



# CLIMATE CHANGE IMPACTS AND VULNERABILITY IN INDIA: URGENT NEED FOR ADAPTATION AND RESILIENCE STRATEGIES

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As the issue of climate change and its impacts become increasingly important, in addition to the attention towards mitigation, adaptation measures are crucial for tackling climate impacts and to build resilience across sectors, region and communities. In order to discuss the major trends in climate impacts in different parts of India and in different socio-economic spheres, a Workshop was organised on **Climate Change Impacts and Vulnerability in India: Urgent Need for Adaptation and Resilience Strategies**. The Workshop also discussed a range of possible adaptation measures to tackle climate impacts.

In this Workshop experts, academics, think tanks, civil society organizations, peoples' movements, NGOs and activists came together to work towards promoting Adaptation as a national, state and local agenda. The Workshop was organised by Focus on the Global South in collaboration with All India Peoples Science Network on September 2-3, 2023 in Chennai, Tamil Nadu, India.

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## INTRODUCTION

India ranks seventh amongst the most climate change-affected regions in the world. In its Sixth Assessment Report in 2022 on Impacts, Adaptation and Vulnerability, the Working Group II of the Intergovernmental Panel on Climate Change (IPCC) or IPCC/AR6/WG2 warns that climate impacts are rapidly worsening, some may already have crossed the ability of many communities to cope with them, and some like sea-level rise and polar/glacier melt may already be irreversible. The Report further cautions that changes in climate will progressively escalate related risks, add to pre-existing socio-economic, ecological and other vulnerabilities, and thus further reduce the ability to adapt and build resilience to climate impacts. These cascading and multi-dimensional impacts have been highlighted in this manner for the first time by scientists in IPCC/AR6 showing the severity of the crisis.

Due to this multi-dimensional nature of climate impacts, IPCC has called for caution against one-dimensional Adaptation actions. The Report also laments that many Adaptation actions tend to be knee-jerk measures, especially tending towards hard infrastructure projects, with serious risk of mal-adaptation, that is, with side-effects possibly worse than the original impacts. IPCC/AR6/WG2 therefore calls for Adaptation measures that look for and avail of co-benefits in mitigation, improved local environment and sustainable development, reduced inequality and improved health and well-being, especially opportunities in the food-energy-water-health nexus and in the area of air pollution.

Against this backdrop, a Workshop was organised by Focus on the Global South and All India People Science Network on September 2<sup>nd</sup> and 3<sup>rd</sup>, 2023, with the objective of unpacking some major existing problems and exploring possibilities for adaptation. The following Report is a summary of the Workshop, where researchers, scientists and activists from Himachal Pradesh, Uttarakhand, West Bengal, Assam, Odisha, Nagaland, Tamil Nadu, Kerala, Andhra Pradesh, and Pondicherry presented major problems in their areas and explored or suggested potential solutions.

The Report is structured thematically, examining a wide range of issues. It first addresses the impact of infrastructure such as dams, roads, unscientific construction techniques and development models in the western Himalayas in the context of increasing occurrence of landslides, destructive floods and rapid glacial melt. It then moves on to the impact of decreasing forest cover in north-east India and how the amendments in the Forest Conservation Act (1980) and Biological Diversity Act (2002) are changing the landscape of the region. Policy analysts and agriculture scientists examine the impact of climate on agriculture in the paddy fields of West Bengal, in apple growing in Himachal where maladaptation is analysed. Researchers from Tamil Nadu and Odisha also point out the perils of maladaptation impacting livelihoods of small-scale fishers. A study from Pondicherry looks at health systems and care in the context of climate change. Urban researchers examined problems in city design in the context of climate change, and presented participatory methodologies towards adaptation strategies, with Chennai as a case study. A special Session saw presentation of a policy study and resultant comprehensive city-level Climate Action Plan for Chennai covering both mitigation and adaptation that could serve as a model for similar studies elsewhere in the country. Representatives from Kerala spoke about their experiments with establishing and empowering local self-governments (LSG) in an effort to comprehend climate change adaptation and risk mitigation.



## WESTERN HIMALAYAS: CLIMATE IMPACTS AND ALTERNATIVE DEVELOPMENT PATHWAYS <sup>1</sup>

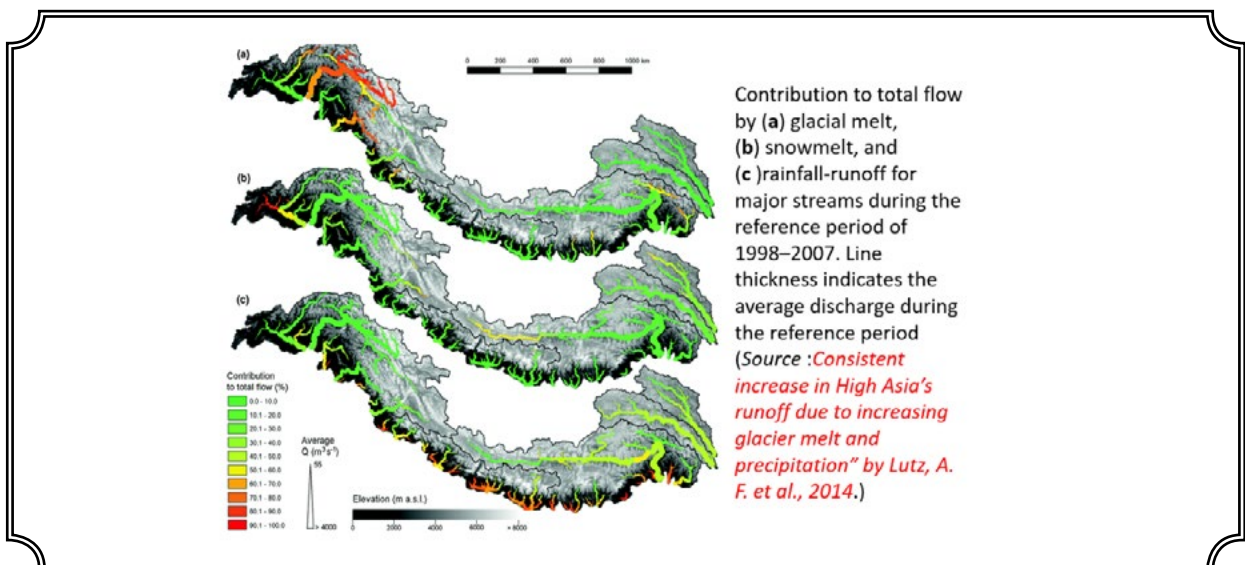
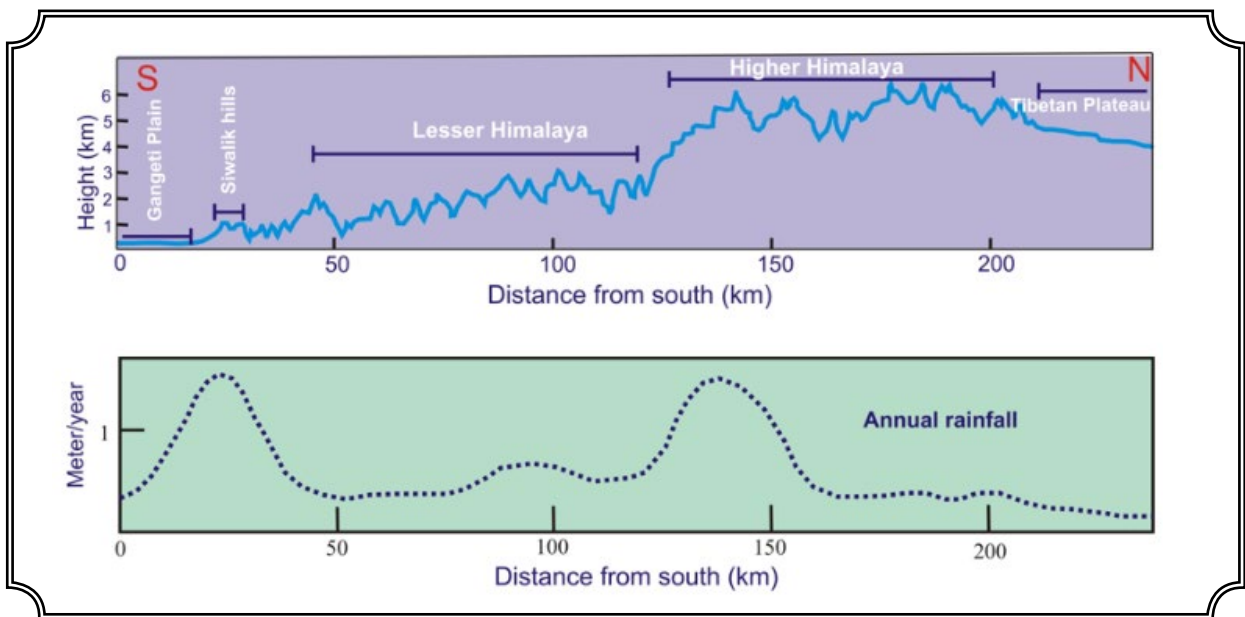
The Indian Himalayas, renowned as one of the world's youngest mountain ranges, possess an inherent geological instability and fragility. They also sit atop tectonic faults and are highly earthquake prone. Notably, in 2000, seismologist Roger Wilhelm advanced a model positing an accumulation of stress within the central Himalayan region. These properties render the region vulnerable to shocks and violent disturbances. Deforestation, unplanned and haphazard settlements and urbanization, improper construction of roads and buildings unsuited to the fragile mountainous area, and poorly planned and badly implemented hydro-electric projects have all rendered the region, especially the Western Himalayas, more susceptible to natural disasters including landslides, floods, forest fires, land subsidence and blockage of waterways leading to gradual disappearance of mountain streams.

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<sup>1</sup> (All information provided in presentations by Tikender Panwar, former deputy mayor, Shimla; S.P. Sati, VCSG University of Horticulture and Forestry, Bharsar Uttarakhand; O.P. Bhuraita, Himachal Gyan Vigyan Samiti)

# CLIMATE IMPACTS IN THE INDIAN HIMALAYAS

The Indian Himalayas and sub-Himalayan region have borne the brunt of climate change, experiencing a substantial warming of 1.5 degrees Celsius – a figure significantly exceeding the national average. This escalating temperature shift and accompanying climatic changes have led to drastic alterations in precipitation patterns, transforming previously arid zones into arenas of intense torrential rain.



For instance, between July 7th and 11 th 2023, an unprecedented 223 mm of rainfall was recorded, a stark contrast to the 50-year average of 41.6mm. Similarly, from August 11th to 14 th this year, 107mm of rainfall was documented, surpassing the 50-year average of 41.7mm.



## Rainfall

7<sup>th</sup> to 11<sup>th</sup> July Normal 50 years average 41.6 mm

2023 223 mm

**436% departure**

11<sup>th</sup> to 14<sup>th</sup> August Normal 50 years average 41.7 mm

2023 107.2 mm

**157% departure**

According to a collaborative study by the HP State Centre on Climate Change (SCCC) and the Space Applications Centre (ISRO) in Ahmedabad, there has also been a 19-27% reduction in snowfall within the catchments of Beas, Sutlej, and Ravi, along with an 18.5% decrease in snow cover during 2020-2021<sup>2</sup>. The region also grappled with a 21-day heatwave in 2022, leading to nearly 3000 forest fires, while instances of extreme rainfall have doubled over the past 50 years.

## DEVELOPMENTAL CHALLENGES AND THEIR IMPACT

Numerous developmental projects, inclusive of hydel power initiatives, extensive road networks, unregulated construction, and a burgeoning tourism industry, are placing immense strain on the delicate mountain ecosystem. For instance, glacial melt in high-altitude regions leads to the release of moraines (an accumulation of boulders, stones, or other debris carried and deposited by a glacier), potentially resulting in devastating floods when dams are erected in these areas. The tragic floods of 2013 in Uttarakhand, especially in the Kedarnath area that claimed at least 200 lives, were not only due to extreme rainfall that year but also due to the release of moraines from an upper glacier in Kedarnath. The fervent pursuit of hydel power, epitomized by Himachal Pradesh's ambitious plan to generate 100,000 megawatts of hydel power by 2030, has raised substantial environmental concerns. At the moment, the state already accommodates 75 operational hydel projects.

## TOURISM AND INFRASTRUCTURAL DEVELOPMENT

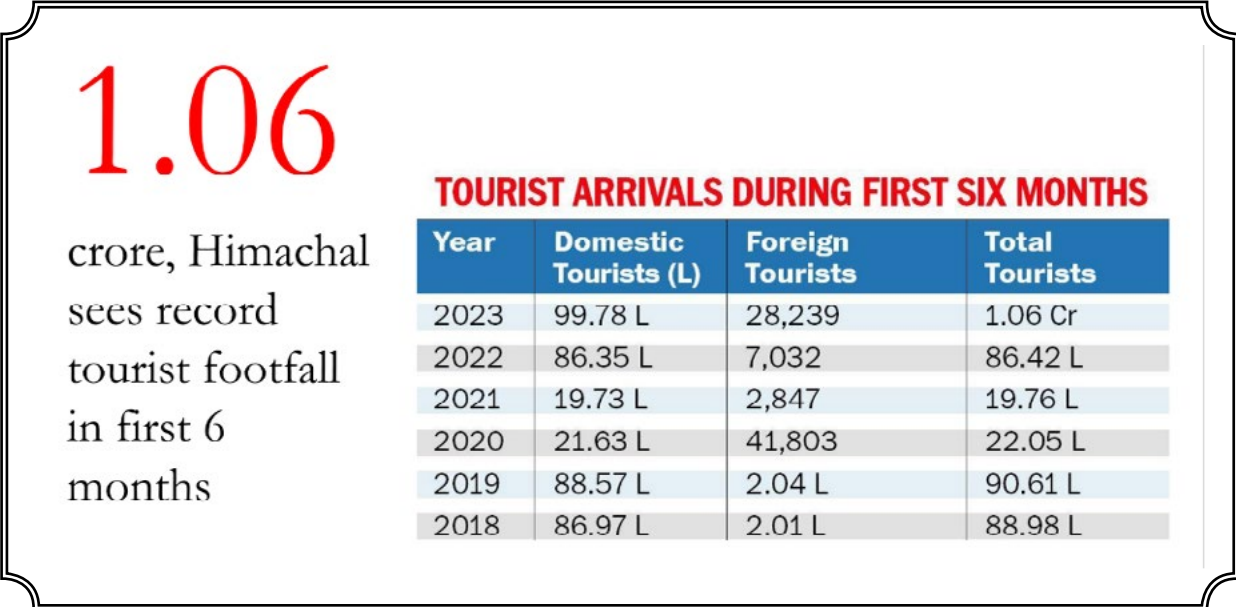
Simultaneously, tourism in Himachal Pradesh is experiencing an unprecedented surge, with 10 million visitors recorded in the first six months of 2023.<sup>3</sup> This surge over the years has led to

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<sup>2</sup> Snow and Glaciers study project (ISRO) DOS GOI Phase-II

<sup>3</sup> <https://www.thehindu.com/life-and-style/travel/himachal-pradesh-tourist-arrivals-break-six-year-record/article>

extensive construction of hotels, other commercial and residential buildings and four-lane highways, supervised by the National Highways Authority of India (NHA). Unscientific construction of these highways has been a major cause for landslides.<sup>4</sup> By themselves, periodic landslides in the region are caused by heavy rainfall on the slopes comprising loose soil and rocks. These leave a trail of debris which accumulates over time and which appears solid but is not. Construction in this area especially tunnelling must be, but is usually not, undertaken after proper geo-technical studies and should ideally not involve very heavy machinery, blasting etc which lead to further disasters in the already fragile area.



## THE SYSTEMIC SHIFT: FROM HABITATS TO RESOURCES

There has been a systemic shift away from viewing mountain regions as natural habitats, to regarding them as resources for exploitation. A certain financial architecture has propelled this model in the

Himalayas causing enormous destruction, with climate change exacerbating impacts. The majority of infrastructure-related projects in the region, encompassing dam construction and

[cle67124119.ece](https://cle67124119.ece)

<sup>4</sup> Preparation of Hazard, Vulnerability & Risk Analysis atlas and report for the state of Himachal Pradesh (<https://hpsdma.nic.in/admnis/admin/showimg.aspx?ID=2671>)



road building, are primarily funded by the World Bank. This influx of concrete and tourism has adversely affected the region's ecological equilibrium. Experts caution that meaningful change can only be realized through the adoption of a radically different development model for the Himalayas.

## RECOMMENDATIONS FOR SUSTAINABLE DEVELOPMENT

To address the pressing challenges confronting the Indian Himalayas, one needs a people-centric approach, entailing a comprehensive perception study involving 100,000 families, 50 block-level dialogues, and state-level conventions. Additionally, there is a need to revisit the recommendations made in 1997, encompassing regulated construction along riverbanks, and tributaries, identifying water-induced disaster-prone areas for mitigation, mapping risk zones, and instituting an interdisciplinary planning process. Moreover, there is a pressing call for the enactment of the Himachal Flood Plain Zoning Bill, which has been under review by the state government since 2018. The current trajectory of development in the Indian Himalayas, coupled with the challenges posed by climate change, demands a paradigm shift. It is imperative to reevaluate the approach towards sustainable development in this ecologically fragile region.



## THE CHANGING LANDSCAPE OF FORESTS IN NORTHEAST INDIA <sup>5</sup>

India boasts of diverse forests, with tropical, temperate, and alpine ecosystems, supporting four out of the 36 global biodiversity hotspots. However, recent years have witnessed alarming changes in India's forest cover, affecting both biodiversity and climate.

### FOREST COVER IN INDIA: A SHIFTING LANDSCAPE

India's forest and tree cover was reported at 80.9 million hectares in 2021, constituting 24.62% of the land mass of the country. Data from World Forest Watch reveals a loss of 127,000 hectares of natural forest in 2021. In India, dense forest cover has seen a decline due to mining, power plants, irrigation, and infrastructure projects. North-east India alone has seen a 79% decline in tree cover in 2020.<sup>6</sup> Changing rainfall patterns in Assam have caused problems for agriculture-dependent communities. There have been successive crop failures and adverse health effects in the state.

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<sup>5</sup> (All information provided in presentations by T Gangadharan, Kerala Sasthra Sahithya Parishad; Tapan Mishra, Paschim Banga Vigyan Mancha; Pranab Choudhury, Centre for Land Governance, Kolkata University; Biplab Ghosh, Bharat Gyan Vigyan Samiti, Assam)

<sup>6</sup> <https://www.downtoearth.org.in/factsheet/north-east-india-saw-largest-share-of-the-country-s-tree-cover-loss-study-79653>



## LEGISLATIVE CHANGES: IMPLICATIONS FOR FORESTS

### AMENDMENTS TO FOREST CONSERVATION ACT AND BIODIVERSITY ACT

On 29th March 2023, The Forest Conservation (Amendment) Bill 2023<sup>7</sup> was introduced in the Lok Sabha. The bill sought to make several changes to the existing Forest Conservation Act, 1980, which was enacted primarily to prevent large-scale deforestation, and setting a set of rules that required permission from the central government to divert forest land for non-forest use. The Bill excludes certain categories of land from the purview of the Act: land recorded as forest before October 25, 1980 but not notified as a forest, and land which changed from forest-use to non-forest-use before December 12, 1996. Land that comes within 100km of India's border areas, which cover large forest areas in the country's north-east region, is also exempt from the purview of the Act; the Bill justified this exemption with reasons of national security projects, small roadside amenities such as tea-stalls, public toilets, and public roads leading to a habitation. The Bill also specifies activities that can be carried out in forests- such as establishing fencing, check posts, and bridges. It allows zoos, safaris and ecotourism within forest land as well. The Bill has been passed by both houses of parliament: the Lok Sabha and the Rajya Sabha amidst protests by forest rights activists, researchers and tribal communities.<sup>8</sup>

On 1st August 2023, both houses of parliament passed the Biological Diversity (Amendment) Bill, 2023. The original Biological Diversity Act, 2002 was enacted with an aim to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use and knowledge of biological resources. These objectives are in line with the International Convention on Biological Diversity- a global treaty for the conservation and sustainable use of biodiversity, of which India is part. The Bill of 2023, now an Act, proposes to facilitate commercial use of traditional resources. It enables fast-track of the patent application process and encourages foreign investment of the country's biological resources. This means that traditional knowledge can be patented without local community consent. In a bid to provide ease of doing business, the Act has also decriminalised offences by charging a penalty between Rs 1 lakh and 50 lakh, instead of a jail term.

### PLANTATIONS VS. NATURAL FORESTS

India aims to absorb 2.5 to 3 billion tonnes of CO<sub>2</sub> by 2030 through afforestation. The country's current forest cover (80.9 million hectares) needs to increase significantly (by 30-31%) to meet the NDC (nationally determined contribution) targets. Most of this increased green cover comprises plantations, not old-growth forests. Monocultures lack species diversity and have

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7 [https://prsindia.org/files/bills\\_acts/bills\\_parliament/2023/Forest%20\(Conservation\)%20Amendment%20Bill,%202023.pdf](https://prsindia.org/files/bills_acts/bills_parliament/2023/Forest%20(Conservation)%20Amendment%20Bill,%202023.pdf)

8 <https://www.telegraphindia.com/jharkhand/east-singhbhum-tribal-march-to-protest-against-forest-conservation-amendment-act-2023/cid/1974239>

lower carbon stock in soil and below-ground flora. Old-growth forests are vital for sequestering carbon effectively. There is a need for a policy that specifically protects existing natural forests and biodiversity-rich ecosystems.

## NORTHEAST INDIA: A FOREST-RICH REGION

Northeast India comprises eight states: Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Assam, Nagaland, Tripura and Sikkim, with rich forest resources, and diverse forest management mechanisms. The north-eastern region of India represents 65% of the country's forest cover, with 4% allocated to reserve and protected areas. Meghalaya, Mizoram, Nagaland, and Arunachal Pradesh have unique approaches to forest governance. Meghalaya, for example, has community forests that are managed by different types of community bodies under varying jurisdictions. Mizoram forest lands are placed under the authority of village council. In Arunachal Pradesh, forest plantations are raised as Anchal forest reserves under the village committee. Nagaland, boasts of 74% forest cover, with over 94% owned by local indigenous communities. Shifting cultivation (Jhum) is practiced by 60% of the population, meeting significant food requirements. Legal pluralism exists in forest ownership and management, connecting people to their land. The communities advocate for Natural Regeneration (ANR) and organizing state-level movements to resist forest degradation, along with promoting Community Forest Management Groups (CFMGs) at the local level for sustainable change. Indigenous peoples and local communities play a crucial role in land conservation and biodiversity protection.



## CLIMATE CHANGE IMPACTS IN ASSAM

In Assam, the districts of Baksa and Nalbari have nearly 5% of the land covered with water bodies, and 51% agricultural land. June to September, the usual monsoon months in the region, have seen a decline in the number of rainy days from 1978-2021. From an average of 51 days in the first ten years, the number of rainy days reduced to 36 in the last ten years. This has essentially led to a situation where the region faces flooding events at certain times of the year and drought due to scarcity of water at other times. 78% of the population of the two districts depends on agriculture for their livelihood. A rise in flooding events has destroyed a number of homes and infrastructure for the poor. Stagnant, water-borne diseases are on the rise.

### Health

- Floodwaters contaminated with human or animal waste, the rate of faecal-oral disease transmission increasing allowing diarrhoeal disease and other bacterial and viral illnesses to flourish
- 40% increase in diarrhoeal disease, cholera, dysentery and typhoid from the region in between 2017-21 from sample survey.
- Increased vector-and rodent-borne and other infectious diseases like collections of stagnant water provide breeding grounds for mosquitoes, potentially aiding in the spread of malaria
- Outbreaks of rotavirus and leptospirosis
- Drastic increase in arboviral diseases like chikungunya and dengue – dengue cases increases 120% in between 2017-21

## ADAPTATION MEASURES

In such a situation, it is important to think of adaptation measures that work well with the changing face of climate. Crop diversification in the form of mixed cropping and switching to native crops that demand less water is one such measure. Using natural methods to control and manage pests, such as covering seeds with a thin layer of sand mixed with well dried cow dung, wood fine ash, dried trees leaves instead of using chemicals is another way of adapting to nature-friendly ways of managing the land. Building awareness around the impacts of climate change on health, and pushing for community centric approaches to healthcare and better infra for public healthcare are some other ways of adapting to a changing climate in this region.

In the face of shifting forest landscapes and climate challenges, Northeast India's rich forests stand as a critical asset. Sustainable practices, legal pluralism, and community involvement offer hope for the preservation of these vital ecosystems. India's journey toward achieving its climate goals and protecting biodiversity hinges on recognizing the value of natural forests and the people who safeguard them.





## CLIMATE CHANGE IMPACTS ON AGRICULTURE: FROM RICE PADDY IN WEST BENGAL TO APPLE FARMING IN HIMACHAL PRADESH <sup>9</sup>

### PADDY PLANTATIONS SUFFER THE ONSLAUGHT OF ERRATIC MONSOON IN COASTAL WEST BENGAL THE COASTAL REGIONS OF WEST BENGAL,

especially the districts of Ramnagar-I, Ramnagar-II, Contai-I, Khejuri -II, Deshapran, and Nandigram-I, have witnessed a continuous decline in rain-fed paddy (Aman) yields, affecting the livelihoods of approximately 84% of the farmers. This decline can be attributed to the impact of climate change, characterized by erratic micro-weather events, reduced rainy days during the monsoon, increasing instances of drought, and unpredictable rain patterns. Farmers face significant challenges, including lodging of harvest-ready plants and water logging due to heavy rain, leading to increased expenditure on labor. Moreover, pest attacks on crops and soil salinity have seen a notable rise in recent decades.

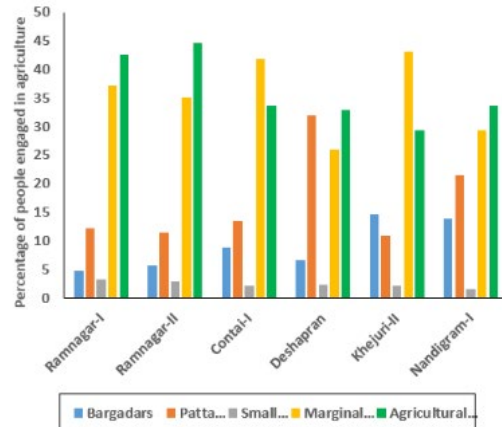
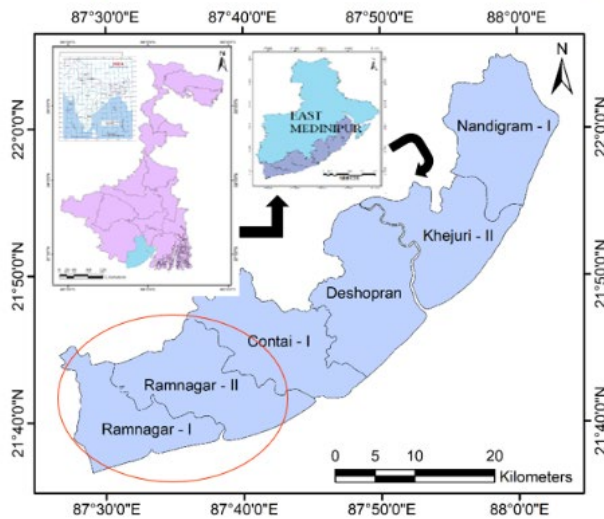
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<sup>9</sup> (All information is obtained from and can be cited to presentations by Parthiba Basu, Calcutta University; Sugata Hazra (former) Faculty, Jadavpur University; Gopinath, MS Swaminathan Research Foundation (MSSRF), Chennai; and Tikender Panwar, former deputy mayor, Shimla)



## Coastal zone agronomic vulnerability

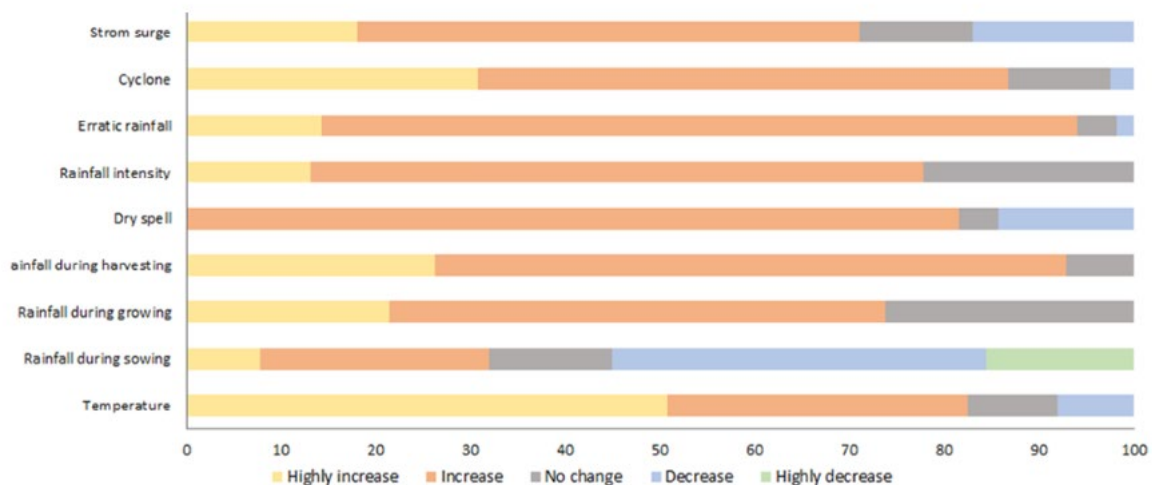
*Exposure of the coastal regions to higher incidences of weather extremes makes its food system particularly vulnerable due to disruptions in crop management and eventual crop losses (IPCC 2007).*



*\*Source: District Statistical Handbook, Purba Medinipur, 2016-'17*

The reduction in total rainfall and the increase in maximum temperature since 1991 has compounded the challenges faced by farmers. Climatic parameters, especially temperature, have shown a statistically significant negative impact on the yield of Aman cultivation, indicating a worrying trend for the future. Furthermore, the Normalized Difference Vegetation Index (NDVI) highlights a shift in the cropping calendar, further exacerbating the challenges faced by farmers.

## Farmers' perception about the changing trend of climatic parameters over last 30 years





Farmers moved away from paddy and towards shrimp cultivation, which caused more problems – it made their land saline, it polluted their soil with pathogens leading to a rise in the number of diseases and further degrading the soil.

## **DROUGHT AND ITS RAMIFICATIONS**

Drought emerges as a critical hazard affecting agriculture globally, with 55 million people being impacted annually <sup>10</sup>. This phenomenon constitutes 15% of natural disasters, but the human toll is staggering, with approximately 650,000 deaths recorded from 1970 to 2019. The economic losses due to droughts from 1998 to 2017 amounted to around USD 124 billion.

India, particularly West Bengal, stands significantly vulnerable to droughts, with 68 to 74% of the country prone to this hazard. The districts of Coimbatore and Tirunelveli in Tamil Nadu, Hassan, Kolar, Davangere, Belagavi in Karnataka, Kalahandi in Odisha, Palamu region and Mirzapur plateau in Uttar Pradesh, Kutch and Saurashtra regions in Gujarat, and Purulia in West Bengal have been identified as drought hotspots.

## **APPLE FARMERS IN A CRISIS IN HIMACHAL PRADESH**

Apple production is an important part of Himachal Pradesh's economy and livelihoods. The state is second in apple production in India and comprises 85% of total fruit production and nearly 48.8% of the total area under fruits. From 1950-51, from just 500 hectares, it covered 5,025 hectares in 1960-61 and by 2021-22, nearly 1,15,016-hectare area has been under apple production. But the apple farmers are in a crisis.

In the post-90s era, the successive state and central governments brought in a number of neo-liberal reforms, opening up the state to massive infrastructural and tourism-driven projects, particularly after the passing of the Fiscal Responsibility and Budget Management Act, 2005. This caused fragmentation of land, making agriculture unsustainable, and apple was the only crop that was able to sustain the impact of the reforms. Trends showed that young people would study abroad and come back to the state to grow apple orchards. The apple economy in the state is around INR 5000 crore.

The current crisis faced by apple farmers in the region can be attributed to multiple factors. In an internationally well documented process, due to climate change with temperatures rising and onset of winter shifting, apples

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<sup>10</sup> <https://www.who.int/health-topics/drought/>

and stone fruit are now fruiting at higher altitudes than before. A large number of apple cultivators in the mid-hills are therefore being forced to abandon their traditional apple or other stone fruit cultivation in favour of other fruit or off-season vegetables. The horticultural research laboratories have not yet succeeded in developing the long-promised quick-chilling or other varieties to suit the changing climate. Besides this systematic climate-induced factor, there has been a substantial increase in the cost of production. Input costs for fertilizers, insecticides, and fungicides have risen by over 300% in the last decade, where the government has allowed an intervention of private market players. Additionally, costs associated with apple cartons, trays, and packaging have dramatically increased. In the last decade, the cost of a carton which was about Rs 30 has risen to Rs 130. Rs 120 is given for grading and packaging and nearly Rs 120 is fleeced from the apple growers by the commission agents. Therefore, the cost borne to market the produce has risen to nearly Rs 370.

Recent developments in science, technology and germination are bringing in a major transformation in this important sector. However, in some important ways, these changes may be labelled mal- adaptation to climate change.

The variety of apple crop used today are rootstocks, cloned high-density varieties. The rootstock varieties are planted close to each other- nearly 1500 trees will be planted in an area of 4000 square meters. While the earlier variety would take nearly 10-12 years to mature, the rootstock varieties start bearing fruit in three years. The cost of planting 1500 plants is nearly Rs 30 lakh and the cropping method is highly mechanized and digital. Unlike the past where plants were planted either on hilly slopes or fields, the new ones are laid in proximate positions with the base covered by artificial material. This is to ensure that water is conserved and the growth of weeds is checked. Artificial Intelligence plays a pivotal role in their production. Fasal,' an Artificial Intelligence (AI) company based in Bangalore with investors from Singapore and Australia, provides the basic architecture of mapping the soil moisture, reading the India Meteorological Department portal, and even advising the farmer on providing nutrients and water to the plant.

This high-density variety of apple farming is making massive inroads in the apple bowl of the country. The rich farmers are rapidly shifting to this form of production where the capital cost of investment varies from Rs 30 lakh to Rs 1 crore depending upon the size of the farm. Those who are shifting to this form of production cite examples of China, Europe, the US and other nations where the per-hectare yield is almost five times that of India.

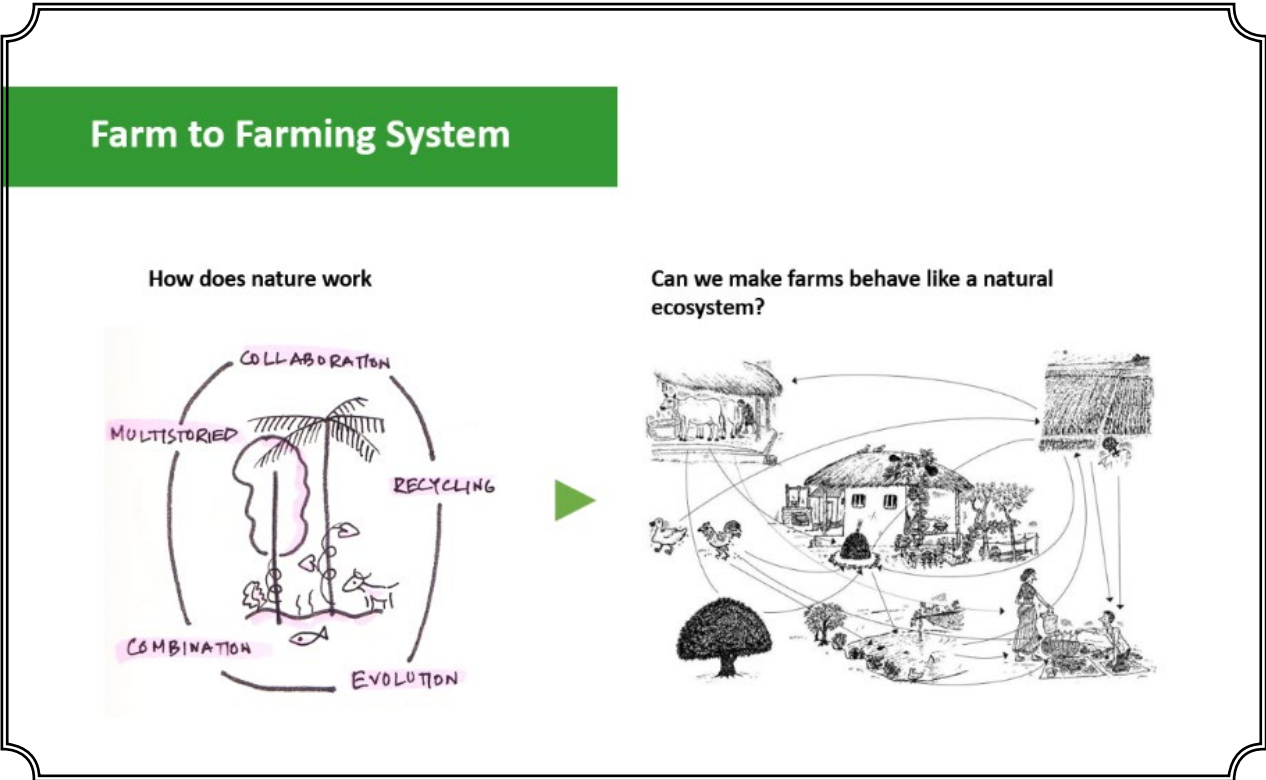




This shift towards capital-intensive apple production methods is leading to a divide, with wealthier farmers making the transition, while 95% of apple farmers are unable to bear the financial burden of such a transformation. The effects of this transformation to mass horticulture production' could also prove to be harmful to the ecosystem in the long run, as farmers have started tapping water both legally and illegally through boring in the hills. The geographical and environmental variation is also large and unpredictable. For instance, unseasonal rains have washed away the flowers and will severely impact the production in the region. With such variation, it is difficult to ensure a set pattern of cropping.

## NEED FOR TIMELY, NEED-BASED ADVISORIES AND ALTERNATIVE METHODS OF FARMING

Rising temperatures, drought, floods, varying frequency of rainfall, erratic micro-weather events has put farmers across the country in a very precarious situation. What they need, most importantly, is an assured social security net against all kinds of crop failures. Secondly, they need to adopt better cropping methods, such as biofarming, or sustainable integrated farming system (SIFS), which is a method of integrated farming that includes working on ways to diversify the farm with a mix of seasonal crops, trees, ponds, livestock and feed. Thirdly, there is a pressing need for real-time, need-based advisories that are communicated in a language and format accessible to all farmers, regardless of their level of education or technological proficiency.





The current scenario necessitates immediate and targeted interventions to address the challenges faced by farmers. This includes a concerted effort to provide timely, need-based advisories to farmers in a format that is easily comprehensible. Additionally, investments in sustainable and integrated farming systems, as demonstrated by successful models like SIFS, should be encouraged. It is imperative to bridge the gap between technological advancements and their practical application in the field.

## **MALADAPTATION- INFRASTRUCTURE IN THE KAVERI DELTA <sup>11</sup>**

Known as the Climate Adaptation in Vennar Sub-Basin in Cauvery Delta Project (CAVSCDP), this state project, considered to be a model of adaptation in the Cauvery delta was carried out between 2016 and 2022, with funding from the Asian Development Bank (ADB) and the Tamil Nadu state government.

The ADB's 2013 study predicted heavy rainfall, leading to increased runoff and subsequent flooding. To mitigate this, the study recommended riverbed desilting, embankment raising, and the construction of infrastructure called tail-end regulators to prevent saline intrusion.

Two major adaptation measures were proposed: one for the hinterland delta and the other for the coastal delta. The project had a significant negative impact in the Cauvery sub-basin and Vennar sub-basin.

Private companies were contracted to develop the infrastructure. The Cauvery delta is a region rampant with sand mining. The construction of embankments required deepening of the river bed. As a result of the deepening of the river, water extended into fields. To combat this, the irrigation officer of the area suggested the construction of bed dams to divert the water back. The demand for bed dams increased, leading to the construction of five dams within a five-kilometer stretch. However, the construction quality suffered due to the lack of local community consultation.

The sluice gates were constructed incorrectly using concrete. This led to challenges in both adaptation and re-adaptation efforts. People from the village raised their voice against sand lorries extracting sand from the area and attempted to stop them. However, the sand was offered for construction of temples, making the people complacent, and their resistance dwindled.

In the coastal delta region, the proliferation of shrimp farms had detrimental effects on the local population involved in aquaculture and agriculture. These farms created issues related to the

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<sup>11</sup> (All information in this section can be cited to the presentation by Shibi Nandan, researcher at Pondicherry University)



placement of regulators designed to prevent seawater intrusion. Disagreements arose between farmers and aquaculture operators, leading to tensions. Notably, many women in the region depended on the brackish water for their livelihoods.

The management of infrastructure in this context became deeply intertwined with politics. Farmers and fishers, often from weaker socio-economic classes and castes, bore the brunt of these political struggles. It is essential to consider how infrastructure can be politicized to benefit the people in these situations.

The history of dams in the delta mirrors the need to control the river for rice cultivation, reminiscent of colonial history. Proposing new infrastructure projects faces similar challenges. Reimagining infrastructure is vital to address these issues.

Regarding implementation, it's crucial to acknowledge that infrastructures are embedded with politics, involving local forces combating historical forces of oppression, such as caste and capital, while seeking climate justice. This raises questions about the viability of finding engineering solutions for climate change adaptation and addressing broader environmental and ecological concerns, considering the historical roots of river infrastructure in the Kaveri delta.

## CLIMATE CHANGE CHALLENGES IN ODISHA <sup>12</sup>

Odisha is a region characterized by a sprawling coastline spanning approximately 450 kilometers, encompassing districts like Balasore, Bhadrak, Kendrapara, Jagatsinghpur, Puri, Khurda, and Ganjam. Additionally, five districts in Odisha face drought conditions, including Bolangir, Bargarh, Nuapada, Kalahandi, and Phulbani.

One of the significant areas influenced by climate change is the Chilika Lake and its surrounding communities. The lake exhibits dynamic water spreads, covering approximately 620 to 650 square kilometers during the pre-monsoon season and expanding to 700-760 square kilometers during the monsoon. However, challenges have arisen due to prawn culture occupying over 20,000 hectares of the lake's adjacent area.

Some of the big issues that the region around Chilika lake faces are: an increased frequency and intensity of cyclones, a decline in fish population impacting more than 150 villages; illegal commercial prawn cultivation thanks to unauthorized expansion of the activity which has negatively affected soil health in the area, causing losses for over 275 surrounding villages engaged in agriculture; distress migration which has affected 275 villages, including 150 fishing communities; insecure livelihood of the fishing community, loss of biodiversity. These problems are further exacerbated by inappropriate fishing practices, industrial chemicals used in prawn cultivation, destruction of mangroves, and poorly managed dolphin tourism

In addition, emerging threats such as the proposed Bharat Mala Project (Coastal Highway Project) and coastal erosion pose significant risks to the ecosystem, environment, and biodiversity in Odisha. Additionally, the depletion of mangrove forests, which are a coastal heritage of Odisha, and the shortage of food for crocodiles have further compounded the challenges faced by local communities, particularly the fisherman community who are losing their traditional livelihoods.

## CLIMATE CHANGE AND HEALTH IMPACTS: ADAPTATION & RESILIENCE STRATEGIES <sup>13</sup>

Climate change poses significant health risks, as highlighted by the National Action Plan on Climate Change and Human Health (NAPCCHH) from the Ministry of Health and Family Welfare in 2016.

The health impacts of climate change are intertwined with social determinants of health and sustainable development. Global disparities in health outcomes due to climate change are often rooted in existing economic, social, and health inequities. These disparities are shaped by the

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<sup>12</sup> (All information in this section can be cited to the presentation by Bharat Gyan Vigyan Samiti, Odisha)

<sup>13</sup> All information in this section can be cited to the presentation by Dr. R. Parthesarathy, Pondicherry Science Forum

unequal distribution of power, income, goods, and services influenced by political, economic, and social forces and norms. Unfair living conditions, including limited access to healthcare, nutritious foods, suitable work and shelter, and community environments, exacerbate health inequalities. Inequities in these social determinants also affect communities' capacity to adapt to climate change.

Certain groups face higher vulnerability, including those in the Global South, impoverished individuals, those lacking access to health services, people with pre-existing chronic diseases, those with low educational status, limited access to information, the very young, the elderly, and, particularly during extreme events, women.

**Climate change adaptation in the context of health can be categorized into three levels:**

**Primary Prevention:** This entails interventions to prevent climate-related health issues, such as re-zoning coastal areas to protect against rising sea levels and more intense weather events.

**Secondary Prevention:** This involves preventing adverse health outcomes once disease has begun but before symptoms appear. For climate change, this includes strengthening disease monitoring, building resilient public health infrastructure, and responding to likely events.

**Tertiary Prevention:** This aims to minimize the effects of existing diseases and involves reactive adaptation and prevention measures.

Recognizing that health co-benefits are immediate and significant, actions such as reducing short-lived climate pollutants, decarbonizing energy generation, promoting clean transportation and household energy, advocating for climate- and health-friendly diets, and improving housing conditions can yield substantial health improvements.

Some case studies highlight the direct impact of climate change on health. For instance, Brazil's dengue epidemic in 2022, with over 1,000 deaths, was linked to relaxed prevention measures and increased home water storage due to climate change. Similarly, the Ebola virus outbreak in West Africa was influenced by agricultural yield reductions, deforestation, and increased human-bat interactions resulting from climate-driven changes.

In India, adaptation strategies led by the government focus on strengthening early warning and surveillance systems, enhancing coordination, developing risk maps for climate-sensitive diseases, improving access to healthcare across income groups, and conducting vulnerability assessments.

To achieve health adaptation in the face of climate change, lessons include the importance of localized assessments, interdisciplinary approaches, and cooperation between health and meteorological sectors for data-driven preparedness and response. National health plans, policies, and budgets should explicitly incorporate climate change risks, and capacity development is crucial for healthcare professionals, policymakers, and the public.





Climate change poses intricate health challenges, driven by existing inequities. Adapting to these challenges requires a multifaceted, collaborative approach that integrates climate and health data, considers specific contextual factors, and incorporates climate risks into health planning and capacity- building efforts.

## URBAN ISSUES AND CLIMATE CHANGE <sup>14</sup>

The 2022 climate change report of the IPCC Sixth Assessment Report (Vol-II)- Impacts, Adaptation and Vulnerability has a focus on India where it identifies three major climate hotspots --- semi-arid and arid regions, Himalayan ecosystem, and coastal zones. Amongst these, the coastal regions in India are some of the most densely populated regions in the country, and are also trading hotspots and engines of economic growth, and contributors of the country's GDP.

In the post 1990s era there has been a growth in the IT and real estate sector, promotion of the idea of smart cities', the metro, and service industries. Many cities with the old-world industries, such as the old textile mills in Mumbai have been replaced by real estate developments. A lot of speculative investment is happening. Many areas have been concretised in the name of beautification. Urban commons, such as the lakes of Bangalore have been encroached upon and concretised. The main focus of this high intensity development is the monetisation of land and infrastructure.

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<sup>14</sup> (All information in this section can be cited to presentations by Souvanic Roy, Indian Institute of Engineering Science and Technology, West Bengal; Dr. Janakarajan, South Asia Consortium for Interdisciplinary Water Resources Studies)

Some of the major problems coastal cities face are sea-level rise in low elevation zones, extreme events such as floods on built infrastructure, salinity intrusion in groundwater, drinking water problems, health issues. And the poorest in these urban regions are often the hardest hit.

State Action Plans on Climate Change (SAPCC) are a framework of action for responding to the effects of climate change in each state. The plans follow a uniform structure, setting out the unique vulnerabilities of the state in relation to a changing climate and the state government's approach for adapting to current and future impacts.

The Mumbai Action Plan on Climate Change, for example, desired to convert landfill sites to urban parks, removal of all encroachments' near canals of the informal sector, relocation of people in the low lying lands. While the adaptation should be focused on the most disadvantaged, it ends up hitting the urban poor the hardest.

In coastal cities such as Chennai, the entire political economy revolves around growth and development. Rapid urban expansion from a core urban area to peri-urban area, massive industrialization, rural-urban migration and conversion of rural poverty into urban poverty, increasing demand for land and rapid changes in land use are some of the ways in which developmental models of cities are viewed. Growth and development directly depend upon the ecosystem services and endowment of natural resources (natural capital). The natural resources are essentially forests, small water bodies, estuaries, brackish-water lakes and creeks, mangrove forests, groundwater, soil moisture, and wetlands. Changes in land-use and land-cover over time can contribute significantly to regional climate change conditions and are by and large unrecognized --- these are mostly a declining area under forest, depletion of wetlands (both inland and coastal), a decline in overall biomass production, distortion of a given natural drainage systems and watersheds, top soil erosion, changes in soil and soil moisture conditions, disturbance in the geological formations, disturbance in the wildlife habitations etc. Most important however is the rise in temperature leading to overall climatological and rainfall conditions, changes in farming practices and agricultural employment, changes in conditions and characteristics groundwater regime, livelihood insecurity etc. A combination of all these factors contributes to floods, landslides, and droughts.

In Chennai for example, the number of wetlands has gone down from having an area of nearly 190 sq.km in 1980 to 71sq.km in 2010 and the built-up area has gone up from 48 sq km in 1980 to 408 sq km in 2010. The unchecked and unregulated urban expansion, increasing pressure on urban land and unsustainable urban-use planning have emerged as the most critical issues contributing to urban risks and vulnerabilities.

Urban planning should be people and ecosystem centric. There is an intrinsic close interaction between the land, water and people. But, they end up becoming more and more disconnected.

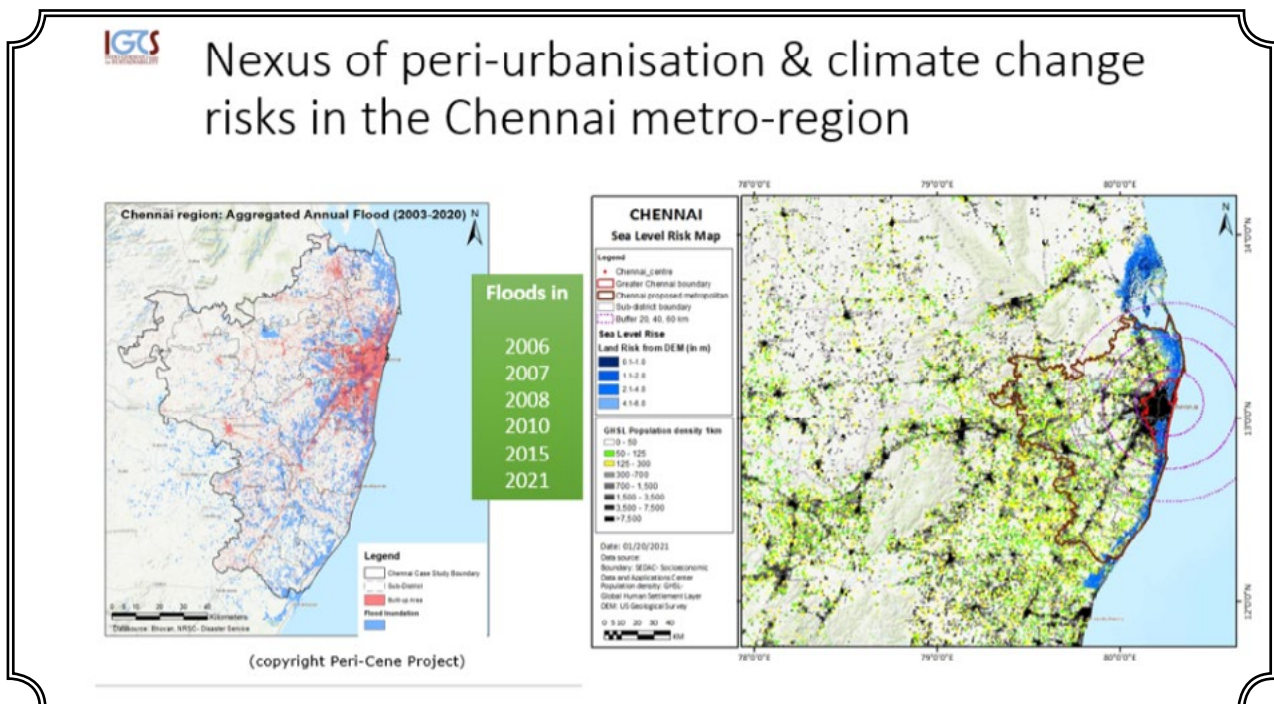
# CHENNAI- A CASE STUDY STUDY 1:

## A VISION PRESENTED BY INDIAN INSTITUTE OF TECHNOLOGY, MADRAS <sup>15</sup>

The study was based on the concept of the peri-cene. The Peri-Cene research project is an international collaboration of UK, Swedish, and Indian partners and funders. It conceptualises peri-urbanisation as a version of the Anthropocene, which is essentially a new kind of global human-environment system shaped by peri-urbanisation

The Chennai metropolitan region is one among the largest urban agglomerations in India and at the same time highly vulnerable to climate change.

Topographically, Chennai is located on the highly exposed southeast coast of India on relatively low and flat coastal land. Three major rivers, the Adyar, Cooum, and Kosasthalaiyar, frequently inundate the city following even shorter periods of rain. Almost all extreme weather events in Chennai- flooding, droughts, cyclones - oscillate around water. Chennai city reported recurrent flooding for the years 2006, 2007, 2008, 2010, 2015, and 2021 due to single day extreme rainfall. The coastal area of about 27.79 sq.km is classified as highly vulnerable for erosion and sea level rise, with the most severe scenario of sea level rise being projected to be approximately 78 cm by 2100.



15 Christoph Woiwoode, IIT Madras

The Climate Change Vulnerability Index of 2021 ranks Chennai the highest among large Indian cities in terms of exposure to climate change-related threats. Moreover, one study <sup>16</sup> finds that Chennai is ranked the most socioeconomically vulnerable to climate change among the metropolitan cities in India. The risk of flooding in Chennai is expected to worsen with climate change, while higher temperatures and more frequent droughts are expected to exacerbate water scarcity in the city.

In such a scenario, adaptive governance has become a term for addressing and dealing with problems such as climate change and other global (poly-)crises of socio-economic nature that render our future uncertain.

For the specific context in the Chennai case study, a perspective of adaptive governance was applied, that is multi-dimensional by deploying this adaptive governance framework, multi-level considering local, intermediate and state governance levels, and multi-scalar applying the pericene approach of the bio-regional (macro), landscape (medium) and community/neighbourhood (local) scales.

There are four such specific synergies and pathways identified based on the multi-scalar notion of intervention:

1. A social eco-innovation and micro-governance in a deprived community in a village within an industrial peri-urban setting (at neighbourhood scale)
2. An eco-tourism pathway on the southern peri-urban fringe characterised by rapid changes in the waterscape and people's livelihoods (at landscape scale)
3. An agro-ecology pathway for food sovereign spaces (at bio-regional scale)
4. A water management pathway (at bio-regional scale)

As an example, within the agro-ecology pathway, urban and peri-urban Chennai has seen tremendous rise in urban gardening initiatives and peri-urban organic farming coming out of civil society over the past 15 years. For a more strategic approach, it is important to communicate the co-benefits of an agro-ecological pathway for the entire metro-region to all stakeholders, especially government agencies.

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<sup>16</sup> *Assessing socio-economic vulnerability to climate change: a city-level index-based approach* by Trupti Mishra and Krishna Malakar, March 8, 2016 [<https://www.tandfonline.com/doi/full/10.1080/17565529.2016.1154449>]





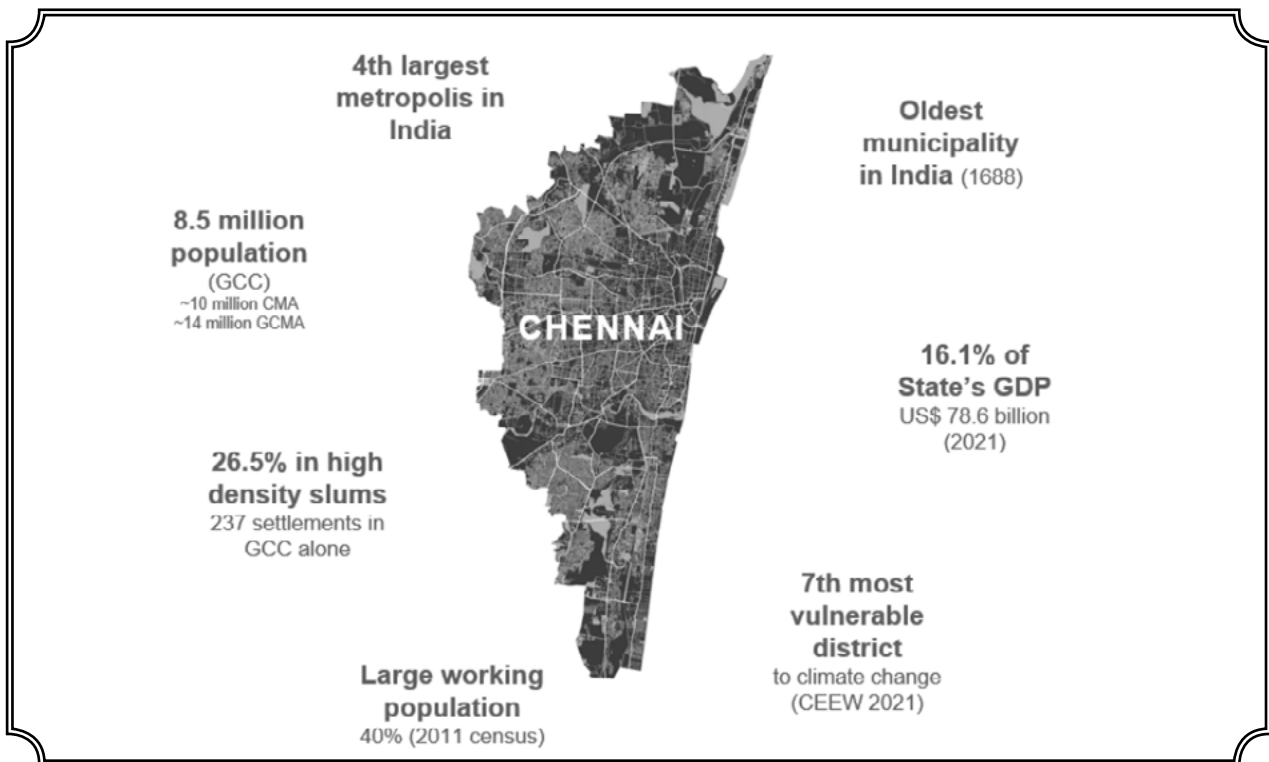
## STUDY 2- PRESENTED BY CLIMACT CHENNAI- A CLIMATE ACTION PLAN FOR CHENNAI <sup>17</sup>

This study aims to look at Chennai through a climate change lens and to develop a potential plan for Climate Action in Chennai at a City-scale. A detailed Approach Paper was circulated and presented. Such a model and the methodology used to develop it could be replicated in other Cities in India. The Approach Paper takes into account, but its analysis of climate impacts and potential solutions differ significantly from the Chennai Climate Action Plan (CCAP) prepared by the Greater Chennai Corporation (GCC). The area covered in the ClimACT study was the Chennai Metropolitan Area (1189 sq.km) and, possibly by extension, the forthcoming Greater Chennai Metropolitan Area (5904 sq km )

Chennai is the 4th largest metropolis in India, and the oldest municipality in the country when it was formalised in 1688. It has a population of 8.5 million in just the Greater Chennai Corporation (GCC) area. It has 26.5% high density in slums, it has a large working population and it is the 7th most vulnerable district to climate change. It also contributes 16.5% of the state's GDP.

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<sup>17</sup> (Kirtee Shah, President, India Habitat Forum(INHAF); Karthik G, INHAF ClimACT-Chennai; D. Raghunandan, DSF/AIPSN and Climate Change Lead, ClimACT-Chennai)



The approach to climate action for this study is focused on adaptation and building resilience to climate impacts, mitigation i.e. reduction of greenhouse emissions, taking into account the multi- dimensional character of climate change issues and therefore looking for solutions that deliver co-benefits across mitigation and adaptation, as well as across different sectors, with a particular focus on equity, access of socio-economically deprived sections, and climate justice. Some of the major sectors examined are as follows.

## URBAN HEAT ISLAND (UHI) EFFECT

Wet bulb temperature (accounting for humidity along with ambient temperature) of 35 degrees Celsius is considered dangerous for survival. Chennai is currently already at 32 degrees and, during heat waves, could quite easily cross the danger mark with serious consequences. Urban temperatures are always at least 1.5 to 2 degrees higher than surrounding rural areas (possibly rising to 5-7 degrees in parts of the City) due to what is known as the Urban Heat Island (UHI) effect due to concretization, reflection of heat off tarred roads and buildings, obstruction to wind flows and loss of green cover etc.. The Study finds that in Chennai, the UHI effect is caused by high usage of large numbers of vehicles, a sharp decline in green spaces, and a shrinking of water bodies. The Study recommends policy incentives and dis-incentives to encourage adoption of energy efficient air conditioners and other appliances, significantly increasing well-distributed green spaces, especially in overcrowded and poorly ventilated low-income and informal settlements, which would also bring co- benefits in mitigation by absorbing considerable

Carbon dioxide (CO<sub>2</sub>) emissions. Water bodies too, for which Chennai was once famous, have dwindled sharply, and their restoration would also assist in cooling. Shaded tree-lined areas, drinking water and staggered timings for construction work would all assist in dealing with heat-stress, besides encouraging pedestrianization, bicycling and other non- motorized transportation.

## **EXTREME RAINFALL AND URBAN FLOODING**

Chennai has historically been a flood-prone City being a flat estuarine area draining the waters of many rivers and streams of the region into the Bay of Bengal. The deluge of 2015 floods caused massive damage. The major causes for this, as also explained in the previous section, are rapid and unplanned urbanisation on floodplains and wetlands which greatly disturbed the natural hydrology of the region, under-capacity storm water drains, and almost complete choking of the major rivers and other natural drains flowing through Chennai into the sea. Some of the potential solutions to prevent such deadly flooding could include expansion of the storm-water drainage system including strategically planned high capacity drains designed in anticipation of extreme rainfall patterns which will be the new normal. It is essential that the three major rivers , the Cooum, Adyar Kosasthalaiyar and numerous minor drains, which are currently fully choked and officially ‘dead’ are totally cleared of all blockages, garbage, encroachments including informal settlements of the poor with adequate compensation and resettlement, and be dredged to restore their depth so as to render them fully ‘live’ waterways that would dramatically increase their drainage capacity. Other measures could include conservation, enlargement of existing water bodies (tanks, ponds etc)long with restoration of deteriorated water bodies and wetlands so as to provide places for excess run-off to be stored. Efficient sewage treatment with zero discharge of untreated sewage into water rivers, canals and drains, and waste-water recycling and re-use at all levels, would also be necessary. These would also help reduce the UHI effect, assist groundwater recharge and management, promote carbon sequestration, develop an integrated blue-green ecosystem for the city, and reduce water pollution.

## **SEA LEVEL RISE AND COASTAL EROSION**

It is projected that 16% of the city will be permanently inundated by 2100. There is saltwater intrusion in freshwater sources, and 36.7% of the city’s coastline is already subject to erosion. The overarching, ever-looming cause is climate change and accompanying sea-level rise. But the dilution of coastal regulation zone laws, continuous infrastructure development along the coastline, destruction of natural barriers such as vegetation, are additionally responsible for this vulnerability. Some of the potential solutions for this are strengthening of the CRZ regulations including extension of the 50m (earlier 100m) prohibition zone to 250-500m from the high tide line for any form of permanent or quasi- permanent structures laws , creating elevated roads along the coastline with strong bunds and foundation, creating regulations for conservation and protection of suitable coastal plantations, submerged reefs to reduce wave action etc.



## MITIGATION

At the outset, the ClimACT-Chennai Approach Paper made clear that it does not agree with the CCAP's planned target of net zero carbon emissions by 2050, a target adopted by the C40 grouping of Cities of which Chennai is a part. ClimACT-Chennai believes that the 2050 net-zero target for different cities across the world runs against the internationally accepted principle of common but differentiated responsibility (CBDR) under which developed countries, which have historically emitted over 70% of greenhouse gases since the industrial era, must therefore shoulder greater burden of emissions reduction than developing countries. Recent Reports by different scientific and UN bodies have clarified that the net-zero target is a global target and implies that developed countries should reach net zero well before 2050, allowing developing countries to reach that target after 2050. India has adopted a target of reaching net zero CO<sub>2</sub> emissions by 2070. There is no particular reason why Chennai, or any other city, should reach net-zero by 2050. ClimACT-Chennai's Approach Paper also shows in detail why a 2050 target would put enormous, perhaps needless, pressure on Chennai especially its electricity generation and distribution systems, and hence recommends a high-ambition pathway striving for maximum possible emissions reduction, but not necessarily net zero by 2050.

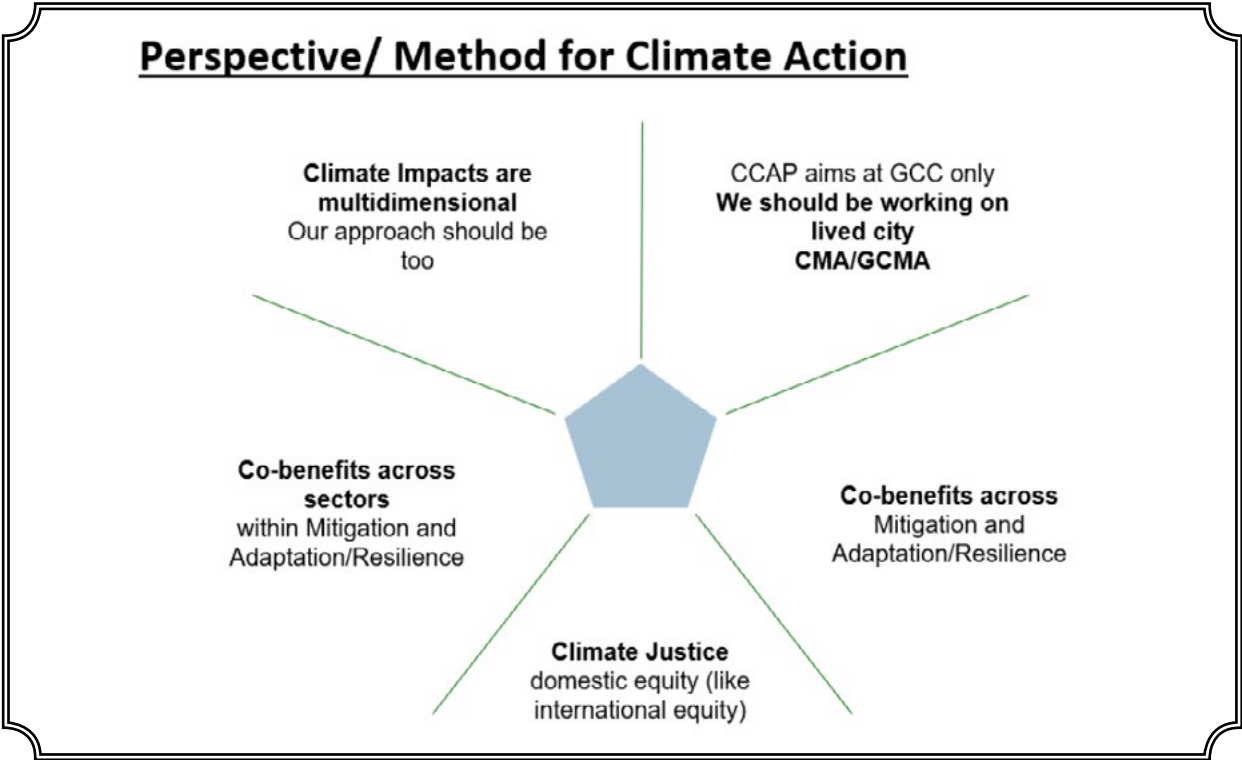
**Transportation** The city's transportation structure has shifted dramatically in recent decades, and is now dominated by personal p3400 public Buses carry 37.4 million passenger-km, compared to 6 million personal 4W carrying only 2.2 million passenger-km, clearly showing that while public transport Buses carry more people in far fewer vehicles occupying less road space



per passenger, whereas a far greater number of 4W vehicles carry far less people but occupy far greater road space on a per capita basis. The Approach Paper recommends a major inter-modal shift from personal 4W and 2W to a greatly increased number of public transport Electric Buses with dispersed routes and the currently fledgling Metro-rail along with last-mile connectivity. A big push should also be given to the transition to E-2W and E-4W with higher and faster targets than projected in the Corporation’s CAP.. These measures will bring huge co-benefits in reduced air pollution and better public health. Pedestrianisation and dedicated bicycle tracks would also further reduce emissions and improve public health, but may take much longer to achieve.

## SOLID WASTE AND WASTEWATER

Chennai is amongst the highest per capita generators of waste in the country. It produces nearly 7000 tonnes of waste per day just within the Chennai Metropolitan Area only. 80% of this waste is dumped un-segregated into landfills which are really just dumps, where considerable Methane gas is generated. Loopholes in the relevant regulations are themselves a major problem. leContractors avoid segregation using this loophole in tendering, and there is weak segregation at household level (largest contributor to waste). Methane has more global warming potential than CO2 and its emission should be urgently checked. Methane generated from sewage has also been grossly underestimated in the Corporation’s CAP, and the City’s sewage treatment is currently below par. The sewer pipelines are old, long and leaky. And Decentralised bio-methanation and, methane recovery are recommended, along with appropriate segregation of sewage from waste-water, with treatment and re-use of greywater.





## BUILDINGS

Buildings are amongst the highest contributors to emissions, including from use of electricity for appliances, energy for cooking etc. They contribute 58% of total emissions in the City. The construction process and embedded emissions in materials used e.g. steel, cement etc further adds to the emissions. The built-up area has gone up from 48% in 1991 to 67% in 2018. Hot and humid climate increases load on cooling appliances. Energy efficient air conditioners, refrigerators, LED TVs and other appliances can save upto 50% energy and emissions, and schemes to incentivize purchase or upgradation of older equipment would assist the transition. Information and public education is required to promote other energy and emissions-saving measures such as lower thermostat settings, switching off appliances at the mains etc. Reducing thermal load of building envelopes i.e. the building structure itself is a very important aspect which, in India, has been neglected except for the Green Building standards (ECBC - energy conservation building code) for large commercial and office buildings. Now building codes (Eco-Nivas Samhita or ENS) have been developed for residential buildings also giving a range of energy-saving options in designs, materials, structural elements (like doors, windows etc), insulating materials etc for different climatic zones in India, with a claim that about 28% energy could be saved in such buildings. The ClimACT Approach Paper lays substantial stress on urgently and speedily promoting new ECBC commercial/office buildings and ENS residential buildings, noting that about 50% of additional building stock is expected to come up by 2030-35. Therefore, all new buildings, reaching 100% by 2040, should follow EE building codes through a combination of mandates, incentives and disincentives, while retro-fitting existing buildings could take longer. This is in contrast with the Corporation's CAP which focuses first on retro-fitting and then on new buildings at a slow pace.

## POWER GENERATION

Power generation in Chennai consumes 25% of the state's power. The average demand in summer is ~3500MW. Power generation for Chennai is largely reliant on coal-fired power plants. The Corporation's CAP target of 100% RE by 2050 is unlikely, with grid instability already a problem. The shift to electronic vehicles will also create higher power. High levels of renewable energy will call for pumped storage, requiring new reservoirs with attendant problems of displacement, environmental damage etc. In this difficult context, the Approach Paper suggests that emphasis be placed on

decentralized SPV including rooftop solar, for which 1.39 GW potential may exist in Chennai, and which will require substantial revision of the feed-in tariffs so as to incentivize rooftop SPV system installation.

## **PARTICIPATORY LOCAL-LEVEL PLANNING FOR CLIMATE CHANGE ADAPTATION: THE KERALA EXPERIENCE <sup>18</sup>**

In an effort to comprehend climate change adaptation and risk mitigation, the state government initiated a plan aimed at establishing and empowering local self-governments (LSG). Presently, there are a total of 266 local self-governance entities, comprising 18 municipalities and 248 village panchayats.

The study focuses on Konni, a town and taluk headquarters located in the Pathanamthitta district of Kerala, India. Konni is renowned for its elephants, lush forests, and thriving rubber plantations. Recognizing that addressing global phenomena requires localized strategies, LSGDs (local self-government departments) are ideally positioned to understand and address climate change issues within their respective localities. LSGDs are tasked with the development of projects aimed at mitigating the impacts of climate change at the grassroots level.

The team conducted an extensive study of the region, which involved the creation of a data analysis sheet. They analyzed daily mean rainfall, assessed maximum and minimum temperatures, calculated hazard risk indices, evaluated flood risks, examined land-use changes, and investigated the effects of climate change on local water bodies, paddy fields, forests, hills, and their implications for the lives of the local population. These implications encompassed areas such as irrigation, agriculture, fisheries, healthcare, access to drinking water, local employment, waste management, and tourism. Additionally, they documented changes in the biodiversity of locally available species of trees, shrubs, plants, animals, insects, and birds, among other factors.

Subsequently, they compiled a list of potential interventions, naming it the ‘Konni-Carbon Neutral Project.’ Some of the proposed interventions included disease mapping, sanitation and waste manage-

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*18 All information in this section can be cited to presentation by Dr Sreekumar of Kerala Sasthra Sahithya Parishad*





ment at the source, the creation of constructed wetlands, the production of bio-fertilizer from organic waste, the establishment of biogas plants, zero-waste initiatives, medicinal plant cultivation, a wage saplings scheme, the mapping of abandoned quarries for water storage (for irrigation or drinking water purposes), wetland conservation, the adoption of energy-efficient equipment, the transition to paperless office governance, the conservation of local seed varieties and cattle breeds, as well as the preservation of water bodies.

By engaging in this comprehensive and localized approach to climate change adaptation, there is a hope to create a model that can be replicated in other regions, fostering greater resilience in the face of environmental challenges.

## **FOSTERING CLIMATE AWARENESS AND EFFECTIVE COMMUNICATION STRATEGIES <sup>19</sup>**

Two fundamental principles take center stage. The first is the adoption of systemic thinking, while the second revolves around individual introspection.

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*19 All information in this section can be cited to presentation by Avinash Madhale from the Centre for Environment Education, Pondicherry, and Christophe Woiwoode from the Indian Institute of Technology, Madras*



## 1. Embracing Systemic Thinking

Systemic thinking emphasizes the need to elucidate how various elements are interconnected within a larger framework. It involves conveying to the public the intricate web of relationships. For instance, illustrating how air pollution is intertwined with broader systemic issues exacerbated by climate change or how flooding in the western Himalayas results from a history of ill-conceived policy decisions, further worsened by climate-related events. To achieve this:

**Economy, Society, and Environment Nexus:** It's crucial to establish connections between the economy, society, and the environment. This entails recognizing that discussions of economic growth often coincide with environmental degradation.

**Empowering Local Communities:** Empowering local communities with information is paramount. This empowerment enables them to engage directly with policymakers, fostering a more informed and collaborative approach to addressing environmental challenges.

## 2. Individual Response to Climate Change

Addressing climate change necessitates a deep internal examination of an individual's role in the world and a reevaluation of personal aspirations. The prevalent capitalist mindset, which focuses on extraction and linear growth, needs rethinking. Key aspects of individual response include:

**Subjective Well-being and Physical Health:** Reflecting on one's own subjective well-being and physical health can lead to a more balanced and sustainable lifestyle.

**Self-reflection and Awareness: Self-awareness is pivotal.** Individuals should contemplate their values, beliefs, and actions in the context of climate change.

**Activation of Core Values:** Prioritizing intrinsic and non-materialistic core values can guide pro-environmental and pro-social attitudes, influencing consumption choices and social activism.

**Deliberate, Flexible, and Adaptive Attitudes:** Encouraging a mindset that embraces adaptability and flexibility, especially concerning climate change and conflict resolution, is essential.

**Inter-connectedness and Compassion:** Fostering a sense of interconnectedness and compassion can drive actions that prioritize equity, social justice, and sustainability.

**Human-Nature Connectedness:** Recognizing the intrinsic connection between humanity and nature can promote sustainability-oriented social learning and innovation.

In conclusion, addressing climate change necessitates both systemic thinking that elucidates complex relationships and individual reflection that fosters values aligned with sustainability. Achieving a harmonious balance between human well-being and environmental health is at the heart of this endeavor.

## A WAY FORWARD

Climate change is an ever-present, ever-looming reality that has begun to prominently show the pre-existing cracks and fissures in the country's policy of linear, extractive, export-oriented, commodity driven, infrastructure heavy model of development and growth. The most important point that has emerged from all the issues above is that the policies, both at the central and state level, around agriculture, infrastructure, renewable energy, climate adaptation, urban city design, and health, need a revamp, with climate change adaptation at its core. The western Himalayan region needs to rethink tourism and infra development, agriculture needs to be more focused on local, seasonal food products as opposed to giving incentives for monoculture, commodity cash crops. Forests need to be protected. Urban, coastal cities need more intelligent design thinking. State Climate Action Plans need to involve the people living in the respective states in the decision-making process. Community participation and collaborative efforts are the need of the hour.



## **FOCUS ON THE GLOBAL SOUTH**

Focus on the Global South is an Asia-based regional think tank that conducts research and policy analysis on the political economy of trade and development, democracy and people's alternatives. It works in national, regional and international coalitions with people's movements and civil society organisations and has offices in New Delhi, Manila, Phnom Penh and Bangkok



## **ROSA LUXEMBURG STIFTUNG (RLS)**

The Rosa Luxemburg Stiftung (RLS) is a Germany-based foundation working in South Asia as in other parts of the world on the subjects of critical social analysis and civic education. It promotes a sovereign, socialist, secular and democratic social order, and aims to present alternative approaches to society and decision-makers. Research organisations, groups for self- emancipation and social activists are supported in their initiatives to develop models which have the potential to deliver greater social and economic justice

India is witnessing extreme weather especially rainfall, related urban flooding and landslides, heat waves, changes in the monsoons and patterns of precipitation, changing patterns of agriculture especially horticulture, rapidly melting glaciers, increased frequency and intensity of cyclones, river floods, coastal erosion, rise in sea temperature and acidification, sea-level rise in deltaic regions, and growth of vector-borne and zoonotic diseases.

All these are causing large-scale destruction of infrastructure, habitat and ecosystems especially affecting deprived sections, severe impact on incomes, and mounting and recurring losses of homes, livelihoods and survival.

Much attention has been paid to mitigation, i.e. reducing greenhouse gas (GHG) emissions driving climate change. However, adaptation measures to cope with the impacts and build resilience have lagged far behind requirements. The UNFCCC deliberations have largely left Adaptation to individual countries to tackle domestically. Adaptation measures are crucial for tackling climate impacts and to build resilience across sectors, region and communities.

The Report discusses and draws attention to major trends in climate impacts in different parts of the country and in different socio-economic spheres, and collates possible well-rounded multi-dimensional Adaptation measures.

