also been identified.
- Sulphate, nitrate and ammonium contribute the most to the formation of secondary inorganic aerosol (SIA) over Dhaka.
- The circulation of air from the Bay of Bengal causes the enrich of marine particles in PM_{10}.

References

Khan MF et al. Comprehensive assessment of $PM_{2.5}$ physicochemical properties during the Southeast Asia dry season (south-west monsoon). J. Geophys. Res., *121 (24)* 14589-14611, 2016.
Taylor, Abundance of Chemical Elements in the Continental Crust: A New Table, Geochim. Cosmochim. Acta 28 (8), 1273–1285, 1964.
Norazman et al. Influence of Monsoonal Driving Factors on the Secondary Inorganic Aerosol over Ambient Air in Dhaka. ACS Earth and Space Chemistry, 5(9), 2517-2533, 2021.

Acknowledgements

The authors would like to thank ICGNB 2022 for accepting the poster and supports. Also thanks to NSU Environmental lab for conducting the experiments. Thanks to CARS, DU for providing the sampling devices and other consumables. A special thanks to NOAA for providing access to launch HYSPLIT.

Diurnal variations and RDD flux of aerosol and reactive gases over Dhaka City

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[2]Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka
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Objectives:

Aerosol and reactive gases play significant role in climate change. This study aims to measure real-time basis of the several fractions of aerosols and reactive gases present in the air of Dhaka city. Besides, the visualization of the variables has been done to know their changes over the city. In addition, respiratory deposition flux has been undertaken to see the change of the particle deposition in different airways in male and female for the exposure of PM_{10} and $PM_{2.5}$.

Methods:

The samples of PM_{10} and $PM_{2.5}$ has been collected by BAM-1020. Oxides of nitrogen has been collected through AMNA-370 and CO by APNA-370. And the sample of SO_2 collected through APSA-370. Software as HYSPLIT and GrADS has been used to view the air mass transportation and wind vector respectively.

Result:

The 24 h mean value shows the guideline provided by the Department of Environment (DOE), Bangladesh and also several other international guidelines (e.g. USEPA, WHO, etc.). Interestingly, the diurnal changes of the PM_{10}, $PM_{2.5}$ and the reactive gases show a short temporal lifecycle and indicate the processes impacting from the local origin.

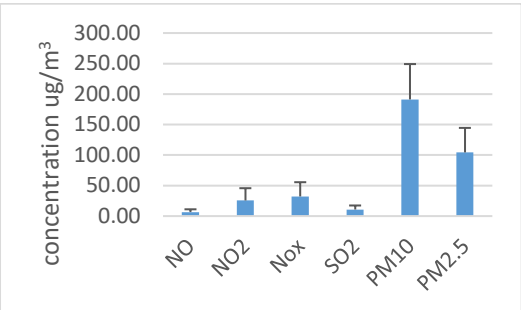

Fig:Concentration summary of reactive gases and aerosol

Fig: Air mass transportation

Conclusions:

The study will help to know the temporal lifecycle of the air particles and reactive gases over Dhaka City. The community may receive a message to plan their outdoor activities with a lower exposure to the pollutants if they are made aware of the changes in the air pollutants over a 24-hour period.

Reference:

Norazman et al. Influence of Monsoonal Driving Factors on the Secondary Inorganic Aerosol over Ambient Air in Dhaka. ACS Earth and Space Chemistry, 5(9), 2517-2533, 2021.

DIURNAL VARIATION and RDD FLUX OF AEROSOL AND REACTIVE GASES OVER DHAKA CITY

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Introduction

The air quality of Dhaka has been one of the most talked-about topics in recent years. This city has been listed for several years as one of the cities with poorest air quality that truly should be taken into consideration. A set of variables such as NO, NO_2, SO_2, CO, PM_{10}, and $PM_{2.5}$ often help to know the change of air quality over a city. The potential sources of those air pollutants as reported in the literature are the emissions from different textile and dying industries, tanneries, brick kilns, chemical and cement factories, vehicles, ocean, volcano, and biomass burning from local or transboundary region (Norazman et al. 2021, Siddiqui et al, 2020). All these pollutants pose serious health risks to humans as they can penetrate deep into the respiratory system. And gradually they accumulate in different body parts through capillaries. The health risks from air pollution are respiratory and cardiovascular diseases, allergies, dementia as well as lung damage. The pollutants also impact on the environment through the formation of acid rain and interrupt the growth of plants and vegetation.

Objectives

- Measuring real time basis of several fractions of aerosols and reactive gases
- Visualization of the variables to understand their diurnal changes
- Studying the interaction of air pollutants and weather variables.

Methods

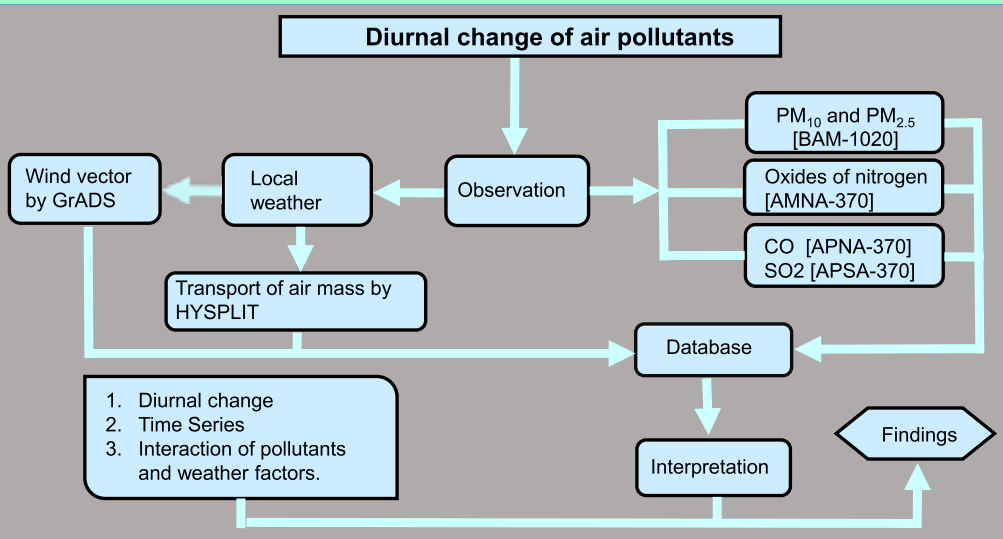

Figure 2: A conceptual framework of the study.

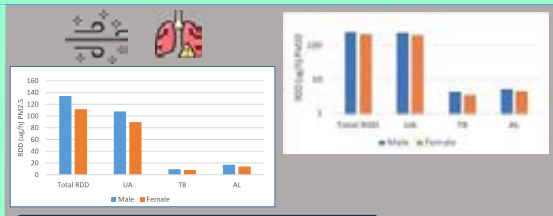

Figure 1: RDD flux for PM_{10} and $PM_{2.5}$

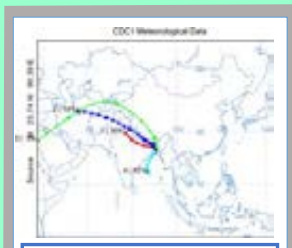

Figure 3: Air mass transportation.

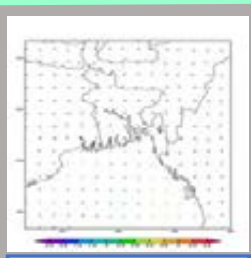

Figure 4: Wind vector.

Results and Discussion

- 24 h mean result of $PM_{2.5}$ was 104.4 µg/m³ ranging from 51.0 µg/m³ to 262.0 µg/m³ which exceeded DoE, WHO and USEPA guidelines.
- 24 h mean result of PM_{10} was also above the guidelines from DoE, WHO, USEPA.
- The diurnal changes of the PM_{10}, $PM_{2.5}$ and the reactive gases show a short temporal lifecycle indicating the processes impacting potentially from the local origin.
- From Fig. 3 & Fig. 4, wind vector and air mass were gradually shifted from the west to the south Bay of Bengal. Thus, the marine area is also a potential sources of air particles as well as the gases observed at the study location.

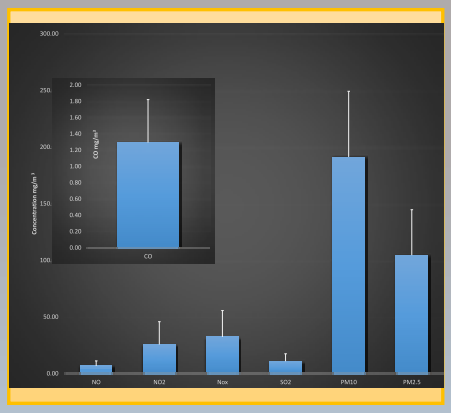

Figure 5: Concentration summary of reactive gases and aerosols

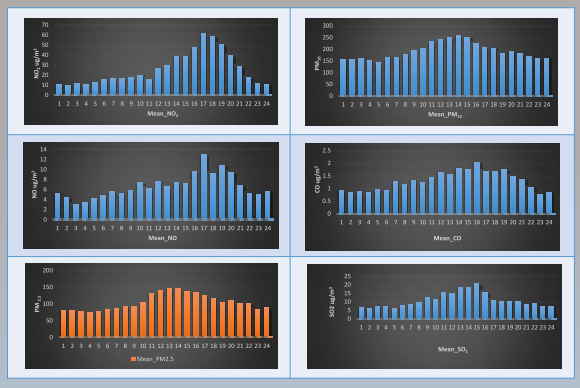

Figure 6: Mean concentration of Aerosols and Reactive Gases

Conclusion

- From this study, the temporal lifecycle of tiny air particles and reactive gases over Dhaka city has been well understood.
- Marine area also plays an important role in transporting air pollutants.
- Thus, it will help the residents of Dhaka city to plan their outdoor activities with less exposure from the pollutants.

Reference

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Acknowledgement

I would like to thank the University of Tokyo and the University of Dhaka for holding the seminar. Also, for creating the opportunity for students to participate in the program. I am honored to get the opportunity to participate in this program.

AMBIENT TEMPERATURE AND NERVOUS SYSTEM DISEASE MORTALITY IN JAPAN FROM 2010 TO 2019: A TIME-STRATIFIED CASE-CROSSOVER ANALYSIS

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***Keywords**: Nervous System Diseases, Neurodegenerative Diseases, Ambient Temperature, Japan*

1. INTRODUCTION

Nervous system diseases (NSD) were the second leading cause of mortality in 2016 causing an estimated 9 million deaths globally [1]. Ambient temperature has been speculated as a risk factor, notably for neurodegenerative NSD [2,3]. However, few studies have examined the association between NSD and ambient temperature, especially at low temperatures. There are also no studies within the NSD subgroups such as Alzheimer's disease. The objective of this study is to examine the association between short-term changes in air temperature and NSD related mortality in Japan.

2. METHODS

We collected daily meteorological data and NSD mortality data from 1 January 2010 to 31 December 2019 in 10 Japanese prefectures (Hokkaido, Saitama, Chiba, Tokyo, Kanagawa, Shizuoka, Aichi, Osaka, Hyogo, and Fukuoka). We conducted a 2-stage analysis based on a time-stratified case-crossover study design. In the first stage, a conditional quasi-Poisson regression model with distributed lag nonlinear model was applied to estimate the exposure-response relationship in each prefecture. In the second stage, a multivariate random-effects meta-analysis was applied to pool the prefecture-specific effect estimates. Minimum mortality temperature (MMT), the temperature with the minimum risk of mortality, was used as reference to compute the relative risk for cold and heat using the 2.5th and 97.5th percentile of daily mean temperature respectively.

3. RESULTS

A total of 162,315 deaths due to NSD were observed during the 10-year study period.

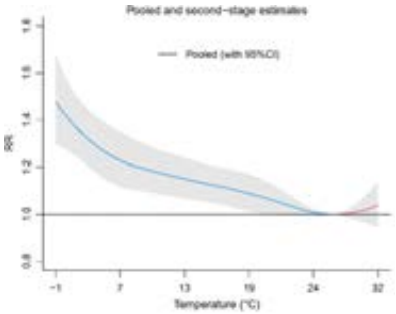

Figure 1. Exposure-response curves for nervous system disease deaths.

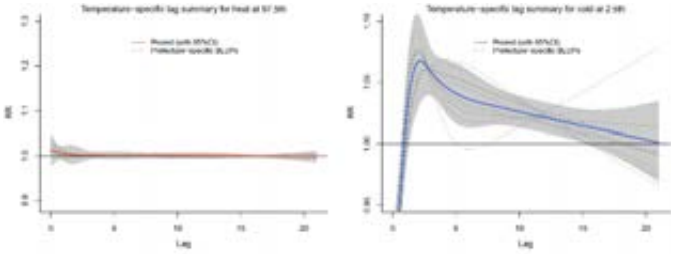

Figure 2. Temperature-specific lag summary for cold at 2.5th percentile (left) and for heat at 97.5th percentile (right).

Table 1. Pooled relative risks of all and cause-specific nervous system disease deaths.

Disease (ICD-10)	MMT	Relative Risk (95%CI)	
		Cold Risk	Heat Risk
Nervous System (G00-G99)	86.4	1.430 (1.278-1.599)	1.026 (0.956-1.100)
Neurodegenerative (G12.2; G20; G21 G23; G30; G31)	84.8	1.368 (1.174-1.594)	1.036 (0.949-1.131)
Alzheimer (G30)	98.9	1.532 (1.167-2.012)	1.008 (0.977-1.040)
Parkinson (G20; G21)	82.7	1.537 (1.125-2.099)	1.208 0.996- 1.464)

Note: ICD-10, International Classification of Diseases, Tenth Revision codes; MMT, minimum mortality temperature (percentile); CI, confidence interval.

4. DISCUSSION AND CONCLUSIONS

Preliminary findings suggest that only cold effect is associated with significant increase in NSD mortality, and those with Alzheimer's and Parkinson's disease are particularly vulnerable. The delayed cold effect for NSD mortality is approximately two weeks. Subgroup analysis found that those below 75 and female are more vulnerable to cold effects. This finding is contrary to previous studies which have consistently suggested that older people are more vulnerable to changes in ambient temperature. More research is needed to identify possible pathways for the observed effects.

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[3] Habibi, L., Perry, G., & Mahmoudi, M. (2017). Global warming and neurodegenerative disorders: speculations on their linkage. BioImpacts, 4(4), 167–170.

GHP

Ambient Temperature and Nervous System Disease Mortality in Japan from 2010 to 2019: A Time-Stratified Case-Crossover Analysis

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Background

- Nervous system diseases (NSD):
  - Involve malfunctions of or damage to the nervous system— the brain, spinal cord, and nerves
  - Commonly caused by infection, vascular disorders, toxic substances, and neurodegeneration
  - Leading cause of DALYs; 2nd leading cause of mortality (2016) Feigin et al., 2019
- Neurodegenerative diseases:
  - Caused by the degeneration or death of nerve cells
  - 1st Alzheimer's disease; 2nd Parkinson's disease

DALYs = Disability-adjusted life years

Existing Literature

Summary of existing literature between temperature and nervous system disease mortality

First Author (Publication Year)	Study Region	Study Period	Mortality Outcome	Cold Association	Heat Association
Su (2021)	China (Harbin; Qingdao; Wuxi; Yancheng; Chengdu)	2014-2017	NSD	+	+
Chen (2021)	China (Guangzhou)	2010-2018	NSD	+	–
Kim (2015)	South Korea (Seoul)	1992-2009	NSD	–	+
Gasparrini (2011)	England and Wales	1993-2006	NSD	–	+
Rey (2007)	France	1971-2003	NSD	–	+
Basagaña (2011)	Spain (Catalonia)	1983-2006	NSD	–	+
Culqui (2017)	Spain (Madrid)	2001-2009	Parkinson's	–	+

- refers to association not studied; + refers to significant positive association
NSD: Nervous system disease

Existing Literature

Summary of existing literature between temperature and nervous system disease mortality

First Author (Publication Year)	Study Region	Study Period	Mortality Outcome	Cold Association	Heat Association
Su (2021)	Ch… (H… W… C…				+
Chen (2021)	C… (G…				–
Kim (2015)	S… (S…				+
Gasparrini (2011)	E…				+
Rey (2007)	Fr…				+
Basagaña (2011)	Spa… (Catalonia)				+
Culqui (2017)	Spain (Madrid)	2001-2009	Parkinson's	–	+

Lack studies:
- in Japan
- on cold effect
- on NSD subgroups e.g., Alzheimer's disease

- refers to association not studied; + refers to significant positive association
NSD: Nervous system disease

Study Objective

- To quantify the association between daily temperature and NSD mortality in Japan from 2010 to 2019.
  - To examine the associations by NSD subgroups (major neurodegenerative diseases, Alzheimer's disease, and Parkinson's disease).

NSD: Nervous system disease

Methods (1/5): Study design

- Study design
  - Time-stratified case-crossover design
- Study region
  - Top ten most populous prefectures in Japan: Hokkaido, Saitama, Chiba, Tokyo, Kanagawa, Shizuoka, Aichi, Osaka, Hyogo, Fukuoka
- Study period
  - January 1, 2010 to December 31, 2019 (10-year study period)

Methods (2/5): Data source

- Variables
  - Outcome – daily NSD mortality
  - Exposure – daily mean temperature: use the temperature with the minimum risk of mortality (minimum mortality temperature) as reference to compare with the 2.5th and 97.5th percentile of the daily mean temperature
- Data source
  - NSD mortality data: Ministry of Health, Labor and Welfare
  - Ambient temperature – an average over several stations in the prefecture: Japan Meteorological Agency

NSD: Nervous system disease

Methods (3/5): ICD Codes

- Used the International Classification of Diseases, Tenth Revision (ICD-10) codes G00-G99.
- For neurodegenerative diseases subcategories, used Mackay's (2019) article* as reference:

Nervous system disease	G00-G99
Major neurodegenerative disease	G12.2 Motor neuron disease G20 Parkinson's disease G21 Secondary parkinsonism G23 Other degenerative diseases of basal ganglia G30 Alzheimer's disease G31 Other degenerative diseases of nervous system, not elsewhere classified
Alzheimer's disease	G30
Parkinson's disease	G20; G21

* Mackay, et al. (2019). Neurodegenerative Disease Mortality among Former Professional Soccer Players. New England Journal of Medicine, 381(19), 1801–1808.

Methods (4/5): Statistical analysis

- **First stage analysis:** *Identify exposure-response relationship in each prefecture*
  - Conditional quasi-Poisson regression model with distributed lag nonlinear model (DLNM)
  - Exposure-response curve: B-spline (3 internal knots at 25th , 50th , 75th percentile)
  - 21-day lag-response curves: Natural cubic spline (3 equally spaced knots in the log scale)
  - Statistical model:

$$E(Y_{i,s}) = \mu_{i,s} = \exp\{\alpha_s + \boldsymbol{\beta}^T \mathbf{x}_i\}, \; Y \sim Poisson(\mu_i)$$

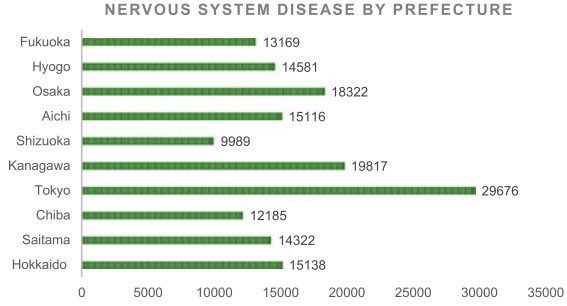
$Y_{i,s}$ represents the number of deaths on day *i* in stratum *s* (year: month: day of week);
α_s is the intercept;
β^T is the coefficient;
x_i is the temperature (cross-basis in DLNM)

Methods (5/5): Statistical analysis

- **Second stage analysis:** *Estimate the pooled effects at the overall levels*
  - Multivariate random-effects meta-analysis
- **Sensitivity Analysis**

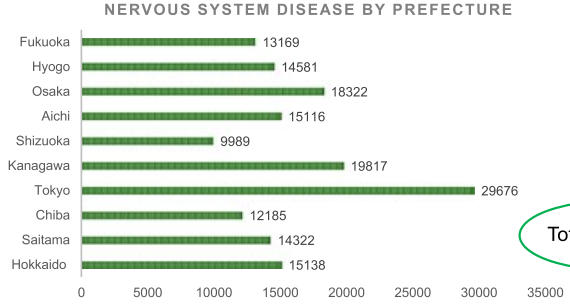
Results (1/8):

Summary statistics of daily NSD mortality data in 10 Japanese prefectures 2010-2019



Results (1/8):

Summary statistics of daily NSD mortality data in 10 Japanese prefectures 2010-2019



Total:162,315

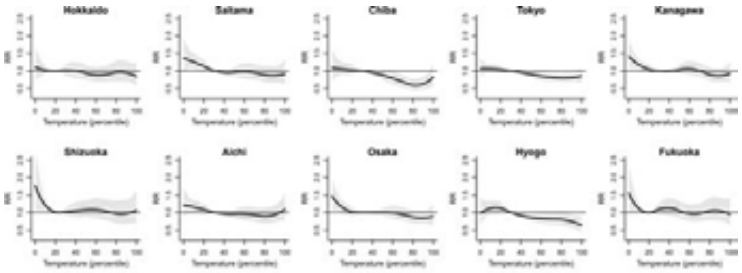
Results (2/8):

Summary statistics of daily meteorological variables in 10 Japanese prefectures 2010-2019

	Ambient Temperature (°C)			
Prefectures	mean (sd)	2.5th percentile	median	97.5th percentile
1 Hokkaido	9.5 (9.7)	-6.3	9.8	25.3
11 Saitama	15.8 (8.6)	2.2	16	30.4
12 Chiba	16.6 (7.9)	3.8	17	29.5
13 Tokyo	16.9 (8.1)	3.7	17.1	30.1
14 Kanagawa	16.6 (7.8)	4	17.1	29.3
22 Shizuoka	17.2 (7.6)	4.6	17.6	29.3
23 Aichi	16.5 (8.7)	2.4	16.9	30.4
27 Osaka	17.2 (8.4)	3.7	17.5	30.7
28 Hyogo	17.2 (8.3)	3.6	17.8	30.1
40 Fukuoka	17.5 (8.0)	4.1	17.9	30.7

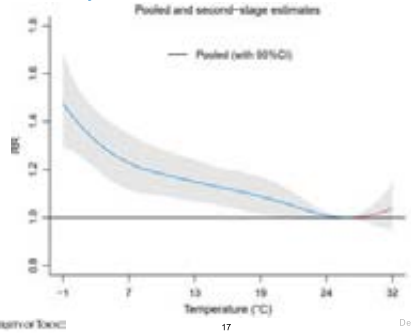
Results (3/8):

Single prefecture first stage exposure–response curve of the overall lag-cumulative association between mean temperature and NSD mortality



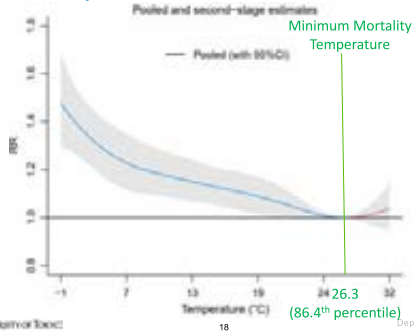
Results (4/8):

Pooled exposure–response curve of the overall lag-cumulative association between mean temperature and NSD mortality



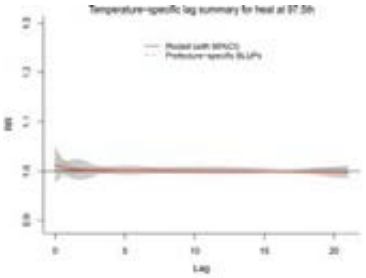
Results (4/8):

Pooled exposure–response curve of the overall lag-cumulative association between mean temperature and NSD mortality



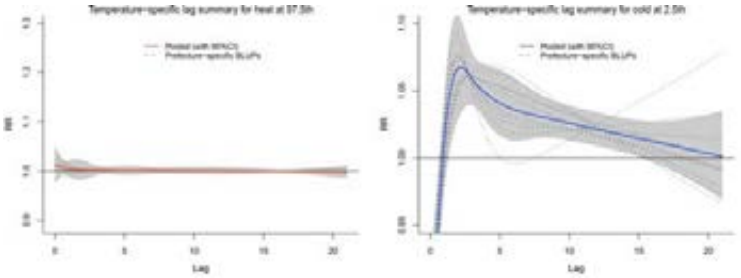
Results (5/8):

Lag pattern between mean temperature and NSD mortality



Results (5/8):

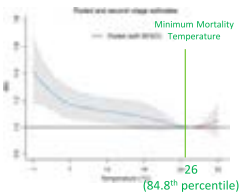
Lag pattern between mean temperature and NSD mortality



Results (6/8):

Pooled exposure–response curve of the overall lag-cumulative association between mean temperature and NSD subgroups mortality

Neurodegenerative Disease

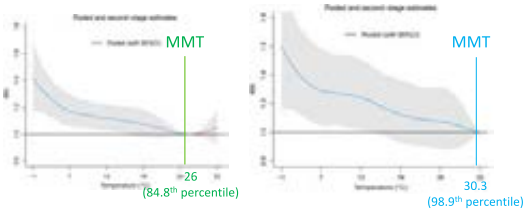


MMT: Minimum Mortality Temperature

Results (6/8):

Pooled exposure–response curve of the overall lag-cumulative association between mean temperature and NSD subgroups mortality

Neurodegenerative Disease Alzheimer's Disease

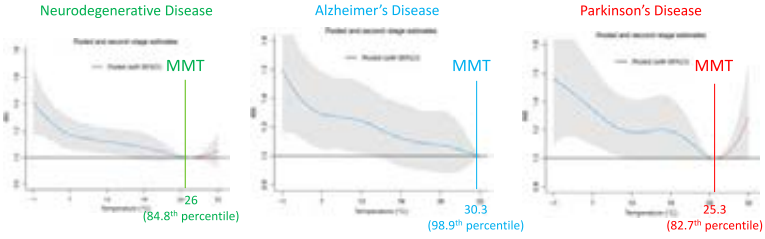


MMT: Minimum Mortality Temperature

Results (6/8):

Pooled exposure–response curve of the overall lag-cumulative association between mean temperature and NSD subgroups mortality

Neurodegenerative Disease Alzheimer's Disease Parkinson's Disease

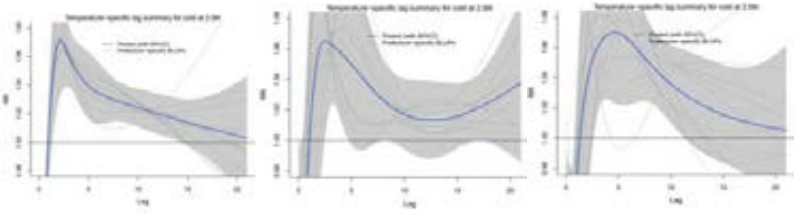


MMT: Minimum Mortality Temperature

Results (7/8):

Temperature-specific lag summary for heat at 2.5th percentile for NSD subgroup mortality

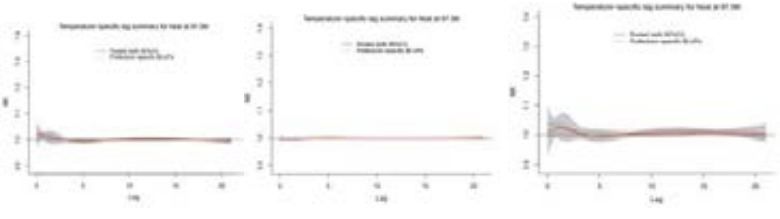
Neurodegenerative Disease Alzheimer's Disease Parkinson's Disease



Results (8/8):

Temperature-specific lag summary for heat at 97.5th percentile for NSD subgroup mortality

Neurodegenerative Disease Alzheimer's Disease Parkinson's Disease



Thank you for listening!

Receptor Modelling and Human Respiratory Deposition Dose in Dhaka City

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Keywords: *Aerosol, Metals, Carcinogen, Deposition flux, Sources*

OBJETIVES: The chemical compositions presenting the aerosol are the key drivers to cause adverse health impacts from the exposure to air pollutants. Thus, this study aims to measure the fourteen metals from PM_{10} and to know their sources and human respiratory deposition dose in Dhaka city.

METHODS: In march 2022, aerosol sampling has been made on the rooftop of North South University. The sample of PM_{10} have been collected on a 24-hour basis using a High Volume Sampler (TEI-108NL, Thermo, India) for 10 days in quartz fibre filters. The filters were extracted with 10 ml of acid mixtures for 40 minutes using a microwave digestor (DartD, Milestone, Italy). After filtration, the extracted samples were analysed using an inductively coupled plasma mass spectrometry (ICP-MS) (NexION 2000, Perkin Elmer, USA) for 14 metals which are As, Cd, Co, Cr, Cu, Hg, Ni, Pb, Zn, Mn, Fe, Se, Be, and V.

RESULTS: From the result we can acknowledge that the predominant metal fractions of aerosols are Zn, Fe, Pb, Mn, Cd, and Cu. Cr, Ni, Hg, Se, Pb As, metals show relatively lower concentration but these metals are known as carcinogens. From the correlation results we can see that several of the carcinogenic metals are well correlated with metals originating from the combustion of fossilised fuel. Coal processing may emit As, Se, and Hg with the aerosol particles identified in the study area. Human respiratory deposition dose of the toxic metals in the pulmonary region may pose adverse impacts to the people who are engaged in the outdoor activities.

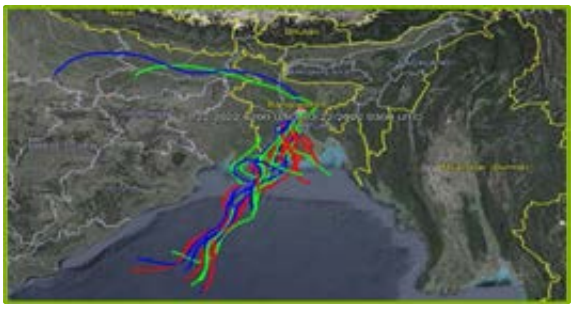

Figure 1: Backward Trajectory for the Transport of air mass by HYSPLIT model

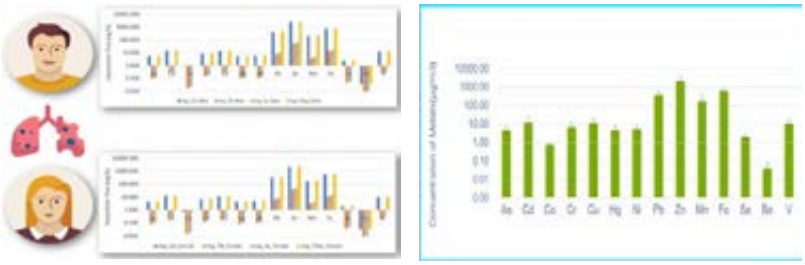

Figure 2: Airways deposition flux of metals from PM_{10} for male and female. And Concentration of metals.

CONCLUSIONS: This analysis detects the metals in Dhaka City and the possible aerosol generating sources. The respiratory deposition dose of the metals in the aerosol phase may help the policy makers with the policy preparation in ensuring the health of local people.

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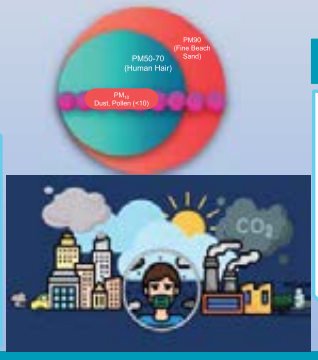
Introduction

Dhaka being the capital of a developing country like Bangladesh, massive amount of toxic air pollutants are being produced. Aerosol is one of the dominant air pollutants that has significant health effects. Exposure of aerosols can lead to the premature deaths of millions of people every year as this pollutant damages lungs and other organs. Among all the aerosol fractions, PM_{10} poses the adverse health effects. Exposure to high concentrations of PM_{10} can result in a number of health impacts such as, coughing and wheezing to asthma attacks and bronchitis to high blood pressure, heart attack, strokes and premature death.



Objectives

The objectives of this study are to:

- Identify the chemical compositions present in the aerosol which are key drivers to cause health impairment.
- Aims to measure the fourteen metals from PM_{10} and to know their sources and airways deposition in the human respiratory tract.

Methods

Figure 1: Location of the Sampling Site

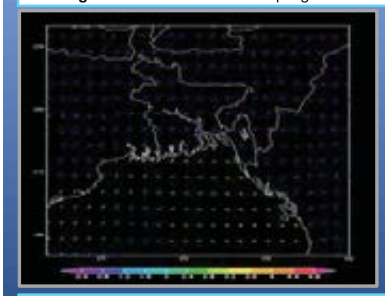


Figure 2: Wind Circulation by GrADS.

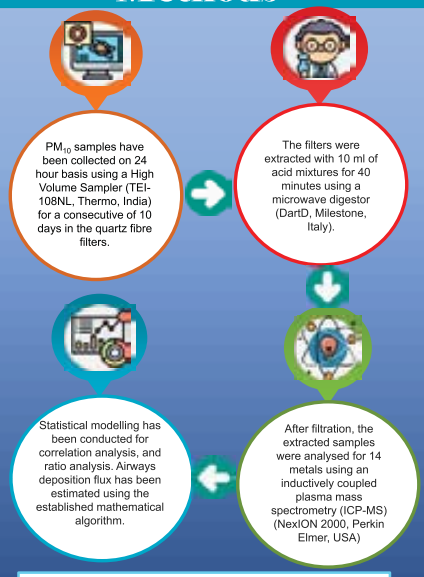


Figure 3: A conceptual framework of the study.

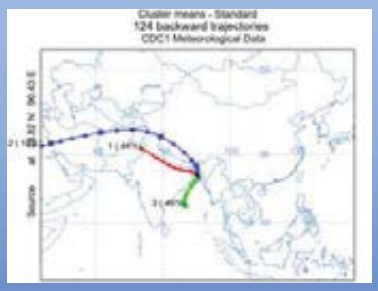


Figure 4: Backward Trajectory for the Transport of air mass by HYSPLIT model

Post winter over Dhaka, wind circulation and transport of air mass start shifting from the Western region towards the Bay of Bengal. However, several of the air mass also blows from the Western Indian bringing polluted plumes. Marine sea salt also a great play role during this time to change the aerosol load over Dhaka.

Results and Discussion

The results show that the predominant metal fractions of PM_{10} aerosols are Zn, Fe, Pb, Mn, Cd, and Cu. Several metals show relatively lower concentration (Cr, Ni, Hg, Se, Pb As) but those metals are well-refereed carcinogens. The correlation results show that several of the carcinogenic metals are well correlated with metals originating from the combustion of fossilised fuel. Coal processing may emit As, Se, and Hg with the aerosol particles identified at the study area. The airways deposition flux of the toxic metals in the pulmonary region may pose a considerable concern to the people engaged in the outdoor activities.

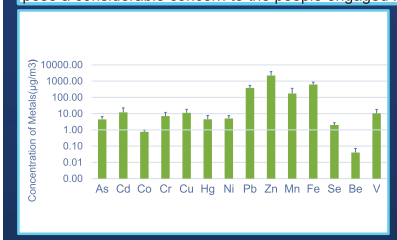


Figure 5: Concentrations of Metals in PM_{10}.

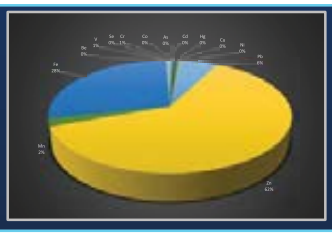


Figure 6: Percentage of Metals in PM_{10}.

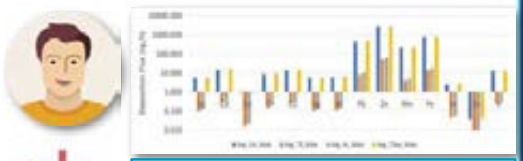


Figure 7: Airways deposition flux of metals from PM_{10} for male.

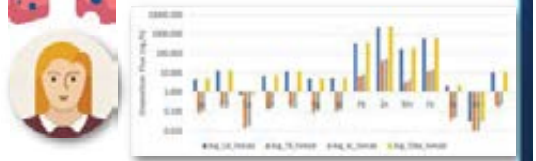


Figure 8: Airways deposition flux of metals from PM_{10} for female.

From Fig. 7 & Fig. 8, the respiratory deposition dose (RDD) for both male and female shows that Pb, Zn, Mn and Fe were largely deposited in the upper airways followed by the alveolar (AL) region and tracheobronchial region (TB).

RDD of As, Cd, Cr, Ni and Hg was also >0.1 ng/h at the AL region which may affect health damage.

Table 1: Correlation among the metals.

Correlations	As	Cd	Co	Cr	Cu	Hg	Ni	Pb	Zn	Mn	Fe	Se	Be	V
As	1.00	0.40	0.18	-0.02	0.03	-0.02	0.52	0.90	0.57	0.87	-0.30	0.58	-0.07	0.63
Cd		1.00	0.62	0.32	0.48	-0.07	0.23	0.02	0.27	0.57	0.47	0.67	-0.21	0.60
Co			1.00	0.82	0.43	-0.32	0.57	-0.05	-0.03	0.43	0.83	0.67	-0.29	0.82
Cr				1.00	0.43	-0.23	0.43	0.12	-0.10	0.36	0.80	0.53	-0.07	0.55
Cu					1.00	-0.13	0.30	-0.12	-0.33	0.17	0.52	0.32	0.21	0.30
Hg						1.00	0.03	-0.14	0.65	-0.05	0.12	0.30	0.11	0.17
Ni							1.00	0.24	0.25	0.63	0.18	0.68	-0.36	0.80
Pb								1.00	0.36	0.67	-0.31	0.36	0.43	0.38
Zn									1.00	0.58	-0.07	0.55	-0.36	0.57
Mn										1.00	0.10	0.73	-0.36	0.88
Fe											1.00	0.52	0.00	0.43
Se												1.00	-0.07	0.90
Be													1.00	-0.33
V														1.00

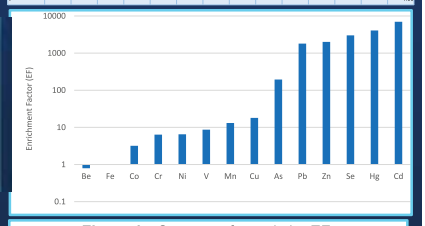


Figure 9: Sources of metals by EF.

Fig. 9 shows that EF values were >1 for most of the metals except Fe and Be indicating their anthropogenic emission sources. <1 indicates their natural emission source.
The pairwise of correlation for metals demonstrates that the metals were emitting from the similar sources.

Conclusion

- **The local circulation and the transboundary emission play a great role to deteriorate the air quality over Dhaka.**
- **The Pb, Zn, Mn, & Fe were the predominant metals in PM_{10}. Cd, Cr, Cu, Ni, & V were also potentially high in PM10.**
- **The anthropogenic sources were stronger than natural process for the aerosol load over Dhaka.**
- **The airways RDD were significantly larger for several metals in the AL region which may pose great health concern for the people in Dhaka City. The results of RDD for metals will a refence to the medical practitioner to deal with a patient suffering from respiratory disease.**

Acknowledgement

The authors would like to thank Dhaka University and Tokyo University for their kindest support.. The authors also acknowledge the North South University for their prompt support to collect samples at the rooftop. Authors also thankful to BCSIR's all scientists for providing analytical services.

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UNRAVELING THE GLOBAL FLOW OF SINGLE-USE PLASTIC PACKAGING

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Keywords: Single-use plastic, Packaging plastic, Material flow analysis, Waste management

1. THE RISE OF PLASTICS

Plastics are hailed as a miracle material. Till 2015, the world has manufactured close to 400 million tonnes of plastic per annum [1]. SUPs have a very short lifespan, and are a resource that suffers from major losses in the economy. Approximately 500 billion plastic bags are used worldwide annually, which equals to more than 1 million bags per minute [2]. This is estimated by experts to have a monetary value of $80–120 billion per annum [3]. This study focused on a global review based on the available studies on SUP packaging from the US, China, Brazil, India, Japan, South Korea, Trinidad and Tobago, and 28 countries representing the EU (EU 28) through the lens of material flow analysis (MFA).

2. RESULTS

The global waste management scenario for single-use plastics

Figure 2 represents the how single-use plastic waste is managed in the study areas. US, China, and South Korea show a significantly higher amount of waste collected than SUPs generated from the packaging sector. These 3 studies are an MFA of all types of plastics in the economy, with China and the US being agglomerated studies. For developing countries, the majority of waste generated came from the packaging sector. The EU had an uncollected waste amount of 140 kilotons and Japan had an uncollected waste amount of 800 kilotons. This meant the EU had a collection rate of a staggering 99%. This is a good testament to their management of waste and the collection system in their region. India boasts a collection rate of 72% as they assumed all collected waste to be sent to recycling, which is not true.

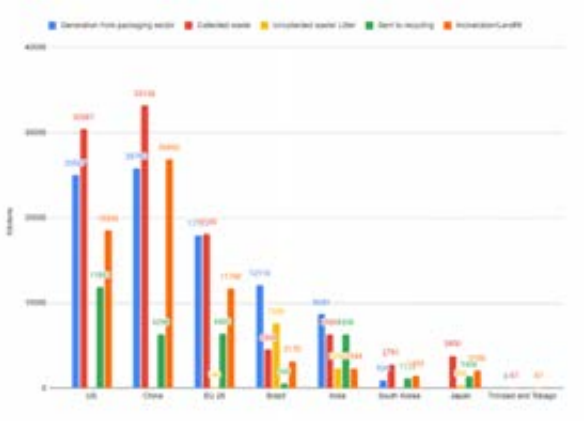

Figure 1. The global waste management scenario for single-use plastic packaging

3. CONCLUSION

SUPs become waste almost immediately, with no stocks remaining, and higher landfilling rates compared to recycling efficiency were prevalent. However, existing policies have concrete directives and frameworks in place with great promise. Increasing the proportion of post-consumer single-use plastics being diverted to recycling and changes in consumer habits can reduce the consumption of SUP packaging and increase resource efficiency.

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August 3, 2022

UNRAVELING THE GLOBAL FLOW OF SINGLE-USE PLASTIC PACKAGING

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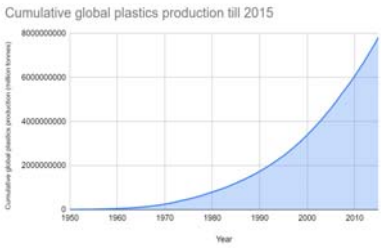
400 million tonnes

THE RISE OF PLASTICS

8300 million tonnes

(Geyer et al., 2017)



2

SOME FACTS ABOUT PLASTIC WASTE

6300 MT

RECYCLED - 600 MT
INCINERATED - 800 MT

LANDFILLED/ NATURAL ENVIRONMENT- 4900 MT

(Geyer et al., 2017)
(The World Economic Forum, 2016)

3

SINGLE-USE PLASTICS AND THE PACKAGING SECTOR

Single-use plastics, often also referred to as disposable plastics, are commonly used for plastic packaging and include items intended to be used only once before they are thrown away or recycled (UNEP, 2018).

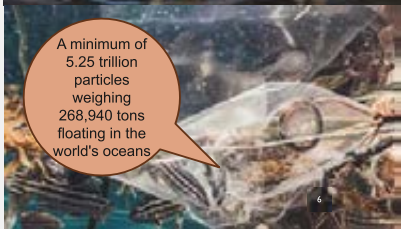
1 year lifetime

Often placed entirely under the umbrella of packaging and containers

4

THE ISSUE OF MICROPLASTICS

12 microplastic fragments (ranging from 5 to 10 µm in size), with spherical or irregular shapes were found in 4 placentas among 6 (Ragusa et al., 2021)

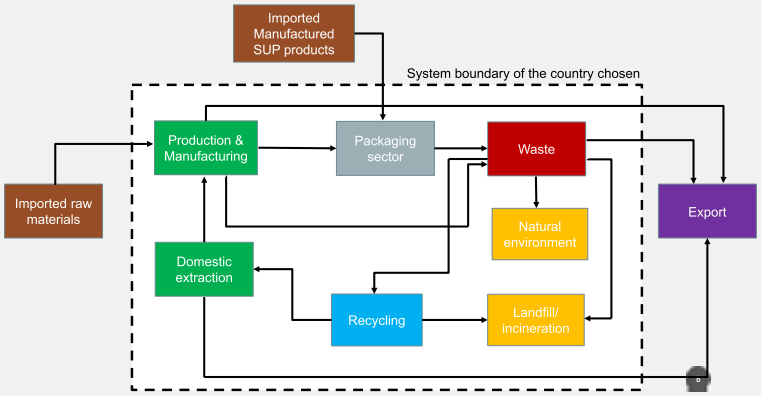


6

THE IMPORTANCE OF THIS LITERATURE REVIEW

- The packaging sector consumes most plastics made across most MFA studies done on plastics
- Very few studies specifically on SUP packaging using MFA
- Most MFA studies on plastic mention the packaging sector, there is a lack of compiled work that highlights the inputs, outputs and flows surrounding the packaging sector
- Worldwide, the use of plastic packaging is increasing and without seeing where packaging plastic flows, it can be difficult for policy makers to make concrete decisions
- This study compiles the existing scattered researches on SUP packaging MFA to provide a global view
- The study will help to develop more holistic policies for SUP packaging going forward.

Framework used for data extraction

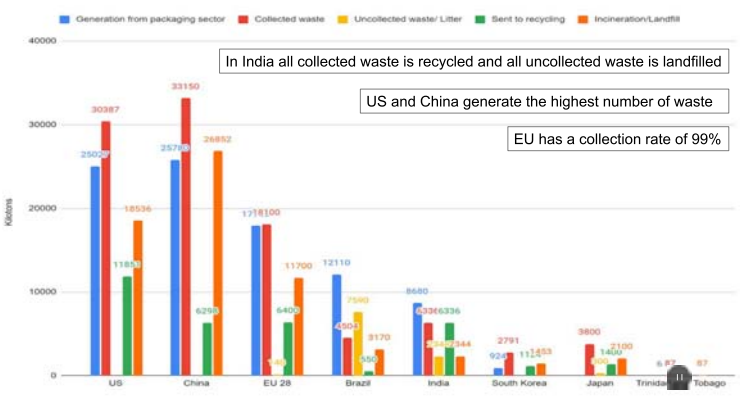


LITERATURE SELECTED

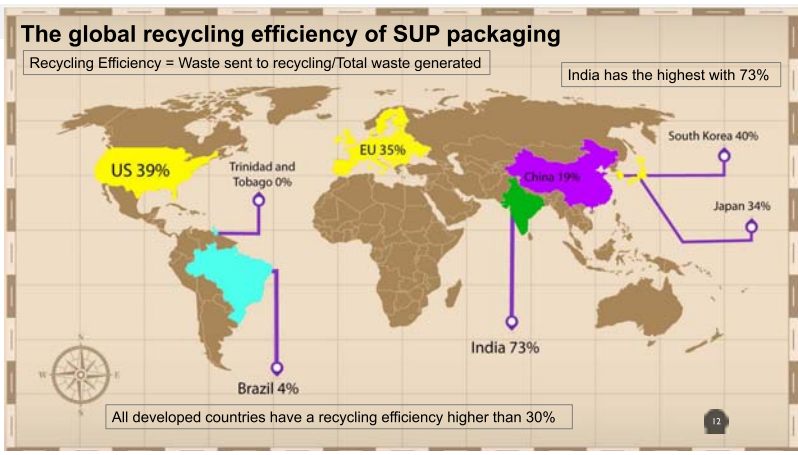
Author	Year published	Scope of Study	Region/ Country
Cimpan et al.	2021	2014	EU 28
M.-Y. Lee et al.	2021	2018	South Korea
X. Jiang et al.	2020	2017	China
Nakatani et al.	2020	2015	Japan
Millette et al.	2018	2016	Trinidad and Tobago
Pincelli et al.	2021	2017	Brazil
India – Australia Industry and Research Collaboration for Reducing Plastic Waste	2021	2019	India
Mengqing Kan	2021	2018	

FINDINGS

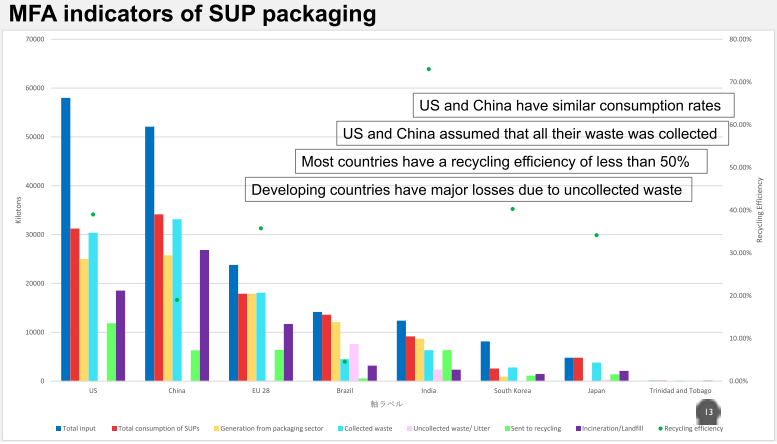
The global waste management scenario of SUP packaging



The global recycling efficiency of SUP packaging



MFA indicators of SUP packaging

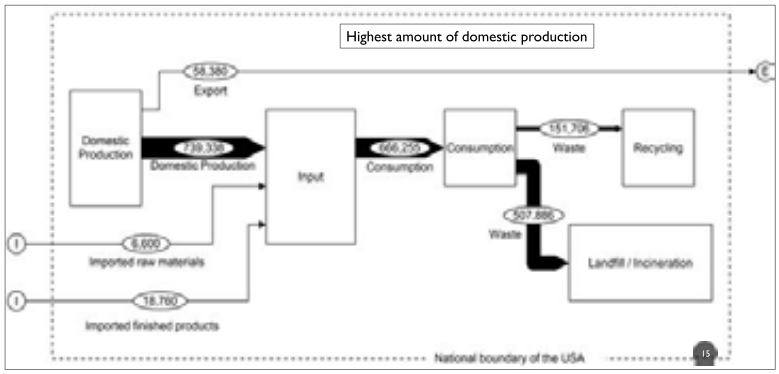


13

MFA OF RESPECTIVE STUDIES ON THE PACKAGING SECTOR

14

SUP packaging MFA of the USA (50 Years)



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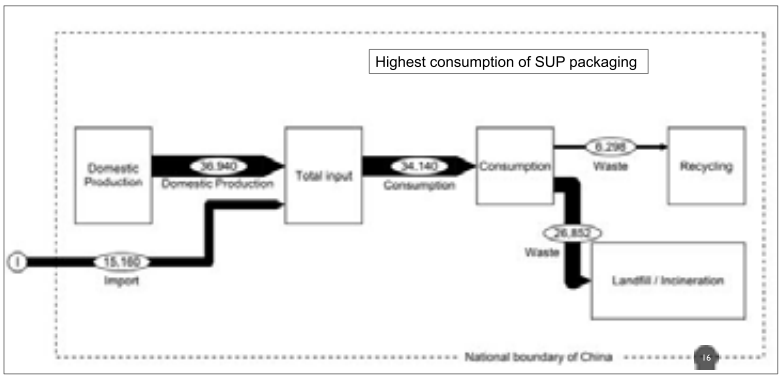
SUP packaging MFA of China



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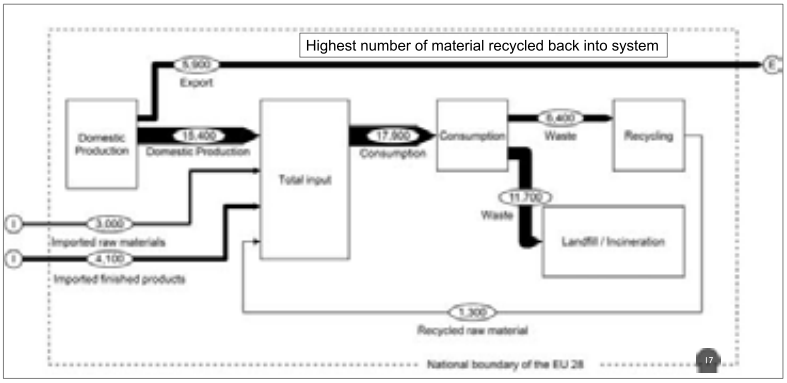
SUP packaging MFA of The EU 28



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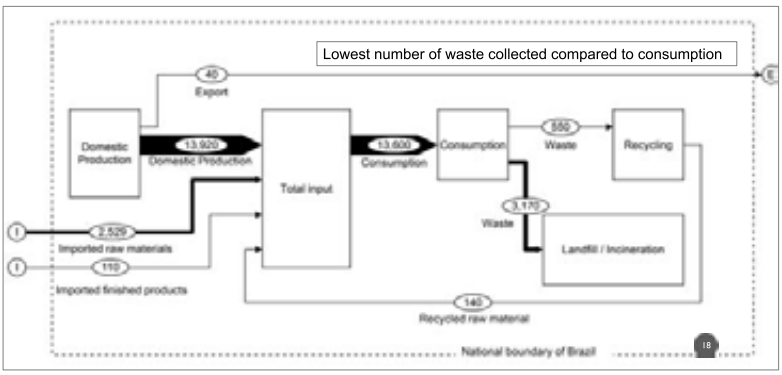
SUP packaging MFA of Brazil



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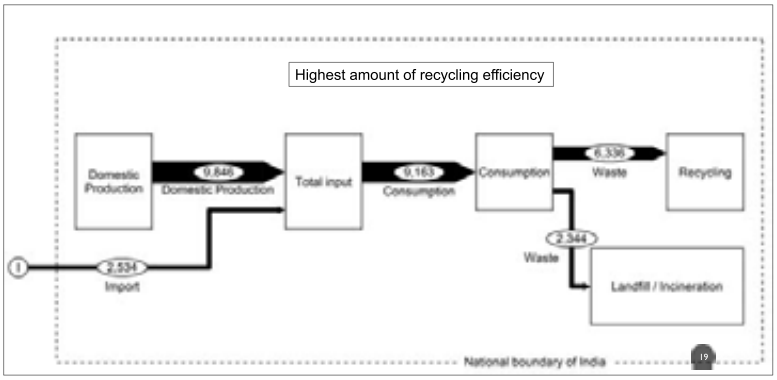
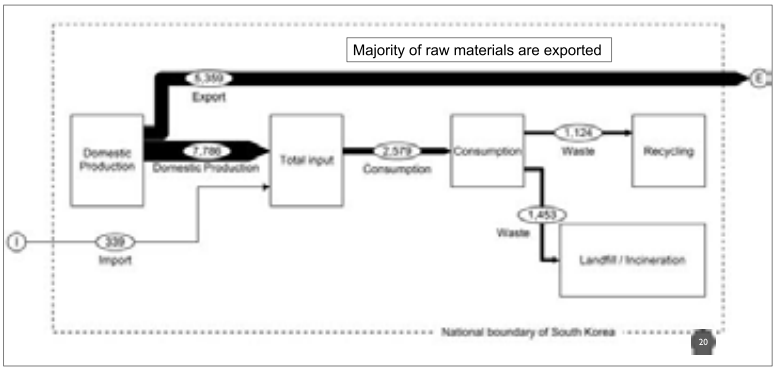
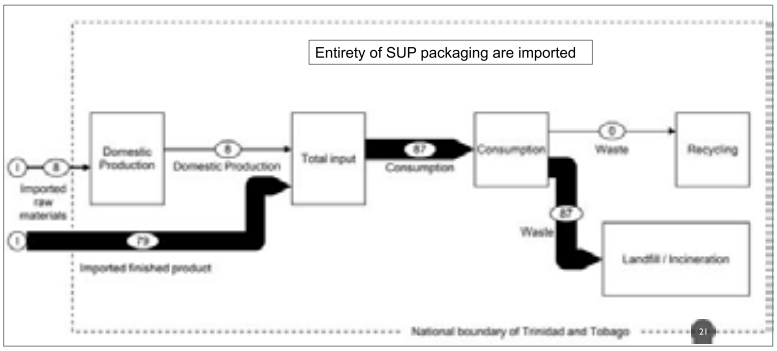
SUP packaging MFA of India



SUP packaging MFA of South Korea



SUP packaging MFA of Trinidad and Tobago



POLICIES AND RECOMMENDATIONS

Policies found from the literature reviewed

Country/ Region	Policies implemented
China	Bans on packaging, waste import, monitoring plastics life cycle
Japan	Prohibit free shopping bags, targets to reduce production, improve recycling, include substitute materials for packaging
India	Establishment of plastic parks, draft for Waste Management Rules 2021 proposed, stricter enforcement of ERP
Trinidad & Tobago	Ban on PS, recycling targets set, using LDPE as a fuel replacement
South Korea	None mentioned in paper, high portion sent to landfill
Brazil	None mentioned in paper, high portion of uncollected waste and landfill
US	None mentioned in paper, have targets mentioned in other literature
EU	None mentioned in paper, have targets and directives mentioned in reports

Ellen McArthur Foundation and plastics

Year	Title of report	Published by	Highlighted policies and remark
2016	The New Plastics Economy Rethinking the future of plastics	The World Economic Forum	Put forward the vision of "The New Plastics Economy",
2018	SINGLE-USE PLASTICS A Roadmap for Sustainability	United Nations Environment Programme	1. Looked at achievements on national and sub-national levels to curb the consumption of single-use plastics 2. offers a 10-step roadmap
2020	Turning the tide on single-use plastics	European Commission	Directive to combat major single-use plastics by implementing new rules

THANKS

MICROBIOME PROFILING AND FUNCTIONAL ANALYSIS OF THE BURIGANGA RIVER SEDIMENT IN DHAKA, BANGLADESH, USING WHOLE-GENOME METAGENOMICS

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Keywords: *Buriganga River pollution, Sediment, Whole Genome metagenomic sequencing, Microbial community, Antibiotic resistance genes (ARGs)*

1. INTRODUCTION

The Buriganga river is the lifeline of Dhaka city, the capital of Bangladesh. Pollution from various anthropogenic and natural sources has contaminated its water and sediment. Sediment is an important exchange matter and carrier in river systems which promotes the migration of adsorbed pollutants and microorganisms, both of which have a significant influence on the river ecosystems. Understanding how nutrient and pollutant availability affects microbial communities in sediments is crucial for predicting future environmental change responses[1].

2. MATERIALS AND METHODS

In this study, 11 samples from different points of the Buriganga river sediment were collected and 4 of the samples underwent whole-genome metagenomic sequencing and were analyzed by using different bioinformatic tools to reveal the microbial community.

3. RESULTS

Taxonomic profiling showed bacterial community dominated the population (90-93%), followed by eukaryotes (3-7 %), archaea (3-4 %), and DNA viruses (<1%).

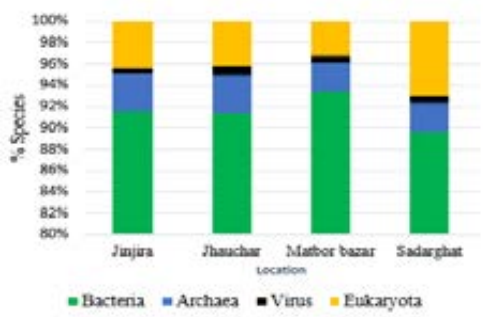

Figure 1: Relative abundance of microbial community

The functional analysis revealed a wide variety of pathways involved in metabolism, signal transduction, cellular processes, etc.

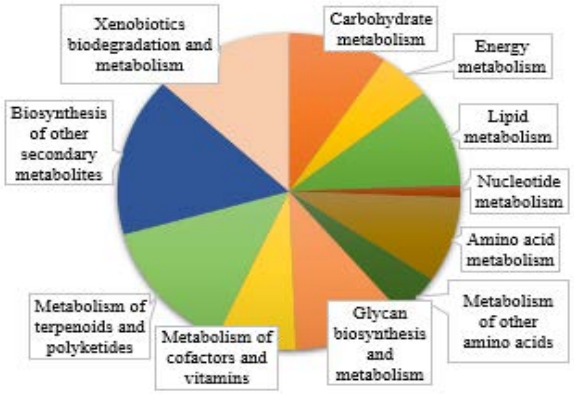

Figure 2: Major metabolic pathways in microbiome

Resistance profiling found 16 different classes of ARGs with a higher abundance of sulfonamide, tetracycline, macrolide, and aminoglycoside resistance genes.

4. CONCLUSION

This pioneering study represents valuable insights into the Buriganga river's sediment microbial community and could be instructive for the ongoing efforts to clean up the Buriganga River.

REFERENCES

[1] F. Zhang *et al.*, "Different response of bacterial community to the changes of nutrients and pollutants in sediments from an urban river network," *Frontiers of Environmental Science & Engineering*, vol. 14, Apr. 2020, doi: 10.1007/s11783-019-1207-3.

MICROBIOME PROFILING AND FUNCTIONAL ANALYSIS OF THE BURIGANGA RIVER SEDIMENT IN DHAKA, BANGLADESH, USING WHOLE-GENOME METAGENOMICS

Presented by –Nayeema Talukder Ema
Co-authors: M.R.I. RANGA, O. SAHA, and M.M. RAHAMAN
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University of Dhaka
Dhaka -1000, Bangladesh

The Buriganga River

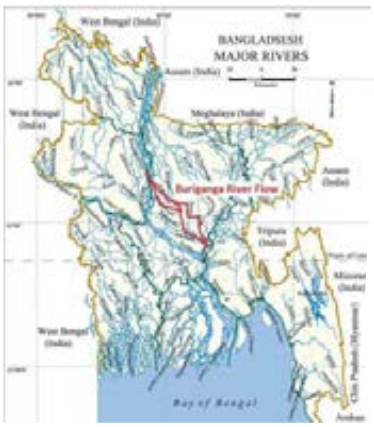


Figure : Map of Bangladesh with major rivers ((*Buriganga River - Banglapedia*, 2022)

Pollution In The Buriganga river

Figure : Different points of the Buriganga river

Study Objectives

- To Identify The Microbial Composition And Their Functional Profiling Through Whole-genome Metagenomic Approach
- To Investigate The Resistance Genes Present Among The Community

DNA extraction

Genomic DNA extracted by DNeasy PowerSoil Pro Kit

Quality control and trimming

Raw reads were checked and trimmed

1 2 3 4 5

Sample collection

Sediment from 11 different points of the Buriganga river was collected

Whole genome metagenomic sequencing

4 samples were sent for WMS

Taxonomic and Functional profiling

The abundance of Bacteria, Eukarya, Archaea and DNA viruses was estimated and metabolic capacity, resistance genes were analyzed

Workflow

Sample collection sites

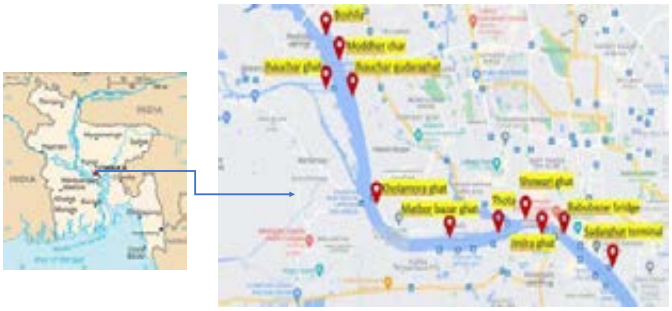
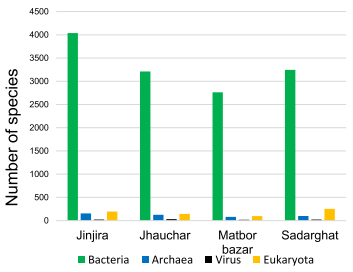
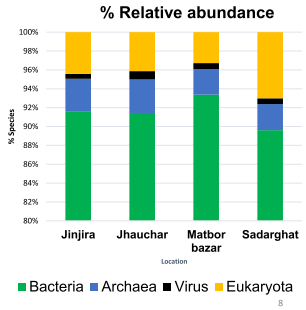


Figure : The study area in the Buriganga River, Dhaka, Bangladesh

Sediment Microbial community analysis through Whole genome Metagenomics

Taxonomic composition of sediment microbiome





Bacterial composition

- Proteobacteria
  - 46.65%
- Actinobacteria
  - 24.78%
- Firmicutes
  - 13.19%
- Bacteroidetes
  - 6.65%
- Cyanobacteria
  - 2.40%

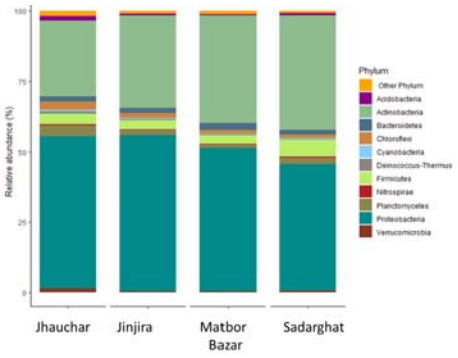


Figure : The Relative Abundance of Bacterial Phyla Present In The Community

Archaeal composition

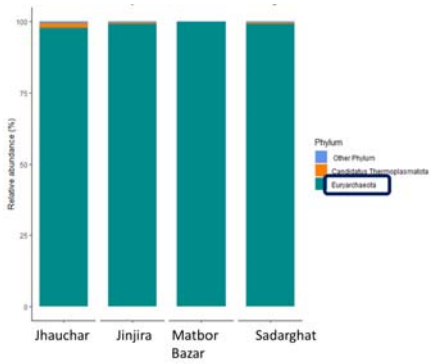


Figure : The Relative Abundance of Archaeal Phyla Present In The Community

Composition of the Eukaryotes

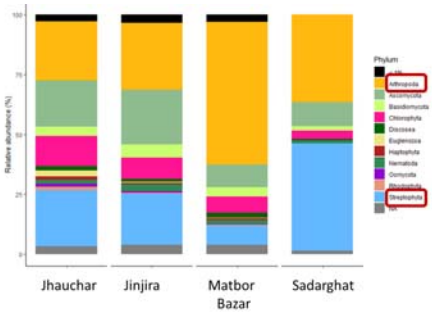
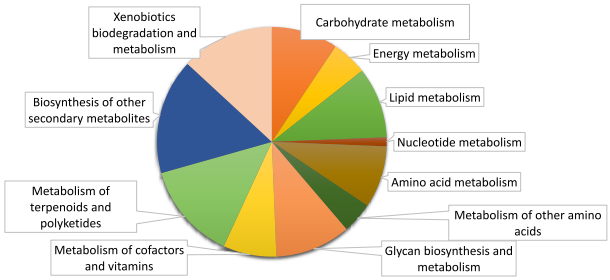


Figure : The Relative Abundance of Eukaryotic Phyla Present In The Community

Metabolic pathways in the microbiome



Antimicrobial resistance profiling

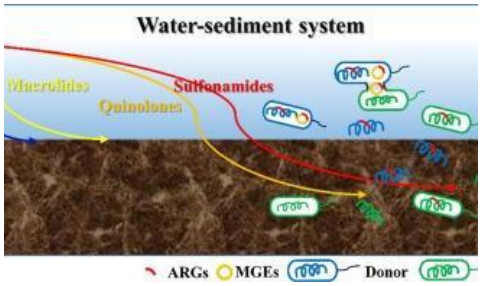


Figure : Antibiotic Resistance Genes in water- sediment system (Deng et al., 2020)

Classes of Antibiotic Resistant Genes

- 16 different classes of antibiotic resistant genes were identified

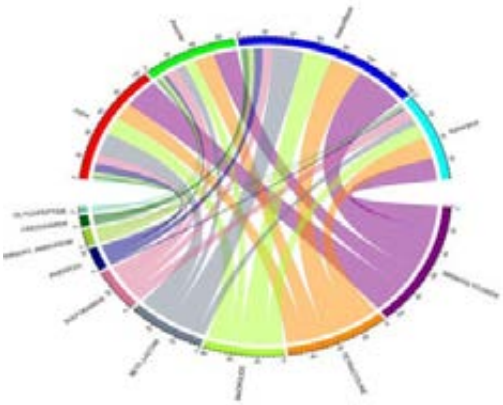


Figure : 1st 9 out of 16 most abundant ARG classes are shown

Antibiotic Resistance Genes

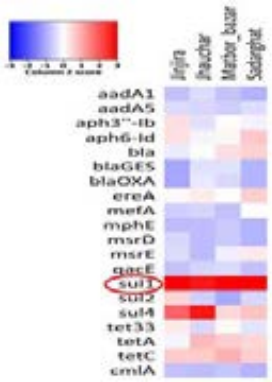


Figure :Heatmap showing relative abundance of top 20 antibiotic resistance genes

Concluding remarks

A diverse microbial population, Bacteria (5346 Species), Archaea (215 Species), Eukaryotes (512 Species), And Virus (77 Species). It is to be noted only DNA virus community was estimated

Several important antimicrobial resistance genes were found

These findings provide valuable insight into the Buriganga river's microbial community which will aid future bioremediation efforts in this polluted river

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- Deng, C., Liu, X., Li, L., Shi, J., Guo, W., & Xue, J. (2020). Temporal dynamics of antibiotic resistant genes and their association with the bacterial community in a water-sediment mesocosm under selection by 14 antibiotics. *Environment International*, *137*, 105554. https://doi.org/10.1016/j.envint.2020.105554

Thank you

HISTORICAL ANALYSIS OF SELECTED ECOSYSTEM FUNCTIONS IN THE CO-MANAGED FOREST PROTECTED AREAS AND BIO-DIVERSE NON-CO-MANAGED FOREST AREAS OF BANGLADESH USING MODIS REMOTELY SENSED DATA

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[2]*Natural Resources Institute Finland (Luke), Paavo Havaksen tie 3, 90570 Oulu, Finland*

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***Keywords**: ecosystem functions, remote sensing, co-management, reserve forest, VCF, homestead forest.*

BACKGROUND

This study analyzed four ecosystem functions via MODIS remote sensing data in the four co-managed forest protected areas (CFPA) and two bio-diverse non-co-managed forest areas (BNCFA) from 2002 to 2021. Ecosystem functions and their indicators such as NPP, GPP, LST, EVI, LAI, NDVI, ET, PET and FPAR in CFPA and BNCFA were assessed.

METHOD

Figure 1. Method of the study

RESULTS

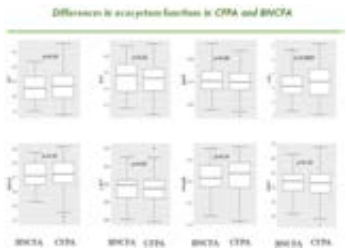


Figure 2. Difference in ecosystem function

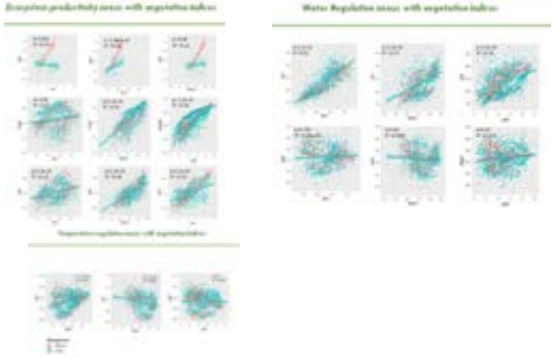


Figure 3. Ecosystem functions with vegetation indices

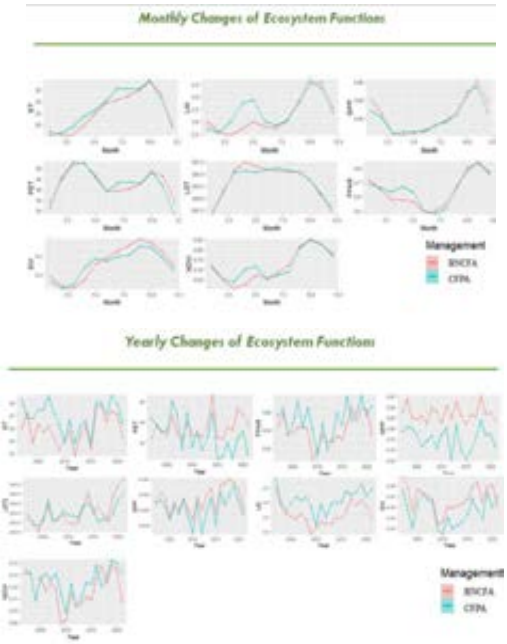


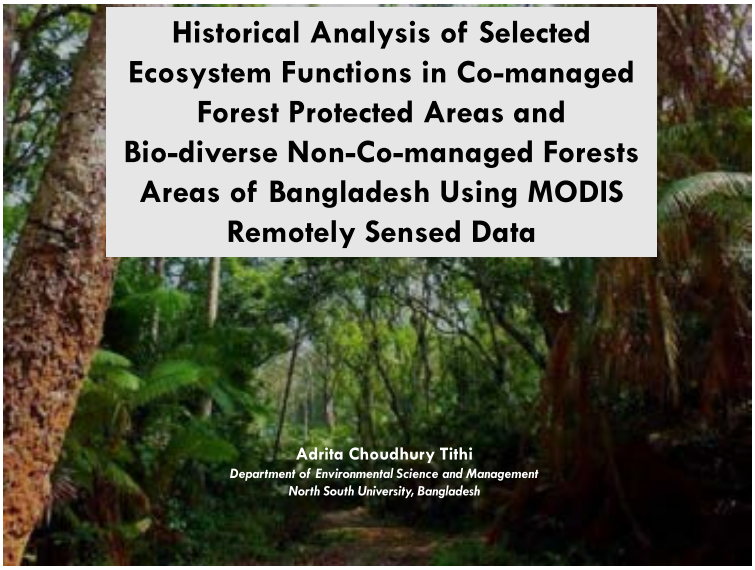
Figure 4: Temporal changes in the ecosystem functions.

CONCLUSION

No such major evidential difference in majority of the ecosystem parameters was observed between the CFPAs and BNCFAs management regimes. Recently, most of the parameters show a deteriorating state in both CFPAs and BNCFAs of Bangladesh. Re-evaluation of management regimes may be shifting some of the practices of BNCFAs to CFPAs as best practices. Further study of the ecosystem functions would be helpful.

REFERENCE

[1] Subroto, S., Caudra, M., Rashid, A. Z. M. M., & Bartholdson, O. J. Sust. For. (2021) https://doi.org/10.1080/10549811.2021.1941121.



Historical Analysis of Selected Ecosystem Functions in Co-managed Forest Protected Areas and Bio-diverse Non-Co-managed Forests Areas of Bangladesh Using MODIS Remotely Sensed Data

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Background and Justification

- Forest ecosystems are being damaged and degraded rapidly because of anthropogenic activities;
- To protect forest habitat protected areas (PAs) and concepts like co-management have been introduced (Rashid et al. 2017);
- Biodiverse non-co-managed forest areas (i.e. reserved forest, VCF, homestead forests and other land uses) are also degrading (The Daily Star 2022);

Background and Justification

- Ecosystem functions are key processes through which an ecosystem generates services;
- Understanding ecosystem functions is crucial to understand forest health;
- To assess ecosystem functions studies mostly investigate indicators such as evapotranspiration, net primary productivity, gross primary productivity, leaf area index, etc.

Remote sensing application of ecosystem functions

- Remote sensing provides well quantified, high temporal and spatial data which can play significant, evidential role in the decision-making process (Lock et al., 2021);
- New innovative technologies such as information product - Remote Sensing-enabled Essential Biodiversity Variables (EBVs) help in monitoring ecosystem (Pettorelli et al. 2016; 2017)
- MODIS is one of the most widely applied images in ecology and conservation studies;

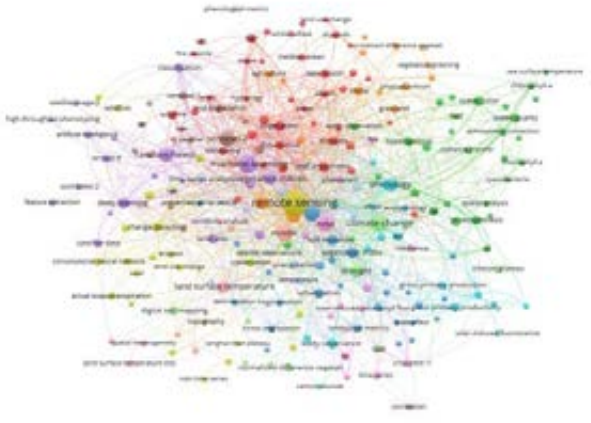


Fig. 1. MODIS remotely sensed images application in ecosystem studies.
Source: Scopus database [Key words: MODIS AND image* AND (ecosystem function)], Time period: 2015-2022].

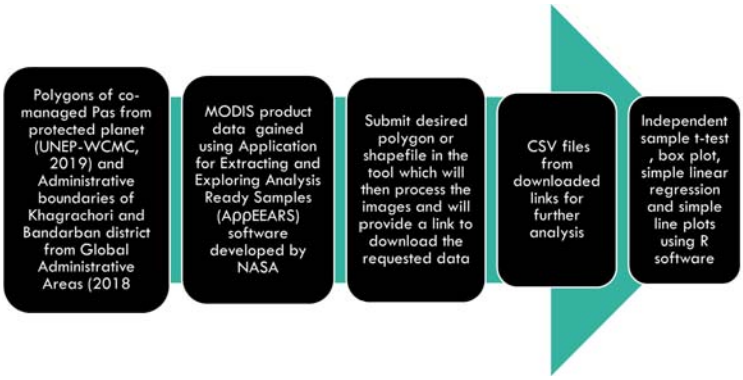
Study Area

Protected areas	Ecosystem	Area (km^2)	Time of Designation	Co-management Declaration	Location
Satchori National Park	Mixed Evergreen	2.43 km^2	2005	2005	Habigonj
Lawachara National Park	Mixed Evergreen	12.5 km^2	1996	2003	Moulvibajar
Rema kalenga Wildlife sanctuary	Tropical evergreen and semi ever green	17.95 km^2	1980	2003	Habiganj
Chunati Wildlife Sanctuary	Tropical semi evergreen	77.63 km^2	1986	2003	Chittagong
Khagrachori district	Tropical Wet Mixed	4,479 km^2	-	-	Khagrachori
Bandarban district	Tropical Evergreen and Semi Evergreen	2,749 km^2	-	-	Bandarban

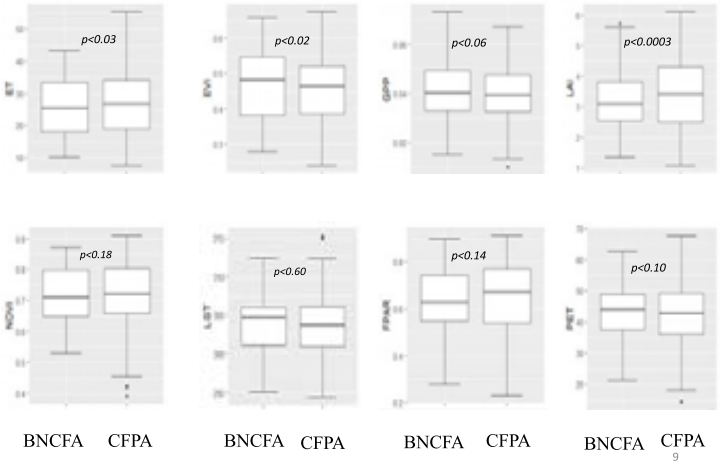
Selected Ecosystem Functions

Ecosystem Functions	Indicators	Products	MODIS product resolution	Units
Water Regulation	Evapotranspiration	MOD16A2.061	500m	kg/m^2
	Potential Evapotranspiration	MOD16A2.061	500m	kg/m^2
Temperature regulation	Land Surface Temperature	MOD21A2.061	1km	Kelvin
	Land Surface Temperature	MOD11A2.061	1km	Kelvin
Ecosystem productivity regulation	Gross Primary Productivity	MOD17A2H.061	500m	kg C/m^2
	Net primary Productivity	MOD17A3HGF.061	500m	kg C/m^2
	Fraction of Photosynthetically Active Radiation	MOD15A2H.061	500m	Percent
Biomass and carbon regulation	LAI (Leaf Area Index)	MCD15A2H.006	500m	m^2/m^2
	Enhanced Vegetation Index (EVI)	MOD13A1.061	500m	Unit less
	Normalized difference vegetation index (NDVI)	MOD13A1.061	500m	Unit less

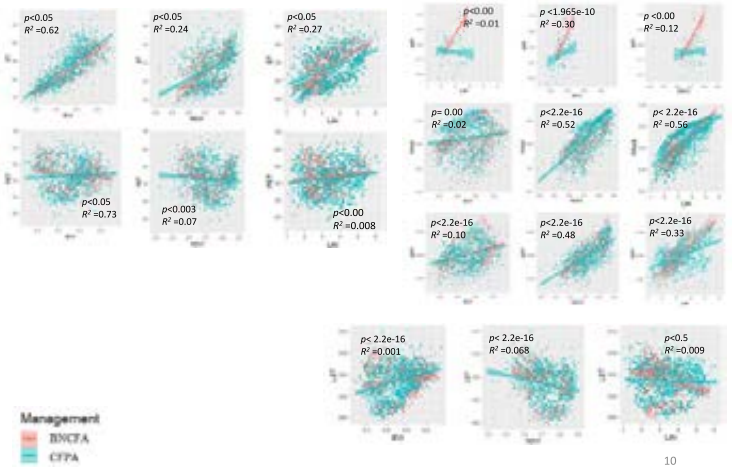
Method



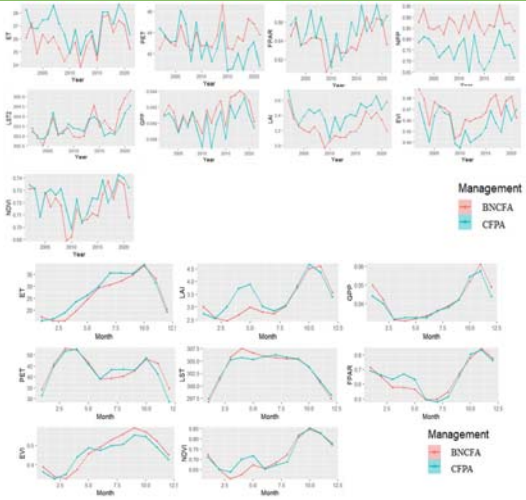
Results *Differences in ecosystem functions in CFPA and BNCFA*



Results *Ecosystem functions nexus with vegetation indices*



Results *Temporal Changes of Ecosystem Functions*



Take home message

- In this study, no such major evidential difference in majority of the ecosystem parameters was observed between the CFPAs and BNCFAs management regimes.
- Even in some cases like the vegetation health and density is in better condition in the BNCFAs.
- CFPAs have not been as efficient and effective compared to the attention given to them.
- (BCNFAs) face challenges which make the conservation and protection of the ecosystem tougher.
- Over the months and years, through many ups and downs, majority of the parameters show a deteriorating state in the recent years in both CFPAs and BNCFAs of Bangladesh.

Take home message

- The Government needs to focus more on the BNCFAs in terms of management, strategies and investment.
- The necessity of re-evaluating the management regimes, may be shifting some of the practices of BNCFAs to CFPAs as best practices.

Thank You Very Much

SPATIO-TEMPORAL CHANGES OF AMBIENT NO2 DURING COVID-19 LOCKDOWNS IN CHINA

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***Keywords**: NO2; COVID-19; air pollution; remote sensing*

1. GENERAL INSTRCUTIONS

Air pollution have been one of the major health affecting factors around the globe. In China, air pollution mostly comes from the high percentage of coal in energy structure, industrial activities and automobile exhaust of cars. During the lockdown policies implemented to restrict COVID-19 spreading from 2020 to 2022 in China, these activities are more and less restricted. Under this situation, it is expected that a decrease in air pollutants caused by human activities will be observed.

Previous research (1) has shown a global trend of decreasing NO2 concentration during the first 4 months of the covid breakout in 2020. However, the concentration changes of other air pollutants, and the effect of lockdown policies in 2021 and 2022 are relatively less analyzed. This study aims to analyze the change in air pollution patterns during the COVID-19 affected time period in several cities in China using satellite data retrieved from the aura satellite's Ozone Monitoring Instrument and the policy stringency retrieved from the OxCGRT database (2). 13 Cities are selected based on different altitudes and latitudes, population and emission composition as the studing area.

Table 1. Selected cities for studying

city	major emission source	latitude	longitude
Harbin	industry	45.75	126.63
Ulumuti	industry	43.36	88.31
Beijing	industry	39.56	116.2
Yinchuan	power	38.49	106.25
Zhengzhou	transportation	34.75	113.63
Xi'an	transportation	34.34	108.94
Nanjing	industry	32.05	118.77
shanghai	industry	31.11	121.29
Wuhan	industry	30.58	114.28
Chongqing	transportation	29.4	106.54
Changsha	industry	28.23	112.94
Shenzhen	transportation	22.54	114.06
Hongkong	power	22.27	114.16

2. RESULTS

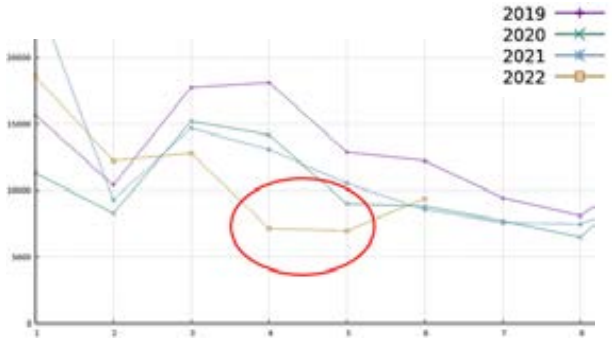

Figure 1. NO2 concentration of Shanghai from 2019 to 2022 (partial). The circled data (April to May) showed a significant decrease.

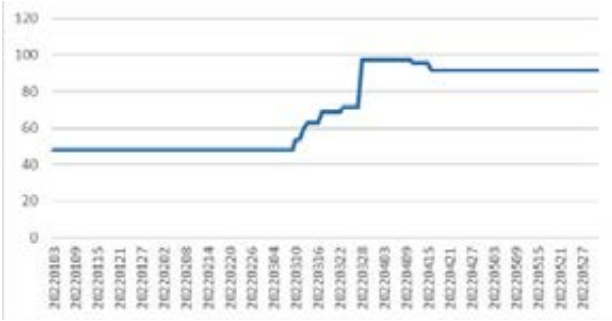

Figure 2. There is a significant increase in Shanghai's policy stringency from April to May in 2022.

3. CONCLUSIONS

In Shanghai, the observed significant decrease in NO2 concentration could reflect the large-scale lockdown event in 2022. However, this could not be applied to all the other cities, especially those with less policy strength. The trend of NO2 concentration needs to be examined in the future to find the significant points and analyze the effect of lockdown policy on them.

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[1] Cooper, M.J., Martin, R.V., Hammer, M.S. et al. Global fine-scale changes in ambient NO2 during COVID-19 lockdowns. Nature 601, 380–387(2022).

[2] Hale, T., Angrist, N., Goldszmidt, R. et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav 5, 529–538 (2021).

Spatio-temporal changes of ambient NO2 during COVID-19 lockdowns in China

FEIFAN HUANG

1.Introduction

Air pollution: contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere.

Common pollutants include NOx, SO2, PM2.5 and others. Air pollutants cause haze, acid rains, and breathing difficulties for humans. This study will focus on analyzing NO2.

China has fossil fuels as the major energy supply which results in large scale air pollution in the 21st century.

Historical examples have shown that restriction on activity (traffic and industrial activities) cause drop in NO2 in a short period of time.

1.Introduction

COVID-19 outbreak in Wuhan quickly spread due to Spring festival traveling.

Wuhan City was locked down on 23 January 2020, and within ten days, most of the provinces in mainland China implemented strict restrictions over transportation and production activities.

After the re-opening of most cities in April 2020. China continued to apply a rather strict policy against covid in the following 2 years.

Recent lockdowns: Shanghai in 2022 from March to June.

Objective

1) Find out if there is noticeable variations in the NO2 concentration after the COVID breakout in 2020.

2) Determine whether these variations could be related to lockdown policy implemented in each city.

2.methods

Data acquire:

Used satellite data that could cover a large spatial scale in detail.

Aura-OMI: started from 2005, 13km x 24km resolution

With a longer time for the data, it is possible to analyze pattern on a long timescale and reduce inaccuracy in trend decomposition.

Collected data for 13 cities in China from 2004 to 2022.

Study area

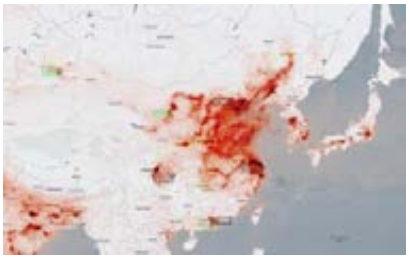
City list	major emission source	Population (million)	Latitude	longitude
Harbin	industry	10-15	45.75	126.63
Ulumuti	industry	<5	43.36	88.31
Beijing	industry	>15	39.56	116.2
Yinchuan	power	<5	38.49	106.25
Zhengzhou	transportation	10-15	34.75	113.63
Xi'an	transportation	10-15	34.34	108.94
Nanjing	industry	10-15	32.05	118.77
shanghai	industry	>15	31.11	121.29
Wuhan	industry	10-15	30.58	114.28
Chongqing	transportation	>15	29.4	106.54
Changsha	industry	10-15	28.23	112.94
Shenzhen	transportation	>15	22.54	114.06
Hongkong	power	10-15	22.27	114.16

Study area

Mega cities(population 15M+, black): Beijing, Shanghai, Chongqing, Shenzhen

Large cities(population between 10M-15M, yellow):Harbin, Zhengzhou, Xi'an, Nanjing, Wuhan, Changsha, Hong Kong

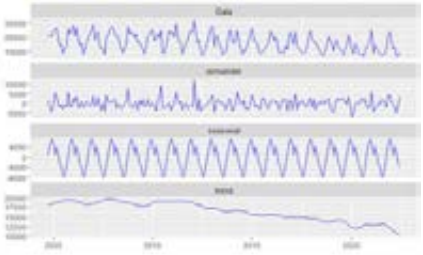
Small cities(population less than 5M, green): Urumqi, Yinchuan



STL decomposition

Seasonal and trend decomposition using loess (STL) is a method that can decompose time-series data in to three components: seasonal, trend and residual.

Primarily useful for studying time series data, and exploring historical changes over time, but can also be applied in forecasting.



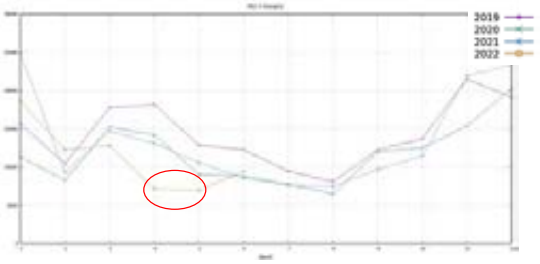
3.results-general trend

In general, trends of NO2 concentration in China can be separated into three regimes:

ground-level concentrations increased in China from 2005–2010, plateaued from 2010–2013, and decreased from 2013–2019. This change was driven by stricter vehicle and power generation emission standards(Cooper.et.al, 2022).

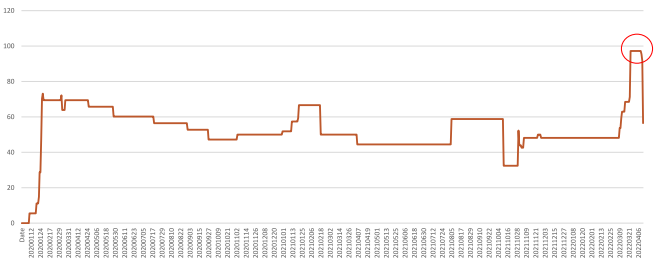
A trend of decreasing NO2 concentrations after around 2013 could be observed in most cities in China with a few exceptions(Hongkong, Wuhan)

Regional case-Shanghai



Plotted graph of NO2 concentration in Shanghai from 2019 to 2022

Policy strength in Shanghai



Month of highest stringency index for each city

yellow: 2020 spring
blue: 2021 summer
Green: 2022 spring

city	1st highest time period	2nd highest period	3rd highest period
Shanghai	2022/04 (97.22)	2020/02 (73.15)	
Beijing	2022/05 (84.26)	2020/03 (78.7)	2020/06-07 (77.78)
Ulumuqi	2021/10-2021/12 (81.94)	2020/02 (79.17)	2020/12 (75.46)
Chongqing	2020/03 (71.3)		
Harbin	2020/02 (87.96)	2022/03 (81.94)	2021/02 (78.30)
Shenzhen	2020/04 (79.63)	2022/03 (78.24)	
Zhengzhou	2020/02 (87.04)	2021/08 (74.54)	2022/04 (74.54)
Wuhan	2020/02 (89.81)	2021/08 (75.93)	
Changsha	2020/02 (81.48)	2021/08 (76.39)	
Nanjing	2020/02 (83.33)	2021/08 (79.17)	
Yinchuan	2020/02 (86.11)		
Xi'an	2022/04 (87.5)	2022/01 (79.17)	2020/02 (77.78)
HongKong	2022/03 (75)	2020/12-2021/06 (71.3)	

Stringency of over 70% is considered as strict lockdown being applied

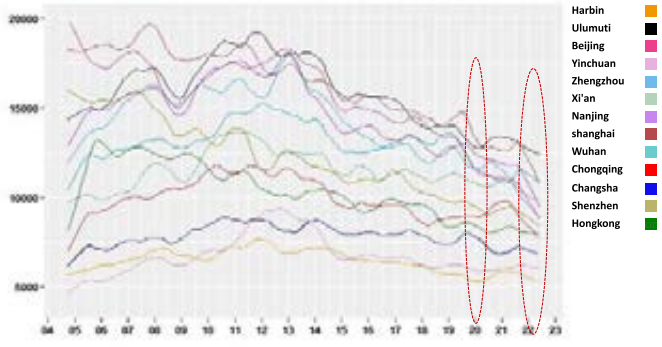
General pattern of trends

All the cities analyzed reflected a strong influence of the 2020 lockdown illustrated by a drop in the trend and strong negative residuals.

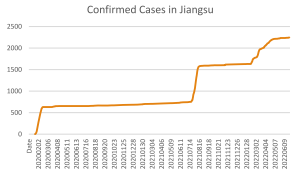
Apart from Wuhan who experienced the most significant decreasing trend, other cities significantly affected by the 2020 lockdown included Shanghai, a mega city, and Changsha which is close to Wuhan.

There are also several cities that experienced an uplifting trend after the lockdown period in 2020. However, the overall decreasing trend resumed for all the cities eventually.

Trend of NO2 in Wuhan



Relationship with confirmed cases



Similar relationship is observed in Changsha, but not in other cities

Conclusions

The trend of NO2 concentration can reflect the lockdown situation during the corona virus breakouts in some degrees by roughly corresponding to the first large scale breakout in 2020 and the second large scale breakout in 2022.

However, further examination needs to be taken to determine whether this is a result of the original trend of decreasing air pollution in China, or a result of covid. The residual data needs to be also taken into consideration.

Cities that are less populated(Wulumuqi and Yinchuan) showed less scale of decrease in trend compared to populated cities.

reference

[1] Cooper, M.J., Martin, R.V., Hammer, M.S. et al. Global fine-scale changes in ambient NO2 during COVID-19 lockdowns. Nature 601, 380–387(2022).

[2] Hale, T., Angrist, N., Goldszmidt, R. et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav 5, 529–538 (2021).

Thank you for listening

TIME SERIES HORIZONTAL SURFACE DISPLACEMENT AND SEISMICITY SCENARIO IN AND AROUND SAGAING FAULT FOR THE LAST 20 YEARS

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***Keywords**: Sagaing Fault, Horizontal Displacement, Sub-pixel Correlation, Optical Image, Vector Field*

1. BACKGROUND

The Sagaing fault is a north-south striking right-lateral strike-slip fault with active horizontal motion historically associated with large earthquakes [1]. Earthquake produces horizontal surface displacements and there remain several techniques for measuring horizontal surface displacement. It can be observed by field surveys or GPS measurements. Although GPS measurements provide both vertical and horizontal information of deformation, continuous scenario is not attainable due to low spatial density of GPS stations and these methods frequently lack details [2]. As a result, these techniques are not very efficient approaches for determining the horizontal surface displacement. Optical images can be used to determine horizontal surface displacement using sub-pixel correlation technique. Horizontal surface displacement may be best assessed by the time series sub-pixel correlation of multiple number of optical images.

2. METHOD

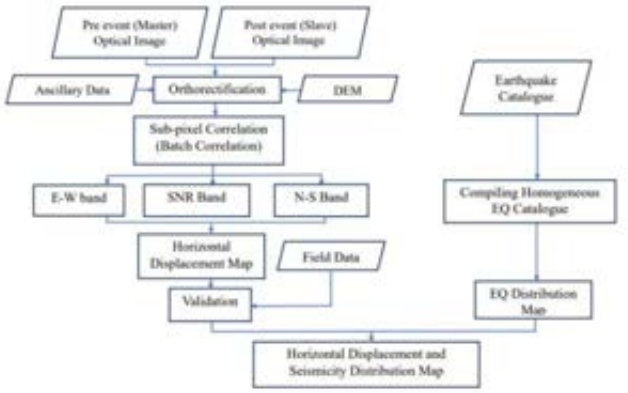

Figure 1. Methodological Framework for this Study.

3. RESULT

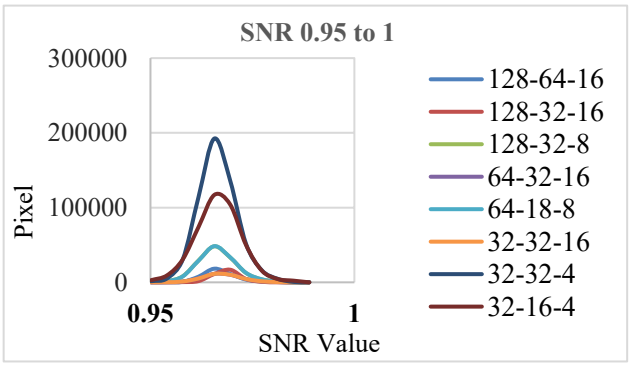

Figure 2. Signal to Noise Ratio (SNR) Value.

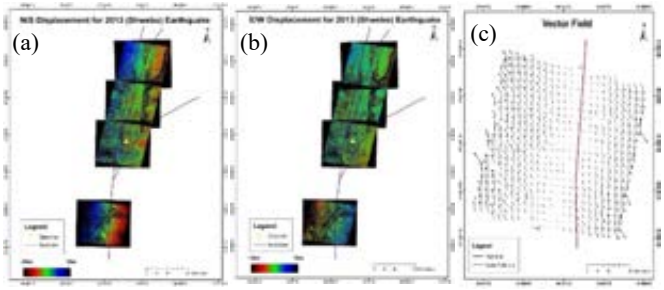

Figure 3. shows (a) N/S displacement, (b) E/W displacement (c) Vector field for 2013 Shwebo earthquake.

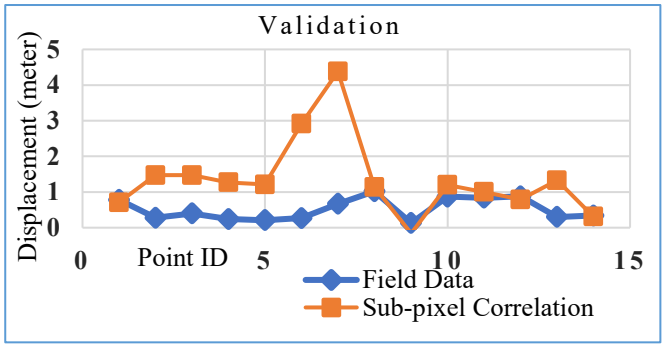

Figure 4. Validation of the Result obtained in this Study.

4. CONCLUSIONS

The key horizontal surface displacement has been found to be less than two meters, as indicated by the displacement field map. The displacement map shows displacements of less than five meters for the most part. This study has several shortcomings that need to be addressed. A higher resolution may improve the final product's quality. The temporal gap between all pre-event images and respective post-event images is a major limitation. Most images used for sub-pixel correlation have cloud coverage, causing temporal decorrelation. Also, changes in vegetation cover, objects relocation, and the presence of several water bodies contributed to the lack of coherence and poor correlation. Though, the precise amount of displacement is difficult to interpret, the purpose has been accomplished and the research questions have been addressed.

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Time Series Horizontal Surface Displacement and Seismicity Scenario in and around Sagaing Fault for the Last 20 Years

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Department of Disaster Science and Climate Resilience
University of Dhaka

Background of the Study

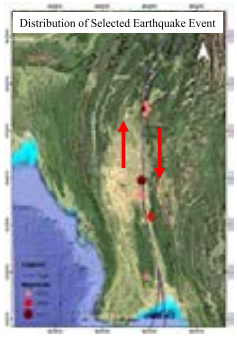
- Sagaing fault: one of the most active strike-slip faults
- Very active horizontal motion in and around Sagaing fault
- Sub-pixel correlation of optical image for horizontal surface displacement measurement
- COSI-Corr for determining the horizontal surface displacement
- Seismicity scenario for the horizontal surface displacement

Research Objective

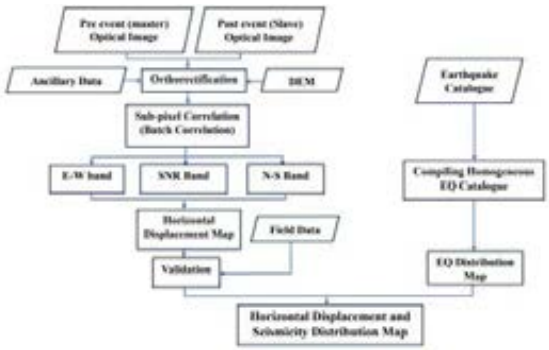
- To derive the time series horizontal surface displacement from the sup-pixel correlation of optical images for the last 20 years.
- To validate the horizontal surface displacement result with GPS measurement/field observation data.
- To map the earthquake spatial distribution at surface.

Study Area

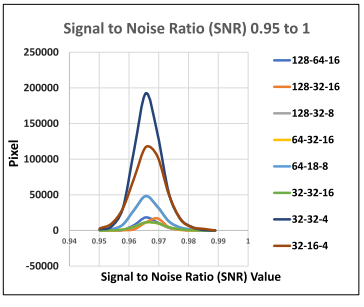
- One of the longest and most active strike-slip faults in the world.
- Strikes north-south through Myanmar into the Andaman Sea.
- Extending about 1200 km between 15°N and 27°N.
- Experienced a large recorded history of seismic activity with very active horizontal motion.

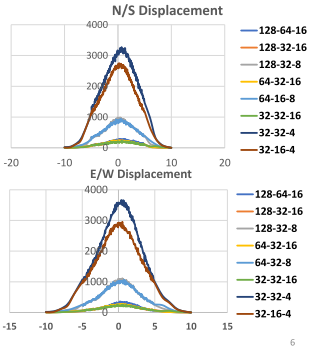


Methodological Framework



Result





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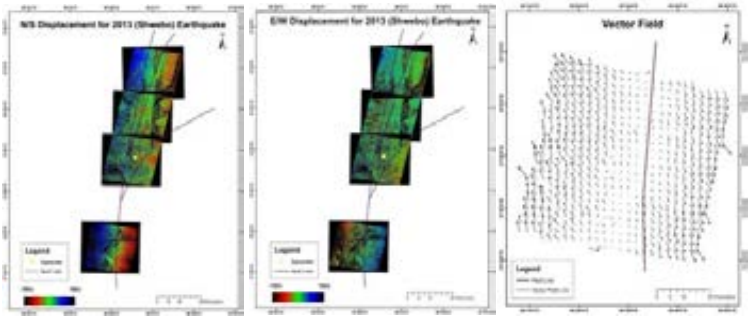
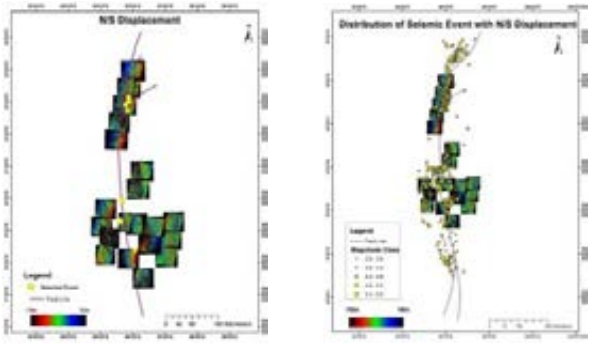
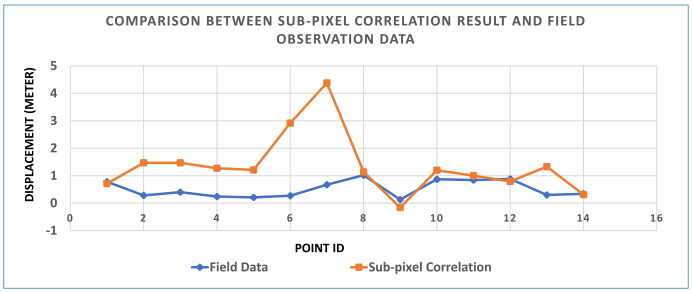


Result



Validation



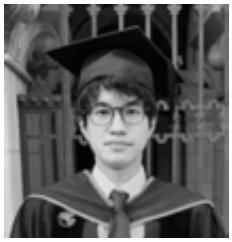
Limitations and Future Scope

- Large temporal gap between images
- Resolution of the satellite images
- Decorrelation due to cloud coverage and other factors

Conclusion

- Key horizontal surface displacement has been found to be less than two meters. The displacement map shows displacements of less than five meters for the most part.
- Small scale mapping of the surface displacement field and seismicity scenario can help to better understand the seismicity scenario in relation to the surface displacement.

Thank you



ESTIMATION OF NIGHTTIME LIGHT DISTRIBUTION IN AN URBAN AREA FOR URBAN ENVIRONMENTAL ASSESSMENT

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Keywords*: Nighttime Light, Urban Environment, Unmixing, Trend Analysis, Developing City*

1. INTRODUCTION

Nighttime Light (NTL) observed from satellites is essential for assessing the urban environment. Previous studies have tried to utilize them to assess socio-economic activities and artificial light's environmental impact [1]. However, it is difficult to identify the source of NTL emission and its reflection from satellite observations alone. This difficulty is a challenge for such applications of NTL. Therefore, to understand the distribution of NTL in urban areas, We study its feature by combining observation and simulations.

The study consists of three steps. 1) Extract the impact of urban areas on NTL from satellite images. 2) Simulate the distribution of NTL using a 3D city model 3) Compare results to demonstrate the extent to which satellites can detect the emission and reflection of NTL in urban areas. In this paper, we explain the first step.

2. METHODOLOGY

The proposed method has two parts: the first is the unmixing. Currently, available NTL image resolution is coarse, and each pixel contains several land cover types. To extract NTL in urban areas from mixed NTL pixels, we use the unmixing method [2]. This method uses high-resolution land cover data to calculate the contribution to NTL for each land cover. The second is trend analysis: We apply the STL decomposition method [3] to unmixed NTL data to isolate the noise and analyze the changes in NTL in urban areas. This method decomposes NTL variations into three components: trend, seasonal, and residual noise. This method enables us to analyze the effects of continuous urban development and seasonal environmental changes on NTL.

3. CASE STUDY

To validate the proposed method, We conducted a case study in Savannakhet, Laos. The region is rapidly urbanizing, and NTL radiance may increase with urbanization. We used the VIIRS product [4] from 2019 to 2021 for NTL data and Copernicus product [5] in 2019 for land cover data.

Figure 1 shows the change in NTL radiance for each land cover. Urban areas produce more NTL than others. In addition, NTL in urban areas shows substantial variation. These trends cannot be seen in mean data without unmixing. This result suggests that the proposed method could extract trends specific to urban areas.

Figure 2 shows the results of STL decomposition focusing on NTL in urban areas.

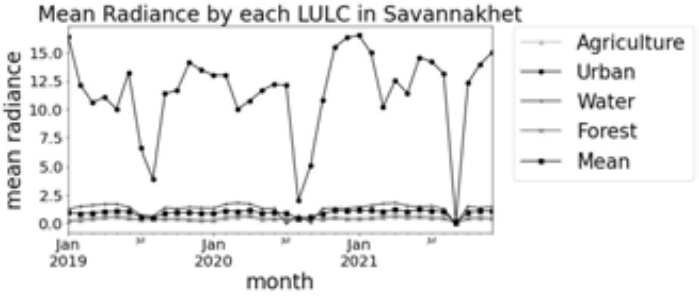

Figure 1. Results of the unmixing method applied to NTL in Savannakhet

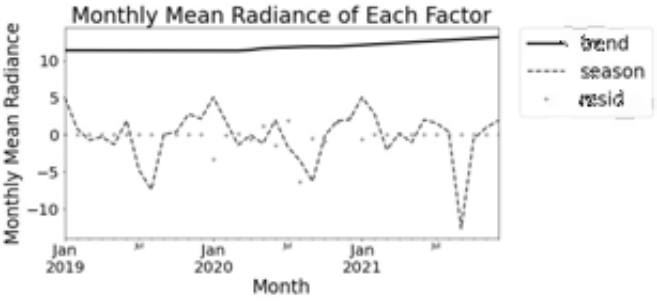

Figure 2. Results of STL decomposition applied to NTL from urban area

The trend component shows an increasing trend. However, the seasonal component shows a cyclical pattern, peaking yearly in summer. These variations are assumed to reflect the trend of urbanization and climate in the target area.

4. CONCLUSIONS

Our proposed method could extract changes in the conditions of the urban area from NTL imagery. This study provides fundamental knowledge in utilizing NTL for urban environmental assessment. We would like to develop our method with simulations for future work.

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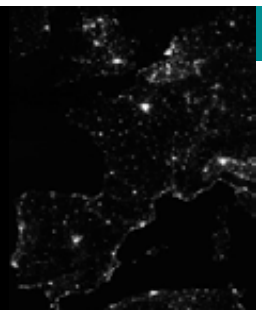
[5] Buchhorn, Marcel, et al. "Copernicus Global Land Service: Land Cover 100m: Version 3 Globe 2015-2019: Algorithm Theoretical Basis Document." (2020)

Estimation of Nighttime Light Distribution in Urban Area For Urban Environmental Assessment



2022/08/04 OHOW Seminar
So Fumiyama
IIS, UTokyo

Background – Rapid Urbanization changing environment

Our current era has been said, “The Century of the City” (Nature, 2020).

- By 2050, more than two-thirds of the human population, are expected to live in urban areas

Urbanization changes many things at Night

- Culture
- Economy
- Environment
  - Light pollution

Fig1：Light Pollution (BBC, 2019)

Background – Nighttime Light, tool for monitoring urban areas

Nighttime light (NTL) images from Satellite are used for monitoring urban areas

- NTL images (Levin et al., 2020)
  - Images capturing light radiated and reflected from the ground at night
  - Much of the nighttime light is derived from human activity
- Characteristics compared to other observation ways
  - Data can be obtained from all over the world
  - Periodic and high frequency

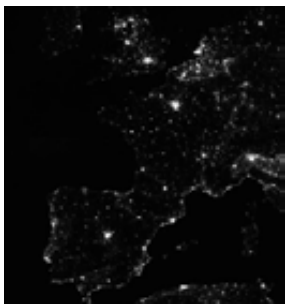


Fig2：Nighttime Light Imagery from satellite

Literature Review – Existing Applications and Limitations

There are limitations of using NTL

- Low resolution and mixing of multiple light sources
  - Such as buildings, factories, street lights, moonlight
- Using sum of NTL as an indicator may cause a misunderstanding about the actual situation in urban areas (Levin et al., 2017)

→ Need to pay attention to the source of the nighttime light

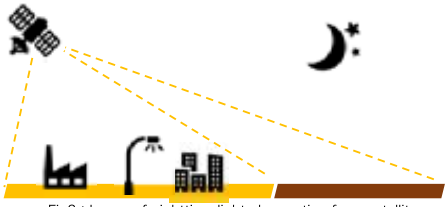


Fig3：Image of nighttime light observation from satellite

Research Objective

Objective

- Estimate the sources and distribution of NTL in urban areas For Urban Environmental Assessment

Method

1. Combine NTL images with higher resolution land cover data to estimate NTL emission per land cover
2. Decompose the NTL data per land cover into a trend factor, a seasonal factor and residuals using time series analysis
3. For each decomposed factor, analyze the relationship between possible factors (e.g. building construction, snow cover, etc.) and NTL variations

Method① - Unmixing

1. Combine NTL images with higher resolution land cover data to estimate NTL emission per land cover

   - Based on a technique called Unmixing (Li et al. 2014)

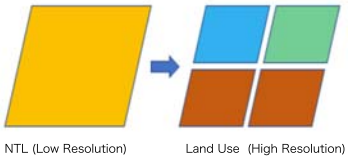


Fig4 : Concept of Unmixing

Method ② - Decomposing

2. Decompose the NTL data per land cover into a trend factor, a seasonal factor and residuals using time series analysis

   - Based on a technique called Seasonal and Trend decomposition using Loess (STL) (RB Cleveland et al. 1990)
   - The overall NTL was decomposed into 3 components, as (total) = (trend) + (season) + (resid)

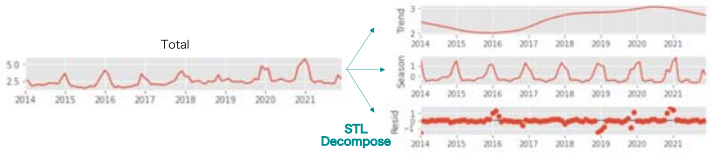


Fig5 : Example of STL analysis

Case study

- Objective
  - Examine proposed method 1 and 2
- Area of Interest (AOI)
  - Savannakhet, Laos
    - One of rapidly developing cities in Asia
- Hypothesis
  - Proposed method will be able to detect the rise in urban lights associated with development.
- Data
  - NTL data from VIIRS
  - LULC data from Copernicus

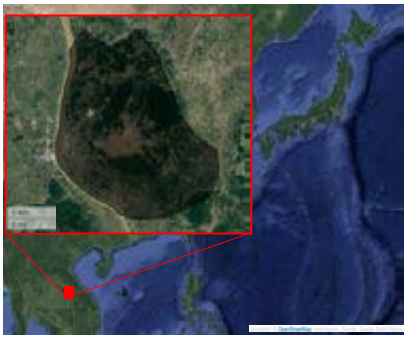


Fig6 : Area of Interest

Result and Discussion ①- Decomposing into LULC

- Much NTL is emitted from the urban area in AOI
- Changes in NTL in the urban area cannot be observed from mean NTL

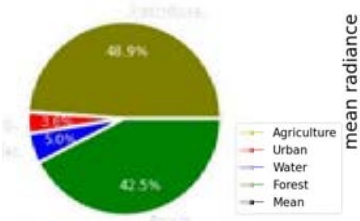


Fig7 : Percentage of each Land Cover in AOI

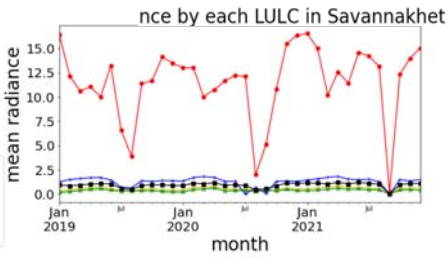


Fig8 : NTL variation by land cover

Result and Discussion ② - Decomposing into trend and seasonal factor

- Apply STL decomposing to examine the NTL from the urban area
- Trend factor of NTL is increasing
  - This is consistent with the continued economic development of AOI
- A seasonal decrease is observed around August each year

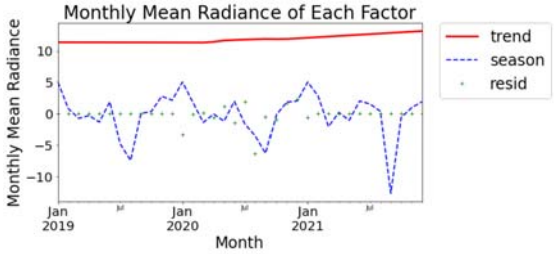


Fig9 : Time variation of each factors of NTL from the urban area

Conclusion

Conclusion

- Nighttime light is an important tool for observing environmental changes in urban area
- This study developed a method to extract the impact of urban areas on NTL from satellite images.
- In the case study, proposed method could extract trends in NTL which suggest urban development

Future Work

- Simulate the distribution of NTL using a 3D city model
- Compare results to check the extent to which satellites can detect the emission and reflection of NTL in urban areas.

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TIME-SERIES ANALYSIS OF LANDCOVER DYNAMICS AND THEIR RELATION WITH COASTLINE MIGRATION ALONG KUAKATA COAST, BANGLADESH USING REMOTE SENSING TECHNIQUES

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***Keywords**: Kuakata; landcover; LULC; DSAS; coastal erosion; coastline migration*

1. INTRODUCTION

Most studies carried out on the changes in the coastline of Bangladesh indicate higher accretion than the erosion of the coasts ruled by estuarine conditions [1]. Kuakata, located at the southernmost tip of the coastline of Bangladesh is a panoramic beach that offers a full view of sunset and sunrise. In 2016, the total gross recreational benefit of this area was estimated to be approximately 29.55 million per year in Bangladeshi Taka [2]. previous studies on this coast suggest that more erosional activities occur along the coastline compared to coastal accretion [3]. However, these studies on the Kuakata coast neither focused on landcover change analysis nor tried concluding the interrelationship between coastline shifting and subsequent landcover changes. But to mitigate the effects of coastal erosion and save the tourism in Kuakata, changes in landcover associated with erosion and accretion need to be explored. The present study aimed to determine whether any distinctive pattern exists relating coastal erosion and landcover dynamics of Kuakata.

2. STUDY AREA

The study area (figure 1) is the coastal region belonging to Lata Chapli and Dhulasar unions of Kalapara upazila in Patuakhali district within Barishal division of Bangladesh.

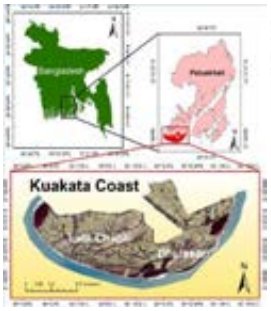

Figure 1. Location of the study area

Figure 2. Methodological framework of the study

3. RESULTS

From 1989 to 2020, 476.0807 hectares of coastal land was eroded away while 302.8112 hectares were accreted in Kuakata.

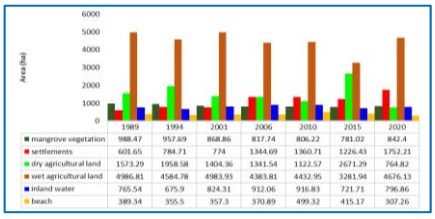

Figure 3. Total area (hectares) covered by land-use types from the year 1989 to 2020

Table 1. Summary statistics of erosion rate calculation

percent of all transects that are erosional	71.78%	percent of all transects that are accretional	28.22%
maximum value erosion (m/year)	-47.67	maximum value accretion (m/year)	23.51
average of all erosional rates (m/year)	-8.03	average of all accretional rates (m/year)	13.04

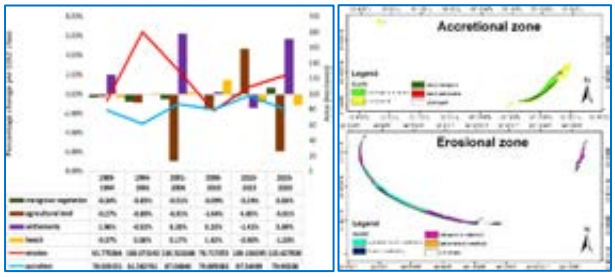

Figure 4. Change analysis of LULC vs. coastline

Figure 5. LULC changes from 1989 to 2020 in the accreted and eroded area

4. CONCLUSIONS

The change detection results give a detailed insight of interclass changes in LULC. Most eroded zones were either mangrove forests, beach or agricultural lands, formerly. Now these areas have changed to waterbodies. Settlements were lost along the western coast due to erosion. Newly accreted lands are mostly shown to be beach, mangrove vegetation or agricultural lands. Study findings suggest that changes in beach and mangrove vegetation classes have significant correlation with coastal erosion-accretion processes.

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August 3-4, 2022

17:00-20:00(JST), 14:00-17:00(BST)

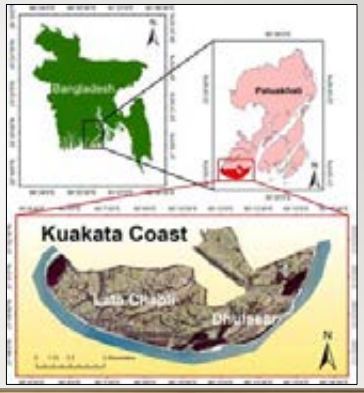
OneHealth OneWorld

Time-series Analysis of Landcover Dynamics and Their Relation with Coastline Migration along Kuakata Coast, Bangladesh Using Remote Sensing Techniques

Presented by **Aishia Fyruz AishI**

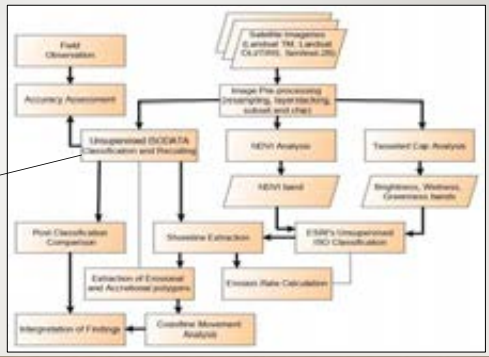
Background

- Highly dynamic coastline of Bangladesh
- Study Area: Kuakata coast
- Total gross recreational benefit = 29.55 million per year in Bangladeshi Taka (M. S. Hossain & Islam, 2016)
- Coastal erosion and salinity intrusion
- Relation between coastal erosion and landcover dynamics

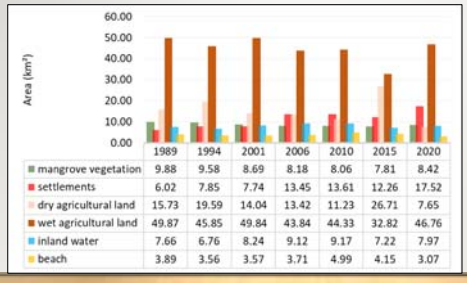


Methodology

1) mangrove vegetation
2) settlements
3) agricultural land
4) waterbody and
5) beach



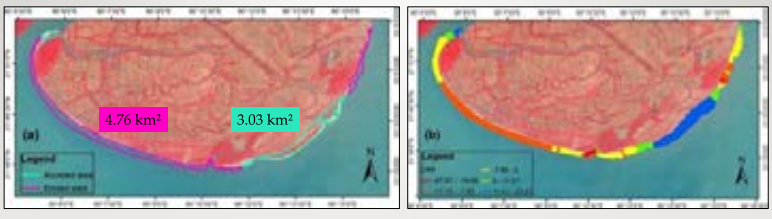
Landcover Classification Results



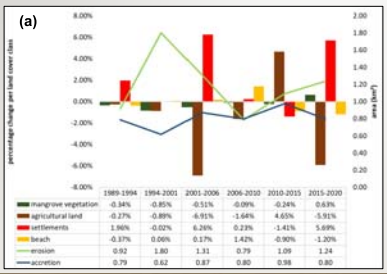
	1989	1994	2001	2006	2010	2015	2020
mangrove vegetation	9.88	9.58	8.69	8.18	8.06	7.81	8.42
settlements	6.02	7.85	7.74	13.45	13.61	12.26	17.52
dry agricultural land	15.73	19.59	14.04	13.42	11.23	26.71	7.65
wet agricultural land	49.87	45.85	49.84	43.84	44.33	32.82	46.76
inland water	7.66	6.76	8.24	9.12	9.17	7.22	7.97
beach	3.89	3.56	3.57	3.71	4.99	4.15	3.07

Overall Accuracy = 83.1%

Linear Regression Rates (LRR)



Relationship between Coastal Erosion and Landcover Dynamics

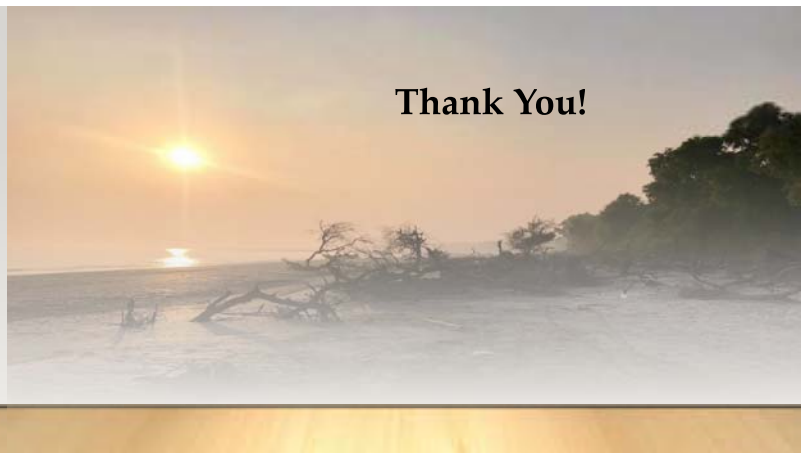


	1989-1994	1994-2001	2001-2006	2006-2010	2010-2015	2015-2020
mangrove vegetation	-0.34%	-0.85%	-0.51%	-0.09%	-0.24%	0.63%
agricultural land	-0.27%	-0.89%	-6.91%	-1.64%	4.65%	-5.91%
settlements	1.96%	-0.02%	6.26%	0.23%	-1.41%	5.69%
beach	-0.37%	0.06%	0.17%	1.42%	-0.90%	-1.20%
erosion	0.92	1.80	1.31	0.79	1.09	1.24
accretion	0.79	0.62	0.87	0.80	0.98	0.80

Conclusion and Future Scopes

- Similar study on the entire coast of Bangladesh
- Appropriate beach protection measures
- Relocation of the tourism industry and future developments





Thank You!

HIGHLY ACCURATE REAL-TIME ESTIMATION OF VOID THICKNESS INSIDE CONCRETE BY SPECTRAL ANALYSIS PATTERN MATCHING OF GPR SIGNAL

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***Keywords**: Non-destructive inspection, GPR, Void thickness, Frequency response, Pattern matching*

1. INTRODUCTION

Damage caused by aging public infrastructure is a growing problem in Japan, and it is necessary to detect internal damage in concrete structures before it surfaces.

One of the non-destructive inspection methods for concrete is the electromagnetic radar method, which is based on the amplitude and intensity of the received signal, called B-mode (Figure 1.)[1]. Since this method is subjective and requires the skill of the person in charge of the inspection, it is desirable to be able to estimate the damage automatically and with high accuracy. Therefore, the objective of this study is to establish an algorithm to estimate the thickness of a void in concrete accurately and in real time.

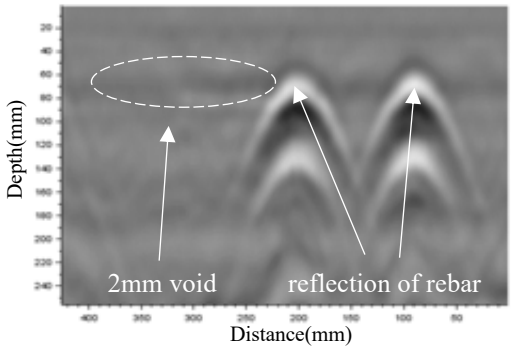


Figure 1. B-mode image by electromagnetic radar

2. ALGORITHM FOR ESTIMATING THICKNESS

As the void thickness decreases, it becomes impossible to distinguish its peak due to the subtractive interference caused by the upper and lower reflected waves. Therefore, we focused on the frequency response because the reflected wave has a frequency dependence depending on the void thickness change[2]. Figure 2. shows the spectrum for different void widths, and since the spectrum also changes as the void thickness changes, we thought that the void thickness could be estimated by performing pattern matching of the frequency spectrum.

Figure 3. shows the results of applying the algorithm to 20mm and 110mm rectangular void. In addition to spectral matching, information on the extreme values of the time waveform and comparison of the spectral centroid of the theoretical value with that of the measured value enable highly accurate estimation of the void thickness at a lower computational cost.

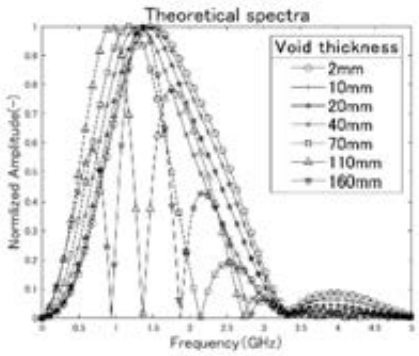


Figure 2. Theoretical spectra for multiple thickness

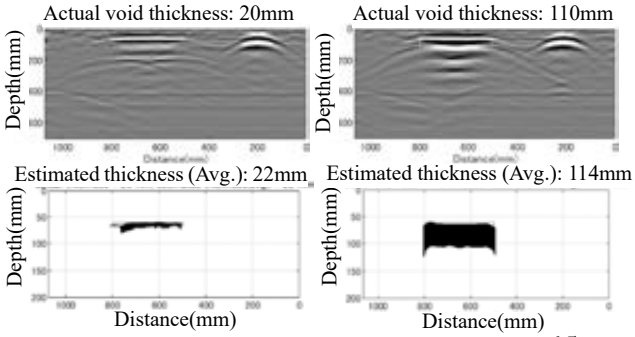


Figure 3. Estimation of rectangular void thickness of 20mm and 110mm by the algorithm

3. CONCLUSIONS

By focusing on both the frequency responce and time waveform of the reflected wave, I succeeded in quantitatively estimating the void thickness even with a very weak signal compared to a rebar.

REFERENCES

[1] Thanop Thitimakorn etal., Subsurface void detection under the road surface using ground penetrating radar (GPR), a case study in the Bangkok metropolitan area, Thailand, Geo-Engineering (2016) 7:2

[2] Pedret Rodés J., Pérez-Gracia V., Martínez-Reguero A., Evaluation of the GPR frequency spectra in asphalt pavement assessment, Construction and Building Materials 96 (2015) 181–188

1st Joint Student Seminar between The Univ. of Tokyo and Univ. of Dhaka

August 3-4, 2022

OneHealth OneWorld

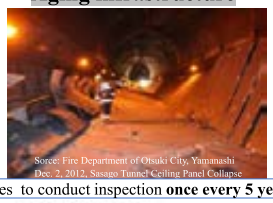
HIGHLY ACCURATE REAL-TIME ESTIMATION OF VOID THICKNESS INSIDE CONCRETE BY SPECTRAL PATTERN MATCHING OF GPR SIGNAL

S. IWAI[1], T. MIZUTANI[2]

[1] 2nd-yesr master's student, Department of Civil Engineering, The University of Tokyo, Tokyo, Japan,
[2] Associate professor, Department of Civil Engineering, The University of Tokyo, Tokyo, Japan

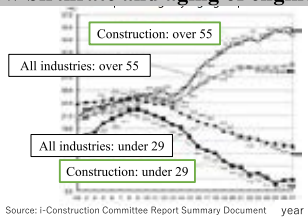
Background the current state of social infrastructure in Japan

Aging infrastructure

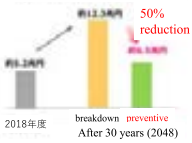


Obligates to conduct inspection **once every 5 years**

Low birthrate and aging of engineers

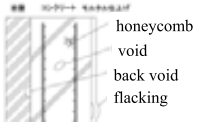


Forecast after 30 years (FY2048)



Preventive maintenance

want todetect damage before it surfaces



internal damage

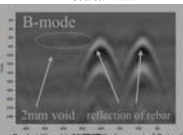
Existing technology & Research objective

ex) infrared thermography method

ex) hammering method
Source: Bridge Research Association

ex)Impact elastic wave method
Source: PWRI

State-of-the-art electromagnetic radar equipment (portable GPR)



Source: Ryohei Kiyoshi, 2022,"Development of Detection Method for Internal Defects in Concrete Using Electromagnetic wave method", Dissertation

Smartphone for drawing and analysis→low computation load.

出典）鉄筋探査機（電磁波レーダ法）、https://www.kgs-inc.co.jp/product/

Research objective

Construction and implementation of a low-computational-cost algorithm for automatic, highly accurate, from portable GPR signals.

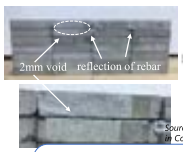
Existing technology & Research objective

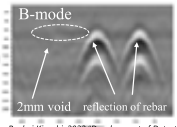
ex) hammering method
Source: Bridge Research Association

ex)Impact elastic wave method
Source: PWRI

My research topic

State-of-the-art electromagnetic radar equipment (portable GPR)





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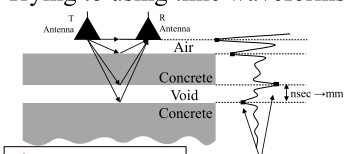
Research objective

Construction and implementation of a low-computational-cost algorithm for automatic, highly accurate, from portable GPR signals.

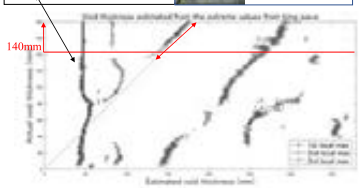
Trying to using time waveforms

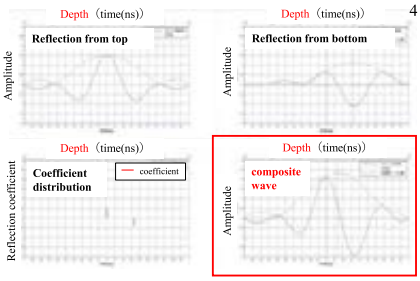


Transmitted wave radiated from the antenna

Boundary reflection due to void

Using experimental data

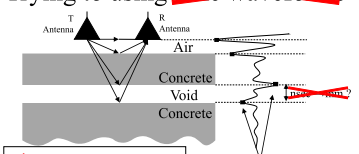




Reducing interference by void from 50mm to 1mm

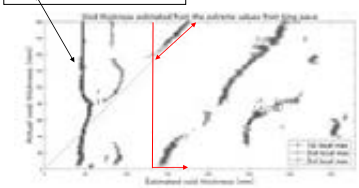
Impossible to estimate the small thickness from time waveform

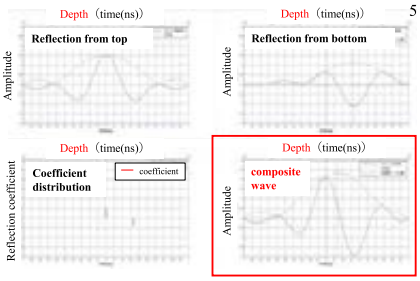
Trying to using time waveforms



Transmitted wave radiated from the antenna

Boundary reflection due to void





Reducing interference by void from 50mm to 1mm

Impossible to estimate the thickness from time waveform when void thickness is small

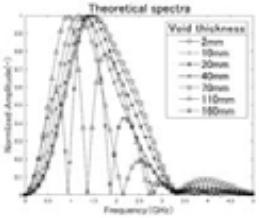
Proposal of an algorithm focusing on **frequency spectrum**

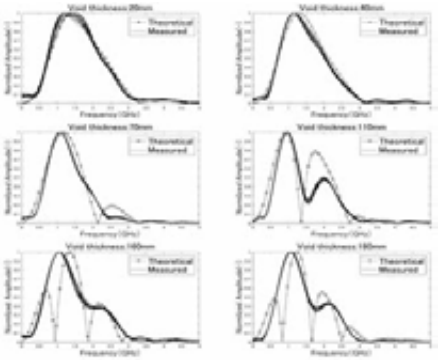
$$h_t = \alpha f(t) + \sum_{n=1}^{5} \alpha^{2(n-1)} \beta f(t - an)$$

$$\downarrow \mathcal{F}$$

$$H(\omega) = \left(\alpha + \sum_{n=1}^{5} \alpha^{2(n-1)} \beta \right) F(\omega)$$

$$= Z(\omega) \times F(\omega)$$





➡ Pattern Matching Using Spectral Shapes

Proposal of an algorithm focusing on **frequency spectrum**

$$h_t = \alpha f(t) + \sum_{n=1}^{5} \alpha^{2(n-1)} \beta f(t - an)$$

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$$H(\omega) = \left(\alpha + \sum_{n=1}^{5} \alpha^{2(n-1)} \beta \right) F(\omega)$$

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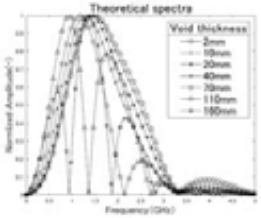
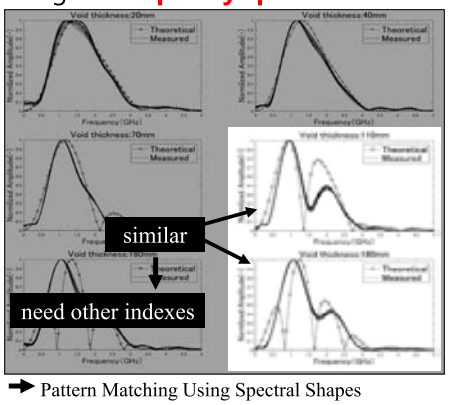
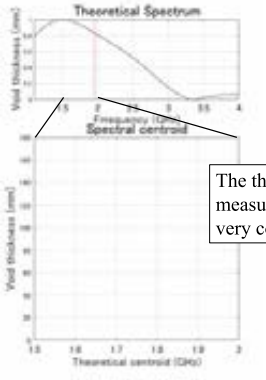




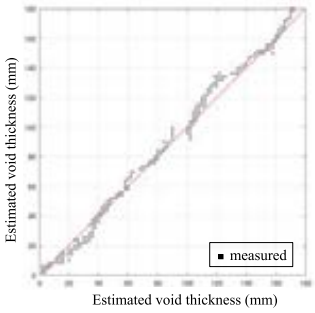
➡ Pattern Matching Using Spectral Shapes

Another index - spectral centroid



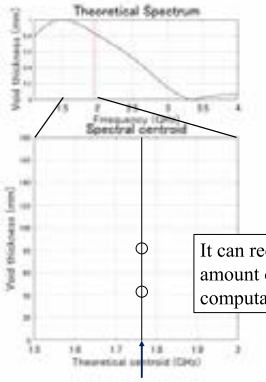
The theoretical and measured values are very consistent.

Applied the algorithm to all void thickness (2mm to 180mm)



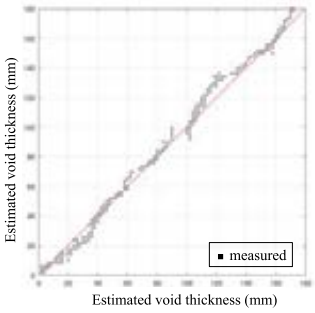
Succeeded in estimate all void thickness with only single algorithm

Another index - spectral centroid



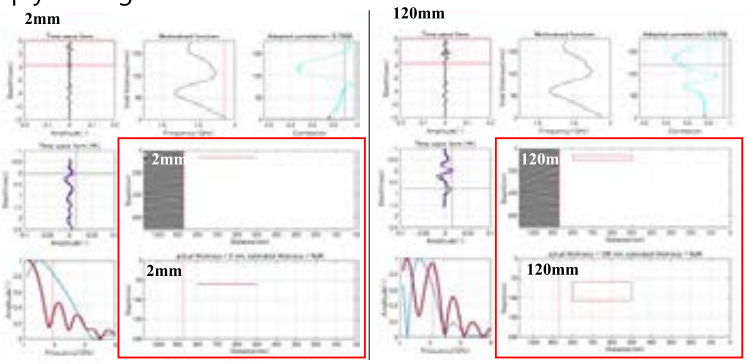
It can reduce the amount of computation.

Applied the algorithm to all void thickness (2mm to 180mm)



Succeeded in estimate all void thickness with only single algorithm

Apply the algorithm to two dim.



succeeded in obtaining highly accurate estimates for both small and large thickness of void

EARTHQUAKE AND RAINFALL INDUCED LANDSLIDE HAZARD ASSESSMENT OF KUTUPALONG ROHINGYA CAMP USING METEOROLOGICAL AND GEOLOGICAL INFORMATION

ANIKA SAMM-A[1], A. S. M. MAKSUD KAMAL[2], MD. ZILLUR RAHMAN[2]

[1]Research associate, Dept. of Disaster Science and Climate Resilience, University of Dhaka, Dhaka, Bangladesh

[2]Professor, Dept. of Disaster Science and Climate Resilience, University of Dhaka, Dhaka, Bangladesh

Correspond to ANIKA SAMM-A (anikasamma@gmail.com)

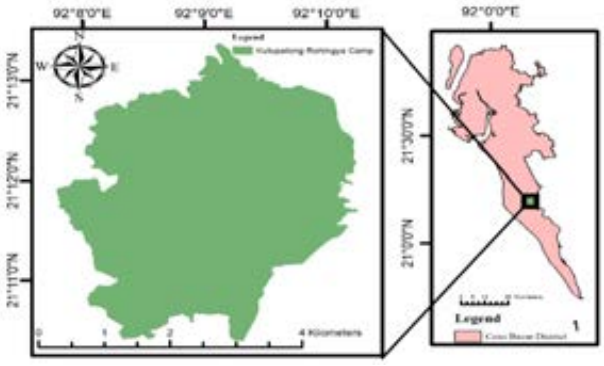
***Keywords**: Monte-Carlo simulation, Landslide, factor of safety*

INTRODUCTION

Landslide is a common hazard in mountainous areas with severe impacts. Both rainfall (intense and prolonged) and earthquakes can trigger these events [1]. Kutupalong rohingya camp area lies in a region within the seismic Zone-II In monsoon, the camp experiences prolonged intensified rainfall just like the rest of Bangladesh, mainly in June-July month. With rainfall incidents, the pore water pressure within the soil increases and shear strength decreases. This study considers both earthquake and rainfall as contributing factors; takes into account the duration of rainfall, designs the physical property parameters with Monte-Carlo simulation and IDW interpolation, finds the landslide-prone areas through Monte-Carlo simulation and direct calculation; finally compare their results. Monte Carlo simulation has been chosen for the study to address the uncertainty issue regarding the physical property parameters. The simulation considers random values from any probabilistic distribution rather than grabbing one specific value. Using this simulation, the study has dealt with the uncertainty of soil physical property parameters as well.

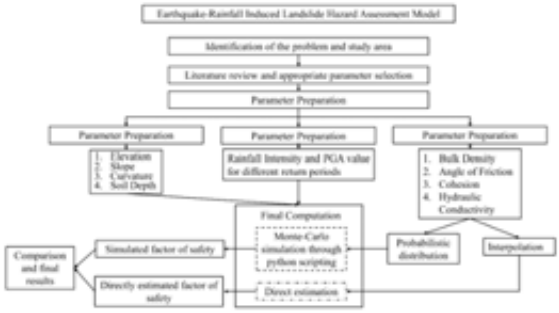
STUDY AREA

Figure 1. Kutupalong Rohingya Camp



METHODOLOGICAL FRAMEWORK

Figure 2. Methodological framework for the study



RESULT

Figure 3: Landslide-prone areas for different return period.

Return Period (years)	Monte- Carlo Simulation				Direct estimation			
	1 Day	2 Day	4 Day	8 Day	1 Day	2 Day	4 Day	8 Day
50	9	11	14	24	8	10	13	23
75	10	11	15	25	8	10	14	24
100	10	11	15	26	9	10	14	25
200	11	14	19	35	9	12	17	34
475	12	15	21	40	11	13	20	39

CONCLUSION

Camp no 17, 20, and 20 extension are found to have a significant amount of vulnerable areas at all the hazard scenario combinations owing to their curvature pattern (more convex or concave planes compared to other camps).

The study has executed a validation test using the landslide inventory of previously occurred ones, showing that the ROC curves possess AUC values ranging from 85% to 93% for all the assessed scenarios at different confidence levels. The study's findings can be adopted for risk-sensitive land-use planning of the camp area.

REFERENCE

[1] Terzaghi RD, Voight B (1979) Karl terzaghi on rockslides: The perspective of a half-century. Dev Geotech Eng 14:111–134. https://doi.org/10.1016/B978-0-444-41508-0.50010-7

Earthquake and Rainfall Induced Landslide Hazard Assessment of Kutupalong Rohingya Camp Using Meteorological and Geological Information

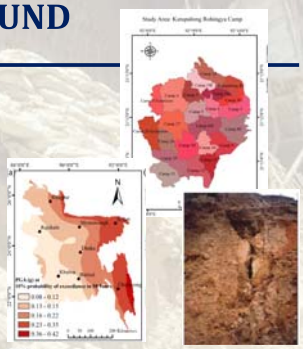
Presented by
Anika Samm-A
Department of Disaster Science and Climate Resilience
University of Dhaka

BACKGROUND

Why this research?

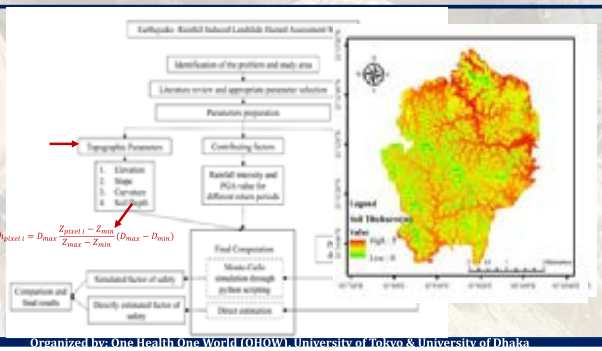
Research Objective

1. To define the topographic and soil physical property parameters affecting landslides.
2. To define the Contributing factors (earthquake and rainfall).
3. To map the landslide-prone areas for different contributing hazard scenarios



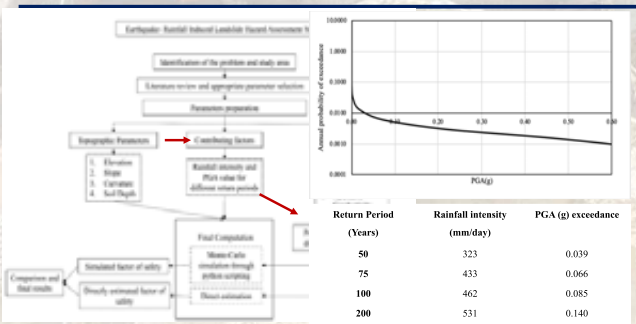
Landslide in Hoanok, Maheshkhali

MATERIALS AND METHOD



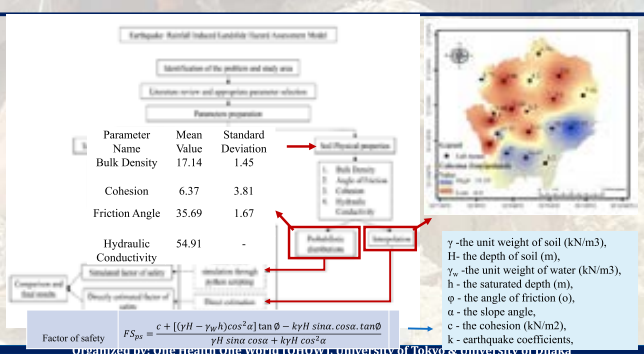
$$Soil\ depth_{pixel\,i} = D_{max} - \frac{Z_{pixel\,i} - Z_{min}}{Z_{max} - Z_{min}}(D_{max} - D_{min})$$

MATERIALS AND METHOD



Return Period (Years)	Rainfall intensity (mm/day)	PGA (g) exceedance
50	323	0.039
75	433	0.066
100	462	0.085
200	531	0.140
475	618	0.230

MATERIALS AND METHOD

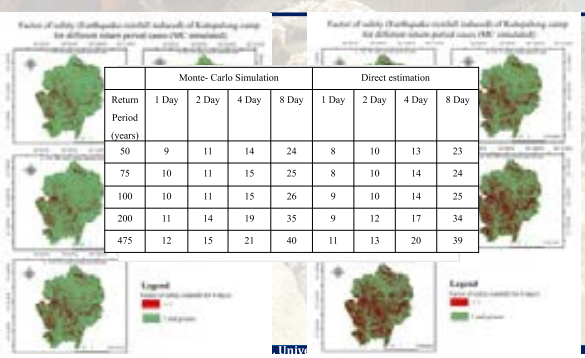


Parameter Name	Mean Value	Standard Deviation
Bulk Density	17.14	1.45
Cohesion	6.37	3.81
Friction Angle	35.69	1.67
Hydraulic Conductivity	54.91	-

$$\text{Factor of safety} \quad FS_{ps} = \frac{c + [(\gamma H - \gamma_w h)\cos^2\alpha]\tan\emptyset - kyH\,sina.cosa.tan\emptyset}{\gamma H\,sin\alpha\,cos\alpha + kyH\,cos^2\alpha}$$

γ -the unit weight of soil (kN/m3),
H- the depth of soil (m),
γ_w -the unit weight of water (kN/m3),
h - the saturated depth (m),
φ - the angle of friction (o),
α - the slope angle,
c - the cohesion (kN/m2),
k - earthquake coefficients,

RESULTS



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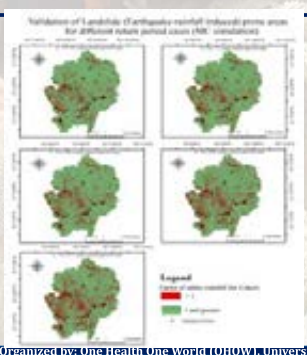
100	10	11	15	26	9	10	14	25
200	11	14	19	35	9	12	17	34
475	12	15	21	40	11	13	20	39

VALIDATION



Test Result Variable(s)	Area AUC	Std. Error	Asymptotic 90% Confidence Interval	
			Lower Bound	Upper Bound
Return period 50 years	0.907	0.037	0.845	0.968
Return period 75 years	0.907	0.037	0.845	0.968
Return period 100 years	0.907	0.037	0.845	0.968
Return period 200 years	0.912	0.037	0.851	0.973
Return period 475 years	0.917	0.036	0.857	0.977

CONCLUSION AND FUTURE SCOPE OF RESEARCH

CONCLUSION

- Both earthquake and rainfall are considered as contributing factors
- Two different approaches are taken to address soil physical property uncertainties
- Different hazard scenario (return period and rainfall duration) assessed

WAY FORWARD

- A more detailed geological investigation may feed the parameters more accurately
- Factor of safety estimation in updated methods

Thanks
Any Questions
??

ESTIMATION OF SUBSURFACE PIPES USING 3D RADAR IMAGES

[1] S. YOTSUMOTO, [2] T. MIZUTANI, & [3] T. IMAI

[1]2nd-year Master Student, [3]1st-year Master Student
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Correspond to [2]Assoc. Prof. T. Mizutani (mizu-t@iis.u-tokyo.ac.jp)

***Keywords**: Ground Penetrating Radar, Digital Signal Processing*

1. GENERAL INSTRCUTIONS

The maintenance and management of underground buried pipes, whose total length is more than 1 million km in Japan alone, is an urgent issue in social and security related terms. A serious road collapse in Fukuoka, Japan, in 2016 shows the effect of aged buried piped on subterranean soil stability. Therefore, it is crucial to analytically estimate the features of underground pipes and subterranean space.

Ground penetrating radar, or GPR, is a geophysical method to survey subsurface using radar pulses. This study employs 3D radar images of subsurface collected by a GPR-equipped vehicle, which can scan road subsurface at 50km/h.

Yamaguchi et al (2020) [1] proposes the combination of CNN-based algorithm and an inverse analysis using Kirchhoff migration to detect underground buried, but its low precision, i.e., plenty of false positives against few true positive, prevents its applicability to real road subsurface data. In this context, the aims of the study are:

- to develop an algorithm that can distinguish true positives from false positive
- to clarify 3D layouts of subsurface pipes, including depth, direction, slope and size.
- to clarify the effectiveness of three-dimensional digital signal processing, including 3D spatial frequency filters and edge detection.

2. MEDHODOLOGY & RESULTS

Theoretically [2], GPR reflection is hyperbolic because the round-trip time of pulses corresponds to the depth (Z) of target objects at each scan position (X). The spatial depth Z is a function of time t, light velocity c_0 in vacuum and relative permittivity of soil ε.

$$Z^2 = depth^2 + X^2 \quad where \quad Z = \frac{c_0}{2\sqrt{\varepsilon}}t$$

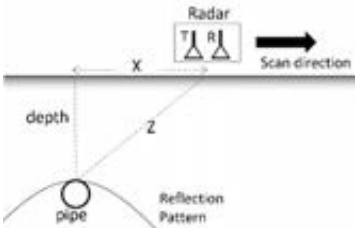


Figure 1 The theory of depth estimation in a GPR image

The equation 1 shows the simplest model of determination of depth of target pipes, but pipe radii, the thickness of air layer, and the inhomogeneity of soil relative permittivity need to be integrated into models for more accurate estimation.

As illustrated below, the algorithm proposed in this research is a multi-step processing. Firstly, original 3D radar images are filtered in frequency domain as a result of Fourier Transform. Secondly, generated theoretical hyperbolic images are examined to filtered radar images to find hyperbolas that fit best the images. The theoretical hyperbolas generated based on target spatial depth and relative permittivity provide the information on the 3D layout of buried pipes.

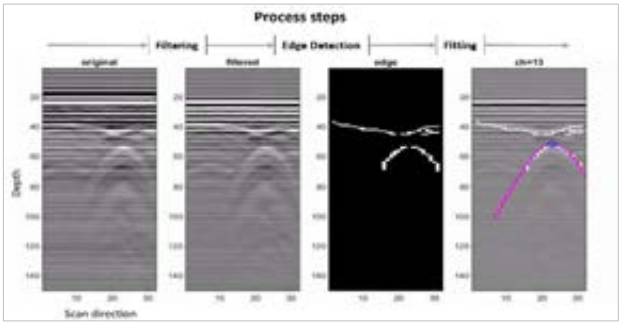


Figure 2 illustrates the process of radar images, composed of frequency filtering, edge detection and fitting.

3. CONCLUSIONS

The study demonstrates the feasibility of accurate estimation of subsurface pipes using digital signal processing of 3D radar images. High resolution of 3D radar images and design of 3D spatial frequency filters are important key factors to accurately estimate subsurface characteristics. Also, the study implies that the size of GPR antenna and the radius of underground pipes affects accuracy of estimation.

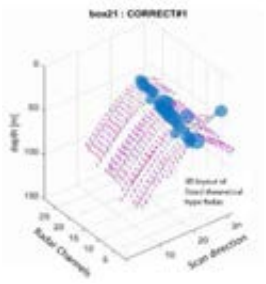


Figure 1. This is 3D layout of a hyperbolic reflection as a result of the processing.

REFERENCES

[1] T. Yamaguchi, Automatic 3-D Localization of Utility Pipes and Void from Ground Penetrating Radar Signals by Deep Learning and Digital Signal Processing, *Doctoral Dissertation*, 2020.

[2] Raffaele Persico, Introduction to Ground Penetrating Radar Inverse Scattering and Data Processing., IEEE Press, New Jersey, 2014.

OHOW 2022

August 4th, 2022

Voluminous imaging of underground spaces and structure using 3D frequency filtering and edge detections.

Department of Civil Engineering,
School of Engineering,
The University of Tokyo

M2 / **Shuto YOTSUMOTO**

(M1 T. IMAI & Assoc. T. MIZUTANI)

Background 1 – Demands from society

A road collapse in 2018 in Fukuoka, Japan

Source: an article on Nov. 7, 2018, the Sankei Shinbun

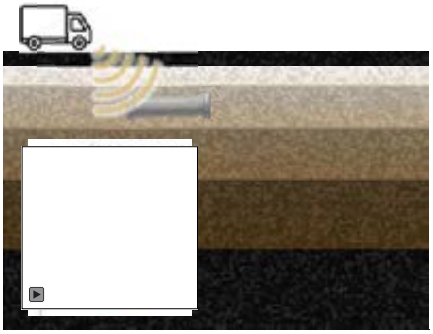
- **Japan has 1,000,000+ km long subsurface pipes in total**
- **Many of them are old (50+ years)**
- **Corroded pipes creates huge voids, which cause road collapses**

Underground pipe corroded

Source : Yamagata Survey Corporation

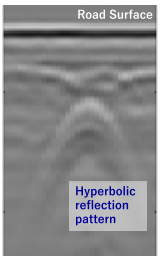
Background 2.1 – maturity of technology (**hardware**)

- **Detecting underground pipes : urgent issue for social security.**
- **Ground penetrating radars (GPR) is a promising solution (cost/effectiveness)**

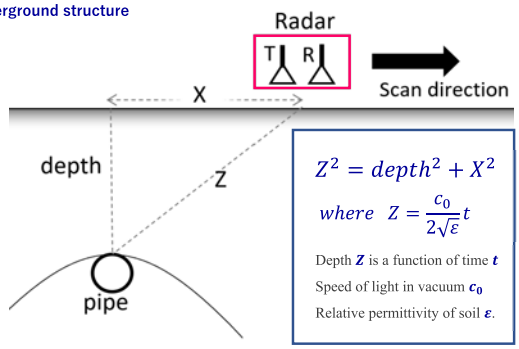


Background 2.2 - Detail about the Ground Penetrating Radar

Typical reflection pattern of underground structure
➔ Hyperbolic



How?



$$Z^2 = depth^2 + X^2$$

$$where \quad Z = \frac{c_0}{2\sqrt{\varepsilon}}t$$

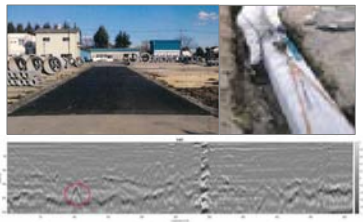
Depth Z is a function of time t
Speed of light in vacuum c_0
Relative permittivity of soil ε.

Previous Study - CNN Approach

In this context, we

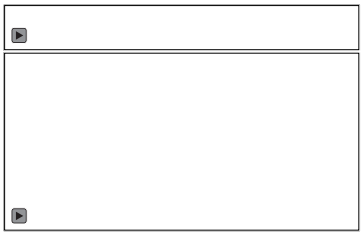
- **Built an experimental field with pipes etc,**
- **Obtained 10000km real road data, 300km of which are annotated.**

Experimental field with pipes in Gumma, Japan



Yamaguchi (2020)

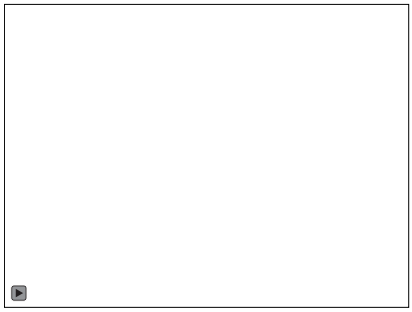
- **Developed a deep neural network model to detect underground pipes…**
- **Trained with a dataset of 200+ km road data.**
- **Works well in an experimental field, but detects plenty of false positives in real roads**



Previous Study – CNN Approach + Kirchhoff's Migration

Yamaguchi (2020) also…

- **Applied migration after CNN to reduce false positives.**
- **But it still had many false positive in real data.**

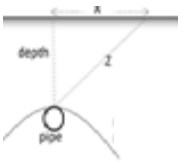


Issue & Hypothesis

- Need to reduce false positive pipes obtained by the CNN detector.
- Study the 3D alignment of pipes and map them in a 3dimensional way.

If I generated theoretical hyperbolas and fit them to radar images, could I distinguish true positive from the false positive ?

- **Using a certain "similarity" between a theoretical pattern and a radar image, can I choose actual pipes?**



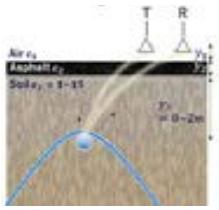
$$Z^2 = depth^2 + X^2$$

$$where \quad Z = \frac{c_0}{2\sqrt{\varepsilon}} t$$

Depth $\boldsymbol{Z}$ is a function of time $\boldsymbol{t}$

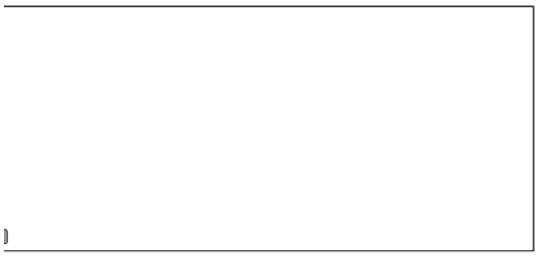
Speed of light in vacuum $\boldsymbol{c_0}$

Relative permittivity of soil $\boldsymbol{\varepsilon}$.



Test the hypothesis 1

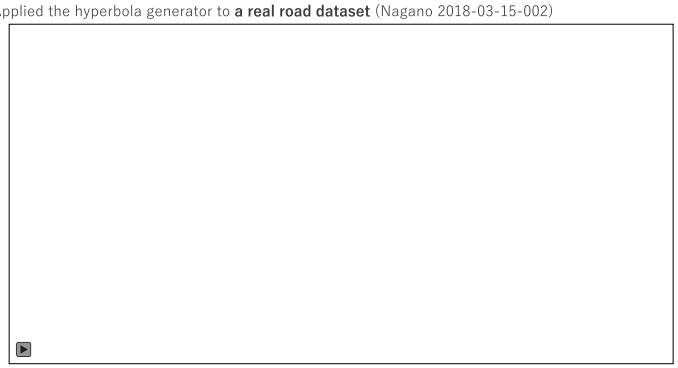
Generate hyperbola (around 60,000)
Examine one by one the inner products between each generated hyperbola and the radar image
Select the hyperbola with the **highest inner product** with the image.



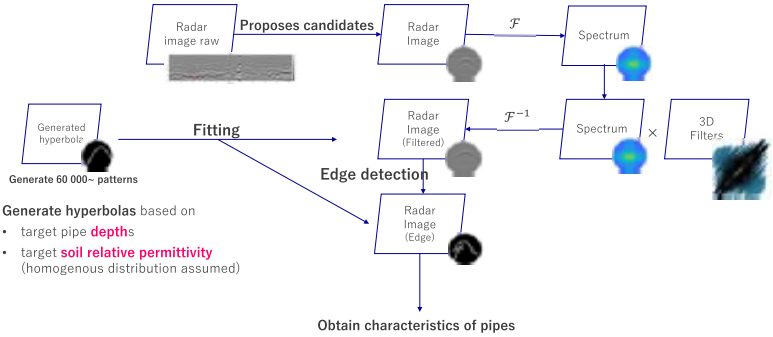
Condition
- 3 layers model (air/asphalt/soil)
- Each layer has a homogeneous permittivity
- Air/asphalt layer thickness known
- Radius of pipe = 0m;
- Antenna size = 0m;
- Generate hyperbola changing soil thickness and soil permittivity

Test the hypothesis 2

Applied the hyperbola generator to **a real road dataset** (Nagano 2018-03-15-002)

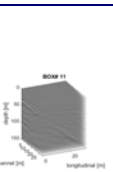


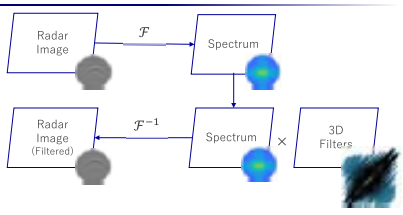
Methodology



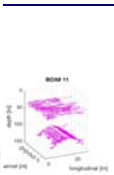
Generate hyperbolas based on
- target pipe **depth**s
- target **soil relative permittivity** (homogenous distribution assumed)

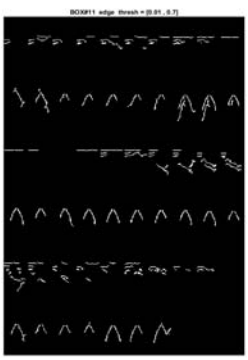
Methodology – Step 2 **3D filtering**

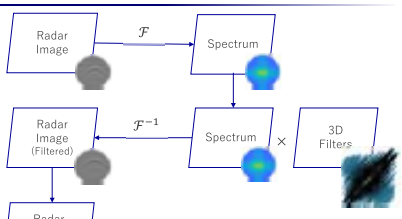




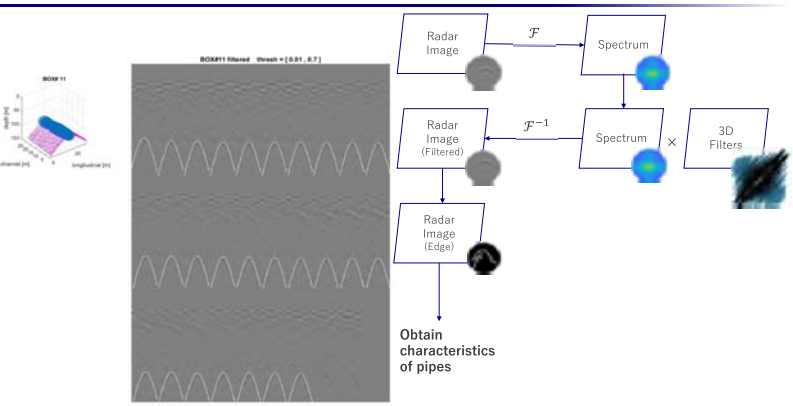
Methodology – Step 3 Edge Detection







Methodology – Step 4 Fitting



Result

Completely distinguished TP from FP
Actual pipes illustrated by pink

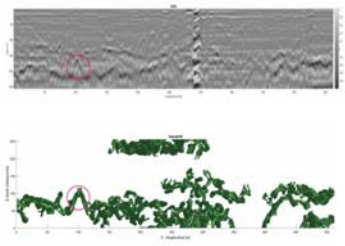
Summary & Future Plan

This study is on-going. Need to Apply the algorithm to a large scale area 1M km
Now detecting pipes is under the assumption that pipes are perpendicular to roads.

What if pipes are parallel to roads or diagonally aligned ?
What if pipes are tilted or broken or deformed?

Need to go beyond 2D (layer-by-layer) analyses.

3-dimensional edge detection



References

REFERENCES

[1] T. Yamaguchi, Automatic 3-D Localization of Utility Pipes and Void from Ground Penetrating Radar Signals by Deep Learning and Digital Signal Processing, *Doctoral Dissertation*, 2020.

[2] Raffaele Persico, Introduction to Ground Penetrating Radar Inverse Scattering and Data Processing., IEEE Press, New Jersey, 2014.

Thank you for listening

AMBIENT SEISMIC NOISE LEVELS IN THE BENGAL BASIN, BANGLADESH

N. ZANNAT[1], A. H. FARAZI[2], ASM M. KAMAL[1], M. Z. RAHMAN[1], and M. S. HOSSAIN[1]

[1] Department of Disaster Science and Climate Resilience, University of Dhaka, Dhaka-1000, Bangladesh
[2]Department of Geology and Mining, University of Barishal, Barishal-8200, Bangladesh
Correspond to Shakhawat Hossain (sahkhawat@dsm.du.ac.bd)

***Keywords**: Seismic ambient noise, Power spectral density, temporal variation of noise, Seismic station performance*

1. BACKGROUND

Ambient seismic noises are small-amplitude ground vibrations generated by anthropogenic (transport, manufacturing) or natural sources such as, wind, oceanic and coastal waves that are permanently recorded by the seismogram. Contamination of the seismograph recordings by SAN energy makes it difficult to analyze data for earthquake monitoring by reducing the signal to noise ratio. In this study we quantify SAN levels in the Bengal Basin to observe their geographical and temporal variation. The seismic stations, used herein, were deployed temporarily from 2007 to 2010 and 2010 to 2015 for evaluating the tectonically active BB. This study, additionally, brings a scope of evaluating performance of these stations.

2. METHOD

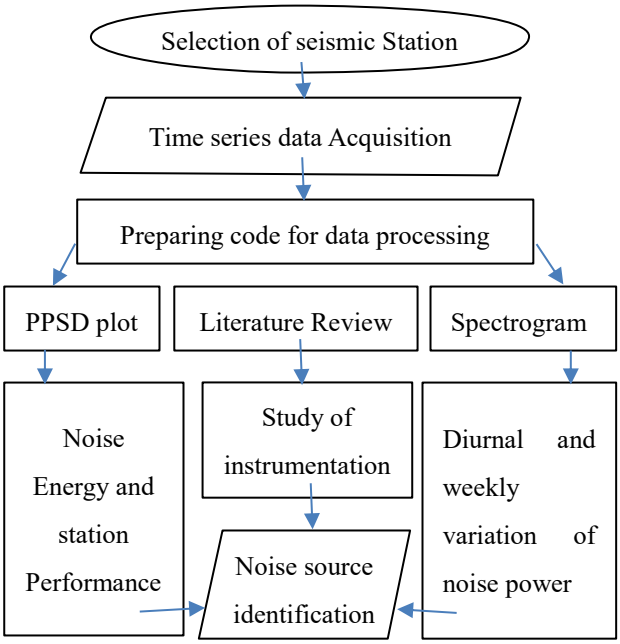


Figure 1. Methodological Framework of the study

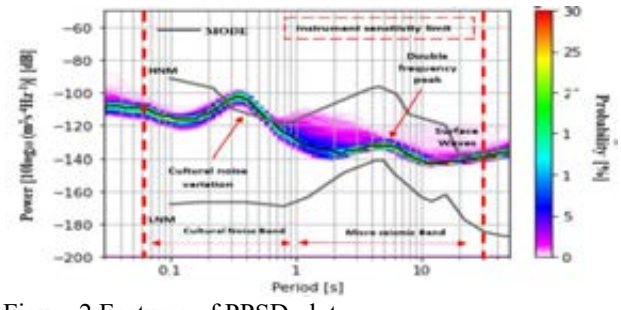


Figure 2 Features of PPSD plot

3. RESULTS

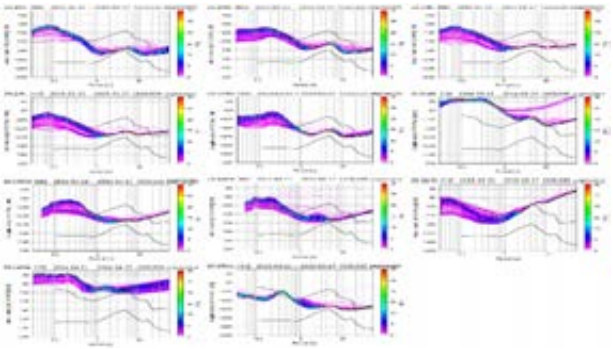


Figure 2. Distribution of Probabilistic Power Spectral Density (PPSD) plots for the 11 seismic stations

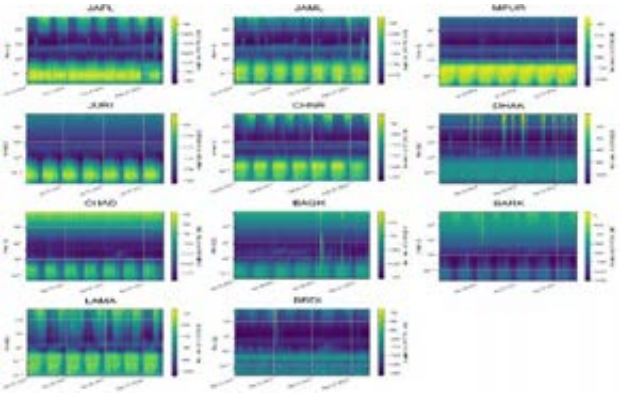


Figure 3. Spectrogram for the 11 seismic stations

4. CONCLUSIONS

Within 20-30 s period band, SAN energy might be related to thermal variation and/or poor performance of sensors as at some stations PSDs are exceeding the NHNM. Within 10-20 s period band, some stations exhibit that PSDs are exceeding the NHNM. The 1-10 s period band is also characterized by high energy and eventual occurrence of the PSDs above the NHNM for some stations, whereas at some stations the PSDs are within the NHNM and NLNM. Within the 0.02-1 s period band, high energies above the NHNM are observed which could be possibly related either poor sensor performance or noise generated from power supplying generators.

5. REFERENCES

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Ambient Seismic Noise Levels in the Bengal Basin, Bangladesh

Presented by

Naharin Zannat
Department of Disaster Science and Climate Resilience
University of Dhaka

Background

- Small Amplitude Ground Vibration
- Unwanted signal!!!!
- Noise energy can prohibit detection of earthquakes

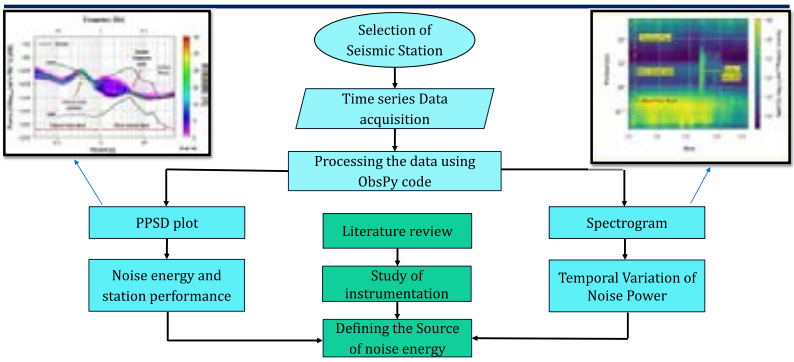
Figure 1. Seismometer

Figure 2. Seismic Station in Bangladesh

Objectives

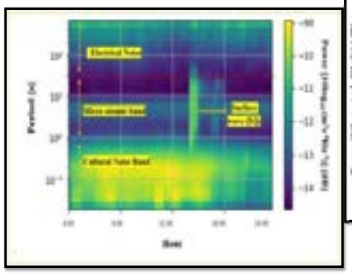
- Analysis of the seismic ambient noise energy at individual station
- Evaluation of seismic station performance
- Defining the source of noise energy at different frequency bands

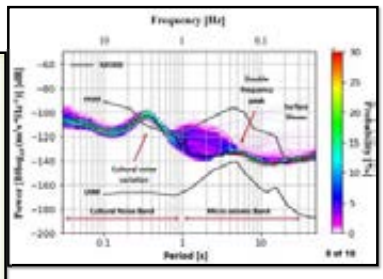
Methodology: Work Flow



Features of Plots

Spectrogram

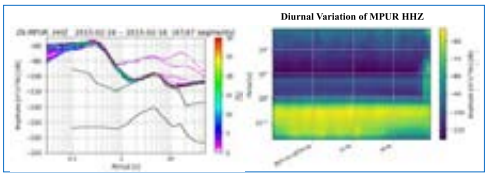


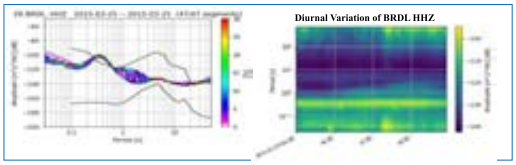


Probabilistic power spectral density (PPSD)

Result

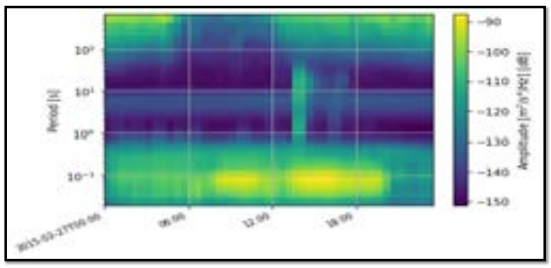
- Highest level of ambient seismic noise
- Low variation of noise power





- lowest level of ambient seismic noise
- Variation of noise power at micro seismic band

Result



Strong diurnal variation of cultural noise is found at station JAFL

Key Findings

- At the cultural noise band (period <1s), almost all the stations exceeded the NHNM and the noise level decreases while working hours is over (after 5-6 pm).
- At micro seismic noise band (period >1s-), noise is mostly related to weather condition
- within 20-30 s period band (long period band), noise is related to poor performance of sensors.

Thank You

HAZARD INDEX AND POTENTIAL CANCER RISK OF HEAVY METALS IN THE GROUNDWATER OF BANGLADESH

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[2] Graduate student, Norwegian University of Science and Technology (NTNU), Norway,
[3] Associate Professor, Department of Environmental Science and Management, North South University, Bangladesh,
Correspond to M.M. Rahman (mohammad.rahman@northsouth.edu)

***Keywords**: Hazard index, potential cancer risk, groundwater, heavy metals*

1. INTRODUCTION

Bangladesh is heavily dependent on groundwater sources for drinking purposes as the amount of fresh surface water is decreasing. Groundwater is the primary source of drinking water for 144 million inhabitants of Bangladesh. Studies have found that around 35-77 million people in Bangladesh are at risk of drinking contaminated water.

An insight into the overall health risk from different groundwater constituents, especially heavy metals, is vital for the sustainability of groundwater.

2. OBJECTIVES

- To present a nationwide Health Risk assessment of Bangladesh groundwater based on population density by calculating Hazard Index (HI) and Potential Cancer risk (PCR).
- To investigate the relation of HI and PCR with Chronic Daily Intake (CDI) in children and adults.

3. METHODS

Databases used for the study

A publicly available dataset from UNICEF [1] was used for the study which included:

- 2923 groundwater samples
- 2330 from shallow tube wells (STW, depth <150m)
- 573 from deep tube wells (DTW, depth >150m)
- 5 heavy metals - arsenic, cadmium, chromium, lead, and nickel.

Equations used for calculation

- Chronic Daily Intake (CDI) [2,3,4]

$$CDI = \frac{C_W \times IRW \times EF \times ED}{BW \times AT} \quad (1)$$

- Hazard Index (HI) [5,6]

$$HQ = \frac{CDI}{RfD} \quad (2)$$

$$HI = \sum HQ \quad (3)$$

- Potential Cancer Risk (PCR) [2,7,8]

$$PCR = CDI \times SF \quad (4)$$

3. CONCLUSIONS

- The groundwater of Bangladesh is at a high risk of Cadmium, Arsenic and Nickel contamination in decreasing order of severity, which might lead to cancer.
- DTWs were relatively safer than STWs.
- PCR increases slightly with CDI in adults
- Children are at a greater risk compared to adults.

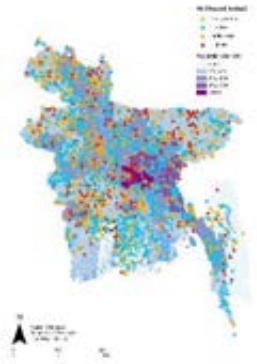

Figure 1 Map of HI from STWs & DTWs in Groundwater of Bangladesh

REFERENCES

[1] Johnston, R., & Zheng, Y. (2009). Bangladesh national drinking water quality survey. 105.
[2] Ezugwu, C. K., Onwuka, O. S., Egbueri, J. C., Unigwe, C. O., & Ayejoto, D. A. (2019). Multi-criteria approach to water quality and health risk assessments in a rural agricultural province, southeast Nigeria.
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Hazard Index and Potential Cancer Risk of Heavy Metals in the Groundwater of Bangladesh

LAMIA MAHZABIN, AFRIDA BINTH IQBAL, DR. MOHAMMAD MOSHIUR RAHMAN

What is Hazard Index?

- Hazard Index is the non-carcinogenic risk imposed by individual elements calculated by taking the summation of Hazard Quotient

What is Potential Cancer Risk?

- Potential cancer risk associated with the ingestion of heavy metals in water refers to the level of cancer threat posed to an individual due to exposure to a potential carcinogen over a lifetime

Objectives

- To present a nationwide Health Risk assessment of Bangladesh groundwater based on population density by calculating Hazard Index (HI) and Potential Cancer risk (PCR).
- To investigate the relation of HI and PCR with Chronic Daily Intake (CDI) in children and adults.

Methods
Dataset used for the study

- A publicly available dataset from UNICEF (Johnston & Zheng, 2009) was used for the study which included:
- 2923 groundwater samples
- 2330 from shallow tube wells (STW, depth <150m)
- 573 from deep tube wells (DTW, depth >150m)
- 5 heavy metals –

1. Arsenic
2. Cadmium
3. Chromium
4. Lead
5. Nickel.

Methods
Equations used for calculation

- **Chronic Daily Intake (CDI)**

(Ezugwu et al., 2019; Mgbenu & Egbueri, 2019; US Environmental Protection Agency (USEPA), 1989)

$$CDI = \frac{C_W \times IRW \times EF \times ED}{BW \times AT} \quad 1$$

- **Hazard Index (HI)**

(Li et al., 2016; Zhang et al., 2018)

$$HQ = \frac{CDI}{RfD} \quad 2$$

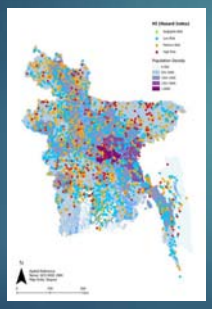
$$HI = \sum HQ \quad 3$$

- **Potential Cancer Risk (PCR)**

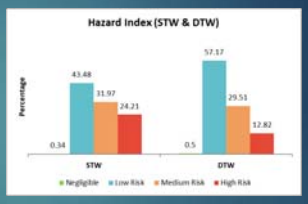
(Ezugwu et al., 2019; Rahman et al., 2018; Ukah et al., 2019).

$$PCR = CDI \times SF \quad 4$$

Results
Hazard Index (HI)

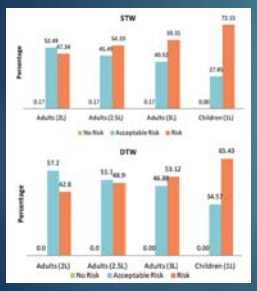


HI map of Bangladesh

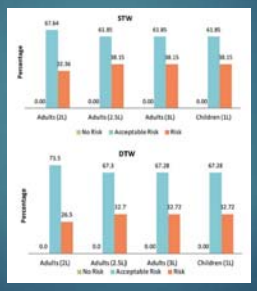


HI from STW and DTW

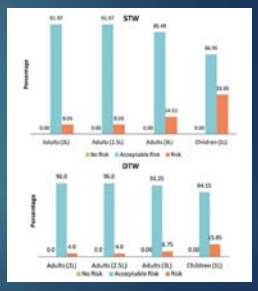
Results
Potential Cancer Risk (PCR)



PCR from Cadmium



PCR from Arsenic



PCR from Nickel

Conclusions

- The groundwater of Bangladesh is at a high risk of **Cadmium**, **Arsenic** and **Nickel** contamination in decreasing order of severity, which might lead to cancer.
- **DTWs** are relatively safer than STWs.
- PCR increases slightly with CDI in adults
- **Children** are at a greater risk compared to adults
- There is a positive relation of HI and PCR with population density

Recommendations

- Further research is needed for Cadmium removal techniques
- Intervention is required for discarding risky shallow tube wells

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Thank you!

EXPLORATION OF GUT MICROBIOME IN IRRITABLE BOWEL SYNDROME PATIENTS IN BANGLADESH USING WHOLE GENOME METAGENOMIC ANALYSIS

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Keywords: *Irritable bowel syndrome, microbiome, metagenomics, microbiota*

1. INTRODUCTION

Irritable bowel syndrome (IBS) is the most prevailing functional gastrointestinal condition worldwide. Most epidemiological studies showed psychiatric comorbidities in patients such as anxiety, depression, and neuroticism for IBS and IBS-associated diseases [1]. In recent times, there has been considerable medical interest in the role of the microbiome in the development of IBS and studies showed that the gut-microbial composition of IBS patients is different compared to a healthy individuals [2]. The focus of this study was to explore potential differences in microbiota in IBS patients (n=5) compared to a healthy group (n=5) utilizing whole genome metagenomics.

2. MATERIALS AND METHODS

The Sheikh Russel Gastroliver Institute & Hospital, Mohakhali, Dhaka was selected as the site of sample collection. QIAamp Power Fecal Pro DNA Kit was used to extract DNA from the fecal material. Illumina-based shotgun sequencing was done and Illumina processing program was used to filter short, mixed, and low-quality reads from raw sequence data. Following that, sequence read was analyzed by using different bioinformatic tools and R program.

3. RESULTS:

The IBS patients had diverse microbiota compared to healthy controls, and their diversity was attributed to harmful bacterial species. The results from this study were further compared with publicly available world dataset.

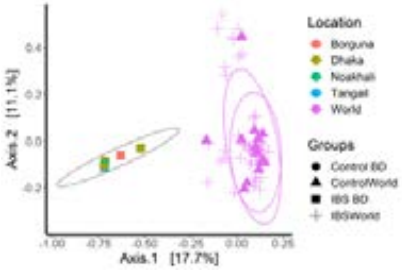

Figure 1: Beta diversity analysis with world dataset

In beta diversity analysis, significant difference with world dataset was observed. *Prevotella copri* is the most abundant species in healthy individuals in Bangladesh accounting 48.18% to 72.77%, whereas it estimates 2.44% to 23.22% in the IBS patients. Reduced number of *Prevotella copri* may be replaced with more diverse harmful bacteria that cause dysbiosis in the IBS patients. Gram-negative genera such as *Klebsiella*, *Phocaeicola*, and *Bacteroides*, were more predominant in IBS patients compared to controls.

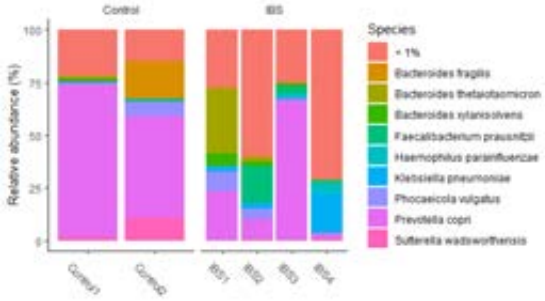

Figure 2: *Prevotella copri* is the most abundant species from Bangladeshi healthy individuals

4. CONCLUSION:

From the analyzed data we have found microbial community pattern are similar for the control samples but the microbial marker for disease was ambiguous with this small number of samples. The study established an advanced protocol to study the gut microbiome in Bangladesh. The promising findings of this pilot study warrant further extended study with more samples from IBS patients and healthy individuals to reveal the signature microbiome and functional markers for the diagnosis and treatment of the disease.

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1st Joint Student Seminar between The Univ. of Tokyo and Univ. of Dhaka

August 3-4, 2022

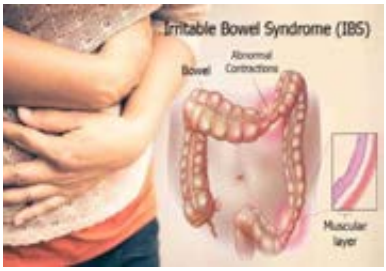
OneHealth OneWorld

Exploration of gut microbiome in irritable bowel syndrome patients in Bangladesh using whole genome metagenomic analysis

Presenter: Md Shahriar Kabir Shakil
PhD Fellow, Department of Microbiology, University of Dhaka
Co-authors: Dr. Md Mizanur Rahaman, Prof. Dr. Donald James Gomes, Department of Microbiology, University of Dhaka

IRRITABLE BOWEL SYNDROME(IBS)

- IBS is a functional gastrointestinal disorder.
- It is a common disorder that affects the large intestine (Colon).

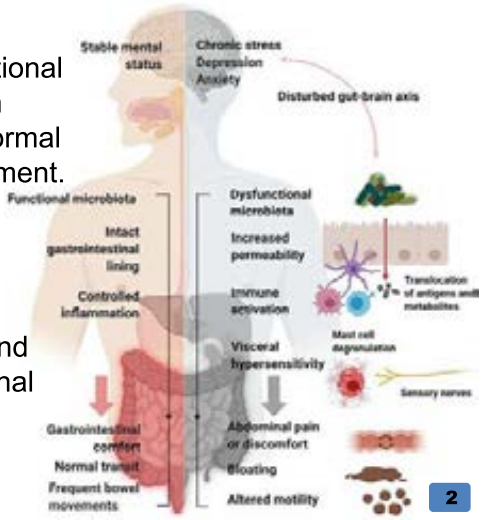


- IBS is characterised by multiple symptoms such as stomach cramping, abdominal pain, bloating and changes in bowel movement.
- It is a chronic condition that is more commonly seen in women.

1

Role of functional microbiota in maintaing normal bowel movement.

Dysfuntional microbiota and gastrointestinal disorder.



2

Source: https://doi.org/10.3389/fcimb.2020.00468

Why this research?

- Globally, IBS is spreading fast
- Developing countries are recording more cases as they adopt to western culture and food habit
- There is no research regarding the pattern of gut microbiome of Bangladeshi IBS patients

3

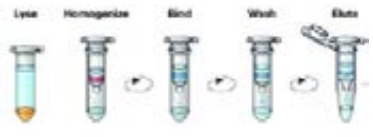
Research objectives:

- To **characterize the gut microbial composition** in IBS patients
- To **find distinct molecular signatures for IBS**
- To **find potential virulence factors** associated with the microbiome of IBS patients
- To **facilitate the advancement of IBS diagnosis**

4

Methods in brief

Sample collection



DNA extraction

Metagenomic sequencing

5

Results

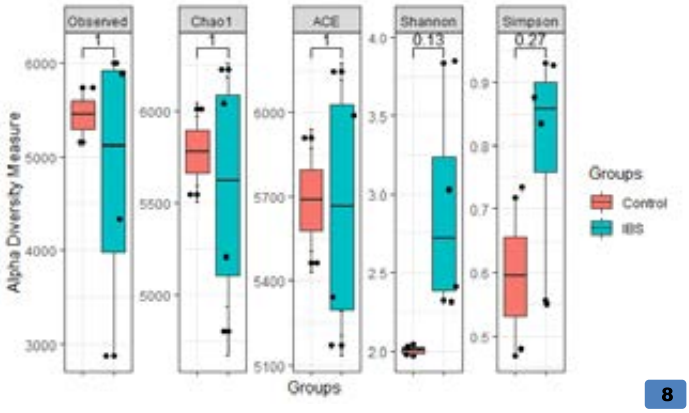
6

Demographic data of IBS patients and Control group

Sample	Age	Sex	Location	Marital status	Lactose intolerance	Stool type	Diabetes	Hypertension	Family history	Antibiotic consumption	Education
IBS1	70	Male	Tangail	Married	Yes	Diarrhea	No	No	No	No	8
IBS2	27	Male	Dhaka	Single	Yes	Alternating	No	No	No	No	13
IBS3	26	Male	Dhaka	Married	Yes	Mixed	No	No	No	No	12
IBS4	25	Male	Borguna	Married	Yes	Alternating	No	No	Yes	No	16
Control 1	35	Male	Noakhali	Married	No	Normal	No	No	No	No	18
Control 2	27	Male	Dhaka	Married	Yes	Normal	No	No	No	No	17

7

Alpha diversity- Diversity within Samples



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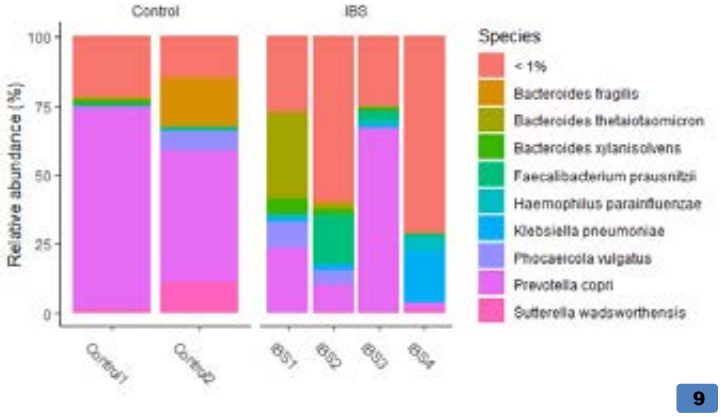
Relative abundance of most common organisms



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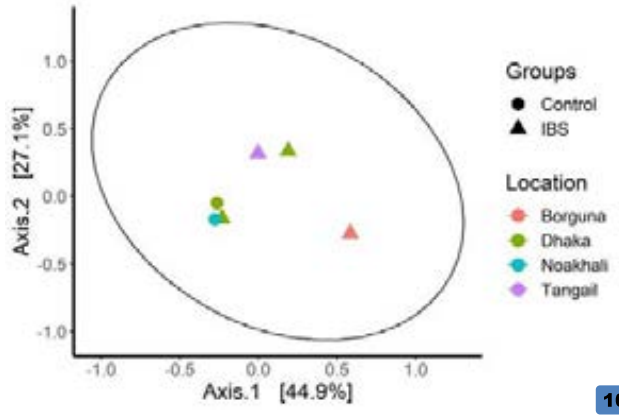
Beta diversity-Diversity Between samples



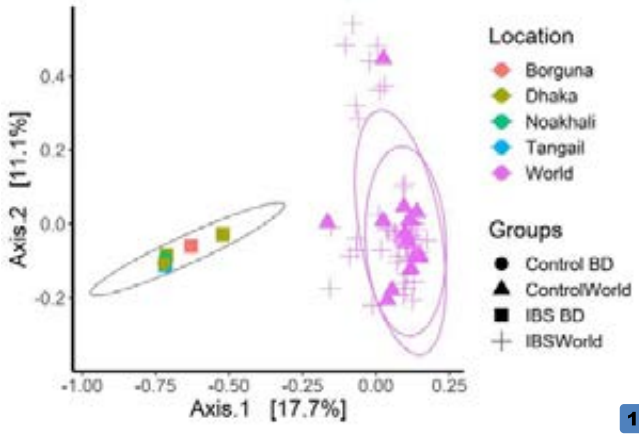
10

Comparison with world data

A dataset containing 70 IBS patients and healthy people from around the world was downloaded from [BioProject accession PRJEB34992 (EMBL)]

11

Beta diversity analysis between Bangladeshi population and world dataset showed distinct difference in their composition



Key findings

IBS patients had decreased number of good bacteria such as Bifidobacterium, Lactobacillus
IBS patients had increased number of bad bacteria such as Klebsiella
Prevotella, Klebsiella, Eubacterium are dominant bacterial genera in Bangladeshi samples
Klebsiella has more virulent factors that may trigger immune response
All IBS patients had multidrug resistant microbes in their gut

Limitation and future direction

- Higher number of samples could not be processed and sequenced due to limitation of time, cost and computing power.
- Metagenomically assembled genomes could not be retrieved because of sequencing depth.

❖ The study opens the door for more research on identifying definitive pattern in IBS patients for disease identification.

Thank you

PREPARING TWO COLUMN PAPER WITH MS WORD THE AFTERMATH OF THE FLOOD CRISIS ON THE ULTRA-POOR AND POOR COMMUNITIES IN BANGLADESH: EFFECTS ON HEALTH, NUTRITION AND ECONOMY OF THE DISASTER AFFECTED POPULATION

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Keywords: *Bangladesh, floods, health, nutrition, economy, poor, ultra-poor.*

BACKGROUND AND MOTIVATION

This study analyses how the month-long flood had a detrimental effect on the public health, nutrition and economic situation of the rural ultra-poor and poor population in the northern parts of Bangladesh. It seeks to explore the damaging consequences of the devastating floods on health, nutrition, food safety, economy and social security in the rural ultra-poor and poor families. Our aim behind the study is to act as a catalyst in helping the victims of this natural disaster by informing policymakers and members of academia as it tried to measure the harmful results of the June 2022 floods on the livelihoods, nutrition and physical health of the disaster affected rural ultra-poor and poor.

METHOD

The study uses primary data (quantitative) from a survey conducted on 100 beneficiary families of the government institution Palli Karma Sahayak Foundation (PKSF) and non-profit organization SAJIDA Foundation during June 2022. SAJIDA Foundation launched a project to aid those affected by recurring floods and river erosion brought on by changes in the Jamuna and Brahmaputra rivers, in collaboration with PKSF and the World Bank.[1] Respondents belong from this project's enlisted households. The survey uses a structured questionnaire including multiple sets of questions.

RESULTS

Nearly 61% households have reported that at least one member was affected by an infectious disease. Infectious diseases include cholera, diarrhoea, dysentery, skin diseases along with several other water borne diseases. At least one member from 42% of the respondent households have paid a visit to the Upazila Health Complex once for treatment purpose.52% households claimed not to possess adequate food supply for the next 1 month. 29% of the households did not possess enough supply for a week. This greatly impacts the nutritional state of the suffering families.57% of households reported at least one earning member became unemployed due to the flood. 34% of the families had at least one member with a stable income. Due to the disaster, 69% households have significantly lesser ($p<=0.01$) income than before.

CONCLUSION

For the rural poor in northern Bangladesh, the floods of June 2022 brought about a variety of challenges. Because of the flooding, infectious diseases are now more likely to spread. Due to the limited food supply in the affected areas, which has led community members into malnutrition, the food safety has also been severely harmed. The catastrophe has led to lower incomes and a shortage of unemployment.

REFERENCE

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THE AFTERMATH OF THE FLOOD CRISIS ON THE ULTRA-POOR AND POOR COMMUNITY OF BANGLADESH

EFFECTS ON HEALTH, NUTRITION AND ECONOMY OF THE DISASTER AFFECTED POPULATION

A Study by Shirajum Munira Dewan

Institute of Health Economics, University of Dhaka.

The Devastating Consequences of The June 2022 Floods in Bangladesh

Devastating flash floods that started in May 2022 and spread to nine northeastern districts of Bangladesh, including Sylhet, Sunamganj, Moulvibazar, Habiganj, Kishoreganj, Netrakona, Brahmanbaria, Mymensingh, and Sherpur, have badly affected an estimated 7.2 million people. The five districts that are most severely affected out of the nine are Sylhet, Sunamganj, Moulvibazar, Habiganj, and Netrakona.[1]

Rain triggered floods lasted for a month

Millions of people were stranded

The month long disaster affected…

Health

The floods created a host of health problems. The most prominent one was the increase of infectious water-borne diseases. People's mental health and well-being were adversely affected.

Nutrition

The floods greatly hampered the availability of food and food safety for future months, thus impacting the communities' overall state of nutrition. The children are its most vulnerable victim among all age groups.

Economy

A large population suddenly lost employment opportunities, was paid less, had lesser scope for work & faced increased expenditure, resulting in lesser net income.

Background

This study analyzes how the month-long flood had a detrimental effect on the public health, nutrition and economic situation of the rural ultra-poor and poor population in the northern parts of Bangladesh. It seeks to explore the damaging consequences of the devastating floods on health, nutrition, food safety, economy and social security in the rural ultra-poor and poor families. Our aim behind the study is to act as a catalyst in helping the victims of this natural disaster by informing policymakers and members of academia as it tried to measure the harmful results of the June 2022 floods on the livelihoods, nutrition and physical health of the disaster affected rural ultra-poor and poor.

Objectives

- Investigating rural poor population's post-disaster health outcomes.
- Observing the link between disaster and the nutritional state of rural poor communities.
- Identifying the immediate changes in economy of the rural poor before and after a disaster.

Methods

Primary data was collected from a survey conducted on 350 beneficiary families of the SAMRIDDHI project, a collaborative endeavor between government institution Palli Karma Sahayak Foundation (PKSF) and non-profit organization SAJIDA Foundation. The survey was carried out during the first week of July 2022 . SAJIDA Foundation launched a project to aid those affected by recurring floods and river erosion brought on by changes in the Jamuna and Brahmaputra rivers, in collaboration with PKSF and the World Bank.[2] Respondents belong from this project's enlisted households. The families are from ultra-poor/poor background.The survey has used a structured questionnaire which include multiple sets of questions that were customised to fit the context of the population. The sampling method was random sampling. I used cross-sectional studies in order to estimate the prevalence of different health outcomes in the population. Econometric modelling was used for calculating the aggregate effect on net income because of the flood. The independent variables include loss of work days, loss of income per day, loss of employment, expenditure because of flood. The dependent variable is aggregate net income.

***Extreme/Hardcore/Very Poor/Ultra-Poor:**

These terms are often interchangeably used by microfinance institutions for targeting the same category of the poor people. The most likely social indicators would be as follows: illiterate persons, no sellable skill other than manual labor, poor nutrition and health conditions, poor sanitary situation; may face food insecurity in 2-3 months of a year; may not have any influence in the village. Housing and other asset holding may be as follows: may or may not have own house; in case of own house it is expected to be made of cheap local materials; do not own any cultivable land. Income and employment characteristics are expected to be as follows: irregular small income often affected by agricultural seasonality; work as domestic help and day labor or live on charity; little household assets; may not have any livestock. An estimated bottom 10-15% of rural families may fall under this category.[3]

Findings

Health

The floods led to various community health concerns . Access to fresh water became impossible. Waterborne infectious disease was the major health problem among the population. Nearly 69% households have reported that at least one member suffered from an infectious disease. Infectious diseases include cholera, diarrhoea, dysentery, skin diseases along with several other water borne diseases. 61% women reported having urinary tract infection. 57% responders' mental health was negatively impacted. 72% of the respondents agreed their well-being was compromised because of the ongoing situation. At least one member from 42% of the respondent households have paid a visit to the Upazila Health Complex once for treatment purpose.

Nutrition

62% households claimed not to possess adequate food supply for the next 1 month. 29% of the households did not possess enough supply for a week. The floods have negatively affected food safety of the population. Nearly all of the households reported their crops damaged because of the flood. Only dry foods, which possess very little nutritional value seem to be available. All of these situations result in poor state of nutrition among the disaster affected people, especially infants and children. 67% of the infants and children (aged 1 to 10) of the selected population showed two or more symptoms of malnutrition.

Economy

56% of households reported at least one earning member became unemployed due to the flood. Due to the disaster, 71% households have significantly lesser ($p<=0.01$) net income than before. 73% of the household responded they had trouble finding work because of the floods. The aggregate net income of the study population after the flood is much lower than that of before the floods. The sudden upheavals of the disaster triggered drastic economic changes in the communities.

Recommendations

- Introducing rainwater harvesting techniques.
- Conducting regular sanitation & health awareness interventions.
- Embracing climate-resilient cultivation approaches
- Creating disaster-resistant livelihood opportunities.
- Enabling disaster risk minimizing policies.

Conclusions

For the rural poor and ultra-poor in northern Bangladesh, the floods of June 2022 brought about a variety of challenges. Because of the flooding, infectious diseases, especially water-borne ones are now more likely to spread. Due to the limited food supply in the flood affected areas, the food safety was also severely harmed, leading community members, especially children to malnutrition. The catastrophe led to lower aggregate net income and a shortage of unemployment in the population.The floods negatively impacted the overall well-being and livelihoods of the rural poor and ultra-poor population.

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Acknowledgements

I sincerely appreciate the authorities at Palli Karma Sahayak Foundation (PKSF) and SAJIDA Foundation for their kind support.

QUALITATIVE ASSESSMENT ON EARTHQUAKE PREPAREDNESS AMONG ACADEMICS, MINISTRIES AND PRIVATE INSTITUTIONS

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Keywords: *Qualitative earthquake preparedness assessment, Structured questionnaire-based assessment, post-earthquake response, Meta-analysis*

1. INTRODUCTION

Earthquake has one of the deadliest potential natural disasters in terms of affecting a country's life and economic assets (Alipour et al, 2014). Qualitative studies help the policymakers, and the ministries to make more informed decisions to find out the gaps in risk management and threats which in turn promotes restructuring and strengthening of the post-earthquake response system, such as relief systems, and healthcare services (Ren et al, 2020).

2. METHODOLOGY

This research accumulates detailed data and sophisticated summarization of current mitigation, preparedness, and response system for both government and academic sector activities concerning potential earthquake risk in Bangladesh. Since this is ongoing research a holistic depiction of the current capacity, strengths, and shortcomings will be done and the research will produce unequivocal future recommendations for earthquake risk management in the sector of research, policy-planning structure, mitigation, preparedness, and awareness in Bangladesh. A synoptic qualitative study-based framework will be formed depicting comprehensive situation analysis from the perspective of research activity, funding allocation, policy plan formulation and implementation, skilled personnel availability, training, and awareness level. Meta-analysis has been done to understand earthquake prediction-based research policy and planning documentation for mitigation, adaptation, and response. Secondary data and documents have been reviewed earthquake risk assessment-based relevant institutional guideline, international articles consisting successful earthquake, preparedness measures. Structured questionnaire formulation for individual sectors and interview is ongoing considering the key personnel from senior researchers from academia, senior government employees, NGO's and the gathered information will be used to find out the strengths, weaknesses and gap of EQ disaster management in Bangladesh and finally framework will be developed.

3. OUTCOME ASSUMPTIONS

There are two possible outcome scenarios that can be assumed from this research. The first likely situation would be a very good collaboration between academicians, ministry, and NGO's but lack of funding, technology and institutional management for EQ in Bangladesh, the second scenario might be the individual sectors are very strong on their own, but the collaboration between these institution is not strong enough to create a resilient earthquake preparedness and management and most importantly follow-up of management system in Bangladesh, for example, the training facilities are properly given to the designated employees, other than that the availability of the funding for the research is also can be an issue.

4. CONCLUSION

This study is aiming to minutely determine these weaknesses and gaps between the academic, ministerial and private institutions to strengthen the earthquake preparedness and management system in Bangladesh.

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[2]. Ren, Z., Guo, J., & Yang, C. (2020). Loss of homeland: a qualitative study of the changes in perception of relocated Sichuan earthquake survivors with posttraumatic stress disorder. *BMC psychiatry*, *20*(1), 1-11.

Qualitative Assessment on Earthquake preparedness among Educational, Government and Private institutions

Presented By
Ayesha Ershad

Supervised By: Sheikh Samanin Tasnim
Co-Supervised By: Dr. A. S. M Woobaidullah

Background

- As five geological fault lines run through our country if an earthquake with a magnitude of 7 or greater happens in Bangladesh, it will lead to a major human tragedy due to faulty structures of the buildings and improper awareness (Raihanul et al, 2016).

- The five major fault zones that run through Bangladesh are:
  - o Dauki Fault Zone
  - o Bogra Fault Zone
  - o Shilong Plateau
  - o Assam Fault Zone
  - o Tripura Fault Zone (Abdullah & Nusrath, 2017)

- As a result of four active sources of earthquakes in the Bay of Bengal, Bangladesh is at high risk for moderate to strong earthquakes that could cause extensive damage and the deaths of thousands of people. There is also a possibility of a tsunami, which could also have a serious impact on the nation.

Bangladesh is still not fully prepared to tackle the aftermath of a strong earthquake.

Background : Bangladesh's Earthquake Risk Zones

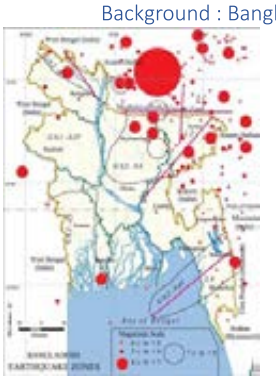

Fig 1: Bangladesh Earthquake Zones (Banglapedia, 2021)

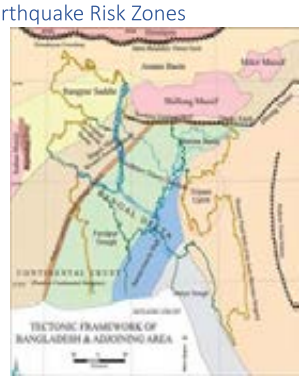

Fig 2: Tectonic Framework of Bangladesh and Adjoining Area (Raihanul et al, 2016)

Background (continued)

Date	Name	Magnitude (Richter)	Epicentral Distance from Dhaka (km)	Epicentral Distance From Sylhet (km)	Epicentral Distance from Chittangong (km)
2 April, 1762	Chittagong Earthquake	7.5			Uncertain but close to south of Chittagong
10 January, 1869	Cachar Earthquake	7.5	250	70	280
14 July, 1885	Bengal Earthquake	7.0	170	220	350
12 June, 1897	Great Indian Earthquake	8.7	230	80	340
8 July, 1918	Srimangal Earthquke	7.6	150	60	200
2 July, 1930	Dhubri Earthquake	7.1	250	275	415

Table 1: Major Historical Earthquakes in Bangladesh (Tahmeed et al, 2015)

Rationale

- According to the rough estimation If an earthquake of 7.5 magnitude happens at the Madhupur Fault,
  - Around 72,000 buildings will be demolished
  - Around 53,000 buildings will partly demolished
  - 61,000 people will be dead if the earthquake happens at 2pm
  - 88,000 people will be dead if the earthquake happens at 2am
  - 30 million ton debris will be deposited
  - 12 lakhs trucks will be needed to collect those debris

https://earthquake.usgs.gov/earthquakes/eventpage/us6000i71j/executive

Objectives

The main aim of the research is to perform a qualitative assessment of the prevailing Earthquake preparedness and response mechanism of Bangladesh and to identify strengths, gaps, and state of collaboration within and between academicians, ministries, NGOs, and Emergency service providers.

Specific Objectives:

1. Holistic and meticulous depiction of current capacity, strength, and shortcomings and formulating an unequivocal future recommendation for earthquake preparedness and response in the sector of research, policy-planning structure, mitigation, preparedness, and awareness in Bangladesh.
2. A synoptic qualitative study-based framework formulation with comprehensive situation analysis in the perspective of research activity, policy-plan formulation and implementation, skilled personnel availability training, and awareness level.
3. Accumulation of detailed data and sophisticated summarization of current mitigation, preparedness, and response for both government and academia sector's activities concerning potential earthquake risk of Bangladesh.
4. Feasible and befitting recommendation formulation considering the research findings incorporating enlightenment from international practices.

Research Questions

1. What are the current capacities, strengths, and shortcomings regarding earthquake preparedness and response among selected stakeholders?
2. How can a framework be developed which systematically represents the results from situation analysis in a very graphic way?
3. What are the key concepts that should be covered in the semi-structured interview questionnaire designed for each type of stakeholder?
4. How do formulate a concise, informative, customized questionnaire considering the variety of stakeholders being interviewed?
5. What are the recommendations produced from Meta-Analysis and Semi-structured interview results that can address the shortcomings in preparedness and response for earthquakes?

Methods

Fig 4: Phases of Semi-Structured and Literature-Based Review Inspired from (Hanna et al, 2016)

Results and Discussion

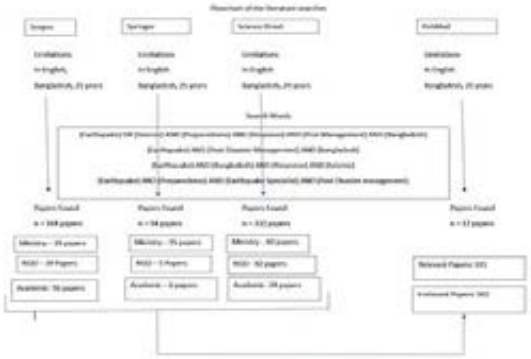

Fig 3: Flowchart of the Literature Searches using Meta-Analysis (Inspired from (Hanna et al, 2016)

Results and Discussion (continued)

Category	Goals	Sample Questions	Response from Academicians	Response from Ministries and Government institutions	Response from NGOs	Response from Emergency Service providers
Contextual	Identifying the from and nature	• Since when has the government considered earthquakes a significant disaster in the case of policy and disaster management plan formulation? • Are earthquakes considered a major disaster among the NGOs in Bangladesh like cyclones and floods?	•	• Since 2010 Bangladesh Government has considered Earthquake as a significant Disaster.	•	
Diagnostic	Examine the Reasons	• Which parts of the National Resilience Program help to deal with earthquakes? • What are the Earthquake Hazard Management Mechanisms in Bangladesh?	•	• National Resilience Program helps to deal with Earthquake. A contingency plan is being made.	•	
Evaluative	Appraising the effectiveness	• Are the earthquake preparedness drills performed in every educational institution and workplace every three months as per the SOD? • How much have the priority groups benefited from DEEPER's earthquake Awareness campaign?		• No, the drills are not being performed every three months, they are usually performed 2 times in a year in March and October.	•	

Table 2: Categories of Questions along with summarized obtained response Inspired from (Ashish & Bruce, 2009)

Results and Discussion (continued)

Category	Goals	Sample Questions	Response from Academicians	Response from Ministries and Government institutions	Response from NGOs	Response from Emergency Service providers
Strategic	Identifying new policies and plans	• What is the level of awareness among policymakers in considering seismic hazard management a part of the integrated disaster management system for Bangladesh? • Is there any earthquake insurance mechanism in Bangladesh like NEHRP? • If not, why not? How much is it feasible to create this insurance mechanism?	• There is somewhat awareness among our policymakers. • The officers which were trained are getting phased out and the current officers don't have much exposure. • Bangladesh does not have an earthquake insurance mechanism like NEHRP. The insurance companies and local people are not hotheaded about earthquake insurance.	We have Urban Resilience project, three departments are working under this project DDM, BAUK, and City Corporation are working for the capacity building, policy intervention and risk assessment.	•	

Results and Discussion (continued)

Summarized review and Interview Findings(still updating):

Strengths	Weaknesses
• National Earthquake Committee in 2008	• Lack of follow-up training and Funding
• Risk Assessment of 10 major Cities	• Drill guidelines are not being followed
• Seismic Micro Zoning	• Lack of implementation and review of the contingency plan
• Buildings Retrofitting	• Lack of proper collaborations between within GO sectors
• Earthquake Contingency Plan • Training and drill provided to emergency frontline service providers like Fire Service and Civil Defense, National Army	• Lack of updated and shared database of progress in EQ research, policy development, strengths, resource availability within academicians, GOs and NGOs.

Thank you For Your Attention

RIVERBANK EROSION AND LOCAL ADAPTATION: THE CONTEXT OF CHAR AREAS IN BANGLADESH

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***Keywords**: Flood, Riverbank Erosion, Adaptation Strategies. Migration, Char, Bangladesh*

1. BACKGROUND

Riverbank erosion is a gradual and silent disaster that ranks at the top in terms of losses incurred in Bangladesh, where 30-40% of the entire population lives near river banks or on river islands (*char*) [1,2]. The majority of riverbank erosion research focuses on the disaster's risks and consequences. Though some studies investigate various adaptation techniques adopted by the erosion-affected populations in *char* regions, these were very context-specific. This study intended to offer a comprehensive picture of riverbank erosion in Bangladesh by stock-taking research conducted so far and examine various local adaption strategies used by people living in *char* areas of Bangladesh.

2. METHODOLOGY

A secondary literature review was used in this study. The findings are based on a content analysis of selected riverbank erosion studies in Bangladesh. Search strategies for literature included PubMed, Google, and Google Scholar. All of the following keywords were used in advanced searching: 'riverbank erosion', 'adaptation', 'coping strateg*', 'riverbank erosion-induced migration', 'migration', '*Char*', and 'Bangladesh' in conjugation with Boolean algebra (AND, OR). Additional descriptive data were gathered from reports of the Bangladesh Water Development Board (BWDB).

3. FINDINGS

The most erosion-prone area in Bangladesh was Sirajganj district. In addition, some coastal areas, some districts of Dhaka and Mymensingh, and the northern parts of Bangladesh were more prone to riverbank erosion. Riverbank erosion-induced displaced people tended to devise and undertake corrective rather than preventive strategies to adapt to their hazardous riverine environment [3,4]. While preventive measures were adopted in the pre-disaster phase, corrective strategies were adopted during or after the hazard. As a result of erosion, migration was typically a forced choice rather than a voluntary adaptation strategy. The majority of *char* residents stay put locally. Most often, they move between nearby or adjacent *chars*. On average, people displaced by riverbank erosion resided on more than six *chars* [4].

We found three types of migration among people affected by riverbank erosion in *char* areas: permanent, temporary, and cyclical migration, which could be attributed to a variety of environmental factors [5]. People tended to stay in their positions until or unless the risks made it impossible to stay. In such cases, short-distance temporary migration was usually preferred, but if the damage or loss was severe, the affected people permanently migrated to preferred locations. In times of hardship, cyclical migration was used to find work. When deciding whether to migrate, erosion-affected people considered a variety of environmental, social, economic, and political push/pull factors [1,6]. The fight against riverbank erosion appeared to be a problem for those who were exposed and affected, with some assistance from various NGOs, but little concern from the government.

4. CONCLUSIONS

Bangladesh is facing a major threat from riverbank erosion. This situation is even more concerning because it has long-term consequences for people's lives, making them vulnerable. Local governments should take the lead in reducing vulnerability and providing faster and more efficient responses. Given the magnitude of this phenomenon and the number of people at risk, riverbank erosion adaptation strategies should be planned more comprehensively and effectively so that losses can be minimized and people can resume their normal lives.

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1st Joint Student Seminar between
University of Tokyo and University of Dhaka
3-4 August 2022

Riverbank Erosion and Local Adaptation: the context of *Char* areas in Bangladesh

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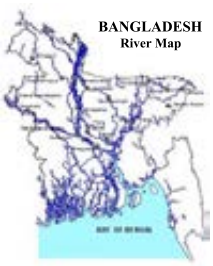
Presentation Outline

- Riverbank Erosion in Bangladesh
- Research Objectives
- Methodology
- Findings of the Study
  - ✓Riverbank erosion-prone areas in Bangladesh
  - ✓Adaptation Strategies for riverbank erosion in *Char* areas of Bangladesh
  - ✓Migration as an Adaptation Strategy in *Char* areas of Bangladesh
- Recommendations
- Conclusion

Riverbank Erosion in Bangladesh

- Riverbank erosion ranks first in terms of losses incurred in Bangladesh where 30-40% of the entire population lives near river banks or on river islands (*char*).
- Around 15-20 million people are at risk from the effects of riverbank erosion in the country.
- About 10,000 hectares of land are eroded per year by riverbank erosion in Bangladesh.



Research Objectives

- The majority of riverbank erosion research focuses on the disaster's risks and consequences.
- Less attention has been given various adaptation techniques adopted by the erosion-affected populations, specially in *char* regions.
- This study intended to offer a comprehensive picture of riverbank erosion in Bangladesh by **stock-taking research conducted so far** and examine various **local adaption strategies** used by people living in *char* areas of Bangladesh.

Research Methodology

- This paper is the outcome of the secondary literature review.
  - Sources of literature: PubMed, Google Scholar, and Google
  - Period: 1970 to 2020
  - Number of studies included: 20
- The findings are based on the content analysis of selected studies.

Findings

Riverbank Erosion-prone Areas in Bangladesh

- The Brahmaputra and Jamuna river are more prone to erosion due to their braided configuration.
- Following districts were more prone to riverbank erosion:
  - Sirajganj, Kurigram, Lalmonirhat, Gaibandha and Rangpur in North
  - Chandpur, Manikganj, Rajbari, Shariatpur, and Faridpur in Dhaka zone
  - Tangail and Jamalpur in the Mymensingh zone
  - The coastal areas of Patuakhali

Findings: Adaptation Strategies

The riverbank erosion affected people devise and undertake both **preventive** and **corrective** strategies to adapt.

Pre-hazard Adaptation Strategies	During-hazard Adaptation Strategies	Post-hazard Adaptation Strategies
• Raising houses on plinths • Placing of barriers around the house • Using the movable housing materials in constructing their houses • Using different types of materials to protect river bank erosion (e.g., piled sandbags, soil bags, and brick) • Using *Muchan* and *Pataton* (houses built with either bamboo or wooden ceiling in the upper part of the shelter where people live) • Preparation of *Jagon* (a float made out of water hyacinth and thatch) • Borrowing and selling land and other productive assets	• The shifting of family members, tangible properties and livestock from the erosion affected area • Taking shelter on the embankment of the river, on neighbor's land, nearby char villages. • Salvaging housing structure • Standing crops are taken by the displacees • Selling livestock • Reducing the number of meals and relying on inexpensive food • Depending on relief	• Relocating homestead in a nearby area • Searching for alternative sources of income • Treating diseases

Findings: Migration as an Adaptation Strategy

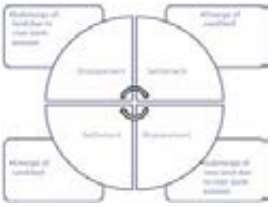


Figure: Continuous process of forced migration due to riverbank erosion in Char areas (Das et al., 2014)

Types of Migration	Causes	Destination
Permanent	Massive Erosion, Heavy Rainfall, permanent flooding causing heavy material/non-material loss.	If possible, on the same or nearby Char, mainland, short distances, Urban areas
Temporary	Significant hazards that have an effect for a limited period do not cause irreversible damage.	Homes of other family members elevated roads, embankments, Mosques, Schools, Nearby villages on mainland
Cyclical	Insufficient income, Financial and material loss, need to repay loans	Other Chars, local headquarters (different district), Urban areas

Recommendations

- Local governments should take the lead in reducing vulnerability and providing faster and more efficient responses.
- To cope with the material losses incurred by hazards, insurance systems for the poor may be set up through collective savings groups.
- Given the magnitude of this phenomenon and the number of people at risk, riverbank erosion adaptation strategies should be planned more comprehensively and effectively so that losses can be minimized and people can resume their normal lives.

Conclusion

- Bangladesh is facing a **major threat** from riverbank erosion. This situation is even more worrying for people living in *Char* areas.
- Local **adaptation strategies vary** depending on the severity of the erosion, but they are neither efficient nor capable of mitigating losses and improving the lives of the affected people.
- Migration was typically a **forced choice** rather than a voluntary adaptation strategy.
- It is, therefore, important to **prioritize riverbank erosion adaptation strategies**, and to support the affected people to minimize the risks and ensure that people are less vulnerable and more resilient in erosion-prone areas of Bangladesh.

Thank you

Please let us know your questions/comments:

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NEXUS BETWEEN DISASTER AND INFECTIOUS DISEASES: EXPERIENCE FROM RECENT FLOOD IN BANGLADESH

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***Keywords**: Disaster, Flood, Infectious diseases, Sylhet, Bangladesh*

1. INTRODUCTION

Natural disaster is one of the major causes of deaths in developing countries [1]. Recently, massive flood has ravaged in the northeastern part of Bangladesh, mainly in Sylhet division. This study attempts to explore whether there is increased rate of infectious diseases after the flood.

2. OBJECTIVE

This study aims to explore the nexus between recent flood and causing of infectious diseases in Sylhet, Bangladesh.

Figure 1. Flooding in Sylhet, Bangladesh

3. METHODOLOGY

This study has conducted both qualitative and quantitative analysis. All districts of Sylhet division were included in the study area. Quantitative data was obtained from MIS, Directorate General of Health Service. Qualitative data were collected through telephone interviews with several Upazila Health & Family Planning Officers (UHFPOs).

4. FINDINGS

Flood causes water contamination resulting in epidemics of water-borne diseases. The flooding of Sylhet division has damaged more than 12,000 tube wells. As a result, people are consuming contaminated drinking water and suffering from diarrheal disease.

The study revealed that people in Sylhet division are mostly affected with watery diarrhea and the main cause of diarrhea is viral infection. According to qualitative interviews, rotavirus is the common type of organism in most of the diarrheal cases in Sylhet.

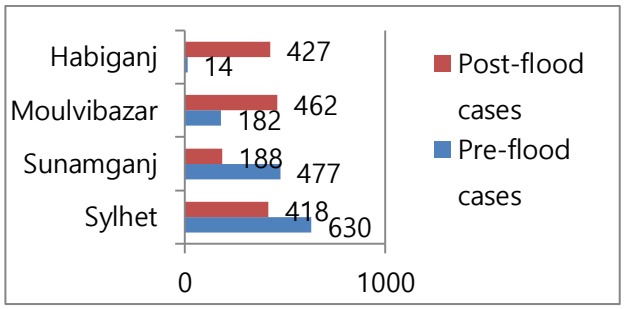

Figure 2. Comparison of incident of diarrheal cases, pre-flood (March 16-May 16, 2022) and post-flood (May 19-July19, 2022)

It was observed that the incidence of diarrheal disease after flood is more than double before flood in two districts of Sylhet (Moulvibazar and Habiganj) (Figure 2). On the contrary, in two other districts (Sylhet and Sunamganj), the number of cases are increasing after flood but the number is comparatively lower than pre-flood situation (Figure2). There is no study as to why the number of diarrheal cases was higher before pre-flood situation. But from qualitative interviews with UHFPOs it was revealed that the post-flood cases were lower due to steps taken by the authority during flood such as distribution of water purification tablet, implementation of water treatment plant, and medical campaign.

From qualitative interviews, it was found that before the flood most of the patients at Upazila Health Complex came with the symptoms of fever, pneumonia, cough, TB, and diarrhea. However, after the flood the patients with diarrhea, skin diseases and fever increased significantly.

5. CONCLUSIONS

This study has quantified the impact of recent flood on infectious diseases in Sylhet, Bangladesh, using a mixed method approach. Results suggest that floods can increase the prevalence of infectious diseases mainly diarrhea due to consuming contaminated drinking water in the study areas. However, from the incidents of two districts (Sylhet and Sunamganj), it can be concluded that infectious diseases can be reduced with proper precautions taken by the authority. Thus, this should be a policy consideration in future.

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1st Joint Student Seminar between Univ. of Tokyo and Univ. of Dhaka

Nexus Between Disaster and Infectious Diseases: Experience from Recent Flood in Bangladesh

Presented by Tisha Chakma

Co-authored by:
Mushfika Binta Latif
Sayma Sadia Nova

August 3-4,2022

Presentation Outline

- Introduction
- Objective
- Methodology
- Findings
- Conclusion
- Recommendation
- References

Presentation Outline

Introduction

- Natural disaster is one of the major causes of deaths in developing countries
- Flood, the most frequent and devastating natural disasters worldwide
- It causes several infectious diseases which are mostly water borne and vector borne

Introduction

- Recently, massive flood has ravaged in the northeastern part of Bangladesh, mainly in Sylhet division
- 72% area of Sylhet division went under water and water level was 74 cm above the danger level in Sunamganj district
- Previous studies reported that the most common type of illness post flood is diarrhea
- No scientific study regarding the nexus between infectious diseases and recent flood
- This study attempts to explore whether there is increased rate of infectious diseases after the flood

Objectives of the study

1. To identify cause and effect relation between flood and infectious diseases (epidemiological triad)
2. To identify the abundance of micro-organism (bacteria, virus etc) after flood (disease theory)
3. To compare the incidence of diarrheal disease before and after flood

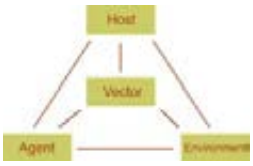
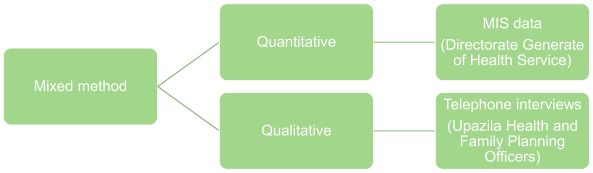


Figure: Epidemiological triad

Flooding in Sylhet, Bangladesh

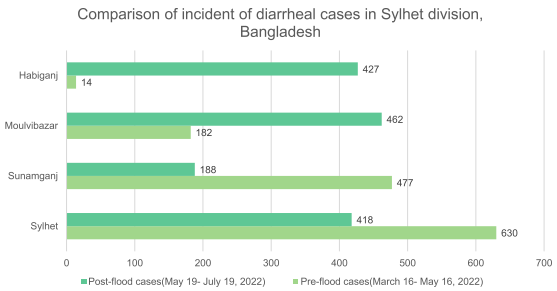
Methodology



Key Findings

- More than 12000 tube wells are damaged
- People are consuming contaminated drinking water and suffering from diarrheal disease
- Mostly affected with watery diarrhea
- Rota virus is the common type of organism in most of the diarrheal cases

Figure 1. Flood affected areas with contaminated drinking water



Steps taken during flood

Distribution of water purification tablet

Implementation of water treatment plant

Steps taken during flood

Dissemination of safe drinking water

Medical Campaign

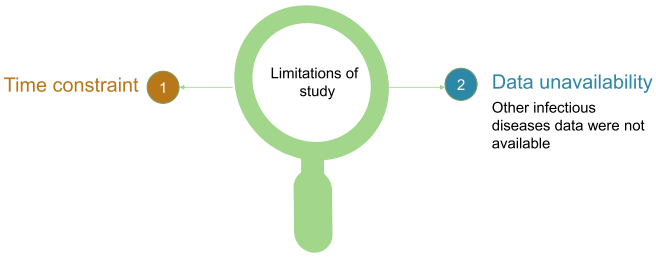
Types of patient at Upazila Health Complexes in Sylhet division

Pre-flood	Post-flood
• Fever • Pneumonia • Cough • TB • Diarrhea	• Diarrhea • Skin diseases • Fever

CONCLUSION

Floods can increase the prevalence of infectious diseases mainly diarrhea in affected areas. Other diseases such as fever and skin diseases also rise significantly during flood.

Limitations of Study



Recommendation

Recommendation

Infectious diseases can be reduced with proper precautions taken by authority. Thus, this should be a policy consideration in future

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Thank you

UTILITIES OF SMART CITIES SERVICES FOR BLIND PERSONS IN INDIA: THE EDUCATIONAL PERSPECTIVES

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Keywords: *Smart Cities, People with Disabilities, Blind Persons, Assistive Technology, Internet of Things, Accessibility.*

INTRODUCTION: The purpose of this research is to determine how utilities smart cities services might help blind people in India become more included in society. Technologies have been used by smart cities in a number of areas to enhance the provision of public services, respond to citizen needs, and track the use of natural resources. Smart Cities projects, which aim to improve citizens' quality of life overall, have already improved how blind people engage with urban areas, services, and other blind people in mobilization for blind.

OBJECTIVES: To include blind people in the benefits of smart cities, we first suggested the concept of an inclusive smart city, which uses smart city technologies to improve the urban experience for persons with disabilities while removing accessibility hurdles in urban areas.

RESEARCH METHODOLOGY: To accomplish this, we started using a multi-instrument approach to gather data from various stakeholders, including people with disabilities, professionals who work with people with disabilities, including blinds, accessibility-related experts, and policymakers. Our goal was to understand the challenges that people with disabilities face when they are moving around the city, the solutions they use to address unforeseen issues, and how they interact with others.

FINDINGS & DISCUSSION: With the Inclusive Smart City's vision in mind, we proposed some tools to assist practitioners and researchers working on the creation of digital urban assistive technologies: a list of specifications, a political structure, an implementation/operation methodology, a business model, a conceptual model, and a system architecture. By interacting with inclusive smart items that are present in urban environments, persons with disabilities are able to learn more about their surroundings, according to the conceptual model we presented. This information enables them to navigate and experience cities in novel ways. In inclusive smart cities, inclusive smart objects offer user-adapted information and services to persons with disabilities while putting an emphasis on the people's skills rather than their disabilities.

CONCLUSION: Users in a simulated circuit were given location-based information and services about the object linked to each code when they read it. The participants gave the Urban Assist application positive feedback and acknowledged the value of the resources and features it offered, which gave them a creative interface to explore the urban area in a fresh, safe, and efficient manner. In conclusion, this new technology has the potential to enhance the independence and autonomy of those with disabilities in urban settings as well as give them the tools they need to be active members of society.

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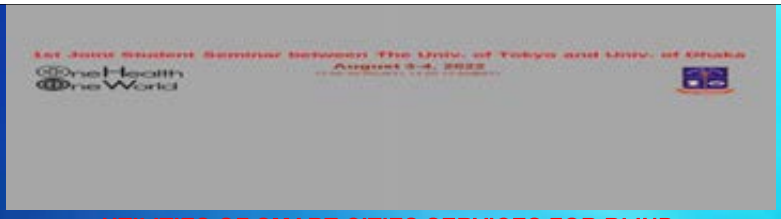

UTILITIES OF SMART CITIES SERVICES FOR BLIND PERSONS IN INDIA: THE EDUCATIONAL PERSPECTIVES

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Introduction

- The purpose of this research is to ***determine how utilities smart cities services might help blind people in India become more included in society***.
- Technologies have been used by smart cities in a number of areas to **enhance the provision of public services**, respond to citizen needs, and track the use of natural resources. I.e: ***Educational Implications***
- Smart Cities projects, which aim to improve citizens' quality of life overall, have already improved how blind people engage with urban areas,Educational services, and other blind people in mobilization for blind.

Objectives

To include blind people in the benefits of smart cities, we first suggested the concept of an ***inclusive smart city***, which uses smart city technologies to improve the urban experience for persons with disabilities while removing accessibility hurdles in urban areas

- To review what kind of utilities of smart cities services for blind persons in india.
- To study educational implications are need for upliftment and quality of life for blind persons in india.

Research Methodology

- To accomplish this, we started using a ***multi-instrument approach*** to gather data from various stakeholders, including people with disabilities, professionals who work with people with disabilities, including blinds, accessibility-related experts, and policymakers.
- Our goal was to understand the challenges that people with disabilities face when they are moving around the city, the solutions they use to address unforeseen issues, and how they interact with others.

- FINDINGS & DISCUSSION:
- With the Inclusive Smart City's vision in mind, we proposed some tools to assist practitioners and researchers working on the creation of digital urban assistive technologies: a list of specifications, a political structure, an implementation/operation methodology, a business model, a conceptual model, and a system architecture.

- By interacting with inclusive smart items that are present in urban environments, persons with disabilities are able to learn more about their surroundings, according to the conceptual model we presented. This information enables them to navigate and experience cities in novel ways.
- In inclusive smart cities, inclusive smart objects offer user-adapted information and services to persons with disabilities while putting an emphasis on the people's skills rather than their disabilities.

CONCLUSION:

Users in a simulated circuit were given location-based information and services about the object linked to each code when they read it.

The participants gave the Urban Assist application positive feedback and acknowledged the value of the resources and features it offered, which gave them a creative interface to explore the urban area in a fresh, safe, and efficient manner.

In conclusion, this new technology has the potential to enhance the independence and autonomy of those with disabilities in urban settings as well as give them the tools they need to be active members of society.

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TERRITORIAL AGGLOMERATION IN DHOLAIKHAL: A MATERIAL FLOW ANALYSIS PERSPECTIVE

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***Keywords**: territorial agglomeration, material flow analysis, metal recycling, end of life vehicle, automobile scrap*

BACKGROUND

Over the past few decades, the automotive market in Bangladesh has become a thriving sector in the light engineering industry with ever-growing demand for auto parts. Currently Dholaikhal is the largest informal market of end-of-life auto-parts within the country, where over 4,000-5,000 shops have emerged over the years, with 30,000-40,000 staff employed [1].

Figure 1: A sixty-year old man breaking a gearbox; he has been employed in this industry for 30+ years.

Large percentage comprises of metal components, notably steel, iron, and aluminum. Annually, Dholaikhal deals with thousands of tons of these metallic parts, and a significant amount of the metal scraps produced here act as a resource for other industries. This has established a network of exchanges where the by-products of one industry have become the raw resources for another through secondary processing.

RATIONALE

Although Bangladesh has made recent development towards manufacturing domestically-made auto-parts, there are no notable national initiatives to efficiently utilize the recycling sector of the end-of-life vehicles (ELV) and improve secondary metal processing. Therefore, this study unravels the inherence of Dholaikhal in Bangladesh's automobile industry, evaluating the potential of metal recyclability and reusability within.

METHODOLOGY

Extensive field surveys and material flow analysis (MFA) have uncovered the patterns of in-use stocks and flows of the metals on five segments of a vehicle.

RESULTS

Annually, 63,910 tons of steel and iron parts and scrap enter Dholaikhal, with an output of 48,052 tons. The corresponding number for aluminum is 56,600 tons and 30,382 tons, respectively. Roughly 8,465 tons of steel and/or iron and 7,235 tons of aluminum scrap are recycled every year.

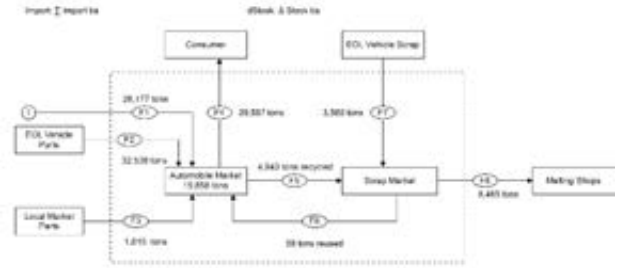

Figure 2: Material flow analysis of steel and/or iron in Dholaikhal system boundary, FY2020-2021

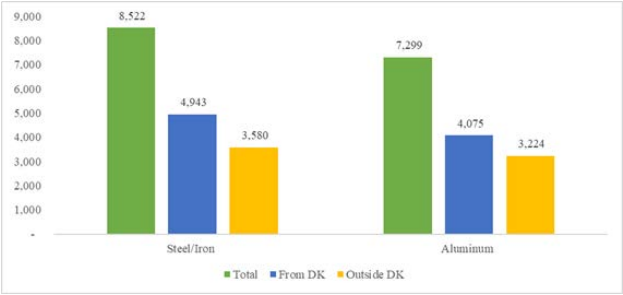

Figure 3: Collection of steel and/or iron and aluminum scrap from within and outside Dholaikhal system boundary, FY2020-2021

CONCLUSION

With the nation's recent initiative towards manufacturing auto-parts, institutionalizing Dholaikhal can provide a feedstock of secondary metal resources in the industry. However, such an initiative must have a carefully planned systemic framework through practical reforms in institutional values to induce a sustainable transition to a formal sector.

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[1] Parveen, S. (2008, November 10). The 'magicians' of Dholaikhal. The Daily Star. Retrieved from: https://www.thedailystar.net/news-detail-62625

TERRITORIAL AGGLOMERATION IN DHOLAIKHAL: A MATERIAL FLOW ANALYSIS PERSPECTIVE

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Date: 4th August, 2022

1

INTRODUCTION

A BRIEF BACKGROUND ON THE STUDY AND ITS RELEVANCE

IMPORTANCE OF END-OF-LIFE VEHICLES AS A SECONDARY METAL RESOURCE

Resources are scarce → Depletion of metals → Secondary metal resources → End of Life Vehicles (ELVs)

- ✓ Resource Decoupling
- ✓ Sustainable and ecologically beneficial
- ✓ Urban Mining

CURRENT STATISTICS ON END OF LIFE VEHICLE (ELV)

Globally vehicle ownership: 1.32 billion vehicles (2016)
- Expected to reach 2.4 billion by 2050, thus the generation of ELVs and their constituent scrap is also expected to increase.

Global generation of ELVs is 40 million cars annually

80% of an ELV can be recycled: Significant contribution to the modern approach to a circular economy.

From an ELV, we can obtain:

- 71% of ferrous metals
- 7% of non-ferrous metals

RELEVANCE OF RESEARCH ON ELV IN BANGLADESH

RISING NUMBERS IN VEHICLE OWNERSHIP

1.12 million registered vehicles (BRTA, 2018)
1.85 times compared to 2010

INCREASING DEMAND OF AUTOMOBILE PARTS

10-12% increase in demand per year

↓

Secondary resource use from ELVs

LACK OF RESEARCH AND INSTITUTIONAL INVOLVEMENT

Dearth of research and development in developing economies, Bangladesh being one in particular.

DHOLAIKHAL AS A METAL RECYCLING CENTRE

Dholaikhal is a thriving hotspot of an automobile marketplace and metal recycling center with a wide range of stakeholders

It has been the pioneer in the country since the 1960s in terms of importing, refurbishing, reprocessing, and recycling automobile components

Dholaikhal is the largest market for this light engineering industry within Bangladesh. Over 4,000-5,000 shops have emerged over the years, with 30,000-40,000 staff employed and marketing about 200 types of machinery.

Annually, thousands of tons of metal is recycled at Dholaikhal, collected from both within and outside sources

DHOLAIKHAL AS A TERRITORIAL AGGLOMERATION

Agglomeration: Tendency of businesses and industries to cluster in close geographic proximity, e.g. Silicon Valley California

Territorial Agglomeration

Consists of loose networks of independent economic agents in the same or related market segments in a restrictive geographic locality

RESEARCH OBJECTIVES

THE STUDY WILL COVER TWO OBJECTIVES:

1. To investigate, assess and quantify the in-use stocks and flows of steel and/or iron (ferrous metals) and aluminum of automobile parts in Dholaikhal, and

2. To assess the significance of Dholaikhal as an agglomeration and investigate its importance in metal recycling, reuse, and remanufacturing.

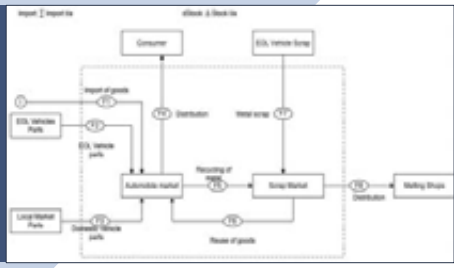
2

METHODOLOGY

MATERIAL FLOW ANALYSIS

USING DYNAMIC MFA:

- This study attempted to uncover the patterns of in-use stocks and flows of metals in automobile parts at Dholaikhal.
- We calculated metal inputs via automobile parts, both through imports and domestic extractions.
- In-use stocks for FY2020-2021 were determined by using mass-balance after quantifying the output flows.
- The metal waste flows, and its current recyclability has also been calculated.



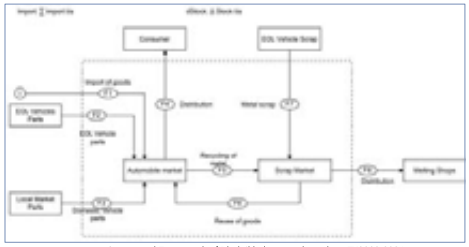
Conceptual Framework of Dholaikhal system boundary, FY2020-2021

CONCEPTUAL FRAMEWORK OF DHOLAIKHAL

The system boundary of the Dholaikhal automobile marketplace comprises of 2 major subsystems:

1. AUTOMOBILE MARKET subsystem that deals with:
   - Input of imported vehicle parts,
   - Input of domestically extracted vehicle parts,
   - Distribution to consumers, and
   - Sending unusable parts to recycling

2. SCRAP MARKET subsystem that deals with:
   - Collection of ELV metallic parts from Dholaikhal,
   - Collection of ELV metallic parts from outside sources,
   - Disassembling ELV parts to smaller recyclable pieces (scrap),
   - Metal-wise segregation of parts, and
   - Distribution of scrap metal



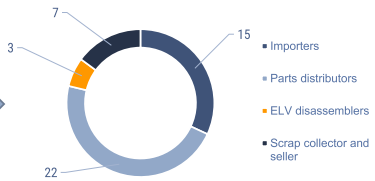
Conceptual Framework of Dholaikhal system boundary, FY2020-2021

STAKEHOLDER PROFILING

Number of different stakeholders in Dholaikhal

Stakeholder Type	Number
Importers	557
Parts distributors	1555
ELV disassemblers	10
Scrap collector and seller	29

Number of Stakeholders Interviewed



Type of vehicular parts dealt by each stakeholder

Stakeholder Type	Body	Engine	Gearbox	Starter and Alternator	Suspension and Steering
Importers	4	5	3	4	4
Parts distributors	5	5	3	4	5
ELV disassemblers	3				
Scrap collector and seller	7				

TYPES OF METALS AND VEHICLE SEGMENTS CONSIDERED

THE STUDY FOCUSED ON PARTS MADE OF STEEL AND/OR IRON AND ALUMINUM:

- These metals constitute 75% of a whole vehicle,
- Only these metals are *actively* recycled within the system boundary of Dholaikhal

1500 CC vehicle: ~ 2,150 kg (80-85% is metallic)

SEGMENTS BEING FOCUSED ON:


Body


Engine


Gearbox


Starter and Alternator


Suspension and Steering

These five segments comprise of 83-93% of the metal content in a vehicle, of which:

- Steel and/or iron comprises of 59-62%
- Aluminum comprises of 35-36%

Composition of iron and/or steel and aluminum in the automobile segments

Segment Type	HS Code	Average metal content per unit (kg)	Steel and/or iron content per unit (kg)	Aluminum content per unit (kg)	Source of metal content
Body	870829	550.0	345.0	172.5	Survey
Engine	870421	199.0	72.0	80.0	Survey
Gearbox	870840	40.0	20.0	20.0	Survey
Starter and Alternator	851140, 851150	21.3	13.4	2.6	Dean et al. (1976)
Suspension and Steering	870880, 870894	475.0	300.0	166.5	Survey
Total	-	1,285.3	750.4	441.6	-

3

RESULTS AND DISCUSSION

IMPORTER DATA

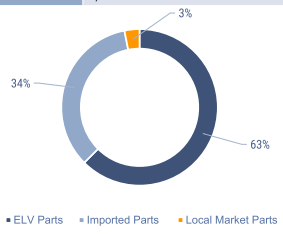
Flow of steel and/or iron and aluminum entering Dholaikhal through import in FY2020-2021

Part	Units	Steel and/or iron (tons)	Aluminum (tons)
Body	31,736	10,949	5,475
Engine	61,904	4,952	6,954
Gearbox	89,797	1,796	1,796
Suspension/Steering	25,833	7,750	4,301
Starter/Alternator	54,506	730	144
Total	263,776	26,177	18,670

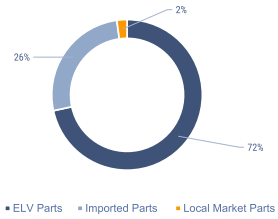
PARTS DISTRIBUTOR DATA

Flow of steel and/or iron and aluminum input collected by parts distributors in FY2020-2021

Source	Steel and/or iron (ton)	Aluminum (ton)
ELV	32,538	33,682
Imported	17,909	12,316
Domestic Market	1,615	1,024

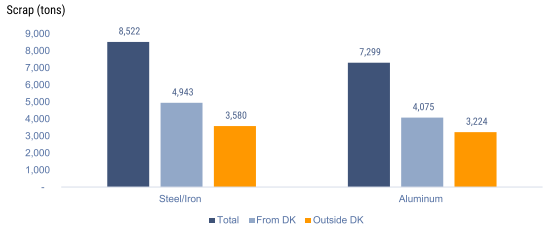


Annual steel and/or iron collection



Annual aluminum collection

SCRAP AND RE-USE DATA

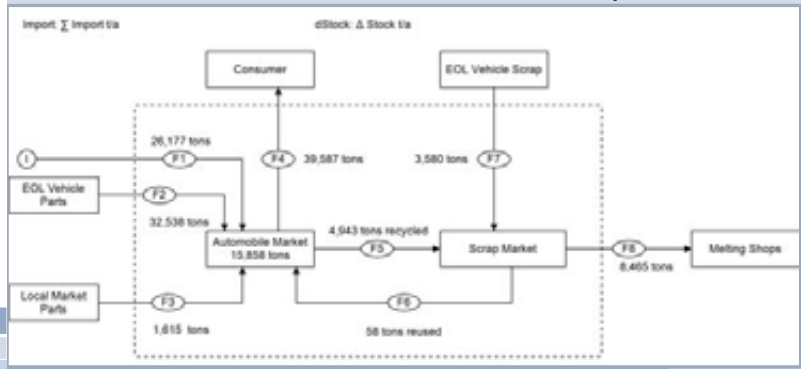


Flow of input of steel and/or iron and aluminum scrap from within and outside Dholaikhal in FY2020-2021

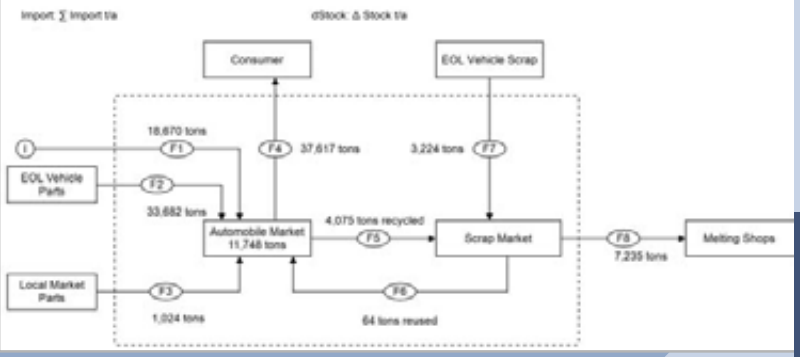
Amount of steel and/or iron and aluminum components re-used in Dholaikhal, FY2020-2021

Steel and/or iron content being re-used (tons)	Aluminum content being re-used (tons)
58	64

MATERIAL FLOW ANALYSIS OF STEEL AND/OR IRON



MATERIAL FLOW ANALYSIS OF ALUMINUM



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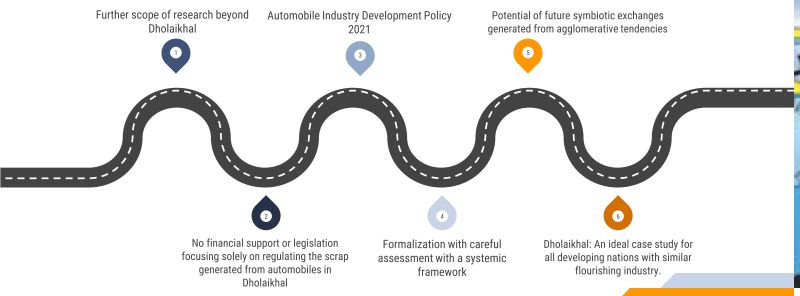
RECOMMENDATION AND CONCLUSION

RECOMMENDATION AND CONCLUSION



THANKS!

Any questions?

WHOLE GENOME ANALYSIS OF MULTIDRUG-RESISTANT *Providencia stuartii* ISOLATED FROM BURN PATIENTS: THE EMERGENCE OF *bla*$_{NDM-1}$ CONFERRING RESISTANCE TO CARBAPENEMS

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Keywords: *Antibiotic resistance, Carbapenem, Providencia stuartii, Burn patients, Whole genome analysis*

1. INTRODUCTION

Since *Providencia stuartii* (*P. stuartii*) is frequently being reported worldwide for its ascending occurrence, high antimicrobial resistance pattern, infection rate as well as mortality rates, it has become a matter of concern especially in case of immune-compromised and burn patients[1]. Inadvertency toward this infectious opportunistic pathogen in Bangladesh, roused the importance and concernment to investigate about this pathogen.

2. MATERIALS AND METHODS

In this study, 18 samples of wound swab were collected from 18 burn patients admitted in Sheikh Hasina National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh. 4 potential isolates identified as *P. stuartii* through biochemical tests and molecular approach were subjected to several phenotypic tests including Antibiogram. Following that, one carbapenem resistant and one carbapenem sensitive isolate were subjected to whole genome sequencing and analysis,

3. RESULTS:

The occurrence of *P. stuartii* was found to be 22.22% (4 within 18 samples/isolates) and all the 4 isolates of *P. stuartii* were proved to be multidrug resistant (MDR). One isolate showed resistance to all the 22 antibiotics tested including carbapenems. 3 out of 4 isolates were predicted to be producing carbapenamase and also all the isolates showed strong biofilm forming capability. The isolates showed greater sensitivity in 0.1M metal solutions of Cu and Zn. The whole genome analysis revealed the antibiotic resistance genes, pathogenicity, virulence factors genes (VFGs) and metabolic pathways. Also, *bla*$_{NDM-1}$, a metallo beta lactamase gene was predicted to be the responsible agent behind complete resistance to carbapenems which was explicable through the antibiogram, gene specific PCR and whole genome analysis.

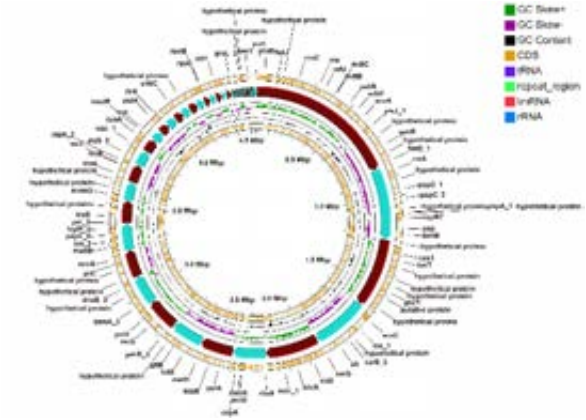

Figure 1: Genome map of an MDR *P.stuartii* reported in this study.

4. CONCLUSION:

This particular study constituted a pioneer report of occurrence of *P. stuartii* in burn patients in the perspective of Bangladesh and its pathogenicity along with antimicrobial resistance pattern through conventional laboratory experiments and comparative whole genome analysis. In order to determine the magnitude of this potential threat all over the country rather than a particular hospital, a widespread and extensive study is required along with further research and investigation about the virulence, pathogenicity and antimicrobial resistance pattern of *P. stuartii.*

REFERENCES:

[1] J. Liu, R. Wang, and M. Fang, "Clinical and drug resistance characteristics of Providencia stuartii infections in 76 patients," *J. Int. Med. Res.*, vol. 48, no. 10, 2020, doi: 10.1177/0300060520962296.

Whole genome and pathogenicity analysis of Multidrug-Resistant *Providencia stuartii* isolated from burn patients: The emergence of *bla*$_{NDM-1}$ conferring complete resistance to Carbapenems

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Introduction

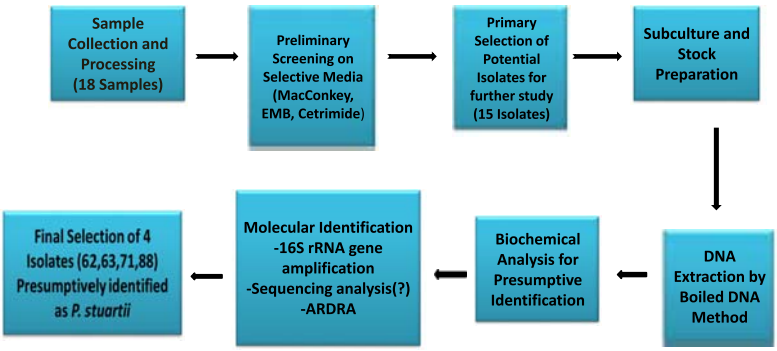
Providencia stuartii is gram negative rod shaped bacteria commonly found in soil, water and sewage. It is an opportunistic pathogen seen in patients with severe burns or long term indwelling urinary catheters.

Why *Providencia stuartii?*

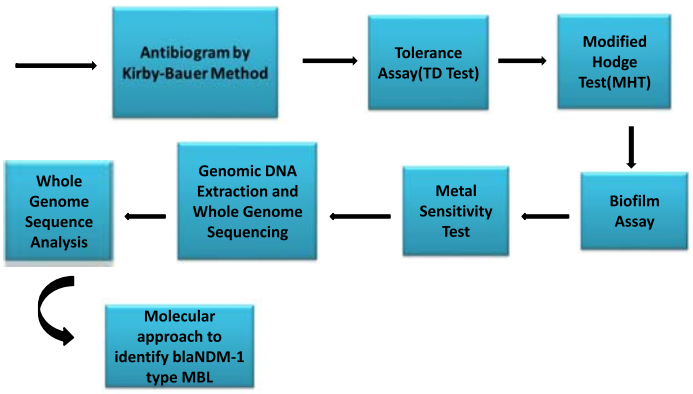
- **Most common** *Providencia* species causing human infections.
-**Opportunistic pathogen** and can frequently cause **nosocomia**l infection.
-Ascensive incidence in **burn patients** causing severe infections worldwide.
-Mortality rate can be around maximum **30%** according to several reports.
-Mortality rate in patients having bloodstream infections is around **6-33%.**
-High **antimicrobial resistance** pattern.
-**Invasive property** allows migration to several organs and cause endocarditis, peritonitis, pericarditis, meningitis etc.
-No whole genome sequencing report has been published yet from Bangladesh.

Literature Review

Workflow



Workflow contd.



Whole Genome Sequence Analysis Pipeline

- Quality Checking by **FastQC**
- Trimming the sequence by **Trimmomatic**
- Genome Assembly using **SPADES**
- Genome Annotation by **PROKKA** and **RAST** Server
- Identification by **Kmer Finder**, **Kbase Server** and **NCBI BLAST**
- Genome mapping and visualization with **Proksee** (Previously **CGView Server)**
- Pathogenecity detection by **Pathogen Finder Tool**
- Virulence Factors Determination by **VFDB** , **Virulence Finder** and **Victors database**
- Antimicrobial Resistance Genes Investigation by **ResFinder**, **AMRFinder, CARD** and finding Correlation with the data of Antibiogram
- Plasmid Assembly by **PlasmidSPADES**
- Plasmid annotation by **Prokka**
- Plasmid mapping for AMR genes by **Proksee**

Results

Presumptive Identification
(Microscopy, Culture Based and Biochemical analysis)

Culture Based:


MHA


Cetrimide


Cetrimide


MacConkey


Cetrimide

Microscopy and Biochemical Analysis:


Citrate Test


MIU


VP


MR


Indole


KIA


Gelatin hydrolysis


Oxidase test


Catalase test


Microscopy 1


Microscopy 2

Presumptive Identification
(Microscopy, Culture Based and Biochemical analysis)

Identification:

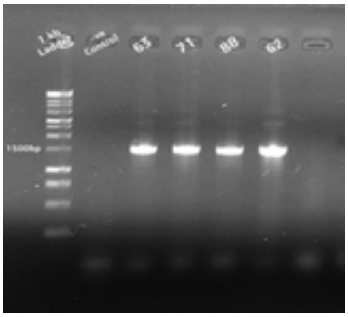
i)*Providencia stuartii*
(62,63,71,88)

ii)*Pseudomonas aeruginosa*
(Others, 11 isolates)

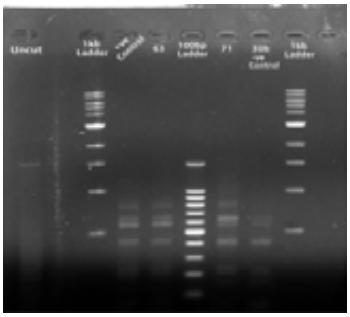
i)Biochemical tests		62	63	71	88	Others
Fermentation	Glucose	+ve	+ve	+ve	+ve	-ve
	Lactose	-ve	-ve	-ve	-ve	-ve
	Sucrose	-ve	-ve	-ve	-ve	-ve
	H_2S	-ve	-ve	-ve	-ve	-ve
	Gas	-ve	-ve	-ve	-ve	-ve
Nitrate Reduction		+ve	+ve	+ve	+ve	+ve
Indole Production		+ve	+ve	+ve	+ve	-ve
MR Reaction		+ve	+ve	+ve	+ve	-ve
VP Reaction		-ve	-ve	-ve	-ve	-ve
Urease Activity		-ve	-ve	-ve	-ve	-ve
Catalase Activity		+ve	+ve	+ve	+ve	+ve
Oxidase Activity		-ve	-ve	-ve	-ve	+ve
Gelatin Liquefication		-ve	-ve	-ve	-ve	+ve
Citrate Utilization		+ve	+ve	+ve	+ve	+ve
Motility		+ve	+ve	+ve	+ve	+ve
Pigment		-ve	-ve	-ve	-ve	+ve
Glucose(Acid)		+ve	+ve	+ve	+ve	-ve
ii)Microscopy						
Shape		rod	rod	rod	rod	rod
Gram Stain		-ve	-ve	-ve	-ve	-ve

Molecular Approach For Identification

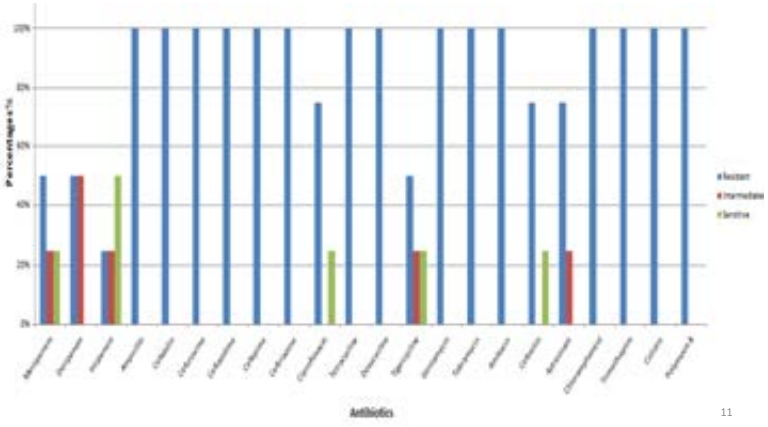
16S rRNA gene Amplification



ARDRA



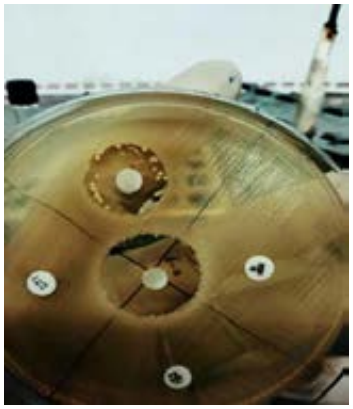
Antibiogram of Four Isolates



Tolerance Assay (TD Test)

Tolerance Assay was carried out to investigate the ability of the test isolates to tolerate carbapenem and retain their viability.

Isolate ID	Tolerance Result
62	Low Tolerance in Doripenem
71	Low Tolerance in Imipenem
88	Moderate Tolerance in Meropenem and Low Tolerance in Imipenem



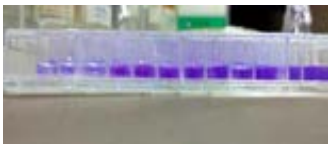
Biofilm Assay and Modified Hodge Test

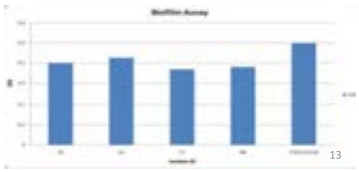
Modified Hodge Test

Three (62,63,88) among the four test isolates showed positive result in MHT indicating the production of carbapenamase.

Biofilm Assay

All of the isolates were revealed to be strong biofilm former.





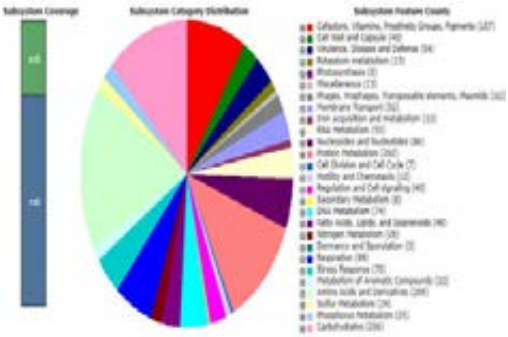
Metal Sensitivity Test

All the isolates showed resistance in 0.01M Iron ,Copper and Zinc solution. They showed greater sensitivity in 0.1M Copper and Zinc solution than of 0.05M solution. All the isolates showed resistance to 0.01M, 0.05M and 0.1M iron.

Comparative Whole Genome Analysis of Carbapenem Resistant (63 no. Isolate) and Carbapenem Sensitive (71 no. Isolate) *Providencia stuartii*

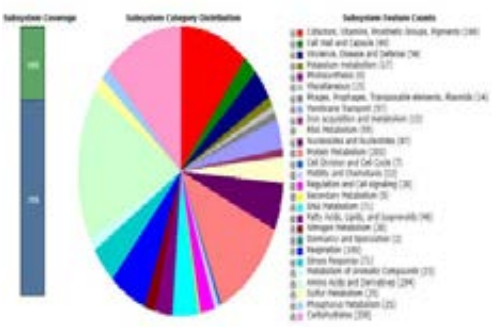
Genome annotation
Isolate no. 63

General Features	Isolate no 63
Genome	Providencia stuartii
Domain	Bacteria
Size	4540408 bp
GC Content	41.3%
Number of Contigs	82
Number of Subsystems	344
Number of Coding Sequences	4555
Number of RNAs	68



Genome Annotation
Isolate no. 71

General Features	Isolate no 71
Genome	Providencia stuartii
Domain	Bacteria
Size	4428595 bp
GC Content	41.7%
Number of Contigs	54
Number of Subsystems	344
Number of Coding Sequences	4378
Number of RNAs	68



Genome Mapping (Isolate no. 63)

Genome Mapping (Isolate no. 71)

Virulence Genes Investigation from Whole Genome

VF Class	Related Genes	Functions
Adherence	[illegible]	Flagella
	pilB, pilM	Type IV Pili Biosynthesis
Iron Uptake	hemA, hem C, hem D, hem L, hem N	Heme Biosynthesis
Quorum Sensing	luxS	Autoinducer 2
Regulation	phoP, phoQ	Two-component system response regulator
Secretion	clpB	ATP dependent chaperone
	hcp	Hydroxylamine reductase
Efflux Pump	farB	Fatty Acid Resistance Efflux transporter permease
Endotoxin	rfaD, rfaE, rfaF	LOS
	WecA	UDP-N-Acetylglucosamine - undecaprenyl-phosphate N-acetylglucosaminephosphotransferase
Fimbrial Adherence Determinants	[illegible]	Fimbrae or Pilus periplasmic chaperone
Immune Evasion	galE	UDP-Glucose-4-Epimerase Gal E
	galU	UTP-Glucose-1-Phosphate Uridylyltransferase GalU
	glmM	Phosphoglucosamine mutase
	pgi	Glucose-6-phosphate isomerase
Invasion	cheB	Chemotaxis response regulator protein-glutamate methylesterase
	cheR	Chemotaxis Protein glutamate-O-Methyltransferase
	cheW	Chemotaxis Protein cheW
	cheY	Chemotaxis response regulator
	[illegible]	Invasion of Brain Endothelial Cells
Motility	motA, motB	Flagellar motor stator protein
Serum resistance	rfbA	Glucose-1-phosphate thymidylyltransferase RfbA
Nutritional Virulence	bioB	Biotin synthase(Biotin Metabolism)

Antimicrobial Resistance Genes Investigation

Isolate no. 63	
Resistance gene	Phenotype
ARR-2	Rifampicin resistance
bla_{OXA-10}	Beta-lactam resistance
bla_{VEB-6}	Beta-lactam resistance
bla_{NDM-1}	Beta lactam resistance(Carbapenem Resistance)
msr(E)	Macrolide, Lincosamide and Streptogramin B resistance
mph(E)	Macrolide resistance
[illegible]	Aminoglycoside resistance
qacE	Disinfectant resistance
sul1	Sulphonamide resistance
qnrD1	Quinolone Resistance
aac(6')-Ib-cr	Fluoroquinolone and aminoglycoside resistance
qnrD1	Quinolone Resistance
tet(A), tet(B)	Tetracycline resistance
dfrA1, dfrA14	Trimethoprim resistance
catA3	Phenicol resistance

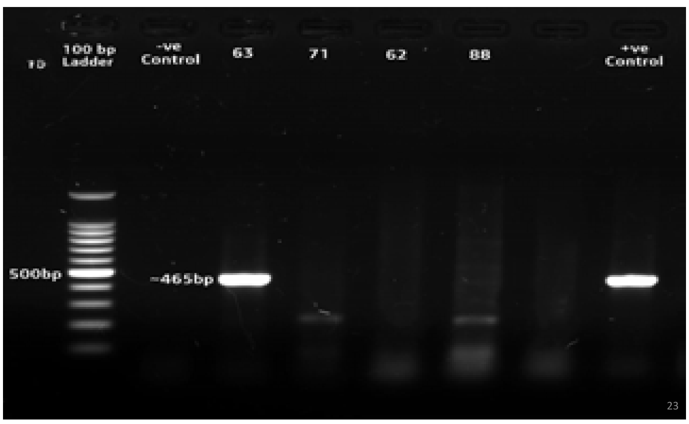
Resistance gene	Phenotype
blaNDM-1	[illegible] ertapenem, imipenem, meropenem, doripenem [illegible]
blaOXA-10	[illegible]
blaVEB-6	unknown beta-lactam

Antimicrobial Resistance Genes Investigation

Isolate no. 71	
Resistance gene	Phenotype
tet(B)	Tetracycline resistance
sul1, sul2	Sulphonamide resistance
qnrD1	Quinolone Resistance
dfrA1	Trimethoprim resistance
[illegible]	Beta-lactam resistance
mph(E)	Macrolide resistance
msr(E)	Macrolide, Lincosamide and Streptogramin B resistance
catA3	Phenicol resistance
[illegible]	Aminoglycoside resistance
qacE	Disinfectant resistance

Resistance gene	Phenotype
[illegible]	[illegible]

Investigation of ***blaNDM-1***



Summary

-Occurance of *P. stuartii* in the total 18 wound samples collected from burn patients was **22.22%**.

-All of the 4 isolates were **multidrug resistant** and one of those were resistant in all the antibiotics tested including carbapenems.

-Tolerance in carbapenems of carbapenem sensitive isolates indicates to a potentiality of approaching toward **complete resistance**.

-**Strong biofilm forming capability** aids in the resistance mechanism to antibiotics.

-Sensitivity in metals like Cu and Zn indicates that metal nanoparticles could become an indispensible viable **therapeutic option** for treating drug resistant infections.

-Whole genome analysis reveals many **virulence genes** which play role in the pathogenicity of *P. stuartii* .

-Comparative whole genome analysis of carbapenem resistant and carbapenem sensitive isolates revealed the significant differences in **antimicrobial resistance pattern**.

-*blaNDM-1* was found to be responsible in conferring complete resistance to carbapenems. As *P.stuartii* has intrinsic resistance to colistin, the carbapenems are considered to be the last line of antibiotics. So, **complete resistance to carbapenems** is surely an alarming concern.

Conclusion and Future Aspects

- **This particular study constituted a primer report on the occurrence of *P. stuartii* in burn patients in the perspective of Bangladesh and its pathogenicity along with antimicrobial resistance pattern through conventional laboratory experiments and comparative whole genome analysis. Complete resistance to carbapenems of this organism through the emergence of bla_{NDM-1}, is indicative toward an alarming situation as carbapenems are considered to be the last line antibiotic to combat this pathogen.**
- **In order to determine the magnitude of this potential threat all over the country rather than a particular hospital, a widespread and extensive study is required along with further research and investigation about the virulence, pathogenicity and antimicrobial resistance pattern of *P. stuartii.***

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Thank You

A STUDY OF ECOLOGICAL BIODIVERSITY IN DUDHIA OF DARJEELING DISTRICT, WESTBENGAL

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[2.] *PhD Scholar, Geography department, Coochbehar Panchanan Barma University, Coochbehar, India.*

Keywords: *Ecology, Biodiversity, Flora, and fauna, Ecosystem, Sustainable development. Man and Environmental relationship.*

1. ABSTRACT

The present investigation is an attempt to study of ecological Biodiversity in dudhia of Darjeeling district. Ecology enriches our world and is crucial for human wellbeing and prosperity. It provides new knowledge of the independence between people and nurture that is vital for protection of our Environment, maintaining clean air and water and sustaining biodiversity in a changing climate. Ecology provides the essential basis for nature conservation. Investigator were used to collect the data primary and secondary source and interactive to local people's. To find out the Ecological Biodiversity of an area that concert ration of Water pollution, forest degradation, landslide, land use, human settlements and plants and animals. So, maintaining a mosaic of habitats ensure the survival of a rich variety of species.

2. BACGROUND

The surveyed area Dudhia is located on the outskirts of Siliguri along the meandering Balason River. Situated at an elevation of about 300m above the sea level. It is extended between 26°47' N and 88°18' E. The river Balason descends at this site through the interlocking spurs in the north and takes the braided pattern. Dudhia is surrounded by some of the best tea gardens of the area such as Longview Tea Garden, Gyabari Tea Garden, Panighatha Tea Graden. The climate of Dudhia resembles to those of tarai region of the district. During summer it is hot and humid and during winter it is cool and cold. It also experience heavy rainfall during monsoon which also sparks widespread flooding in the village. Soil here is less fertile due to this agriculture is quite difficult to close densely forest ecology, flora and fauna, like sal,paccasaj , Chilaum, Maina, Simul, Gamari, Harra, Barrah, Amla etc. Moist land is mainly occupied by Lampati, Mandam, Toon, Champ, Pamsaj , Malagiri, Gokul, Tejpat, Angare etc. all plants, animals and micro-organism (Biotic components) in the area functioning together with all of the non-living physical (abiotic) factors at the environment. The forest ecosystem is very important in dudhia. But recently human interference in this area, human settlements, deforestation, established of army camp, picnic spot. etc and also effect of climate change, Air Pollution,

3. OBJECTIVES

Evaluate the present scenario and ecological biodiversity of Dudhia. • identify the flora and fauna of an area. • correlate the growth of population with the ecological biodiversity of Dudhia. •To identify the ecological changes. •To identify the physical, environmental and climatic condition of the area. •To identify problem and challenges faced by people of Dudhia.

4. METHODOLOGY

Field observation was conducted in order to examine natural vegetation, soil, climate, flora and fauna etc. Purposive sampling methods were used for the selection of key informant like were required. Relevant journal, article, book etc.

3. CONCLUSIONS

The area has slowly become polluted due to human activities The dudhia region was systematically cleared for settlements and tea plantations. Immediate attention must be paid to control for the degradation of these natural environment.

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Fig. Ecological Biodiversity in Dudhia

A STUDY OF ECOLOGICAL BIODIVERSITY IN DUDHIA OF DARJEELING DISTRICT, WESTBENGAL

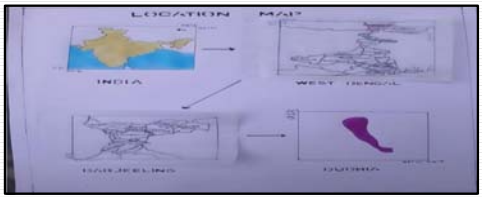
DUDHIA

Introduction

- The Word ‘biodiversity’ has been coined from ‘biological diversity’ for the first time by Walter G. Rosen in 1985.
- It came into force after the formulation of the United Nations Convention on Biological Diversity during the United Nations Conference on Environment and Development at Rio de Janeiro in June 1992
- It is the variation in ecosystems found in a region or the variation in ecosystems over the whole planet.
- Ecological diversity includes variation in both terrestrial and aquatic ecosystems.

Study Area

- The surveyed area Dudhia is located on the outskirts of Siliguri along the meandering Balason River.
- Situated at an elevation of about 300m above the sea level.
- It is extended between 26°47’ N and 88°18’ E.
- The river Balason descends at this site through the interlocking spurs in the north and takes the braided pattern.
- Dudhia is surrounded by some of the best tea gardens of the area such as Longview Tea Garden, Gyabari Tea Garden, Panighatha Tea Garden.



Concept of ecological place about Dudhia:

- The origin can be traced back to the days of ‘land’s grab’ movement of 1967 during the regime of United Front Government at West Bengal.
- Spaces were forcibly occupied by landless people.
- Dhudia is one of such village. Its original name was Jamadar Bhitta (Faloda Tea Estate)
- The colour of this this jhora was as white as dhudh (milk) and so when the immigrants settle here, they coined name Dudhia.

Objectives

- Evaluate the present scenario and ecological biodiversity of Dudhia.
- Identify the flora and fauna of an area.
- Correlate the growth of population with the ecological biodiversity of Dudhia .
- To identify the ecological changes.
- To identify the physical, environmental and climatic condition of the area.
- To identify problem and challenges faced by people of Dudhia.

Methodology

- Both primary and secondary source of data have been used for study.

Primary data

- collected through survey, interview and field observation.

Sampling technique

- Purposive sampling

Secondary data

- Relevant journal, article, book etc.

Physical Characteristics (Climate/ Weather Report) :

- Dudhia experiences warm and temperate climate with annual range of temperature of 13 degree centigrade and the mean annual temperature is 34.33 degree centigrade.

Relief Features:

- Dudhia valley is located on the banks of river Balason at an altitude of about 290mtr above sea level.

Soil:

- Dudhia valley consist of coarse and silty soil which are not much fertile because it is acidic in nature.

Natural Vegetation:

- Trees like Sal, Panisaj, Simul, Gamari, Khair, Shisso, Champ, Chilauni are found here.

Forest and ecological system

- Forest ecology is basically the scientific study of the interrelated pattern, processes, flora, fauna and ecosystem in forest. The management of dudhia forest consists of all plants, animals and micro-organism (Biotic components) in the area functioning together with all of the non-living physical (abiotic) factors at the environment. The forest ecosystem is very important in dudhia.

Human interference on the ecological Biodiversity:

- Humans impact the physical environment in many ways: overpopulation, pollution, burning fossil fuels, and deforestation. Dudhia is a buzz with activity during the winter months as it is one of the most popular picnic spot for the locals including people from Siliguri and the nearby regions. This have triggered climate change, soil erosion, poor air quality, and undrinkable water.

	Deforestation	**Agricultural**	**Overpopulation**	**Drainage system**
Factors Affecting	(i) Barren Land (ii) Loose the fertility of the soil (iii)Alter wildlife habitats (iv)Loss of biodiversity (v) Global warming and climate change disrupting the cycle of condensation and evaporation	(i)Destruction of wildlife (ii)Lead to desertification (iii)Soil degradation	(i)Exploitation of land (ii)Environmental pollution (iii) Hunting (iv)Overconsumption (v)Construction of building and houses	1)Aquatic resources Degradation (ii) Aridity and erosion (iii) Water pollution (Destruction of fresh water, aquifer recharge areas) Climate change and extinction Fishing for food

Problems

- Lack of Proper Educational Institution.
- Deforestation
- Poor Economic Condition.
- Absence of clean drinking water.
- Infertile Soil.
- Lack of local transport and communication
- Climate Change.
- Loss of Biodiversity

Suggestions

- Hospitals or Health Centres should be build in order to get proper medical facilities or proper treatment.
- Soil fertility can be improved by incorporating cover crops that add organic matter to the soil structure and promote a healthy fertile soil.
- Home water treatment capability through the use of filters, solar disinfection to make drinking water clean and safe.
- Transport and Communication can be easier if more local vehicles (Auto, Public Buses) is added.
- More trees should be planted which also helps in purifying the air, attract wildlife and birds, prevent soil erosion, clean the water and add grace and beauty to our home.

Conclusion:

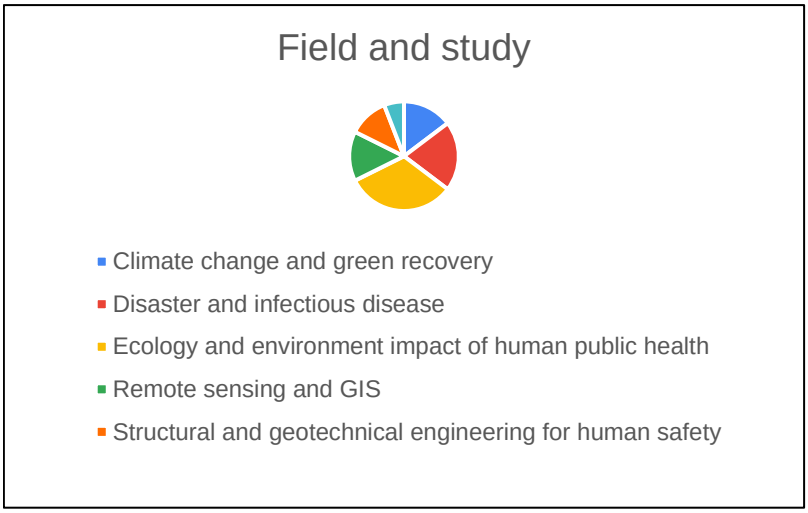
- The area has slowly become polluted due to human activities.
- The gun firing of SSB (Sashastra Seema Bal) also adds pollution to the air.
- The dudhia region was systematically cleared for settlements and tea plantations. Immediate attention must be paid to control for the degradation of these natural environment.
- Save the natural biodiversity.

Thank you

APPENDIX

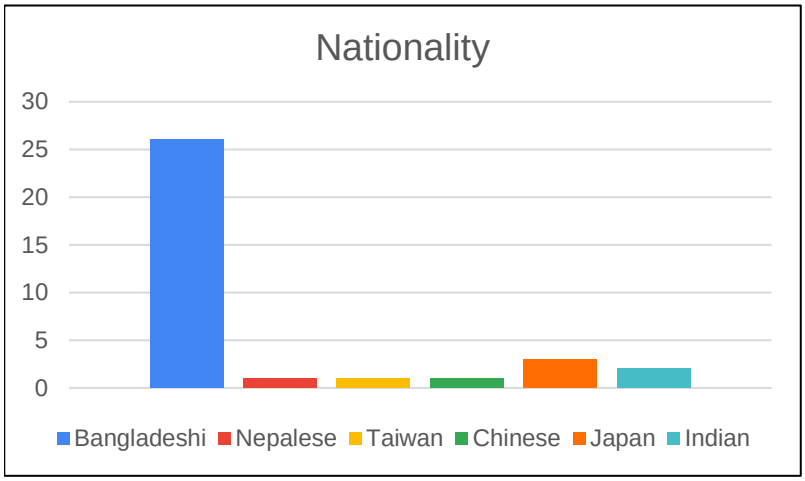
1. Field Study

Field	
Climate change and green recovery	5
Disaster and infectious disease	7
Ecology and environmental impact of human public health	11
Remote sensing and GIS	5
Structural and geotechnical engineering for human safety	4
Transportation and human mobility	2
	34



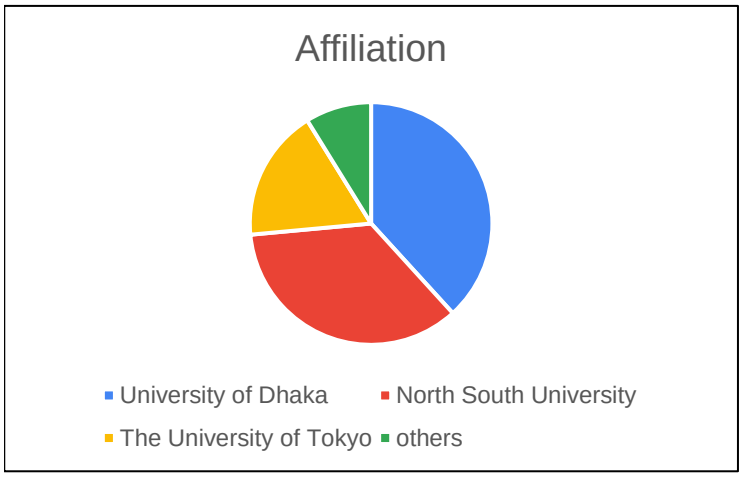
2. Nationality

Nationality	
Bangladeshi	26
Nepalese	1
Taiwan	1
Chinese	1
Japan	3
Indian	2
	34



3. Affiliation

Affiliation	
University of Dhaka	13
North South University	12
The University of Tokyo	6
others	3
	34



4. Prefix

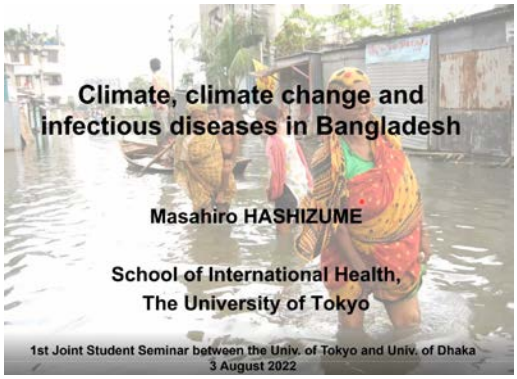
Mr	12
MS	21
others	1
	34

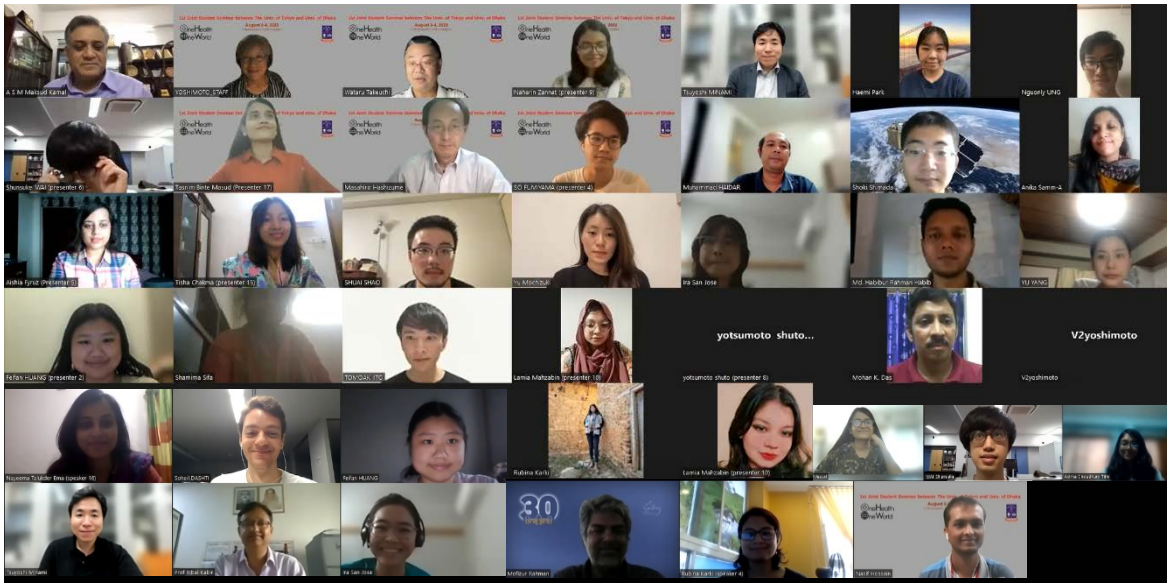
PHOTOS

Chairman: Prof. Wataru Takeuchi UTokyo, Co-chairman: Prof.Dr. A S M Maksud Kamal , Univ. of Dhaka

Special Lecture:

Prof. Masahiro Hashizume, UTokyo. Prof. Iqbal Kabir, MoHFW Assoc. Prof. Tsuyoshi Minami, UTokyo





Group photo

東大OHOW・ダッカ大学第１回合同学生セミナー

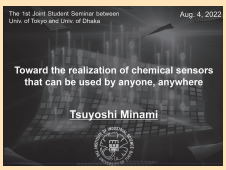
ワンヘルス・ワンワールド連携研究機構（OHOW）は、８月３日（水）、４日（木）にウェビナー形式でThe 1st Joint Student Seminarを開催した。本所はバングラデシュの工学系大学のトップ校であるバングラデシュ工科大学（BUET）にリエゾンオフィスを設置しているが、今回は医学部を有する国立ダッカ大学と初めて連携をした。

OHOW機構長である本所 竹内 渉 教授の開会挨拶ののち、本学 医学系研究科 橋爪 真弘 教授（国際保健学）、バングラデシュの Ministry of Health and Family Welfare （MoHFW）のDr. Iqbal Kabir 教授（疫学と気候変動）、本所 南 豪 准教授（超分子材料デザイン）、ダッカ大学の研究担当副学長Dr. ASM Maksud Kamal 教授 （災害マネジメント）が招待講演を行なった。学生の発表は、バングラデシュからはダッカ大学や私学の雄North South Univ.などから26件、インドは２件、日本は本学から６件の、合計34件 あった。 うち 21件が女子学生による発表であったことが印象的で、８分という短い発表時間にも関わらず、皆工夫して他分野の聴衆にもよく分かる素晴らしい発表であった。具体的には、顧みられない熱帯病（Neglected Tropical Diseases, NTDs）に対する気候変動の影響評価、ベンガルトラなど野生生物と人間とのコンフリクトに関する調査研究、ダッカ市内での交通・建設起源の大気汚染悪化と健康被害の関連分析、EV車普及に向けたマテリアルフローとライフサイクルアセスメントに関する研究、衛星リモートセンシングを用いたベンガル湾のマングローブと海面変動計測、プラスチックごみによるブラマプトラ川・ベンガル湾海洋汚染のモニタリング、日本における気候変動と精神疾患との関連分析、河川堆積物内のマイクロバイオーム・ゲノム分析、バングラデシュの生態系保全とエコシステムサービスの歴史的変遷に関する研究、日本での地中レーダー（GPR）を用いた埋設物の健全性評価手法、などが話題となった。ワンヘルス・ワンワールドという概念が対象とするヒト・動物・地球環境から社会が直面している様々なリスクについて理解するとともに、これらに対応するために関連学術分野を総合的・協調的に発展させるための有意義な議論が行われた。

（人間・社会系部門　教授　竹内 渉）

集合写真

セミナー後、今後の研究に関しての意見交換
上段左 竹内教授、Kamal 教授、下段左　南准教授、橋爪教授



橋爪教授、Kabir 教授、南准教授、Kamal 教授の特別講演

One Health, One World (OHOW),
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edited & photos by Eiko Yoshimoto
Issued in January 2023