सत्यमेव जयते

REPORT SUMMARY OF WEBINAR

CLIMATE CHANGE AND DISASTERS "AGGRAVATING URBAN RISKS"

29TH OCTOBER, 2021

13th October, 2021

nidm
Resilient India - Disaster Free India

Organized by:

National Institute of Disaster Management (NIDM)

Ministry of Home Affairs, Govt. of India

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The views, information, or opinions expressed during the webinar are solely those of the individuals involved and do not necessarily represent the view of the National Institute of Disaster Management (NIDM).

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Introduction

Background

The overwhelming majority of disasters in the past ten years (83% of all disasters triggered by natural hazards) were caused by extreme weather- and climate-related events, such as floods, storms and heatwaves. The number of such disasters triggered by extreme weather- and climate-related events have been increasing since the 1960s and has risen almost 35% since the 1990s. The proportion of disasters attributable to climate and extreme weather events has also increased significantly during this time. Even when the total number of disasters flattened in the last two decades, the proportion attributable to climate and extreme weather events, such as floods, storms and heatwaves, continued to rise, from 76% of all disasters during the 2000s to 83% in the 2010s. These extreme weather- and climate-related disasters have killed more than 410,000 people in the past ten years, the vast majority in low and lower-middle-income countries.

Since 2010, adaptation has been a core component of the international climate agenda and the importance of disaster risk reduction has been explicitly recognized (UNFCCC, 2010). However, capacity and financing remained limited, and of course, climate change was only adding to a challenging agenda (as recognized in Sendai). More and more, people realized that climate change was not only already happening, but also already having real impacts on people and ecosystems. This led to increasing emphasis on what climate negotiators now call 'loss and damage', noting that climate change can include irreversible impacts (such as the death of coral reefs due to warming oceans): 'losses, as well as impacts such as the destruction of infrastructure where reparation is possible: 'damage'. These have been applied to the impacts of extreme events as well as longer-term changes, such as coastal inundation (where sea level rises to lead to flooding of infrastructure and risks to safety).

The 2013 UN Climate Change Conference established the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts. This was set up to address loss and damage associated with the impacts of climate change, including extreme events and slow-onset events, in developing countries that are particularly vulnerable to its adverse effects. Yet no financing was provided to avert, minimize or address loss and damage. Indeed, developed countries, worried about the potential liability for rising damages, even insisted on an explicit recognition that the inclusion of a reference to loss and damage in the Paris Agreement implied no liability or compensation. Since then, the calls for the financing of loss and damage – ranging from the most-affected countries seeking compensation from the biggest contributors to climate change to investment in humanitarian response – have been growing stronger and stronger, supported by developments in attribution science, which is showing more and more clearly the role of climate change in individual hazards that have triggered disasters.

Climate change and cities

More recently, it has been recognized that there are limits to how much one can adapt to climate change's effects and that if these limits are reached, losses and damages would occur. This is due to the fact that the adaptations required are either pricey, physically or technically impossible, socially unpleasant, or just insufficient to avoid some harm to people, the environment, and assets. Global temperatures are rising.

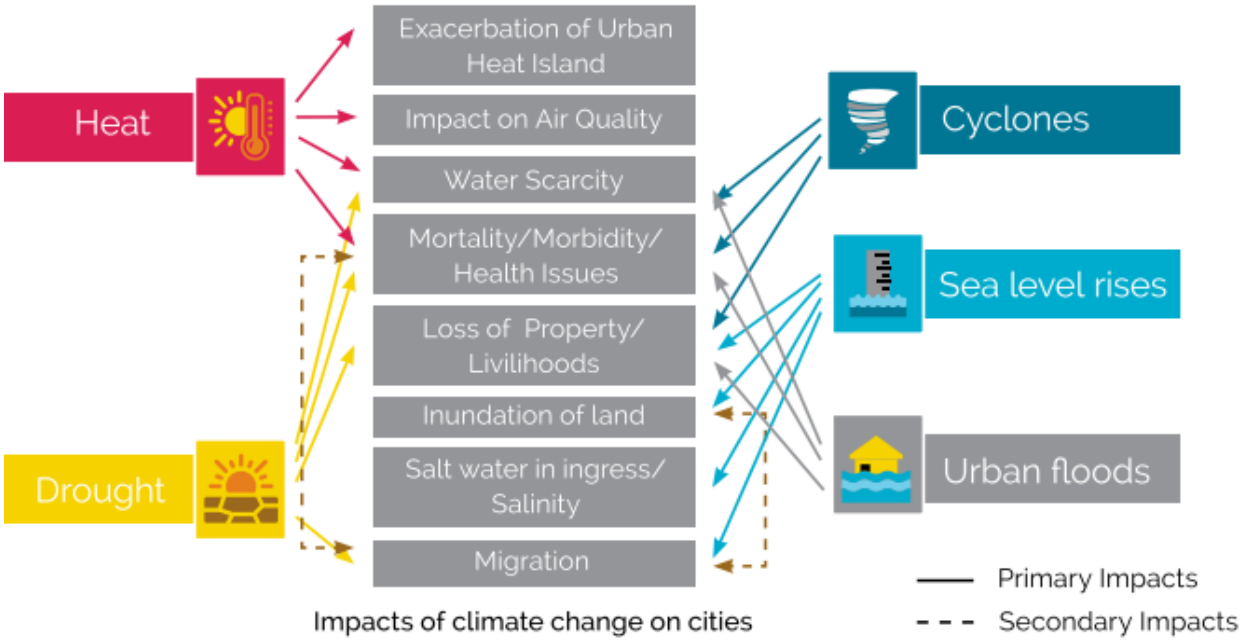

Figure 1: Highlights the role of climate on cities from a disaster point of view (Source - Bulkeley, H. (2013). Cities and climate change. Cities and Climate Change, 1–268. https://doi.org/10.4324/9780203077207)

All of this has a significant financial impact on essential city services, infrastructure, housing, human livelihoods, and health. Cities, on the other hand, are a big contributor to climate change, as urban activities are major sources of greenhouse gas emissions. Estimates suggest that cities are responsible for 75 per cent of global CO2 emissions, with transport and buildings being among the largest contributors. Figure 1 highlights the effect of climate change on cities and its after-effects in the form of disasters.

Only with a coordinated approach and action at the global, regional, national and local levels, can success be achieved. It is essential, therefore, to make cities an integral part of the solution in fighting climate change. Many cities are already doing a lot by using renewable energy sources, cleaner production techniques and regulations or incentives to limit industrial emissions. Cutting emissions will also reduce local pollution from industries and transport, thus improving urban air quality and the health of city dwellers.

Indian context

India has seen significant urbanisation, with more than 30% of the population now living in cities, with that figure predicted to rise to 40% by 2030. According to estimates, India's built environment (man-made places such as buildings) would triple by 2030, accommodating 200 million additional urban residents. As Indian cities accommodate expanding populations, they will encounter problems in providing basic requirements like housing and transportation, which will result in increased demand for energy and water, increased emissions and waste creation, decreasing air quality, and health consequences. Nearly 44 per cent of India's rapidly growing carbon emissions have urban origins, emanating from transport, industry, buildings, and waste contributing towards climate change. Within urban areas, the megacities, metro cities and class I cities generate 59 per cent of the GHG emissions in the country. As a result, our cities are subject to increased water stress, the heat island effect, and the frequency and intensity of extreme weather events such as urban floods and droughts. Furthermore, as a total of 102 cities in India, 43 of which are Smart Cities, are already experiencing poor air quality, city managers face severe problems. Floods in India's major cities have resulted in the loss of life and property, interruption of transportation and electricity, and outbreaks of diseases, the most noteworthy of which were Mumbai in 2005, Surat in 2006, and Kolkata in 2007, as well as Chennai in 2017 and Kerala in 2018 and more recently Patna flood in 2021. Climate change-related changes in rainfall patterns, as well as several other urbanization-related issues, were important contributors to these occurrences. These incidents also draw attention to the related loss of life, public property, and inconveniences, particularly as a result of traffic congestion. According to a report published in 2018, 1.6 billion people will be regularly exposed to extremely high temperatures in over 970 cities around the world, including Bengaluru, Chennai, Delhi, Jaipur, and Kolkata, and over 800 million people will be vulnerable to sea-level rise and coastal flooding in 570 cities around the world, including Chennai and Mumbai. Many Indian cities saw record-breaking high temperatures in 2019, with temperatures reaching 40°C in major cities and 45°C in some of the worst-affected regions.

Aim & Objectives of the webinar series

Aim

The aim is to understand and mitigate the effects of climate change-related disasters in the context of Indian cities through better urban planning.

objectives

- Understanding Disasters: Key Concepts and Terminologies on the issues of disaster risk reduction, climate change and development Urban Growth, Disaster and Climate Vulnerability: – Global, Regional and Indian context
- Identification of risks faced by cities and framework for disaster risk reduction
- How to incorporate climate Change in Urban Planning and Design for disaster risk reduction
- Highlighting the role of urban local bodies and town planning professionals in making cities resilient to disaster and climate change
- Pragmatic examples of such implementation strategies with a key focus on Indian cities
- DRR in cities and its contribution to PM's 10-point agenda and Sendai framework
- Challenges ahead and way forward

Target Audience

- Officials from the Department of Urban Development of concerned State/UT
- Executives/professionals from other Government agencies/boards, programmes/schemes, including public sector undertakings,
- Members/representatives of non-governmental and community organizations engaged in activities related to assessment, planning, implementation or monitoring of any aspect of disaster management, environment and development, and
- Faculty members/professionals from training, education and research institutes and other master trainers related to urban planning/development, environment, housing, disaster management, etc.
- Private Sector: Officials/professionals involved in water supply, sanitation, environmental health, waste management, power, industries, communication, risk management, etc. in cities.

Programme Team

1. **Patron**
   Major General Manoj Kumar Bindal, Executive Director, NIDM
2. **Convenor**
   Prof. Dr. Santosh Kumar, Head of GIDRR Division, NIDM
3. **Coordinator**
   Mr. Prabhjyot Singh, Young Professional (YP), NIDM
4. **IT Support**
   NIDM

Agenda

Session Theme	Resource Persons	Time & Duration
Welcome Address	Mr. Prabhjyot Singh, YP, NIDM	11:00 – 11:05 am
Address And Course Overview	Prof. Dr. Santosh Kumar, Head GIDRR Division, NIDM	11:05 – 11:30 am
Keynote Address	Maj. Gen. Manoj Kumar Bindal, Executive Director, NIDM	11:30 – 11:45 am
	TECHNICAL SESSION	
Overview of the Topic	Mr. Prabhjyot Singh, YP, NIDM	11:45 – 11:55 am
Panel discussion	Mr. Dileep Kumar, National Consultant, UNDP Ms. Vaishnavi T G Shankar, Lead, training and capacity building, C-Cube, NIUA Prof. Saswat Bandyopadhyay, Project Director, CUPP, CEPT University	11:55 – 12:45 pm
Open House (Q & A)	Mr. Prabhjyot Singh, YP, NIDM	12:45 – 12:55 pm
Vote Of Thanks	Mr. Prabhjyot Singh, YP, NIDM	12:55 – 1:00 pm

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Summary

The session started by providing a brief introduction to the topic by the Young Professional Mr. Prabhjyot Singh. Then the panellist members showed their concerns for the topic of discussion which is described below-

Introduction

- *We have seen in the past many years that the disasters are mainly triggered by extreme weather events that have increased to a great extent. These disasters have impacted millions of people in terms of loss to properties, loss to businesses and life loss. Even at the global level, South-Asian countries are more prone to natural disasters. With the population growing at a tremendous rate, more people are exposing themselves to natural disasters and the situation get worse for the low-income developing counties. All these disasters force people to displace and to look for some safer place and cities play a key role in such conditions.*
- *Looking from a city perspective, climate change is changing the city scenario rapidly with new limits are set every year to define the risk capacity. Our urban centres are themselves exposed to disasters such as urban flooding, heat islands, air and water pollution, water scarcity etc. which want us to question that if cities are not safe then which place is? Only with a coordinated effort at the local, regional and national levels can success be achieved for disaster mitigation.*

Technical Session

Mr. Dileep Kumar

- *Climate is changing and it is a reality. Climate is changing due to global warming. And climate change (Jal-Vayu) is nothing but change in water and air and if we can control these two components, we can control climate change.*
- *The first IPCC report highlighted the fact that climate is changing.*
- *Climate change is a human-made disaster now.*
- *Both living (animals, humans, micro-organisms, etc.) and non-living things (soil, air, water, etc.) interact with each other in an environment. And living things are dependent on non-living things. So, if anything happens to the non-living components, livings will automatically be affected.*
- *There are 17 sustainable development goals and goals number 13, 14, 15 are very important.*
- *Goals number 13 talks about climate action.*
- *Sendai framework for disaster risk reduction is adopted in the year 2015 globally which is mainstreamed at the national level in the form of PMs 10-Point Agenda. When such policy frameworks are implemented, we will develop resilience towards disaster.*
- *Resilience is nothing but the coping capacity of a region to cope-up in a disaster situation.*

- *In the recent IPCC-6 report of 2021, it has been highlighted that due to continuous increase in anthropogenic activities in the past few years, we might reach the threshold of 2.5-degree rise in temperature by 2030 instead of 2050 which is a red alert for the global community.*

Mrs. Vaishnavi Shankar

- *India has experienced many extreme disasters in the past few decades. E.g, Cyclone Nisarga in Maharashtra, cyclone Amphan in Odisha and West Bengal, cyclone Fani in Kerela and many more.*
- *As per the studies, the heat waves are going to increase 75-fold times in a business-as-usual scenario.*
- *Over 140 cities in India are prone to a high risk of flooding especially cities in coastal regions.*
- *If we look at cities then cities consist of various land-uses such as Physical and social infrastructure, utilities, residential, commercial, heritage, industries etc. which is getting impacted in a disaster situation.*
- *The land-uses together are acting as a system and resilience will be decided on how well these components of the system work together.*
- *Apart from shocks (flooding, pollution, heat waves, disease outbreak, etc.), there are pre-existing stresses (Water scarcity, affordable housing, air quality, lack of social cohesion, ageing infrastructure) in every city which multiplies the overall disaster damage.*
- *A very important assessment framework is presented by our panellist member which assesses the cities development from a climate lens.*
- *In this assessment framework, five thematic areas have been identified and each thematic area has some indicators which will help in the assessment. Such an exercise will help us prioritize and strengthen the gaps in the existing system.*
- *One example of building resilience which is given the panellist is the 'Oasis School Yard, Paris'. The challenges are the urban heat island effects and the risk of stormwater flooding due to impervious material. A simple solution was to replace the impervious surface and plant more trees to tackle both the problems. After successful experimentation, such ideas were implemented in other community schools also. Refer to the annexure for more such examples.*

Prof. Saswat Bandyopadhyay

- *World meteorological organization has published a report about the global mean abundance of carbon dioxide. The global mean abundance of CO_2 is 403 ppm today.*
- *There is also a stark difference in global carbon emission between countries of the global north and the global south.*
- *Availability of granule level data. Despite having data at the global and national levels, such data sets are not downcasted to the local level or city level.*
- *Traditional cities drainage systems are designed taking into the past 30 years water run-off data and future projections for the next few decades.*

But even despite such projection, due to climate changes the values of these run-off coefficients change at a much faster pace than was expected.

- *Much of our cities are focused on building and so there also presents an opportunity to rethink this whole concept of building in terms of building material, designing, planning, etc.*
- *Highlighted the importance of scientific evidence from a climate change perspective and its implementation at a city level just like a 'Klimatorium'.*
- *Institutions and governance should be present at the city level also. Kerela is one example where the state tries to localize disaster management at the gram panchayat level.*
- *The second important point is the rate of urbanization happening in India. We are creating, destroying and modifying according to our needs and this urbanization have a significant impact on our environment, especially on microclimate.*
- *To provide solutions to problems due to climate change every inch of city cost and our solution should be oriented in this manner taking into account the existing situation of cities and not some utopian ideas.*
- *Using some of the natural and traditional material can significantly help in coping with the situation.*
- *Build Back Better with natural solutions so that the built that we are building should be resilient and at the same time sustainable.*

Question asked by Participants

Question 1: What kind of a role do you see of artificial intelligence in this changing climate scenario in the cities and how can we incorporate this?

Answered by Mr. Dileep Kumar

The emergence of artificial intelligence (AI) and its progressively wider impact on many sectors requires an assessment of its effect on the achievement of the Sustainable Development Goals. Using a consensus-based expert elicitation process, we find that AI can enable the accomplishment of 134 targets across all the goals, but it may also inhibit 59 targets. However, current research foci overlook important aspects. The fast development of AI needs to be supported by the necessary regulatory insight and oversight for AI-based technologies to enable sustainable development. Failure to do so could result in gaps in transparency, safety, and ethical standards.

Addition by Mrs. Vaishnavi Shankar

Use of social media platforms to interact directly with the public and collect data when the disaster is happening to map the on-ground situation for multiple hazards.

Key Takeaways

- Climate is changing and it is a reality we need to accept this to move forward.
- As per the studies, the heat waves are going to increase 75-fold times in a business-as-usual scenario. Over 140 cities in India are prone to a high risk of flooding especially cities in coastal regions
- We need to find ways to build resilience at the local level especially in cities which is the centre of civilization because the climate is changing the city scenario rapidly with new limits are set every year to define the risk capacity.
- An in-depth understanding of the existing city land-uses is required for understanding the gaps and to better prepare ourselves better in this direction.
- Availability of granule level data. Despite having data at the global and national levels, such data sets are not downcasted to the local level or city level to tell the local scenario of disaster.
- Much of our cities are focused on building and so there also presents an opportunity to rethink this whole concept of building in terms of building material, designing, planning, etc
- Every inch of city cost and our solution should be oriented in this manner taking into account the existing situation of cities and not some utopian ideas.
- Build Back Better with natural solutions so that the built that we are building should be resilient and at the same time sustainable.

Panellist Members

Prof. Saswat Bandyopadhyay

Prof. Saswat Bandyopadhyay has over 22 years of experience in the urban development sector in South Asia with a focus on city development planning and designing environmental infrastructure. He was also involved in several pan-Asia pilot initiatives such as ADB Green Cities Toolkit in Asia, CDIA Localization of CIIPP Toolkits in India & Nepal, Piloting of World Bank Supported Cultural Heritage and Tourism Assets based City Development Strategies and Sustainable Tourism Assessment Toolkit for India. He has worked in India, Bhutan, Bangladesh, China, Nepal and in Pacific Island Countries.

Mrs. Vaishnavi Shankar

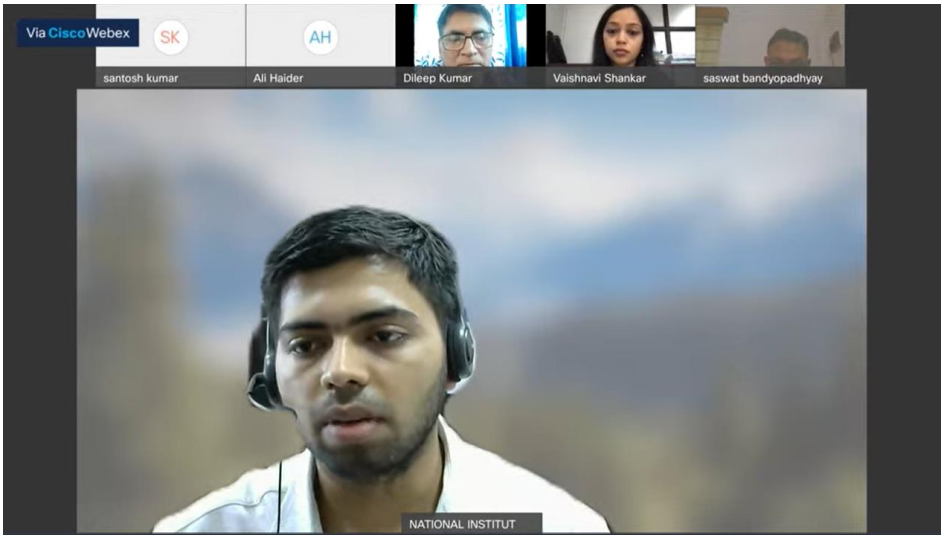
Mrs. Vaishnavi is an urban development practitioner with over 10 years of research, policy advocacy and capacity building experience in the areas of climate resilience and governance, hazard risks and their perception, community resilience, socio-economic revitalization of heritage settlements, and up-gradation of informal settlements. At C-Cube, Vaishnavi's work focuses on strengthening local capacities for adopting climate measures. She has earlier worked with Mahila Housing SEWA Trust, India Habitat Forum and the Centre for Conservation Studies, CEPT University. Vaishnavi is a Chevening Scholar and holds a Master's degree in 'Urbanization and Development from the London School of Economics and Political Science and a Bachelor degree in Architecture from the B.M.S College of Engineering, Bangalore.

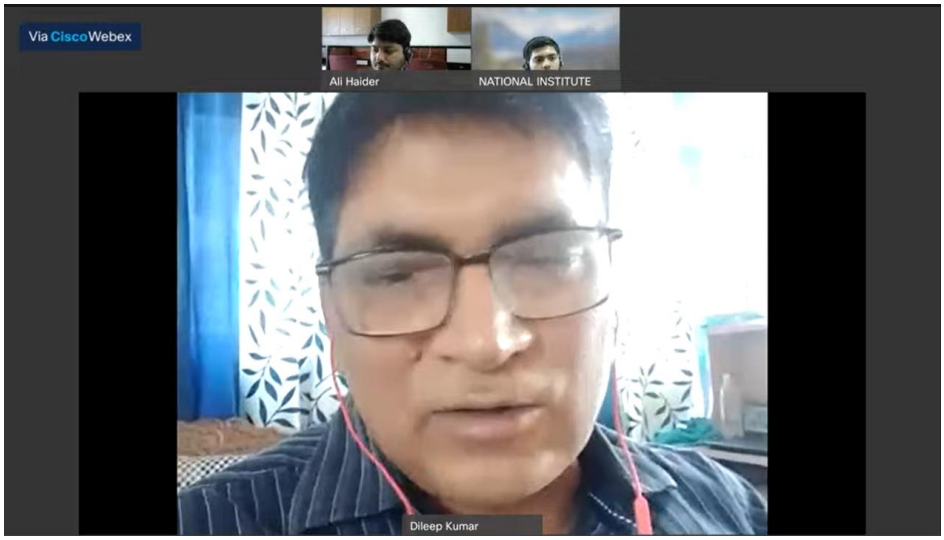
Mr. Dileep Kumar

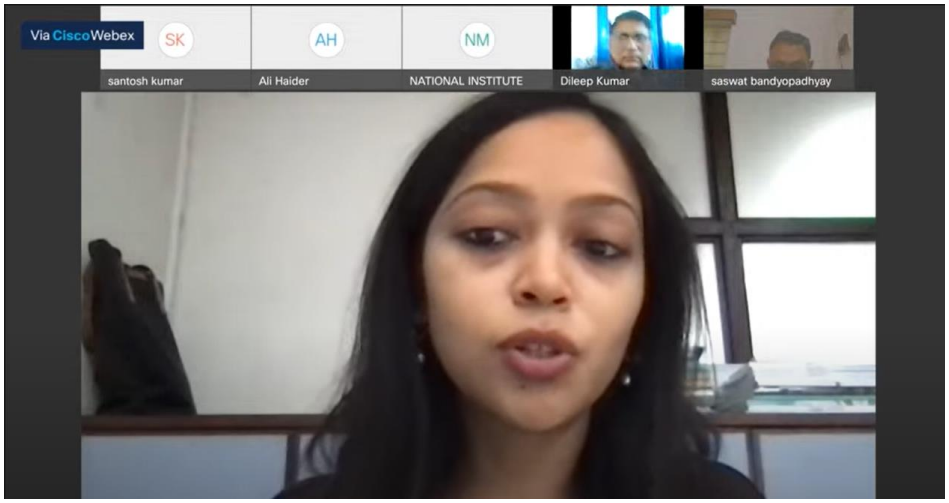
Mr. Dileep Kumar has more than 20 years of experience as a disaster risk reduction specialist. National consultant for UNDP. He holds M Sc. degree in natural sciences and biotechnology. Worked as a city project coordinator in UNDP in which he did training, design and implementation for disaster and development issues for Urban risk reduction and climate change adaptation. He has also worked in the Strengthening of Early Warning System for Hydro-meteorological Disasters.

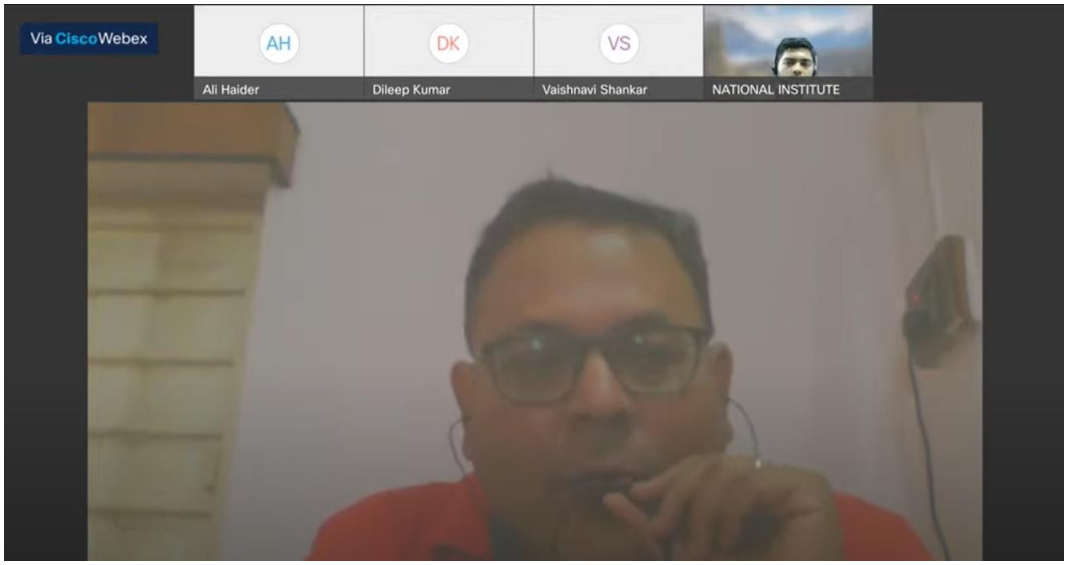
Miscellaneous

Photos









Participant's list

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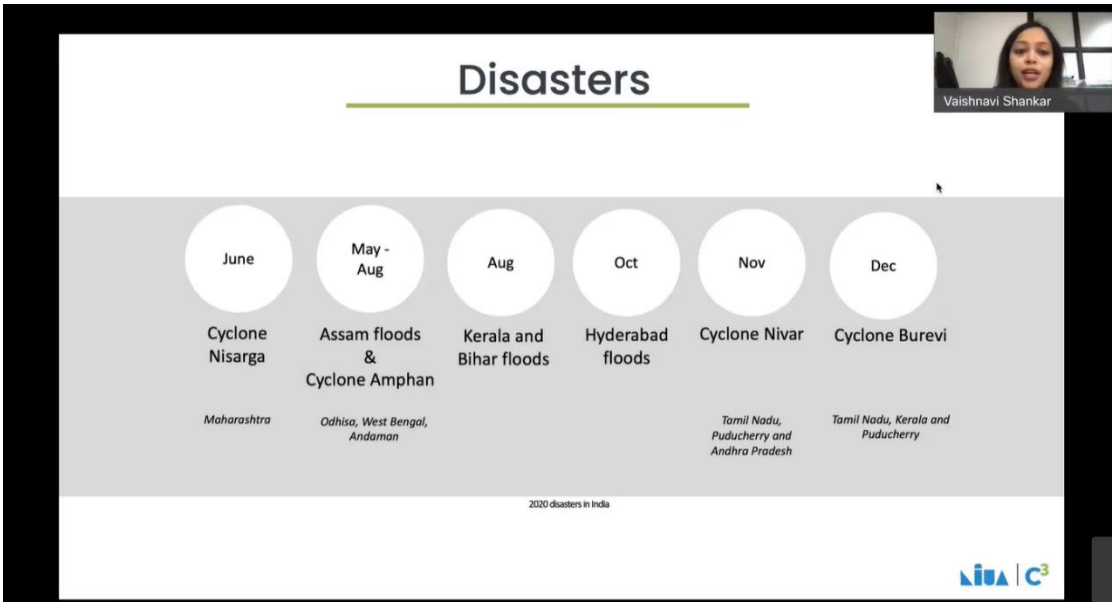
Poster

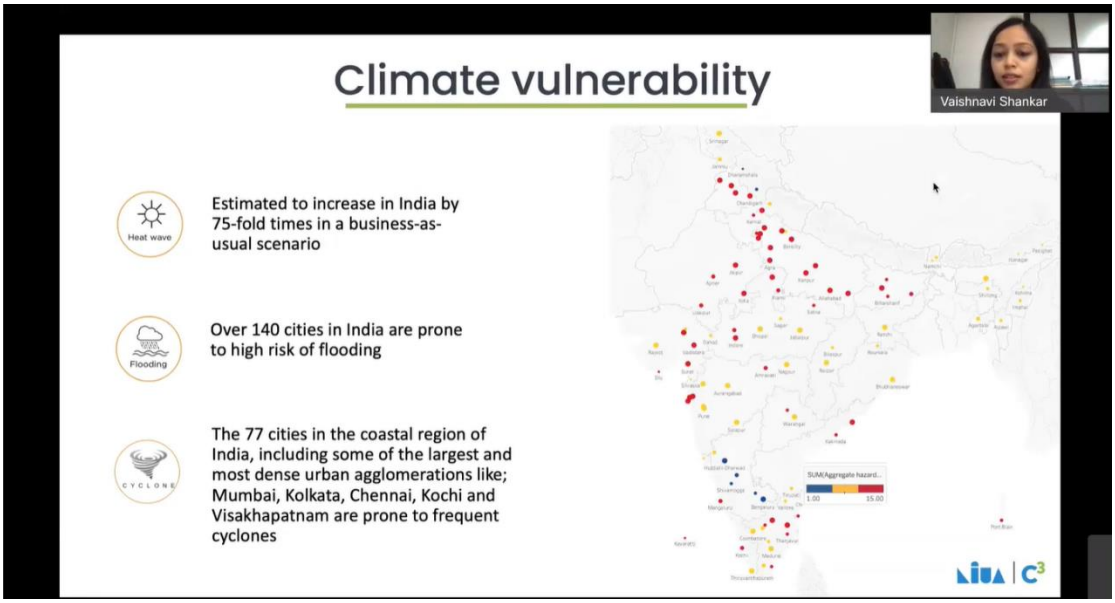
You Tube Link – https://youtu.be/IaIFlJSEngM

Annexure

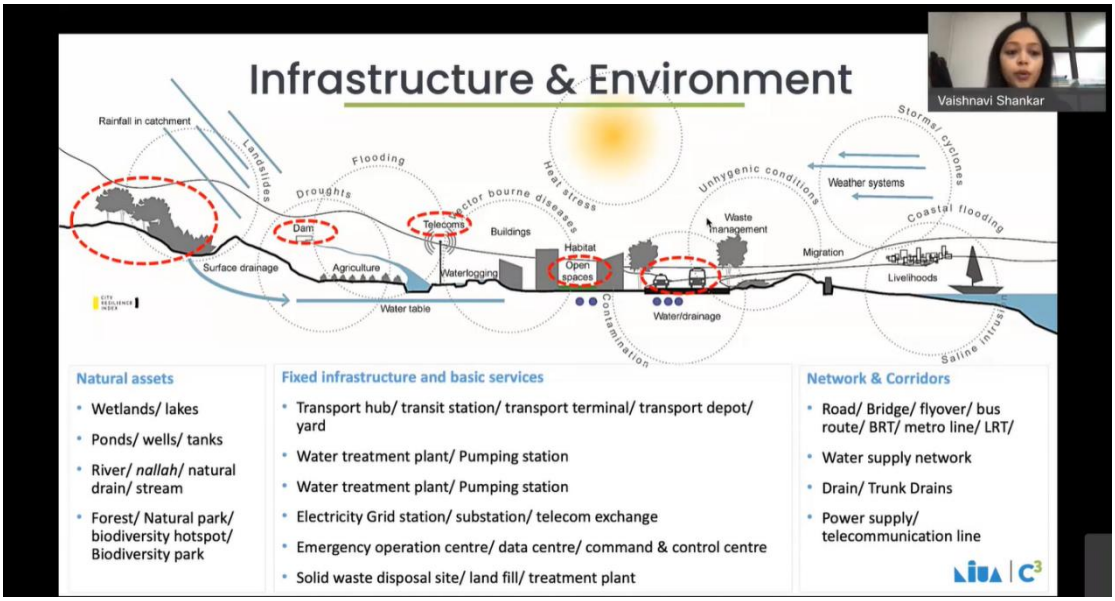
Presentation slides

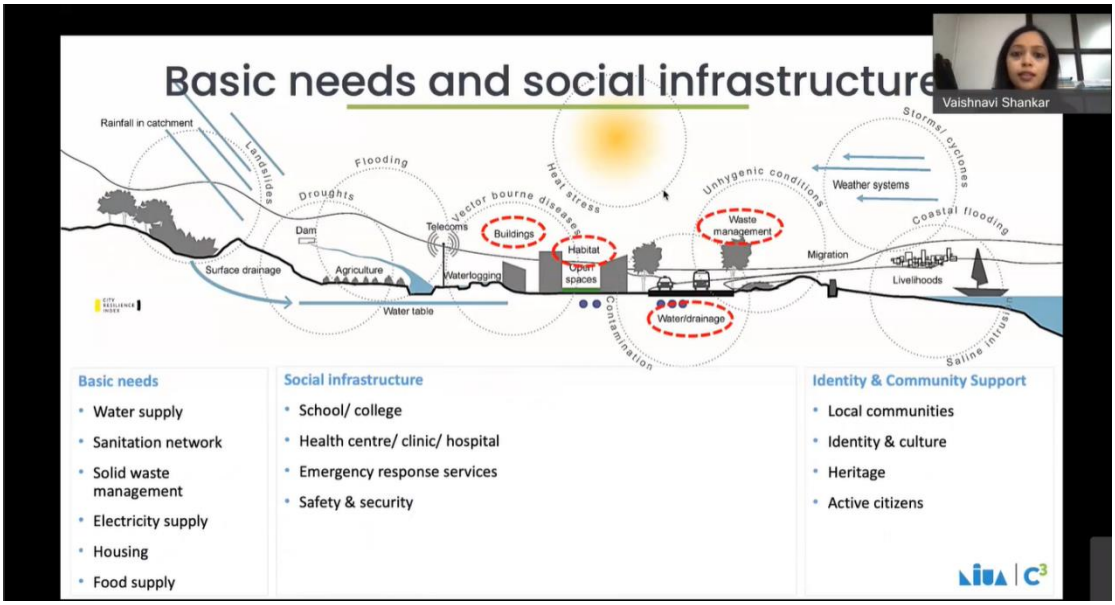
Mrs. Vaishnavi Shankar




Climate vulnerability
Vaishnavi Shankar
Heat wave
Estimated to increase in India by 75-fold times in a business-as-usual scenario
Flooding
Over 140 cities in India are prone to high risk of flooding
CYCLONE
The 77 cities in the coastal region of India, including some of the largest and most dense urban agglomerations like; Mumbai, Kolkata, Chennai, Kochi and Visakhapatnam are prone to frequent cyclones

Cities and climate change
Vaishnavi Shankar
Image: https://constructionmanagermagazine.com/climate-change-is-no-longer-an-afterthought/


Infrastructure & Environment
Vaishnavi Shankar
Rainfall in catchment
Landslides
Flooding
Droughts
Heat stress
Vector bourne diseases
Unhygenic conditions
Storms/ cyclones
Weather systems
Coastal flooding
Dam
Telecoms
Buildings
Habitat
Open spaces
Waste management
Migration
Livelihoods
Surface drainage
Agriculture
Waterlogging
Water table
Water/drainage
Contamination
Saline intrusion
Natural assets
Wetlands/ lakes
Ponds/ wells/ tanks
River/ nallah/ natural drain/ stream
Forest/ Natural park/ biodiversity hotspot/ Biodiversity park
Fixed infrastructure and basic services
Transport hub/ transit station/ transport terminal/ transport depot/ yard
Water treatment plant/ Pumping station
Water treatment plant/ Pumping station
Electricity Grid station/ substation/ telecom exchange
Emergency operation centre/ data centre/ command & control centre
Solid waste disposal site/ land fill/ treatment plant
Network & Corridors
Road/ Bridge/ flyover/ bus route/ BRT/ metro line/ LRT/
Water supply network
Drain/ Trunk Drains
Power supply/ telecommunication line


Basic needs and social infrastructure
Vaishnavi Shankar
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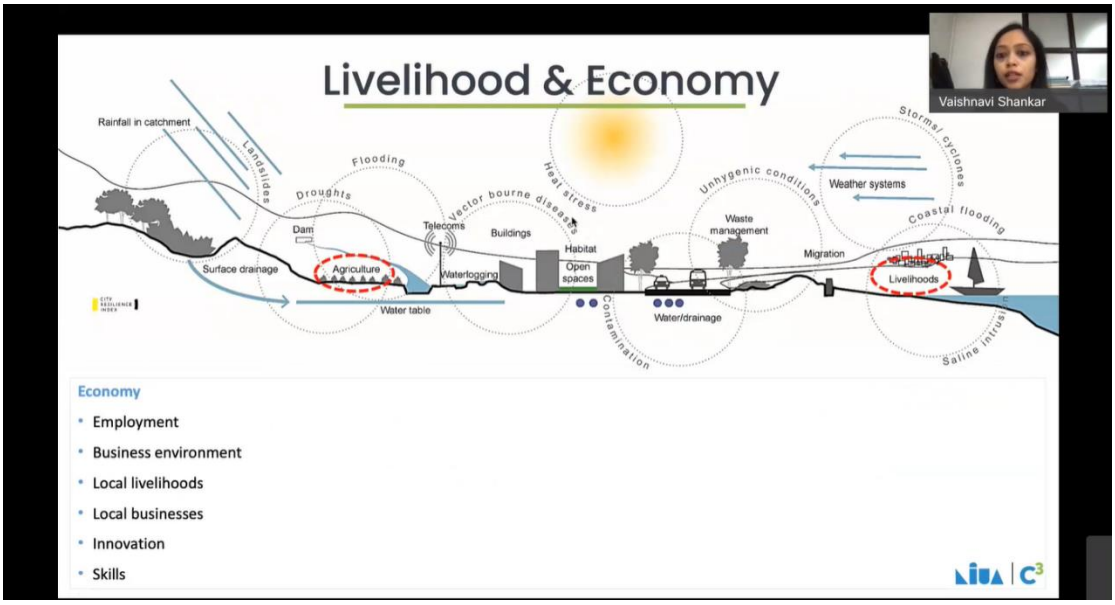
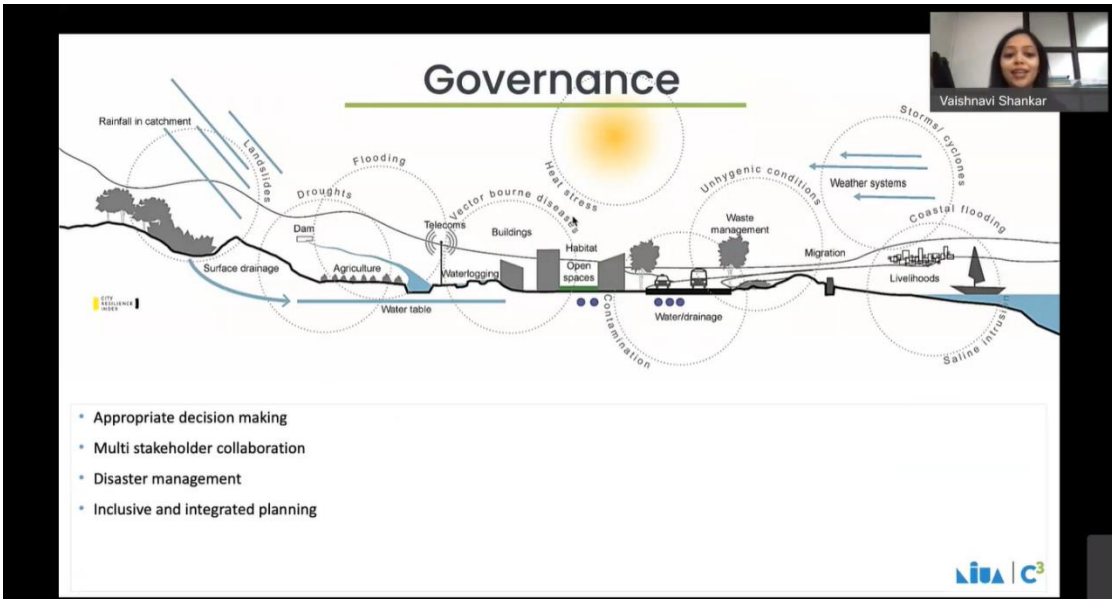
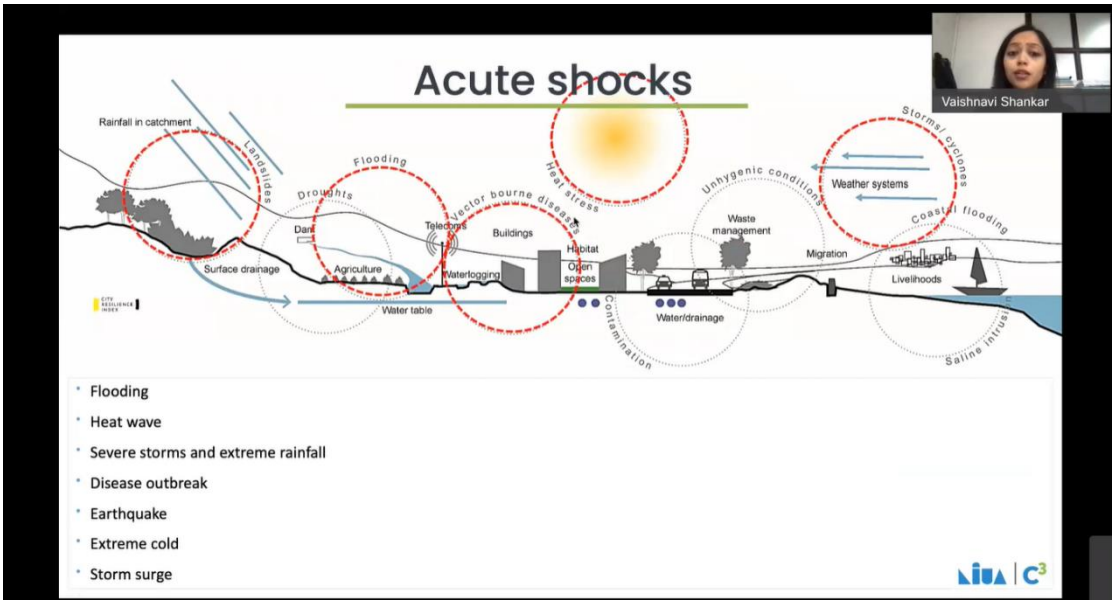
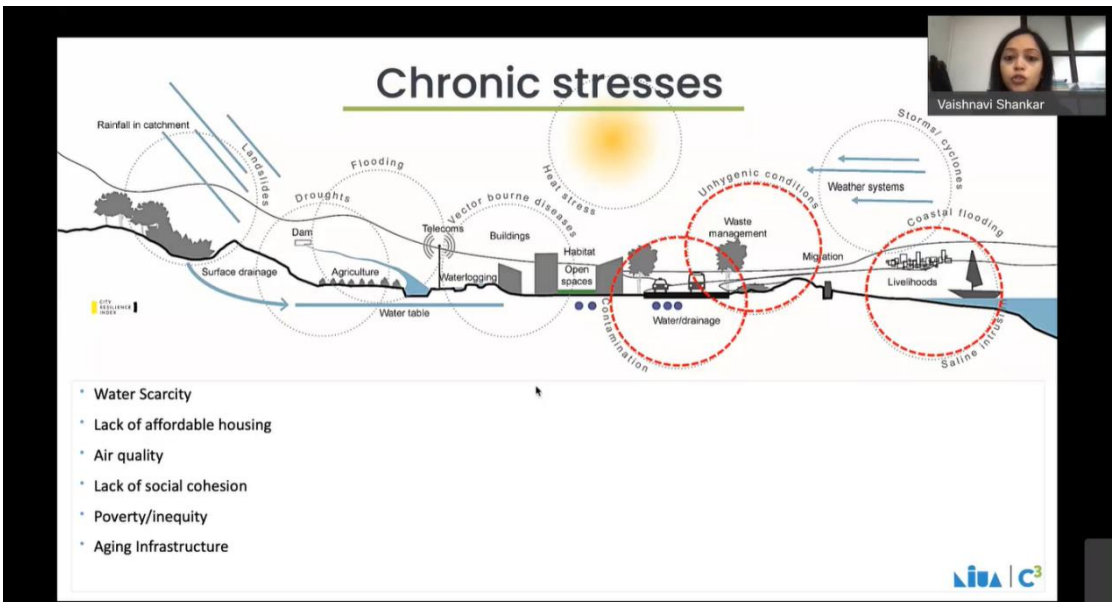
Water/drainage
Saline intrusi
Basic needs
Water supply
Sanitation network
Solid waste management
Electricity supply
Housing
Food supply
Social infrastructure
School/ college
Health centre/ clinic/ hospital
Emergency response services
Safety & security
Identity & Community Support
Local communities
Identity & culture
Heritage
Active citizens

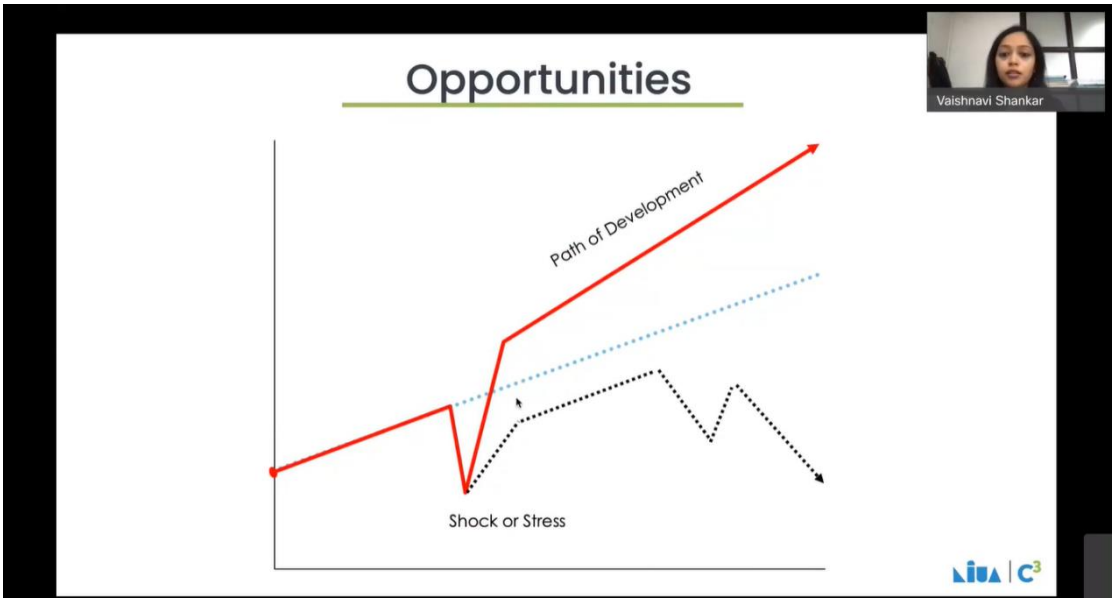

Livelihood & Economy
Vaishnavi Shankar
Rainfall in catchment
Landslides
Flooding
Droughts
Heat stress
Vector bourne diseases
Storms/ cyclones
Weather systems
Unhygenic conditions
Coastal flooding
Dam
Telecoms
Buildings
Habitat
Open spaces
Waste management
Migration
Surface drainage
Agriculture
Waterlogging
Livelihoods
Water table
Contamination
Water/drainage
Saline intrusi
Economy
Employment
Business environment
Local livelihoods
Local businesses
Innovation
Skills

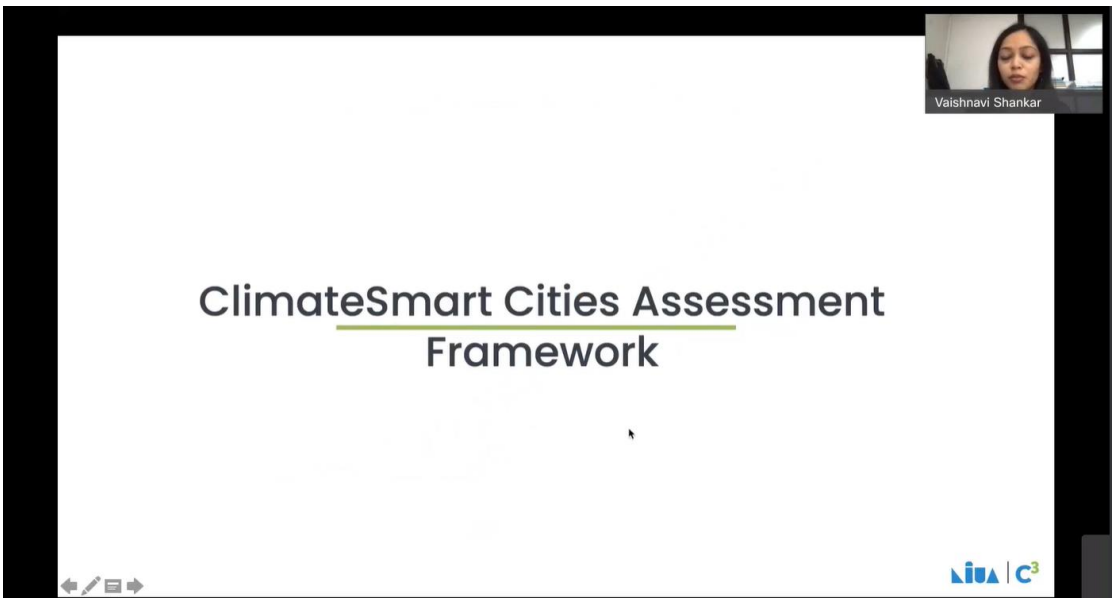

Governance
Vaishnavi Shankar
Rainfall in catchment
Landslides
Flooding
Droughts
Heat stress
Vector bourne diseases
Storms/ cyclones
Weather systems
Unhygenic conditions
Coastal flooding
Dam
Telecoms
Buildings
Habitat
Open spaces
Waste management
Migration
Surface drainage
Agriculture
Waterlogging
Livelihoods
Water table
Contamination
Water/drainage
Saline intrusi
Appropriate decision making
Multi stakeholder collaboration
Disaster management
Inclusive and integrated planning

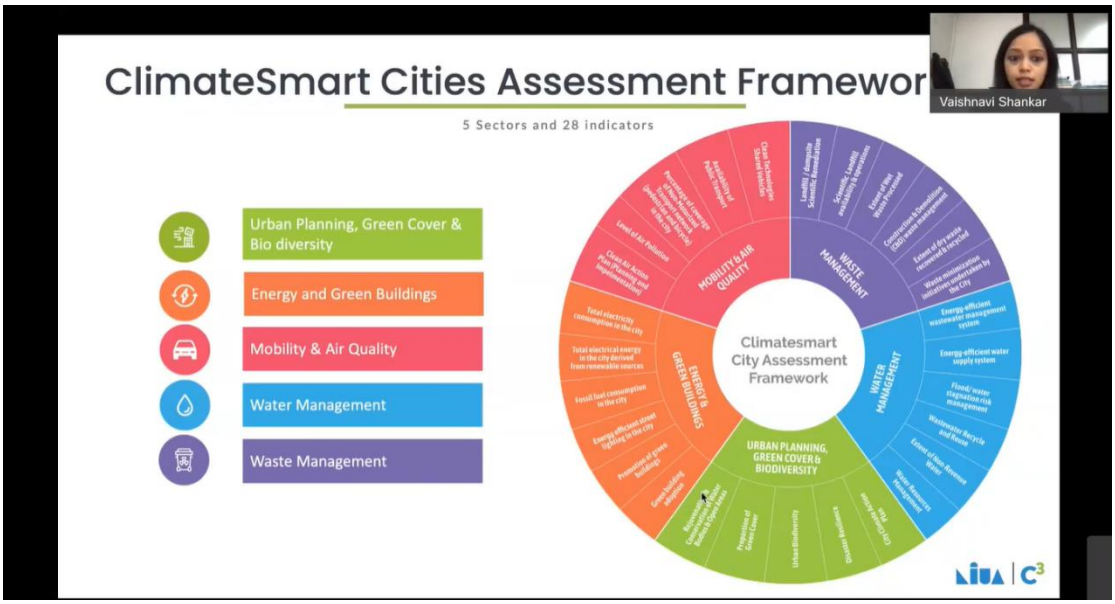

Acute shocks
Vaishnavi Shankar
Rainfall in catchment
Landslides
Flooding
Droughts
Heat stress
Vector bourne diseases
Storms/ cyclones
Unhygenic conditions
Weather systems
Coastal flooding
Dam
Telecoms
Buildings
Waste management
Habitat
Open spaces
Migration
Surface drainage
Agriculture
Waterlogging
Livelihoods
Water table
Water/drainage
Contamination
Saline intrusi
Flooding
Heat wave
Severe storms and extreme rainfall
Disease outbreak
Earthquake
Extreme cold
Storm surge

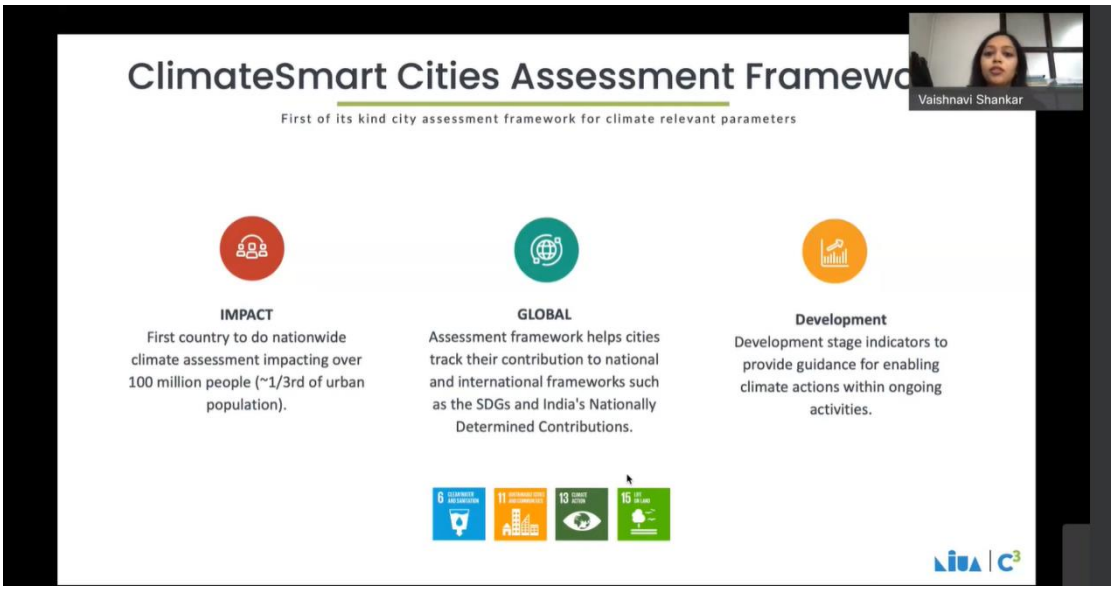

Chronic stresses
Vaishnavi Shankar
Rainfall in catchment
Landslides
Flooding
Droughts
Heat stress
Vector bourne diseases
Storms/ cyclones
Unhygenic conditions
Weather systems
Coastal flooding
Dam
Telecoms
Buildings
Waste management
Habitat
Open spaces
Migration
Surface drainage
Agriculture
Waterlogging
Livelihoods
Water table
Water/drainage
Contamination
Saline intrusi
Water Scarcity
Lack of affordable housing
Air quality
Lack of social cohesion
Poverty/inequity
Aging Infrastructure

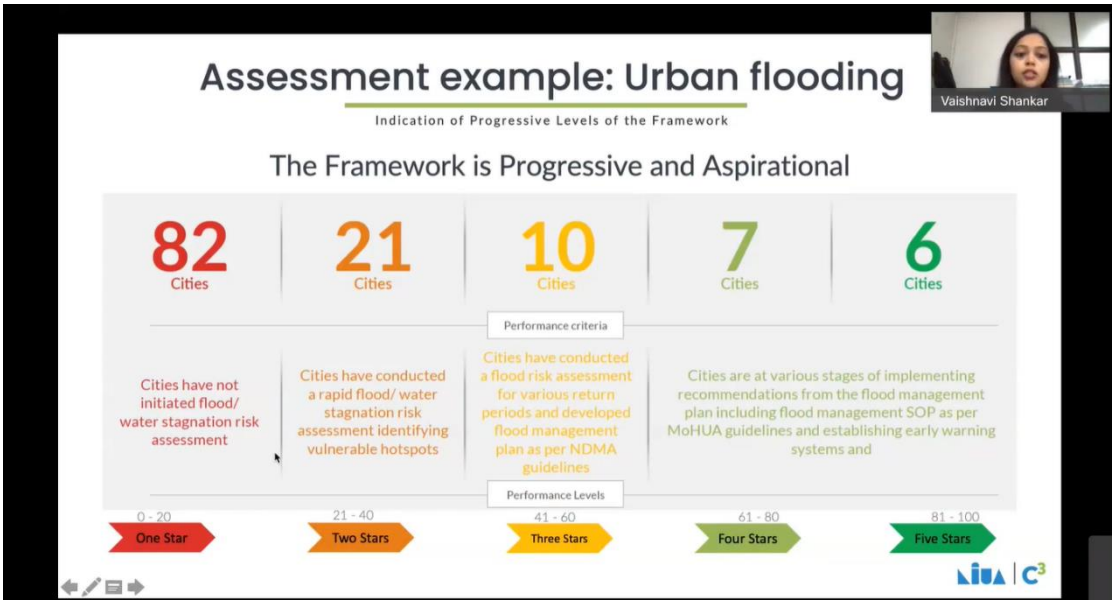
Shock–Stress Linkage
Surat Resilience Strategy
Vaishnavi Shankar
Major Infrastructure Failure
Extreme Rainfall
Hazardous Material Release
Drought / Water Scarcity
Heatwave
Diseases Outbreak
Water Pollution / Shortage
Depletion of Natrual Resources
Ageing Infrastructure
Inadequate Data for Future Planning
Insufficient Transport Network
Exposed Critical Infrastructure
LEGEND
Shocks
Stresses
High Correlation
Moderate Correlation
Low Correlation

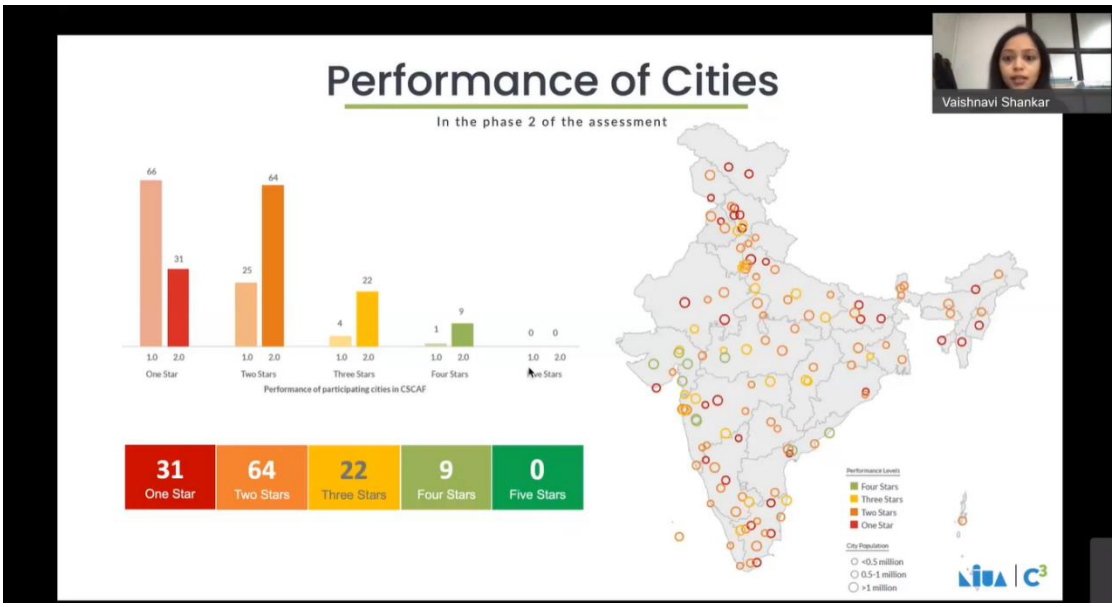

Opportunities
Vaishnavi Shankar
Path of Development
Shock or Stress


Vaishnavi Shankar
ClimateSmart Cities Assessment Framework

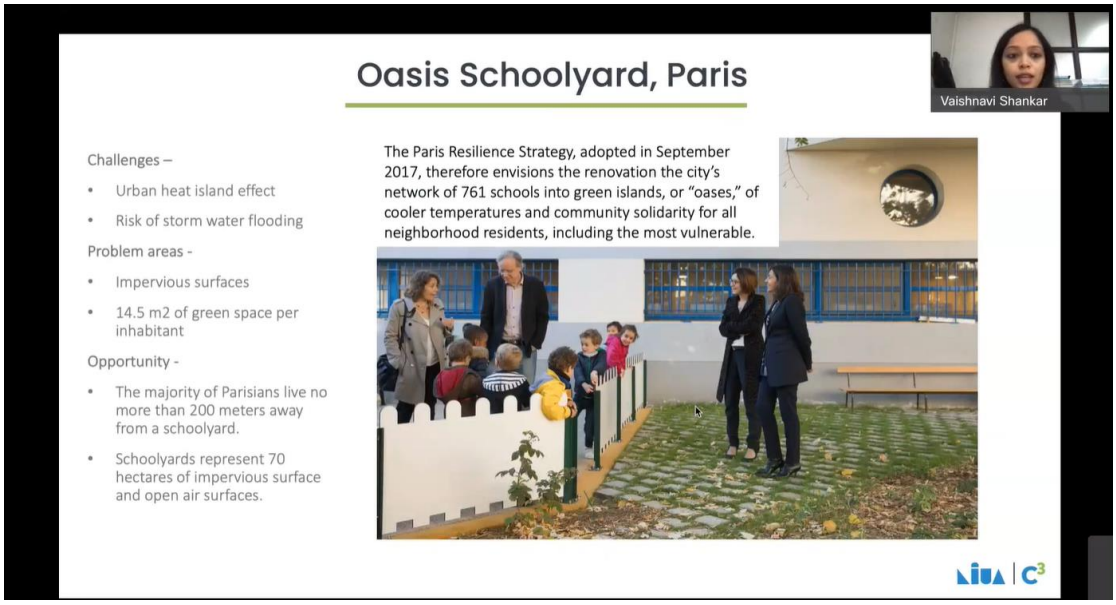

ClimateSmart Cities Assessment Framewor
Vaishnavi Shankar
5 Sectors and 28 indicators
Urban Planning, Green Cover & Bio diversity
Energy and Green Buildings
Mobility & Air Quality
Water Management
Waste Management
Climatesmart City Assessment Framework
MOBILITY & AIR QUALITY
WASTE MANAGEMENT
WATER MANAGEMENT
URBAN PLANNING, GREEN COVER & BIODIVERSITY
ENERGY & GREEN BUILDINGS

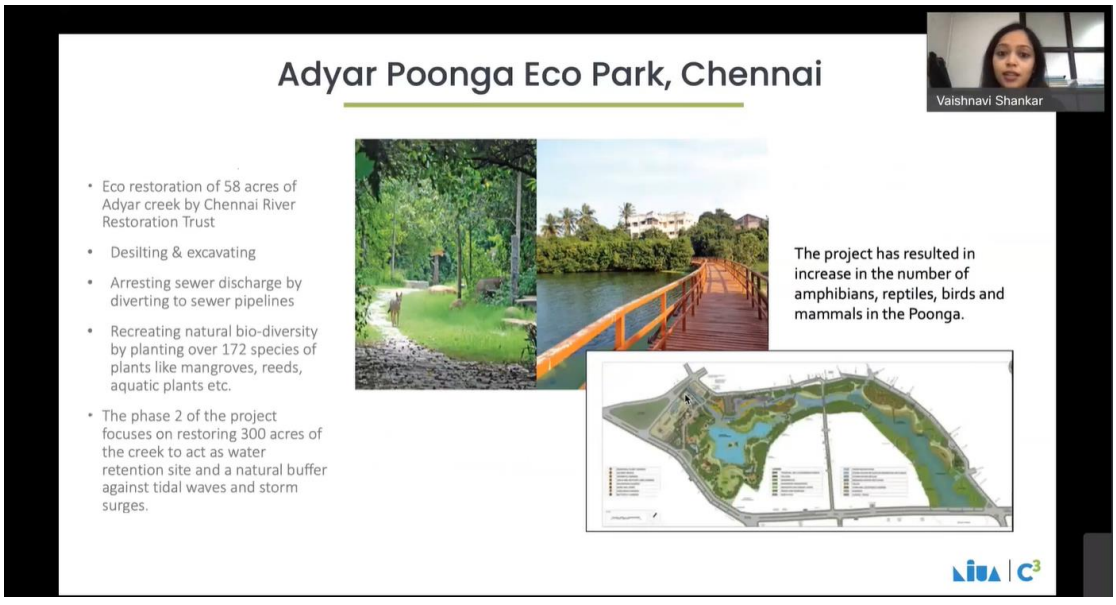

ClimateSmart Cities Assessment Framewo
First of its kind city assessment framework for climate relevant parameters
Vaishnavi Shankar
IMPACT
First country to do nationwide climate assessment impacting over 100 million people (~1/3rd of urban population).
GLOBAL
Assessment framework helps cities track their contribution to national and international frameworks such as the SDGs and India's Nationally Determined Contributions.
Development
Development stage indicators to provide guidance for enabling climate actions within ongoing activities.


Assessment example: Urban flooding
Indication of Progressive Levels of the Framework
Vaishnavi Shankar
The Framework is Progressive and Aspirational
82 Cities
21 Cities
10 Cities
7 Cities
6 Cities
Performance criteria
Cities have not initiated flood/ water stagnation risk assessment
Cities have conducted a rapid flood/ water stagnation risk assessment identifying vulnerable hotspots
Cities have conducted a flood risk assessment for various return periods and developed flood management plan as per NDMA guidelines
Cities are at various stages of implementing recommendations from the flood management plan including flood management SOP as per MoHUA guidelines and establishing early warning systems and
Performance Levels
0 - 20 One Star
21 - 40 Two Stars
41 - 60 Three Stars
61 - 80 Four Stars
81 - 100 Five Stars

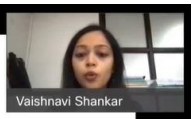

Performance of Cities
In the phase 2 of the assessment
Vaishnavi Shankar
66
31
64
25
22
4
9
1
0
0
1.0 2.0
One Star
Two Stars
Three Stars
Four Stars
Five Stars
Performance of participating cities in CSCAF
31 One Star
64 Two Stars
22 Three Stars
9 Four Stars
0 Five Stars
Performance Levels
Four Stars
Three Stars
Two Stars
One Star
City Population
<0.5 million
0.5-1 million
>1 million

Vaishnavi Shankar
Building Resilience


Vaishnavi Shankar
Oasis Schoolyard, Paris
Challenges –
Urban heat island effect
Risk of storm water flooding
Problem areas -
Impervious surfaces
14.5 m2 of green space per inhabitant
Opportunity -
The majority of Parisians live no more than 200 meters away from a schoolyard.
Schoolyards represent 70 hectares of impervious surface and open air surfaces.
The Paris Resilience Strategy, adopted in September 2017, therefore envisions the renovation the city's network of 761 schools into green islands, or "oases," of cooler temperatures and community solidarity for all neighborhood residents, including the most vulnerable.


Vaishnavi Shankar
Adyar Poonga Eco Park, Chennai
Eco restoration of 58 acres of Adyar creek by Chennai River Restoration Trust
Desilting & excavating
Arresting sewer discharge by diverting to sewer pipelines
Recreating natural bio-diversity by planting over 172 species of plants like mangroves, reeds, aquatic plants etc.
The phase 2 of the project focuses on restoring 300 acres of the creek to act as water retention site and a natural buffer against tidal waves and storm surges.
The project has resulted in increase in the number of amphibians, reptiles, birds and mammals in the Poonga.

Benthemplein Watersquare, Rotterdam



Challenges –

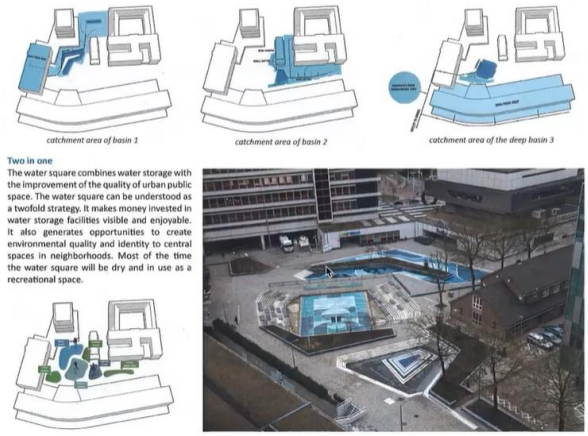
- Flooding

Problem areas -

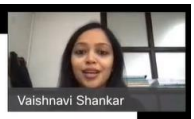
- Impervious surfaces

Opportunity -

- Unused squares in the inner areas of the city – dual usage
- Create environmental quality and
- Identity to central spaces of the neighbourhood

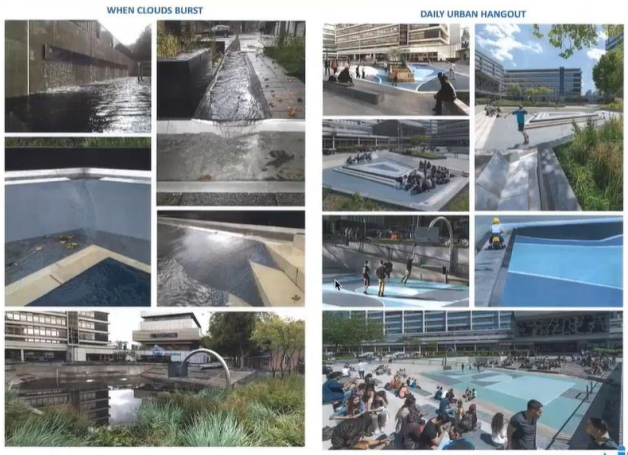


Benthemplein Watersquare, Rotterdam

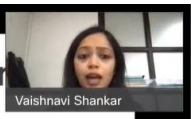


Multi-purpose facility that maximizes investments

- Flood storage infrastructure (that is part of the city's integrated flood management strategy)
- Community gathering place (play areas, green spaces)
- Neighborhood regeneration initiative

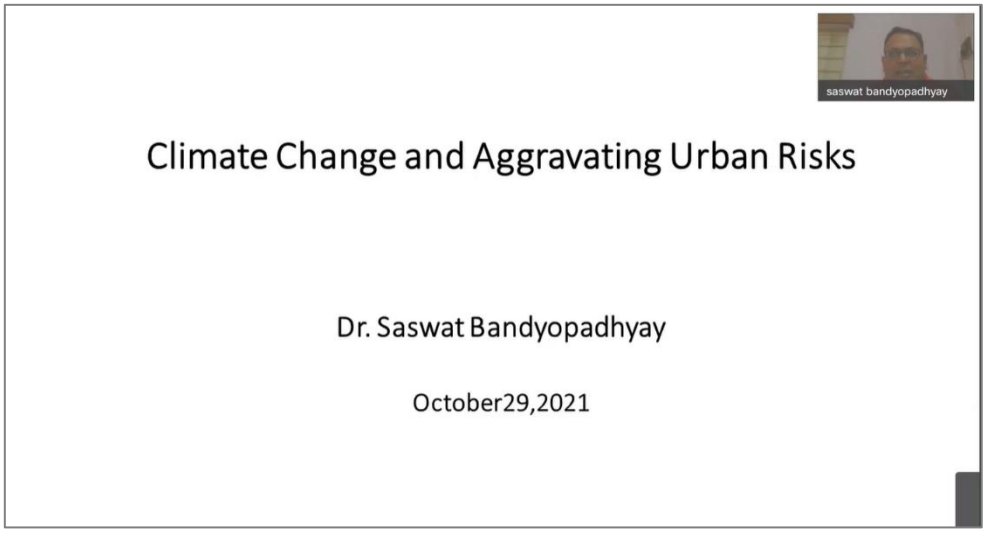


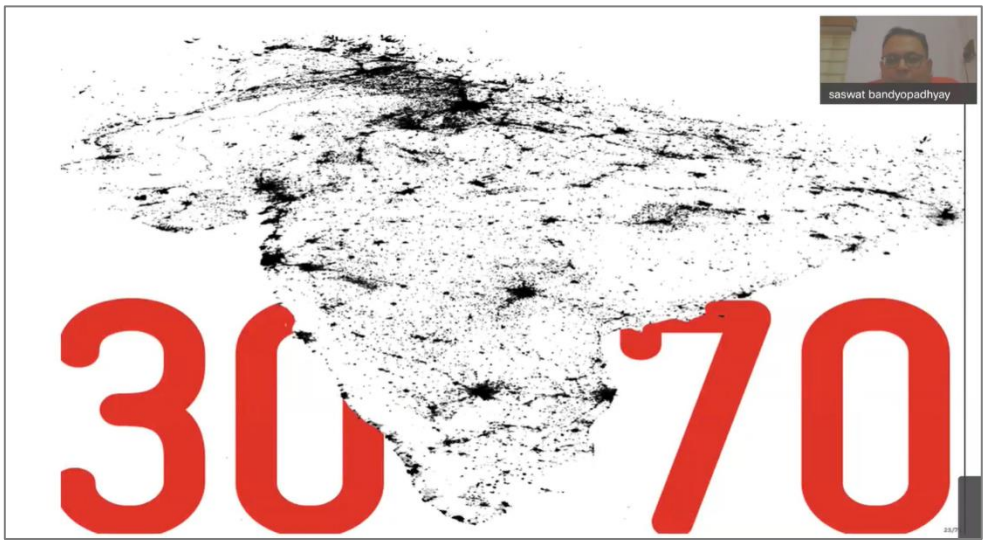
Decision Support System by IBM in Rio de Janer

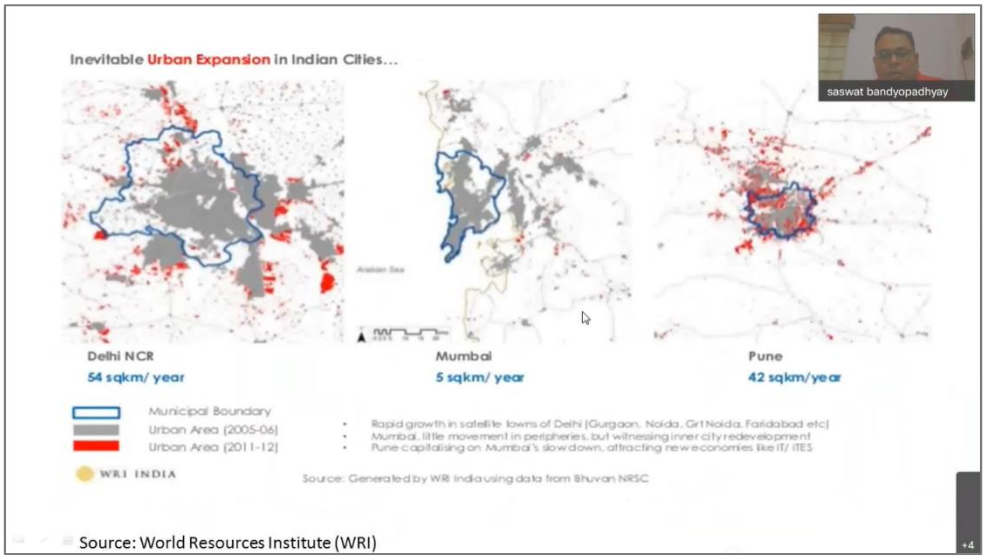


- Informal settlements face landslides and floods resulting in many unnecessary deaths. Reason being - information gap between agencies regarding disaster response.
- The Support System connects departments and supports in predicting rainfall impacts and issues warnings to citizens.
- Support in better coordination with response teams to mitigate damages during shocks like a building collapse.

Prof. Saswat Bandyopadhyay







Source: World Resources Institute (WRI)

Impact of Urbanization over Environment

Impact on biosphere

- Modification of Habitats
- Destruction of Habitats
- Creation of New Habitats

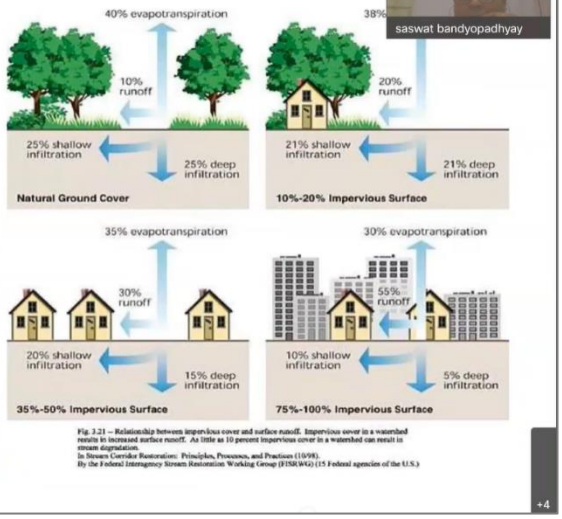
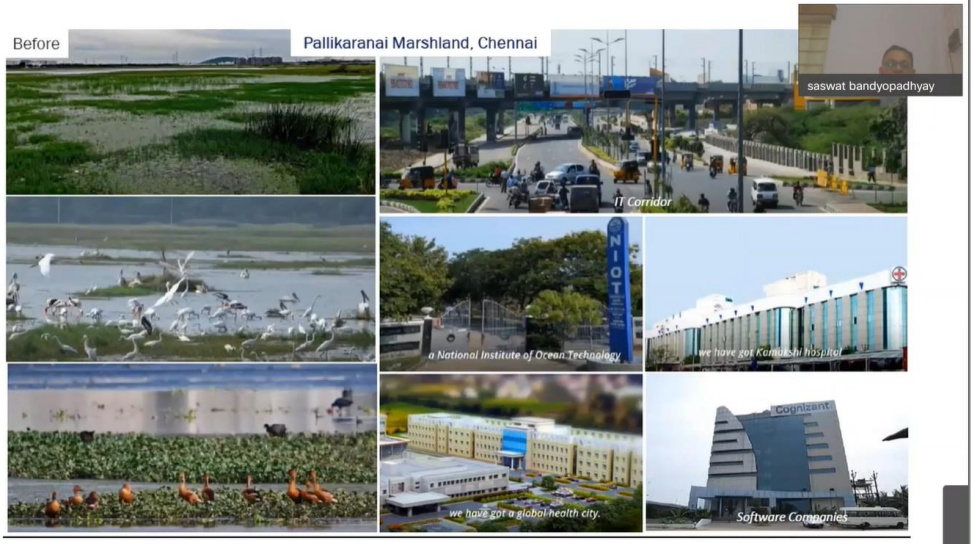
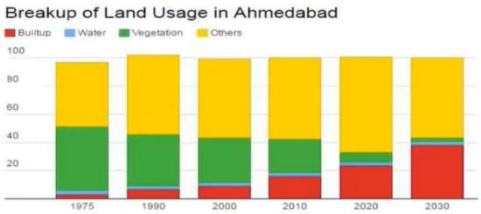
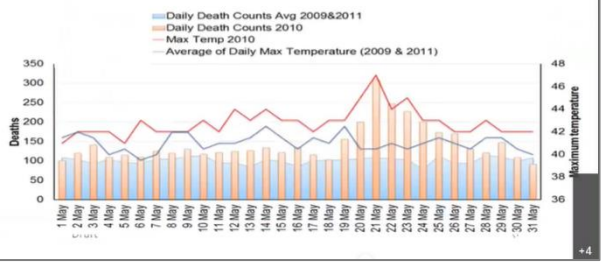


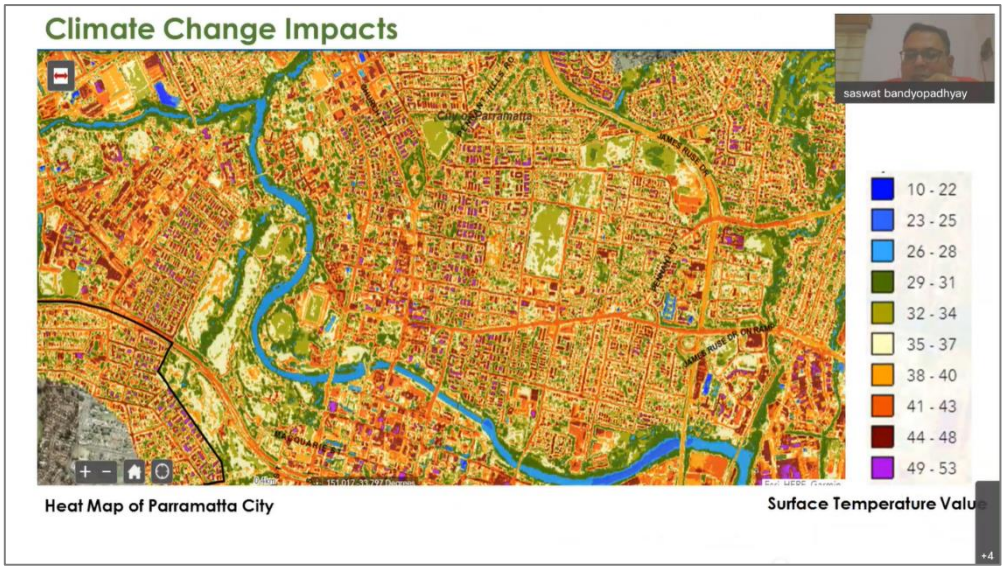
Fig. 3.21 – Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface runoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.
In Stream Corridor Restoration: Principles, Processes, and Practices (1998).
By the Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the U.S.)



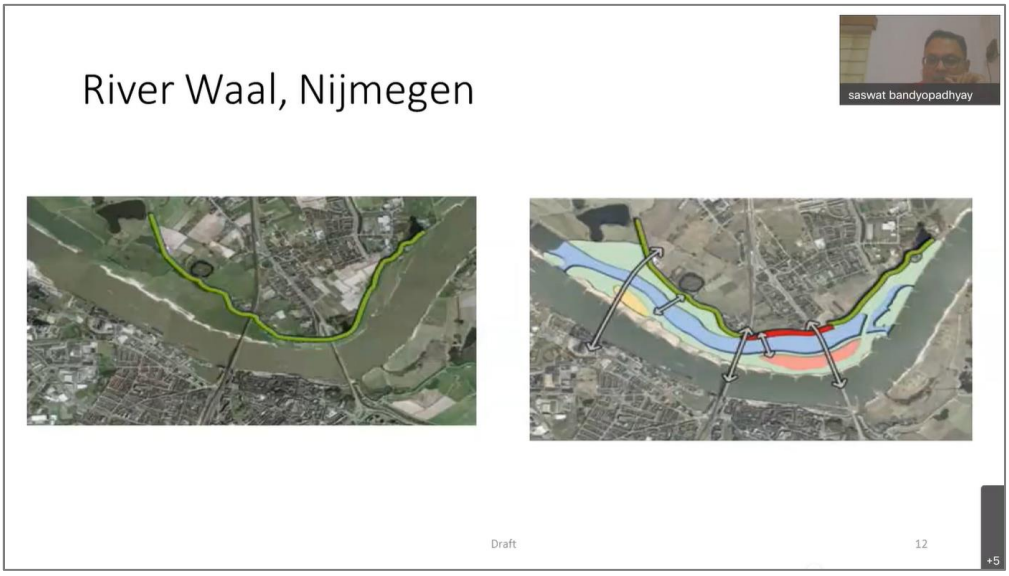
Loss of Greens and Increasing Heat and Flooding Risk Vulnerability



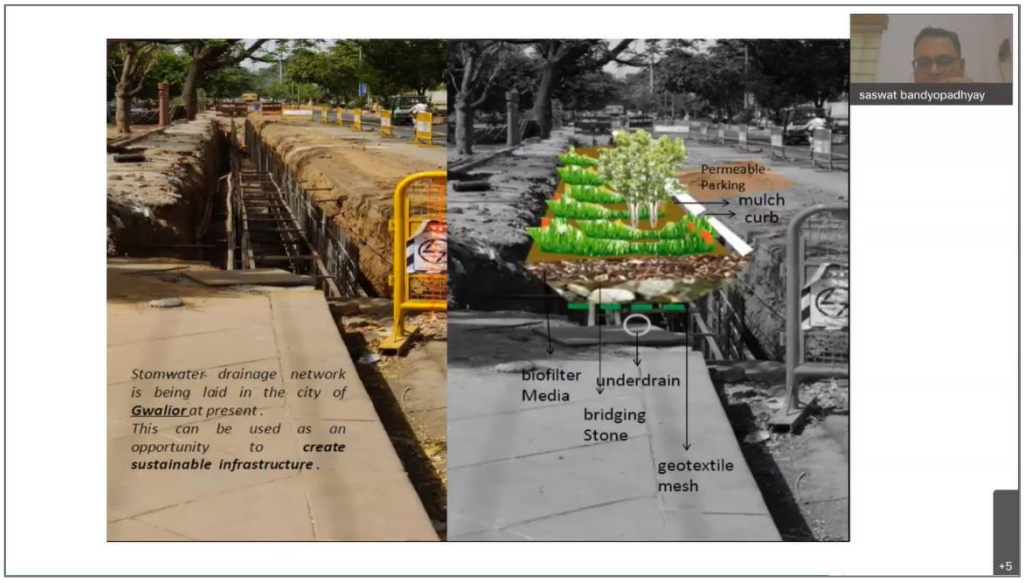



Climate Change Impacts
saswat bandyopadhyay
10 - 22
23 - 25
26 - 28
29 - 31
32 - 34
35 - 37
38 - 40
41 - 43
44 - 48
49 - 53
Heat Map of Parramatta City
Surface Temperature Valu
+4

saswat bandyopadhyay
+5


River Waal, Nijmegen
saswat bandyopadhyay
Draft
12
+5

GREEN INFRASTRUCTURE APPLICATION ACROSS THE GLOBE
saswat bandyopadhyay
Medians with rain gardens manage stormwater runoff from the street ,Arlington ,VA
Permeable pavement parking lane in downtown,NY.
Trench drain conveys runoff into bioretention cells in Washington,DC.
+5


saswat bandyopadhyay
Stomwater drainage network is being laid in the city of Gwalior at present .
This can be used as an opportunity to create sustainable infrastructure .
Permeable Parking
mulch
curb
biofilter Media
underdrain
bridging Stone
geotextile mesh
+5

saswat bandyopadhyay
+5

Canal Restoration, Kolkata
saswat bandyopadhyay
+5

MATERALS USED FOR ENVIRONMENTAL RESTORATION
saswat bandyopadhyay
COCO / JUTE GEOTEXTILES , GEO LOGS, BIOMASS BAMBOO PEGS
BENEFICIAL MICROBES (BM) & PLANTS
+5

Build Back Better with Nature Based Solutions
saswat bandyopadhyay
By 2030
Latin America: USD 7.8 trillion
Asia-Pacific: USD 26 trillion
60% of the world infrastructure we'll see by 2030 is yet to be built
+5

Live
Back
Safer?
saswat bandyopadhyay
+5

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