A Climate Action Series Book

# **Climate Actioneers' Primer** A Beginner's Toolkit



Anand Pendharkar Rahul Palekar Amruta Padgaonkar



## **Climate Actioneers' Primer: A Beginner's Toolkit**

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## **Climate Actioneers' Primer: A Beginner's Toolkit**

A Climate Action Series Book



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#### Publishers





## **Publisher's Note**

By now, every citizen on this planet is aware of the different manifestations of global warming and climate change. Once rare phenomena such as heat waves and cold waves are becoming common occurrences. Citizens, governments and people, though unprepared, are devising coping strategies on the go. According to World Economic Forum 2021 estimates for India, the economic cost of inaction towards climate change could be as high as 35 trillion US dollars (≈2,588 trillion Indian rupees) in the next 50 years. This whopping figure does not mean much to street vendors who have to endure pollution of various kinds and degrees to carry out their daily businesses. Neither does it matter to a farm labourer who realises that the number of hours s/he can be out in the field comfortably, is shrinking and the yield is disproportionately lower than the labour put in. They understand the science as well as the reason behind these drastic climate changes. They might even have simple and local solutions to address these challenges. Unfortunately, they are never consulted for the same. Consultations usually happen between those who produce these whopping figures - like academia or those who contribute towards the acceleration of climate change - like industry, and those who provide solutions in the form of policies and guidelines - like governments.

The present dominant societal construct undermines common wisdom, celebrates the economic gains of a few over the socio-political empowerment of the majority, and remains unapologetic about the irreversible damages it has caused to the planet and its beings. How did we even get here? History provides important lessons for creating a better future. Hence, it becomes imperative to trace the origins of inaction and follow its trajectory till the present to create action plans for the future, based on those learnings.

With this objective in mind, Friedrich-Ebert-Stiftung (FES) India Office, along with its partner SPROUTS, organised the 2<sup>nd</sup> International Sustainability Conference in 2021. The task was simple – to hear from communities and individuals, experts and practitioners, about the reasons behind the present climate crisis and solutions to address the same. We realised that there is no dearth of workable solutions. However, they have not been harnessed to their full potential yet. The reasons for inaction and disinterest

could range from economic compulsion to social unacceptance and political non-engagement. This made us even more determined to produce a solutionoriented compendium that can become common public knowledge and a resource bank for climate action. The result is The Climate Actioneers' Primer: A Beginner's Toolkit.

The Climate Actioneers' Primer has been created to achieve an array of objectives. It follows the concept of 'show and tell', where actions are demonstrated not only as ideas, but as case studies, wherever possible. It provides a holistic view of climate change-related challenges backed by in-depth research. It elucidates the interconnectedness of issues that are mostly seen in silos. Policies and academic research are often loaded with scholastic language and complicated processes which cannot be pursued by a common citizen. The Primer is a collection of sustainable and measurable climate solutions presented in a simple manner, verified by people, experts and practitioners. It provides notes on achievable and successful ideas implemented in different parts of the world that can be contextualised and implemented within a given geography.

The idea is also to initiate cross-sectoral dialogues and bring actors together for collective action wherever possible. It should also raise greater awareness amongst different stakeholders. The solutions can be taken up by students, activists, policymakers, planners, environment enthusiasts, corporates, subject experts, industry or those who recognise they have a stake in the future.

We hope that the Primer will contribute towards

building knowledge and alliances that can jointly address the current climate crisis. We also hope that it will inspire readers to pick up one or more solution towards climate action as it has for us.



**Richard Kaniewski and Mandvi Kulshreshtha** Friedrich-Ebert-Stiftung, New Delhi September 2023

## Contents

	Pg No
Publisher's Note	ii
Acknowledgements	iv
Foreword	V
Congratulatory Messages	vi
About and How to use the Book	xii
Preface	xviii
List and Description of Illustrations, Graphs,	xiv
Infographics and Tables	
Chapter 1: Wake up: Climate Change is Here!	001
Chapter 2: Past and Present Challenges	005
Chapter 3: Effects and Impacts of Climate Change	011
Chapter 4: Social Environment	031
Chapter 5: Human Environment	053
Chapter 6: Modes of Influence	086
Chapter 7: Developmental Indices	108
Chapter 8: Paths to Sustainability	139
Chapter 9: Resources for Climate Action	145
Abbreviations and Glossary	150
References	153
Index	163



Climate Actioneers' Primer: A Beginners Toolkit

## Acknowledgements

The **SPROUTS & FES India** team would like to thank the many individuals and organisations who have whole-heartedly participated in the 2<sup>nd</sup> International Sustainability Conference (ISC) 2021, and contributed to this book. We thank all our contributors (refer inner front cover) for their presentations and submissions during ISC 2021, which have made this book a truly collaborative effort. Their voices and inputs have also made it equally representative of the ideas and aspirations of various stakeholders, and the developments in their diverse sectors.

A special thanks to the **Text Editors,** Kamini Gopal and Vaishnavi Kodakandla, who painstakingly edited the text and gave valuable suggestions and inputs.

All names are in alphabetical order. Respecting the anonymity request by some contributors, we are not disclosing their identity or personal details. However, we are deeply grateful to them, and consider them our pillars of support, just like the others named here. We appreciate their efforts and acknowledge their commitment, despite the limitations of COVID-19.

The herculean task of organising an online international conference and then putting together a 200-page book, seemed near impossible without the enthusiasm and positivism of the Organising Team. The tasks and responsibilities were shared equally by members of **SPROUTS** and **FES India**, viz. Amruta Padgaonkar (Book Co-ordinator), Anand Pendharkar (CEO, SPROUTS and Conference Organiser), Anurag Shanker (Program Manager, FES India and Conference Organiser), Dwiti Das (Web Manager), Mandvi Kulshreshtha (Program Adviser, FES India and Conference Organiser), Purnima Palekar (Master of Ceremonies), Rahul Palekar (Conference Co-ordinator), Sneha Patel (Social Media Co-ordinator), Ulrich Storck (former Country Director, FES India and Conference Host), Vimal Raj (Slack Coordinator), and Yogesh Waghmare (Designer).

The **Volunteers**, located across India, played an integral role in the success of ISC 2021. They participated in weekly meetings, undertook training to manage Slack, created posters, publicity materials, and facilitated the sessions, despite their personal and health challenges. They conducted themselves professionally and were vigilant against cyberbullies and attacks. We sincerely appreciate their hard work, which continued after the conference, via the transcription, editing and uploading of recorded talks, to The Green Channel (YouTube Channel of SPROUTS). These amazing bunch of volunteers were: Apoorva Rao, Chaitanya Mohan, Dheeraj Chavhan, Fariha Hussain, Hitesh N D, Komal Yadav, Nalini Malaviya, Nikhil Disoria, Pranav Bhagwat, Priyanka Chalke, Sakshi Kumbhar, Shruti Gupta, and Siddharth Waradkar.

With the aim to include deaf persons in the climate discourse, we engaged three well-trained and energetic **Sign Language Interpreters**, viz. Gargi Shukla, Preeti Sapra, and Saurav Terp. They worked tirelessly, battling accents, lack of access to presentations, and helped us bringing inclusion and equity to our conference. They smoothly translated all talks, workshops, group discussions, breakout sessions, and even cultural performances, through sign language.

We strongly believe that the message of the 'Climate Emergency' can be conveyed through various media, besides scientific talks and poster presentations. Hence to drive the point home, we partnered with highly motivated and renowned individual Cultural Performers and organisations, viz. Angel Lakra, Anita Pendharkar, Anshu, Apurva Pendharkar, Arpan Lakra, Col. Ashwin Baindur (Retd), Chandpasha NS, Dadapeer Jyman, Harpreet Singh, Jayshree Murali, Kavita Gunderia, Mamta Sagar, Cdr. Pravin Tulpule (Retd.), Rahul Palekar, Reshma Ramesh, Dr. Sachin Kumar, Shashank Johri, Shruti Kulkarni, Shubha Ramachandran, Siddartha MS, Smitha Nair, Subodh Khanolkar, Teesha Thomas, Uma K, 100 Thousand Poets for Change, Adivasi Lives Matter (ALM), Indradhanu Kalarang, and Kavya Sanje.

No project can be successful without the support of our **Family Members, Well-wishers and Conference Associates**. The authors and conference organisers would like to express their whole-hearted gratitude to all of them, viz. Anagha Padgaonkar, Anita Pendharkar, Aruna Patel, Asha Kumbhat, CB Murali, Hasmukh Patel, Jayesh Padgaonkar, Dr. Kaustubh Kulkarni, Narayan Palekar, (Late) Purushottam Pendharkar, Pushpa Palekar, Rajesh Palekar, Rishi Aggarwal, Sachin Palekar, Sangeeta Gupta, Adivasi Lives Matter (ALM), Aseema Charitable Trust, Awaaz Foundation, Chintan, Digital Women (DW) News, FERN, FES Asia, FES MENA, FES

Philippines, FES Vietnam, Let India Breathe, SiddhiLife, Rishi Valmiki Eco-school (RVES), The Keystone Foundation, The Sustainability Platform Asia (TSP Asia), Water Environs, and WWF India.



## Foreword



"The era of Global Warming has ended and the era of Global Boiling has arrived," said António Guterres, Secretary-General of the United Nations. July 2023 has been recorded as the hottest month in human history. As the global climate warms due to anthropological (human-made) interventions, it also gives rise to natural calamities. The devastating wildfires in Canada and Greece; heatwaves in North America, Europe and Asia; cyclones worldwide; and the recent floods in Pakistan, Afghanistan, India, Japan, China, Turkey and the US are testament to the rapidly changing climate. It is time that, apart from governments, institutes and organisations, we as citizens of this planet, need to take action to combat climate change.

During my political career spanning nearly four decades at the Municipal Corporation to the Indian Parliament I have been an ardent advocate of policies and actions related to environment and then that of climate change. Through awareness programmes for corporates, policy-makers, representatives and administrations of local governments, various organisations, colleges I realise a lot still remains to be done. Presently have embarked upon an action oriented awareness drive called "Pune Climate Warriors" in schools of Pune. No change is possible without public will, knowledge, empathy, and enthusiastic participation.

I feel honoured and pleased to present the Climate Actioneers' Primer: A Beginners Toolkit, which is an earnest attempt by SPROUTS, a leading India-based conservation organisation and the Friedrich Ebert Stiftung (FES) India, a nearly century-old German foundation with offices and projects across 110 countries, committed to promotion of social democratic values. Together, they have produced a comprehensive compendium, elucidating the interlinked causes, impacts and solutions to address climate change. It spotlights the role of citizens, industries, communities and policy-makers in taking direct and educated actions, including marginalised communities and individuals, such as children, elders, LGBTQIA+ and wordless people, or persons with disabilities, and other stakeholders, in climate action planning. The Primer has approached the climate emergency from over two dozen intersectionalities, e.g. energy, transportation, policy, media, disability, agriculture, economy, waste, and biodiversity, to name a few. It also has a fold-out of '366 Climate Actions' with daily 'bite-sized' interventions. In this timely publication, students, researchers, educators, actionists, business owners, policymakers and common people will find accurate information to drive them into informed action. I am confident that 'An Action a Day can keep Climate Change away'!

Sure this book will provide inspiration and motivation to ACT to save our Planet Earth.

Yours sincerely.

Charon VY

Vandana Chavan Member of Parliament, Rajya Sabha

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## **Congratulatory Messages**

Ve. VAITHILINGAM Member of Parliament (Lok Sabha) Ex. Chief Minister PUDUCHERRY



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> 11.08.2023 Date : .....

#### MESSAGE

I am extremely happy to know that "Friedrich-Ebert-Stiftung and Sprouts environmental trust", is bringing out a Special Focus on the "The Climate Actioneers Primer: A Beginner's Toolkit (CAP)".

I express my sincere congratulations on behalf of Puducherry to "Friedrich-Ebert-Stiftung and Sprouts environmental trust" on the successful publication of "The Climate Actioneers Primer: A Beginner's Toolkit (CAP)". The book features climate action case studies and best practices from throughout the globe. I am sure this book will be a resource bank for climate action and an array of problem-solving information which can be easily accessible by people of all ages. We acknowledge your outstanding accomplishments and continuous commitment to climate action.

I take this rare opportunity to compliment and appreciate your steadfast dedication and perseverance in spreading the word about the urgent need for climate action. Please accept our heartfelt congratulations on this wonderful accomplishment once more.





#### HIBI EDEN

MEMBER OF PARLIAMENT (LOK SABHA). ERNAKULAM. KERALA

File No. N/5696/2023- MP EKM 12-07-2023

#### <u>Message</u>

I am writing to convey my heartfelt congratulations on the successful release of The Climate Actioneers' Primer: A Beginner's Toolkit (CAP). This remarkable publication not only highlights your unwavering commitment to addressing one of the most critical issues of our time but also serves as an invaluable guide for individuals and organizations dedicated to climate action.

The Climate Actioneers' Primer is an extensive manual, spanning over 200 pages and exploring more than 600 climate actions. Its comprehensive nature effectively underscores the urgency of climate change and provides practical and achievable solutions for all stakeholders to contribute towards building a sustainable future. I commend you for your dedication to combating climate change, as well as your visionary thinking and exemplary leadership.

Your publication not only showcases your commitment to climate change but also demonstrates your creativity and innovative approach. It is through initiatives like The Climate Actioneers' Primer that we can inspire and motivate others to actively engage in climate action. I deeply appreciate your tireless efforts in combating climate change and advancing towards a better future.

I wish you the best of luck in all your future endeavours;



Hibi Eden



Climate Actioneers' Primer: A Beginners Toolkit

Ravi Prakash Verma Ex M.P. Rajya Sabha National General Secretary Samajwadi Party



Residence: C-11,Tara Apartment Alaknanda, Delhi-110019 +91- 09868180092

I am writing to offer Friedrich- Ebert-Stiftung and sprouts environmental trust our heartfelt congratulations on the successful release of The Climate Actioneer's Primer: A Beginner's Toolkit (CAP) on behalf of Samajwadi Party. In addition to highlighting your commitment to addressing one of the most critical issues of our days, your publication serves as a valuable guide for all individuals and parties who are committed for climate action.

The Climate Actioneer's Primer is a comprehensive manual that highlights how urgent climate change is and offers doable, practical answers for all to create a sustainable future, spanning more than 200 pages and exploring more than 600 climate actions.

We extend our heartfelt congratulations and encourage you to keep pushing the bar to motivate others in this endeavor. One must also note that Climate Action, Sustainability and Human Happiness Index are co-related and all efforts must be made in the direction of creating synthesis between the three. Looking forward to working together, for a better future.

Best wishes.

(Ravi Prakash Verma)



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I'm writing to offer Friedrich-Ebert-Stiftung and Sprouts environmental trust my heartfelt congratulations on the successful release of The Climate Actioneers' Primer: A Beginner's Toolkit (CAP).

In addition to highlighting your commitment to addressing one of the most critical issues of our day, your publication serves as a valuable guide for all individuals and parties who are passionate about climate action. The Climate Actioneers' Primer is a comprehensive manual that spans more than 200 pages and explores more than 600 climate actions. The book highlights how urgent climate change is and offers doable, practical answers for all parties involved to help create a sustainable future. I appreciate your commitment to climate change and hope you would keep pushing the envelope, while motivating others to follow in your footsteps.

I once again extend my warmest congratulations on this wonderful accomplishment and wish you the best of luck in all future endeavours.

Best Regards,

National Coordinator, AICC Research Dept.

**एज्या यादव** <sup>र्फ़</sup> विधायक ब्सह प्रदेश प्रवक्ता बाष्ट्रीय जनता दल



Ejya Yadav <sub>ex</sub> MLA spokesperson rashtriya janta dal

पत्रांक. 7! 20.2.3

दिनांक..1.6.07 2.023

I'm writing to offer Friedrich-Ebert-Stiftung and Sprouts environmental trust my heartfelt congratulations on the successful release of The Climate Actioneers' Primer: A Beginner's Toolkit (CAP). My political party Rashtriya Janta Dal applaudes your unwavering commitment and tenacity in raising awareness of the essential needs for climate action. In addition to highlighting your commitment to addressing one of the most critical issues of our day, your publication serves as a valuable guide for all individuals and parties who are passionate about climate action.

The Climate Actioneers' Primer is a comprehensive manual that spans more than 200 pages and explores more than 600 climate actions. The book highlights how urgent climate change is and offers doable, practical answers for all parties involved to help create a sustainable future. We praise your commitment to climate change, as well as your creativity and leadership. We encourage you to keep pushing the envelope and motivating others to follow in your footsteps. We are very grateful for your persistent efforts to combat climate change and advance a better future. We encourage you to keep pushing the envelope and motivating others to follow in your footsteps. We once again extend our heartfelt congratulations on this wonderful accomplishment once more and wish you the best of luck in all future endeavors.

With best wishes Cyris yndan

पूर्वी बोरिंग कैनाल रोड, महालक्ष्मी अपार्टमेंट के पास, सुर सुधा गली, पटना-800001 सुभद्रा सदन, एसडीओ रोड, हाजीपुर, वैशाली-844101 (बिहार) ग्राम+पोस्ट-जलालपुर, प्रखंड-मोहनपुर थाना-पटोरी, मोहनपुर ओ0पी0, जिला-समस्तीपुर-848506

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Al Gore's Climate Leadership Program



Aditya Pundir Director India & South Asia

#### MESSAGE

I am delighted to know that SPROUTS and Friedrich Ebert Stiftung (FES India) have come out with the Climate Actioneers' Primer: A Beginner's Toolkit (CAP). This well– researched and comprehensive book, spanning over 200 pages, effectively underscores the urgency to address the impacts of climate change on our society and communities. It offers more than 600 climate actions, which are practical and achievable solutions for all stakeholders to contribute towards building a sustainable future!

It is even more significant that this resource-packed book's three authors (Anand Pendharkar, Rahul Palekar and Amruta Padgaonkar) are Climate Reality Leaders. We at The Climate Project Foundation commend your dedication to combating climate change, as well as your visionary thinking and exemplary leadership. This remarkable publication highlights your unwavering commitment to addressing one of the most critical issues of our time. Also, it serves as a practical guide for individuals, organisations and government agencies dedicated to climate action.

Your publication showcases your commitment to climate change via creativity and innovative approaches. It is through initiatives such as the Climate Actioneers' Primer that we can inspire, support and motivate others to engage in climate action actively. The CAP will be a strong guiding document for our partners in their tireless efforts to combat climate change and advance towards a better future.

I wish you success in this publication and all the best for your future endeavours.

Aditya Pundir

#### **The Climate Project Foundation**

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## About and How to Use the Book

#### **About the Climate Action Book Series**

This series of seven books intends to educate, enable and engage passionate individuals and groups of residents, migrants, indigenous communities, visitors, activists, and urban and business planners, while providing them with outreach and actioning toolkits. Although dissimilar, all seven books weave seamlessly into each other, to envision a climate-resilient society.

#### **The Publishers**

**SPROUTS** (est. 1995) is a Mumbai-based environmental consulting, ecotourism and research organisation, focusing on climate action via responsible tourism & wildlife conservation. For over 30 years, their research projects have documented the Northern Western Ghats, urban biodiversity in Mumbai and other cities, besides marine regions across India. SPROUTS set up a non-profit SPROUTS Environmental Trust (in 2009), with a vision to achieve a 'Sustainable environment for all' and has trained about 30 Eco-leadership interns. Through numerous beach clean-ups and their signature Nature festival, 'Earth Mela', they gather people to act against the climate crisis.

**Friedrich-Ebert-Stiftung (FES)** is a non-profit German foundation, committed to the values of democracy and social justice. It was founded in 1925 and is named after Germany's first democratically elected President, Friedrich Ebert. FES India, established in the 1980s, is committed to building platforms of mutual trust for open debate and the exchange of new ideas. Using workshops, seminars, exchange programmes, and academic papers. FES India offers nuanced socioeconomic analyses and fosters debates on a national, regional and global level.

#### **The Editors**

**Kamini Gopal,** an Ecologist and Wildlife Biologist, has extensive experience in conservation, from the Andaman Islands to the Kalakkad-Mundanthurai rainforests. With exceptional writing skills, she ventured into content writing and editing for an early dot com start-up. Later, Kamini left the corporate world to establish her successful home-baking business, 22 Baker Street - Holmemade Cakes, which has thrived for a decade. She still freelances as a writer while passionately leading people of all ages to explore urban wilderness areas. Kamini's love for Nature and insatiable hunger for words, continue to drive her innumerable pursuits.

Vaishnavi Kodakandla, a passionate reader and dedicated PhD student in Cognitive Sciences, currently finds solace in the pages of research papers. When she is not wondering about the brain you'll find her brain wandering about which workout she is gonna do next, daydreaming of the next trek or arranging words in a way they sound like poetry.

#### The Illustrator

**Daniel Luis** is a visual artist and teacher, specialising in illustration. He has completed a Bachelor's in Fine Arts with a specialisation in Applied Art. Daniel enjoys exploring the outdoors. He combines his passion for art and the natural world through illustrations and fine art, drawing inspiration from human interactions with the natural environment.

#### How to Use the Book

The Climate Actioneers' Primer: A Beginner's Toolkit (CAP) is a comprehensive guide packed with actionable ideas and suggestions to achieve multiple Sustainable Development Goals (SDGs) simultaneously. It includes case studies, success stories, and Do-it-Yourself (DIY) sections, providing tangible examples of the impact each action or project can have on the psychological, socio-cultural, ecological, and economic stability of global communities.

The main aim of this book is to encourage individuals, corporations, industries, and NGOs, to make meaningful changes in their lifestyles or approaches towards the climate crisis. The case studies offer positive examples that can inspire readers to participate and take climate action. Every chapter and subchapter addresses all the relevant SDGs to help the reader better understand the overall, interlinked and long-term impact of their actions in combating the climate crisis.

SUSTAINABLE GOALS

The book features 50-plus beautiful water colour illustrations, depicting the interconnected nature of socio-cultural and ecological aspects of Indian society, when viewed through the lens of climate change. Each illustration is located in a unique part of India and takes a Yin and Yang like, multi-layered approach. The two-page Cover Illustration is intricate and supposed to be viewed from the back to the front. The complete panorama depicts India's climate journey from a damaged and polluted past (back page) to a sustainable and inclusive future (front page). The spine depicts the present: the slice of time that we are currently inhabiting.

The first two chapters provide an introduction to climate change, as well as past and present challenges we face due to it. Readers are encouraged to read these sequentially. The following five chapters can be read in any order. Each chapter, though independent in its analysis, is interconnected to issues presented in other chapters. Reading through all the chapters, sequentially or otherwise, will ensure the best reader experience. The language has been kept simple for readers of all ages to easily understand the content.

The 24 aspects of climate change covered by this book are sectioned into five chapters (chapters 3 - 7), with each chapter representing a broader theme. Each chapter opens with a brief summary of the theme and its relevance to our lives. The SDGs encompassed in each subchapter are listed at the end of the subchapter.

Each subchapter contains relevant subject information, embellished by guotes from experts taken during the International Sustainability Conference (ISC) in 2021, which feature as box items. The subchapters also contain case studies of best practices followed by organisations or individuals in those fields. All subchapters end with a short list of climate actions that individuals and organisations can undertake to help in the fight against climate change.

Tables, graphs, infographics and illustrations explained are in adjoining captions, and detailed descriptions are listed on pgs. xiv to xvii. Readers who wish to go beyond the climate actions



mentioned in the book, Scan this QR Code for the '366' Climate Actions' Planner'.



The book closes with a concluding chapter, which ties up the analyses from all the preceding chapters. Beyond this, in Chapter 9, the book has hundreds of **Resources** in the form of games, carbon calculators, films, magazines, books, publications, etc. The Glossary section helps readers understand the complex terms and abbreviations used in the book. Citations and links to data mentioned in the book are provided in the **References** section.

Whether you are an individual seeking personal solutions, an organisation looking to implement sustainability practices, or an educator planning to develop climate action curricula, this book serves as a practical guide and reference material. A reader can use this book as a resource with proper credit given to the publishers, to understand the intricacies of climate change and take actionable steps against it. Let the Climate Actioneers' Primer empower you to make a positive impact on the environment and work towards a sustainable future for all.

#### **Quick Reference**

Each chapter has various coloured 'box items' with specific information as follows:



## List and Description of Illustrations, Graphs, Infographics and Tables

Sr. No.	Туре	Title	Description/Subtitle	
1	Cover Illustration	Past, Present and Future of Climate Action	For a sustainable future, we have to transition from climate apathy to alarm, to arrive at educated and collective actions	
2	Illustration 1	Brake Failure Mollem, Goa	Our models of development have gone beyond cautionary limits, becoming unsustainable and dangerous for Earthly inhabitants	
3	Illustration 2	Discoverer's Delight Eaglenest WLS, Arunachal Pradesh	Bugun Liocichla is a passerine bird described in 2006, after being discovered in 1995, from Arunachal Pradesh, indicating mysteries yet undiscovered	
4	Illustration 3	Nature's Bounty Port Blair, Andaman Islands	There are enough natural resources for everyone's needs. But even one person's greed can tip the balance	
5	Illustration 4	Dung to Gold Kali Tiger Reserve, Karnataka	Scarab Beetles are diligent recyclers, working in tandem, to turn dung into food, producing resources for other creatures	
6	Illustration 5	Paper Recycling Shrirampur, Maharashtra	Handmade paper is not only a great way to upcycle cotton and hosiery wastes, but is also a highly coveted art substrate	xiii
7	Illustration 6	Monitoring Lizard Periyar TR, Kerala	Basking and feeding on termite hills, Monitor Lizards are both a prey and predator, in the eternal food web	xviii
8	Illustration 7	A Desolate Future Pondicherry	Droughts impact both nature and human life. Climate change is causing huge resource disparity, stressing out artisanal communities	
9	Illustration 8	E-Waste Overload Shillong, Meghalaya	Piles of irresponsibly disposed e-waste are a glaring reminder of their imperishability, and the consequences of digital excesses	
10	Illustration 9	The Butterfly Effect Kohima, Nagaland	A kid, who experiences the joys of nature, will live sustainably and lead a society that values nature	
11	Illustration 10	Marine Mosaic Kavaratti Island, Lakshadweep	The vibrant life beneath the waves, facing hidden perils from the world above	
12	Illustration 11	Agro-revolution Ludhiana, Punjab	It's time to revolutionalise agro-forestry on a war-footing, considering the looming threat of climate change and global food inadequacies	
13	Illustration 12	Locust Invasion Mandvi, Gujarat	With climate change, locust invasions have increased and become unpredictable. This leads to a struggle for survival for the swarms of insects and humans equally	
14	Illustration 13	Bulls and Bears Mumbai, Maharashtra	Climate events and environmental shifts have profound effects on resource availability, financial markets and economic stability	
15	Illustration 14	Inclusive Public Spaces Kolkata, West Bengal	Green public spaces not only act as urban 'watering holes' for the public who cannot afford to travel far, but also act as havens for urban wildlife to flourish	
16	Illustration 15	Desert Dwellers Jodhpur, Rajasthan	Thriving amidst arid landscape, time-tested water0harvesting techniques or intricately-carved mud houses,0define adaptation and conservation. These are the0cornerstones of life for humans and biodiversity alike0	
17	Illustration 16	Young Eco-warriors Agra, Uttar Pradesh	Empowering youth to make responsible choices while being equipped with determination and a sense of responsibility	039

Sr. No.	Туре	Title	Description/Subtitle	
18	Illustration 17	Bridging the Gender Gap Kanha NP, Madhya Pradesh	By empowering the voices of women, non-binary, and gender-diverse individuals, we unlock fresh perspectives, innovative solutions, and unified efforts towards a sustainable and resilient future for all	
19	Illustration 18	Enabling the Less- abled New Delhi, NCR	Inclusivity in climate action planning is essential and crafting a sustainable future requires acknowledging and accommodating the unique needs and perspectives of people with disabilities	
20	Illustration 19	A Balancing Act Loktak Lake, Manipur	Phumdi Islands in Loktak Lake with the Thamin or Manipur Brow-Antlered Deer or the Dancing Deer	053
21	Illustration 20	Towering Inferno Rushikulya, Odisha	Oil Spills are usually handled by burning the oil spilled in the ocean. This is harmful to marine life and causes immense air and water pollution	
22	Illustration 21	A Tale of Two Worlds Andaman & Nicobar Islands	In the heart of the Andaman Islands, a striking juxtaposition unfolds. The tourism industry needs to respect the ways of original inhabitants	
23	Illustration 22	Nature versus Progress Kochi, Kerala	An elephant marches through an urban landscape, a reminder of coexistence in a changing world	067
24	Illustration 23	Low Carbon Harvest Coimbatore, Tamil Nadu	Choosing to buy local produce, makes a significant impact on mitigating climate change - supporting local farmers, reducing transportation emissions, and fostering sustainable farming practices	071
25	Illustration 24	Living in the Dark Ages Visakhapatnam, Andhra Pradesh	s Health and sanitation are governed by invisible socio-cultural factors, coming to the fore when something goes wrong. Workers in these fields often go unseen and unappreciated	
26	Illustration 25	Victims of Wastefulness Guwahati, Assam	A stark reminder of our impact on nature and future generations	
27	Illustration 26	Loss of Innocence Mandi, Himachal Pradesh	There are many modes through which humans shape thoughts, opinions, society and the environment. These enable humans to play God with the Earth	086
28	Illustration 27	Unveiling Frozen Secrets Gangotri, Uttarakhand	With advanced technology, learnings from research findings play a pivotal role in understanding climate change	087
29	Illustration 28	Unheard Voices Srinagar, Jammu & Kashmir	Media shapes public opinions and cultural zeitgeists by empowering common voices. It is a power and a responsibility that needs to be handled carefully	092
30	Illustration 29	Silently Battling Noise Mumbai, Maharashtra	City dwellers have become numb to the perils of noise pollution, accepting it as a way of life. But policy changes are the result of citizens exercising their rights and demanding change	096
31	Illustration 30	Choice of the Battered Ranchi, Jharkhand	In a democracy, the powerful act of casting one's ballot enables a person to empower a government that embodies the person's core beliefs	102
32	Illustration 31	Disaster Prepared? Sangli, Maharashtra	People need resources, such as food, clothing, and fuel to survive. Do the current developmental indices reflect desired quality of life?	108
33	Illustration 32	Inspiring Curiosity Agartala, Tripura	Education and outreach have the power to inform, educate and inspire people to learn more about the environment	109
34	Illustration 33	Dung Power Panipat, Haryana	Energy runs the world. The transition to renewable energy is complemented by winning against energy poverty. The lines between right and wrong are often blurry	114

Sr. No.	Туре	Title	Description/Subtitle	
35	Illustration 34	Sustainable Housing Yuksam, Sikkim	Houses and dwellings are usually taken for granted by the common people, but they have an incredible potential to be vessels for climate mitigation	
36	Illustration 35	Equitable Infrastructure Etawah, Uttar Pradesh	Public infrastructure reflects the quality of life of the common folk, and acts as one of the foremost pillars of a functional society	
37	Illustration 36	Self-sufficiency Mysore, Karnataka	Skilled and competent workers ensure not only economic progress, but also make households resilient to the impacts of climate change	128
38	Illustration 37	Multimodal Mobility Hyderabad, Telangana	Quick and efficient movement of people is critical for society. Reimagining transport is integral to our fight against climate change	133
39	Illustration 38	An Icy Solution Leh, Ladakh	Solutions to climate problems could be simple or complex, what matters is the courage to try new things to solve the problems we face	
40	Illustration 39	Nocturnal Extraction National Chambal WLS, Madhya Pradesh	We share natural resources with several other creatures. We need to be mindful of the impact of our actions on the environment	
41	Illustration 40	Toxic Legacy Aizawl, Mizoram	Discarded batteries leaching into the soil is a pressing challenge in our climate journey	149
42	Illustration 41	Tools for Change Daman and Diu	There are an array of tools at our disposal to address the issues of climate change	
43	Illustration 42	Puppets on a String Bhuj, Gujarat	Rural, tribal and urban poor communities become rag dolls and puppets on a string, if not prepared for a climate crisis	
44	Illustration 43	Web of Life Manas, Arunachal Pradesh	Networks, resource banks and training can empower people to take action in a sustained manner	
45	Graph 1	Graph 3.1.1	Changes in numbers of threatened species assessed by IUCN across taxa	
46	Graph 2	Graph 3.2.1	Changes in the global land-ocean temperature with LOWESS curves	
47	Graph 3	Graph 3.3.1	Comparison of deaths caused across the continents over the past 15 years due to climate disasters	
48	Graph 4	Graph 3.4.1	Comparison of economic damages across continents, with a focus on major Asian countries	026
49	Graph 5	Graph 3.4.2	Per cent contribution of various climate disasters in global economic loss	
50	Graph 6	Graph 4.2.1	Workforce in various age groups in India	
51	Graph 7	Graph 4.3.1	Comparison of mortality rates for different genders based on their exposure to pollutants and hygiene conditions	
52	Graph 8	Graph 4.4.1	Percentages of types of disabilities in India	
53	Graph 9	Graph 5.1.1	Global CO <sub>2</sub> emission from fossil fuels and land use changes for the past 170 years	
54	Graph 10	Graph 5.2.1	Carbon footprint of different sectors associated with global tourism	
55	Graph 11	Graph 5.3.1	Population of India living in urban areas from 1960-2020, compared to other countries	
56	Graph 12	Graph 5.4.1	Average global greenhouse gas emissions of various major food products	
57	Graph 13	Graph 5.4.2	Levels of risks for different forest management approaches	074

Sr. No.	Туре	Title	Description/Subtitle	
58	Graph 14	Graph 6.1.1	Percentage of articles published from 2006-2015 - A) Terrestrial habitat; B) Marine habitat; C) Freshwater habitat; D) Other habitats; E) Number of articles published that contain more than one driver of CC	
59	Graph 15	Graph 6.2.1	Trend in the active users of various social media platforms for the past 17 years	095
60	Graph 16	Graph 6.2.2	Active social media users of different platforms in 2021	095
61	Graph 17	Graph 7.1.1	Total literate population in India as of 2011	110
62	Graph 18	Graph 7.2.1	Global primary energy consumption by source	115
63	Graph 19	Graph 7.3.1	Global warming potential of different housing materials	120
64	Graph 20	Graph 7.6.1	Country-wise comparison of total $CO_2$ emissions from the transport sector	134
65	Infographic 1	Infographic 2.1: Causes and Impacts of Climate Change	Climate change is a complex phenomenon arising from a network of interconnected causes and cascading impacts	006
66	Infographic 2`	Infographic 3.1: Nature's Blueprint for Life and Resources	The structure and function of ecosystems and the services it provides results in the creation of exploitable resources and liveable conditions on this planet	
67	Infographic 3	Infographic 4.1.1: Impact of Climate Change on Communities	ct Communities, especially the vulnerable section of society, face escalating threats worldwide due to the intensifying effects of climate change – food and water scarcity, displacement, and economic hardships	
68	Infographic 4	Infographic 5.6.1: Per cent Composition of Different Types of Waste	Waste segregation is essential as the decomposition rates and per cent contribution of different waste differs e	
69	Infographic 5	Infographic 6.4.1: Stakeholder Map for the World's Climate Action in (A) 2022 and (B) 2030	This stakeholder mapping is conducted as part of a method called Transformative Change Making (TCM). It uses development cleavages in a society – cultural (x-axis) and material (y-axis) – to determine stakeholder positions. This helps in visualising and comprehending their current interests. As seen commonly, an interest-based alliance does not necessarily result in change. At best it brings different interest groups together on a common platform. However, by understanding the developmental orientation, a broader societal alliance for transformative change can be formed	
70	Infographic 6	Infographic 7.5.1: The Contribution of Various Industry Sectors to GHG Emissions	It can be noted that a lion's share of the contributions is by Energy, Agriculture, Forestry and Land Use, all of which will only increase as the global population increases	129
71	Infographic 7	Infographic 8.1: Climate Action Primer for Combating Climate Change	This highlights the multifaceted approach required to combat the pressing issue of climate change. It underscores the book's core message: that meaningful climate action necessitates a collaborative and holistic endeavour spanning governments, industries, communities, and individuals	144
72	Table 1	Table 2.1	List of of Various International Protocols, Treaties & Panels, 00 and Climate Accidents or Disasters	
73	Table 2	Table 3.4.1	Budgetary Allocations for Environment Ministry of India (2021-22 & 2022-23)	027
74	Table 3	Table 6.3.1	Major Environmental Laws and Policies in India	098

## Preface

The power and resolve of about a billion and half humans can definitely be of juggernaut proportions. However, a wave of action has to begin with a single individual. The 'Power of One' or that of a motivated individual is unmatchable, unstoppable and relentless. Sadly, most people lack the training, deep understanding, conviction and motivation that is necessary to embark on the arduous path of 'climate action'.

There are many approaches that a populous and rapidly-growing economic giant, such as India, can take to achieve sustainable growth, while fulfilling its Nationally Determined Contribution (NDC) towards climate neutrality. It is easy for governments to impose regulations on carbon emissions by citizens, vehicles and industries, in line with global trends and protocols. However, this top-down approach tends to disenfranchise marginalised communities and trample upon the aspirations of emerging, young entrepreneurs. Hence, an inclusive transition, involving various stakeholders, will be more equitable.

Obviously the inclusive approach will be tougher and more time-consuming. But, it will definitely lead to more educated, resilient and engaged citizens. Such an approach would involve educating and training not only children and youth, but also various public-service providers, ground-level workers, *panchayat* members, and artisanal communities. Capacity-building trainings will empower and upskill individuals and collectives make informed decisions and take action, based on validated research data. This progression from 'Knowledge to Sensitivity to Analysis and Action', followed by 'Reflection and Redesigning', is very important to achieve localised and on-the-ground climate action.

Achieving such an ambitious goal of inclusive and equitable growth, which is also climate sensitive, is herculean. It is also fraught with difficulties, given India's socio-economic, cultural and ecological diversity, across regions. There are also aspects of intersectionality, plurality, and the inherent power dynamics of businesses versus communities that have to be taken into consideration while designing climate policies. To remedy this, SPROUTS and Friedrich-Ebert-Stiftung (FES) India Office organised a three-day International Sustainability Conference (ISC) 2021, addressing the problems of climate justice and action from 24 critical and popular, social discourses. The talks by experts, panel discussions, films, posters and other presentations by researchers, and finally the deliberations involving participants from across the world, became the framework for this book.

The authors have collated, summarised and further referenced the subject to put together this 200 page – Climate Actioneers' Primer: A Beginner's Toolkit. We hope that this action-packed book provides ideas and opportunities for individuals, communities, organisations and even policymakers, to engage in inclusive climate action.

Anand Pendharkar Rahul Palekar Amruta Padgaonkar SPROUTS, Mumbai September 2023



## Chapter 1: Wake up: Climate Change is here!



Earth is famously known to inhabit what is called 'The Goldilocks Zone' in space: a region with just the right conditions to nurture and support life. If the overall planetary climate were any hotter or colder than it is, there would not have been much life possible on Earth. The Earth's atmosphere and the living creatures it hosts, together play a pivotal role in regulating its climate. The planet has seen several global heating and glaciation (cooling) events across its history of 4,000 million years. However, none have been so rapid in creating conditions, which may threaten all lifeforms with irreversible and total extinction. Hence, it is imperative that we wake up to the human-generated reality of climate change and take urgent corrective action.

#### The Science behind Global Warming

#### **The Greenhouse Effect**

The Earth's atmosphere allows the superhot ultraviolet (UV) rays of sunlight to pass through it and warm the planet to a comfortable global average temperature of 17°C. The Earth's surface, however, radiates a major portion of this energy back towards space, as infrared

radiation (IR). This process mimics the reflection and heat-trapping mechanism in a plastic or polyethylene 'greenhouse', and is thus called the 'Greenhouse Effect' (GHE). The GHE is critical for the survival of diverse life forms on Earth. Without the GHE, the average temperature on Earth would drop below -20°C, making it difficult for most creatures to survive.

#### **Greenhouse Gases**

The heat radiated from the Earth's surface is trapped in the atmosphere by certain Greenhouse Gases (GHGs), preventing it from escaping into space. This results in the planet retaining heat, and the atmosphere warming up differentially. Major GHGs in descending order of contribution to the Earth's GHE are:

- 1. Water vapour  $(H_2O)$
- 2. Carbon dioxide  $(CO_2)$
- 3. Nitrous oxide  $(N_2O)$
- 4. Methane (CH<sub>4</sub>)
- 5. Ozone  $(O_3)$
- 6. Hydrofluorocarbons (HFCs)
- 7. Perfluorocarbons (PFCs)
- 8. Sulphur hexafluoride (SF<sub>6</sub>)
- 9. Nitrogen trifluoride  $(NF_3)$

These gases cumulatively amount to less than one per cent of our atmosphere. However, their concentrations are rapidly increasing due to large-scale human activity, leading to unsafe levels of atmospheric warming.

#### Role of Human Activity in Global Warming

Back in its Fifth Assessment Report (2014), the United Nations Intergovernmental Panel on Climate Change (IPCC), a group of 1,300 independent global scientific experts concluded that over the past 50 years, human activities have significantly warmed our planet. The Sixth IPCC Assessment Report (2023) has found that current mitigation strategies and funding measures are mostly insufficient to keep global warming below 2°C by the end of the 21<sup>st</sup> century. It also assessed climate risks to be higher than those calculated in the fifth report, signifying that further warming has happened in the year 2022-23. The pertinent question to address is – How does human activity lead to global warming? And, what will be its impact on communities, ecosystems and economies?

#### **Burning Fossil Fuels**

The burning of fossil fuels has led to a significant rise in  $CO_2$  levels, increasing the atmospheric concentration from around 280 parts per million (ppm) during pre-industrial times to over 400 ppm in 2018. This represents a 40 per cent increase since the beginning of the Industrial Revolution in the mid-1700s. Currently,  $CO_2$  concentrations are rising at a rate of approximately 2–3 ppm per year, and it is projected that they will surpass 900 ppm by the end of the 21<sup>st</sup> century. The excessive utilisation of fossil fuels for various purposes such as power generation, transportation, cooking, and heating or cooling has resulted in a substantial release of  $CO_2$  into the atmosphere.

### Agriculture, Forestry and Land

#### **Use Changes**

Agriculture is estimated to be the primary driver for around 80 per cent of deforestation worldwide. Furthermore, agriculture, deforestation, and other land use alterations contribute to one-quarter of net anthropogenic GHG emissions. According to a UN report, livestock is responsible for about 14.5 per cent of these emissions. The key contributors to emissions from livestock are feed production and processing (45 per cent), outputs of GHGs during digestion by cows (39 per cent), and manure decomposition (10 per cent). While atmospheric CO<sub>2</sub> has increased by 40 cent, since pre-industrial times (mid-18<sup>th</sup> century); the amount of methane has more than doubled in the same time period. When compared with the average temperatures of 1986-2005, global average temperatures are expected to rise by 3-4°C, by the end of the 21st century. According to the IPCC, even this small rise would mean catastrophic problems across the globe.

#### **Cement Manufacture and Use**

It is widely accepted that the cement industry produces between five and eight per cent of global, anthropogenic  $CO_2$  emissions. Within this, 50 per cent of emissions arise from the chemical process of manufacturing cement, while 40 per cent is from burning fuel to power the manufacturing process. The amount of  $CO_2$  emitted by the cement industry is more than 900 kg of  $CO_2$  for every 1,000 kg of cement produced. Besides the emissions at the manufacturing stage, the use of cement in buildings, roads, monuments, and structures releases  $CO_2$  and causes the 'Heat Island Effect' in urban areas.

Anthropogenic sources of aerosols include chlorofluorocarbons (CFCs) and halons used in refrigeration systems, fire suppression systems, manufacturing processes, and pollution from cars and factories. Aerosols are also produced during several natural phenomena (forest fires, volcanoes) and isoprene is emitted from plants. Aerosols have a detrimental impact on human health and affect the natural water (rainfall) and carbon cycles.

#### **Climate Emergency**

The Oxford Dictionary defines climate emergency as "a situation in which immediate action is needed to reduce or stop climate change and prevent serious and permanent damage to the environment". Most people consider the declaration of a climate emergency as a 'doomsday approach' by overzealous environmental activists. Yes, they have been facing slightly hotter summers and erratic rainfall. However, to them, an emergency would be something like the Ukraine War, COVID-19 pandemic or the volcanic eruption in Tonga. Their responses are muted, partially due to their ignorance, lack of exposure, and the misinformation that is being actively spread about issues such as global warming (GW) and climate change (CC) by various agencies.

A climate emergency is an existential threat to civilisation. The scenario worsens when coupled with a lack of concern and the ulterior motives of the rich and privileged. This has led to over-exploitation of natural resources and uncontrolled pollution masked as development, pushing our atmosphere, oceans, rivers, glaciers, and natural ecosystems to critical limits. These human excesses have contaminated everything from breast milk to the deepest point in the ocean with microplastics. It has harvested 25,000-year-old fossil water from over 100 m deep wells and mined natural heritage sites to extinction. The aquatic and terrestrial biodiversity that regulates levels of CO<sub>2</sub>, and regenerates our atmospheric oxygen is either burning in warm waters, covered with oil or choking in a continent of floating plastic. The monsoons originating from these waters are weak or erratic. Once they reach inland, they wreak havoc in the form of cloudbursts, cyclones and floods.

But why is the climate emergency so dangerous? One of the most insidious aspects of CC is its exponential nature. If nothing is done soon, it will become impossible to reverse the impending effects of CC. That time is fast approaching. Scientists have identified several global 'tipping points', crossing which will lead to an almost irreversible descent into disaster. Therefore, when contemplating CC, it is crucial to consider the steadily rising temperature trend and the various forms of pollution, floods, droughts, mass extinctions, wildfires, economic collapses, and diseases. Worsening mental health and unemployment are some of the indirect effects of CC.

#### **Tipping Points and International Response**

A tipping point is said to have been reached when even a small change causes a much larger change due to accumulated impacts. It is a point of no return, or when returning to the previous state becomes difficult. Some global tipping points are the West Antarctic ice sheet disintegration, Amazon rainforest dieback, and the Great Barrier Reef (coral) die-offs.

Recent studies confirm that the Greenland ice sheet is nearing its tipping point, possibly within the next 15 years. The ice sheet is already the single largest contributor to rising sea levels. Based on current projections, the sea level is expected to rise by a minimum of 6.1 m in the future. The melting of ice in West Antarctica and Greenland will disrupt ocean circulation. Rising temperatures in the Northern Hemisphere are triggering permafrost degradation and boreal forest dieback.

Global permafrost holds roughly twice as much carbon as the amount currently circulating in the atmosphere. The Siberian permafrost also holds viruses and bacteria completely new to humankind, which will be released as it melts. As the permafrost melts, the released carbon will further elevate temperatures, leading to more ice melt. Thus, it is important to note that tipping points are interconnected with the self-feeding cycle of climate disasters.

Slowly but surely, people and governments are beginning to take notice. The 196 parties at the 2015 United Nations Climate Change Conference (COP 21) negotiated the Paris Agreement. Countries pledged to cap the average global temperature increase to well below 2°C compared to pre-industrial levels. However, the preferred limit for the temperature rise is 1.5°C, recognising that this would substantially reduce the effects of CC. In response to this, the first declaration of a 'climate emergency' was made on December 5, 2016, by the City of Darebin in Melbourne, Australia. This declaration has since been followed by 1,900 local governments in 34 countries, covering over one billion citizens, by enlisting international co-operation.

Nevertheless, it is insufficient to rely on independent planning and actions across disparate geographies and demographics. As much as global action is important, local grassroots-level action is also necessary. Adopting a dual approach of thinking globally and acting globally as well as thinking locally and acting locally, is vital in addressing CC. The UN Sustainable Development Goals (SDGs) are the cornerstone for ensuring timely, effective, and inclusive climate action.

#### What are the SDGs?

Sustainable Development Goals (SDGs) are global goals and targets adopted during the 2015 UN General Assembly (UN-GA), intended to be achieved by 2030 (2030 Agenda for Sustainable Development). The goals are an outcome of extensive deliberations and discussions to formulate collaborative and sustainable strategies. The 17 SDGs encourage actions, advocacy, and outreach at all levels. The UN Division for Sustainable Development Goals (DSDG) provides support and capacity-building training to aid in achieving the goals. SDGs are all-encompassing and span across sectors (environment, socio-economics, health, education, and industry) while achieving resource sustainability. They serve as an urgent call to action for both developed and developing countries alike.

**SDG 1: No Poverty** – Eradicating poverty will ensure equity and equality while combating CC.

**SDG 2: Zero Hunger** – Encouraging sustainable and regenerative agriculture will ensure security. In turn, these sustainable practices eliminate the ill effects of conventional agriculture.

**SDG 3: Good Health and Well-being** – Reducing social disparities will ensure the well-being and good health of people.

**SDG 4: Quality Education** – High quality education will provide better opportunities for employability while Nature-based education will sensitise people, and will encourage them to participate in climate action.

**SDG 5: Gender Equality** – A gender-neutral society will be unified and better equipped to combat impacts of CC, without leaving anyone out of the protective cover.

**SDG 6: Clean Water and Sanitation** – This goal will ensure sustainable management of water and prevent contamination of water resources.

**SDG 7: Affordable and Clean Energy** – Replacing polluting (fossil fuel-based or nuclear) energy with affordable, clean, and safe energy will benefit everyone.

**SDG 8: Decent Work and Economic Growth** – Promoting circular economies will ensure sustainability.

**SDG 9: Industry, Innovation and Infrastructure** – Investing in sustainable infrastructure will reduce carbon emissions.

**SDG 10: Reduced Inequality** – Providing equal access to resources to all socio-economic and marginalised groups will bridge social and economic disparity and combat CC.

**SDG 11: Sustainable Cities and Communities** – Redesigning cities will make them safe, resilient, sustainable, and carbon neutral.

**SDG 12: Responsible Consumption and Production** – Encouraging environment-conscious choices will reduce consumption, segregate and recycle waste.

**SDG 13: Climate Action** – Complementary to SDG 7, and will encourage collaborative efforts towards CC mitigation and adaptation.

**SDG 14: Life Below Water** – Conserving aquatic ecosystems will reduce and control freshwater and marine pollution.

**SDG 15: Life on Land** – This will incentivise conservation and restoration of terrestrial habitats, and also, control illegal trade and poaching.

**SDG 16: Peace, Justice and Strong Institutions** – Bridging the gap between climate actioneers and governing bodies will ensure transparency and better implementation of policies.

**SDG 17: Partnership for the Goals** – Collaborating and creating networks to combat CC will ensure better resource management and implementation of action plans.

The journey of reversing past impacts, neutralising recurring climate disasters, and stabilising global climates is going to be an uphill task. However, only with prudent reflection, honest acceptance of our past mistakes, documentation, and research of our present challenges, will we be able to set off on the path of long-term climate stabilisation. This will require special sensitivity towards a wide array of marginalised and repeatedly-exploited communities while designing futuristic infrastructure, policies and frameworks. Aspects of equity, ownership and redistribution of resources, and owning up to past actions will play a major role in ensuring stability to war-torn, subjugated, and climate-ravaged countries. Finally, it is time to accept the reality that climate emergencies have reached our doorstep and inertia, passivity or inaction is passé. It is time for urgent collective action. The developed world must share technology and funds, and support innovations in climate resilience, to combat the situation or be prepared to host billions of climate refugees.

# 1 NOURING 2 KENOR 3 GOOD MEALTH 4 CUALTY 5 GENDER 6 CLAD MANTERION 1 NOURING 1 SUBJECT 1 SUBJECT

# SUSTAINABLE G ALS

## **Chapter 2: Past and Present Challenges**



#### Historical Disbelief in Climate Change

Ignorance and denial were the greatest challenges, which led to decades lost in our fight against CC. Industries and business leaders were initially reluctant to acknowledge CC, while governments were hesitant to abandon established practices for the distant future. This pattern echoes throughout history. For instance, it took us considerable time to recognise the harmful effects of smoking and lead toxicity.

Even today, influential individuals and groups continue to deny the existence of CC and 'actively' lobby against it. Despite the widespread acceptance of CC as a reality, achieving consensus remains a major hurdle, leading to delays in policy and governance decisions. Since pre-industrial times (before 1850), the average global temperature has already increased by 1°C. However, if we continue with a "business as usual" approach, the temperature could rise by as much as  $4^{\circ}$ C by the end of the century.

#### **Inclusion and Social Equality**

In the past, women as well as racial minorities were denied equal access to education and work opportunities. This reduced the pool of individuals who could think of a CC solution, provide for their families and be active social actors. This lost opportunity has left our economies weaker and societies vulnerable to the effects of CC.

Social exclusion has far-reaching effects on social structures as well as policy. When governing bodies lack diversity and inclusivity, there is a high probability that decisions taken by these bodies will be similarly exclusive. This might mean overlooking the need for female sanitation products during disaster relief, failing to plan for more disabled-friendly facilities, or forgetting to consider indigenous livelihoods before planning infrastructure projects that impact forests..

Social inclusivity not only empowers individuals to stand up for themselves but also to have their voices heard in the social sphere. By including marginalised groups, we foster an inclusive and equitable society that effectively addresses the challenges posed by CC.

#### Present Sense of Urgency

Humans have not evolved to think of long-term scenarios and their consequences. This is one of the toughest obstacles in fighting CC. The fight requires sacrificing, both, industries to transition and profit margins, as we move towards green methodologies and technologies, which are generally more expensive than the current fossil fuel-based technologies.

It might be easy to agree in principle that something needs to be done urgently to combat global warming. But how many of us are prepared to give up our luxuries for the same? How many are willing to pay more for goods, travel by cumbersome public transport and say no to buying new products? How many of us will vote for the same and demand government leaders and businesses to do as we say? Governments naturally do not want to disturb people's present lives for some payoff that might happen 50 years down the line.

And even if they do, taking responsibility for emission reduction and deciding the steps to act upon is not easy at an international level.



Infographic 2.1: Causes and Impacts of Climate Change

# Agreeing on Net Zero and Who Will Bear the Responsibility?

Climate change deliberations are extremely difficult as countries experience effects of CC disproportionately, irrespective of their contributions to emissions. A small island nation like Tuvalu might be one of the lowest carbon emitters. However, its own sustainable practices will not stop it from going underwater if large countries, half a planet away, do not reduce their emissions. The futures of such small nations are largely dictated by factors beyond their control.

Similarly, almost all developed countries have brought about their economic growth and development on the backs of copious and unrestricted use of fossil fuels. As a result, they now possess the economic capacity to implement more expensive green technologies. Many developing and poor countries have a low carbon footprint and use fossil fuels due to their affordability. Would it be fair to impose similar regulations on them? Would it be fair to expect them to make the same sacrifices as the developed countries, who have been responsible for most of today's CC impacts? Answering these challenging questions requires a comprehensive approach. Summits such as the Conference of Parties (COP) and United Nations climate change conferences are some of the global meetings that are held to bring representatives of all nations under one roof to discuss and plan the global response to climate change. These discussions take time, which unfortunately is a diminishing resource. It is also not always possible to have all members, especially developing countries, to agree on making rapid changes in their growth plans.

Though numerous efforts (Table 2.1) were put in place to combat CC since the early 1990s, they were insufficient to combat the simultaneous climate crisis. Governments recognise the urgency of the situation but fail to take responsibility for setting and following robust emissions reduction goals. It is crucial to recognise that achieving the goals set by previous treaties, protocols, or panels alone may not be enough. The evolving climate scenario necessitates the formulation of new goals that are better suited to the current challenges we face.

Year	Protocol/Treaty/Panel/Convention	Year	Accidents/Disasters/Events		
1971	Ramsar Convention	1913	California Heat Wave		
1973	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1919- 1990	Libby, Montana Asbestos Disaster		
1979	Bonn Convention	1970	Bhola Cyclone		
1976	Barcelona Convention	1984	Bhopal Gas Tragedy		
1985	Vienna Convention	1986	Chernobyl Disaster		
1989	Basel Convention	2003	Europe Heatwave		
1992	United Nations Framework Convention on Climate Change (UNFCCC)	2004	The Indian Ocean Earthquake and Tsunami		
1992	Rio Convention	2005	Hurricane Katrina		
1992	Convention on Biological Diversity (CBD)	2010	Deepwater Horizon Oil Spill		
1997	Kyoto Protocol	2010	Haiti Earthquake		
1998	Madrid Protocol	2011	Fukushima Disaster		
2001	Stockholm Convention	2011	Global population crosses 7 billion mark		
2007	Bali Action Plan	2019	Amazon Rainforest Wildfires		
2009	Copenhagen Accord	2020	Second-warmest year in last 141 years (combined land & ocean surface)		
2016	Paris Agreement	2021	Hurricane Ida		
2021	COP 26 (Glasgow)	2022	Tonga Volcano		

#### Table 2.1: List of Various International Protocols, Treaties & Panels, and Climate Accidents or Disasters

#### **Conference of the Parties**

The Conference of the Parties (COP) is the supreme governing body of the UNFCCC. It is convened every year. As of 2015, Parties refer to 196 participating countries — their governments and organisations. They represent the Convention and accredited observers. The Parties have signed a formal consent to make decisions for promoting and reviewing the effectual implementation of the aim of the Convention.

COP1 was held in Berlin, Germany, in March 1995. It focused on reviewing the emission inventories of the Parties and coordinating national communications. UNFCCC aims to prevent dangerous anthropogenic interference with the climate system.

A COP can establish ad hoc subsidiary bodies for a limited period and with a specific mandate. These bodies deal with specific issues as they arise. They are generally open for participation by all Parties and observers. Working groups make recommendations to a COP and may provide a platform for negotiations on a particular issue under the Convention.

A COP also sets up expert groups or organises liaison groups, workshops and think tanks. These are established with varied intentions: providing scientific assessments, skill training, capacity-building, or cooperation with other conventions and organisations.

The agreement from the COP26 in Glasgow was to speed up the reduction in the use of coal and fossil fuel and progressively eliminate associated inefficient subsidies. They only came up with weak wording, agreeing to 'phase down' and not 'phase out' coal, due to a last-minute edit by China and India. However at COP27, India lobbied to expand the narrow approach from COP 26, and include phase down of all fossil fuels, and not just coal.

#### Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is a United Nations body that assesses the science of CC. Headquartered in Geneva, Switzerland, it is composed of 195 member countries. In 2007, IPCC shared the Nobel Peace Prize with Al Gore for their massive efforts to communicate knowledge and the necessary measures to counteract CC.

Governments and leading climate scientists internationally accept the IPCC's work. It is not a

research or monitoring body but collates reports by assessing secondary data. These reports cover various aspects of CC, including scientific, technical, and socioeconomic dimensions. Additionally, they recommend ways to mitigate the implications of CC.

The IPCC's Sixth Assessment Report, published in 2021-2022, mentions that greenhouse gas emissions continue to rise and that existing climate action plans fall short of limiting warming to 1.5°C above preindustrial levels. These reports play a crucial role in shaping the decisions and policies of the UNFCCC.

#### Some Things Cannot be Made Net Zero

The production processes of cement and steel indeed contribute significantly to  $CO_2$  emissions, adding to the challenge of global warming. The chemical reactions involved in the manufacturing of cement and the production of steel release  $CO_2$  as a by-product, and currently, there are no widely adopted alternatives to these processes.

Cement and steel play vital roles in modern society, and their demand continues to grow. While efforts can be made to make the energy used in these processes carbon-neutral, the inherent  $CO_2$  emissions from the reactions themselves remain a challenge.

The only way to bring them to net zero would be to use carbon capture technologies or offsets. However, carbon capture technologies are still being perfected. This brings us to the next part: the need for breakthrough technologies.

# Need for Breakthrough Technologies and Alternatives

The COVID-19 pandemic in 2020 brought the entire world crashing to a standstill. Yet, the drop in global carbon emissions during this time was a meagre five per cent. One would have imagined that the forced shutting down of several businesses, industries and transport, which seriously bruised the economy, would have had a more significant impact on slowing down CC. However, the effect was not significant.

As societies and economies recovered and resumed their activities, there was an expectation of emissions rebounding. In the light of CC, it becomes increasingly clear that a comprehensive and multi-faceted approach is required, going beyond merely reducing emissions and implementing more effective policies. It is essential to promote the advancement of innovative technologies and explore alternatives to inherently carbon-intensive or 'red' materials such as cement and steel.

One specific challenge of the renewable energy industry is intermittency. Wind and solar energy are abundant during certain times of the day and at other times they give a weak output. This variability in availability is also present across seasons.

One possibility could be to store the excess energy in batteries, which would then compensate for the energy deficit during lean energy periods. However, batteries that store such high levels of energy for an extended duration are prohibitively expensive and challenging to implement currently. Better alternatives to batteries or innovation in battery designing is needed to solve the intermittency problem.

Achieving carbon neutrality in industries such as fashion, housing, and agriculture demands numerous interventions. However, transitioning to sustainable practices is challenging, even with the invention of new technologies.

#### **Technology Transitions**

In this era where CC and climate action are trendy, companies worldwide are investing in developing green technologies. They are re-evaluating and transforming industrial processes to emit less and consume green energy. Terms like 'Green Hydrogen', 'Electric Vehicles' and 'Sustainable Housing' are

#### **Iniquitous Climate Impacts**

Climate change is a traumatic story unfolding daily, threatening development and well-being, while making ecosystems and communities more vulnerable to severe climate events. Consequences of this devastation are increasingly evident in the iniquitous impacts on the poor, growing risk to food and livelihood security, compromised access to clean energy, water and ecosystem services, and increasing risk of diseases.

Science is continuously warning us that beyond a certain magnitude and at the present rate of climate change, the risk to sustainable development will become irreversible. This demands advancing climate resilient pathways with speed and scale. A lot will depend on the choices we make and the action we take to reduce the risk of disruption and to accelerate transformative solutions at the early stages of growth. This is particularly relevant in developing economies where the community's ability to cope and adapt is weak and limited.

There are opportunities in the new growth paradigm. Integrating adaptation and mitigation strategies in our development pathways can achieve the co-benefits of economic growth, environmental protection and sustainable development. Mainstreaming these indicators in our development pathways is critical to avoid trade-offs between energy guzzling technologies and low-carbon solutions, or the trap of reduced access to energy, compromising community level adaptation strategies.

Despite the growing crisis, there is a silver lining. Opportunities in participatory communitybased natural resource management foster sustainable use of forests and traditional water conservation methods. It also enhances drought resilience and livelihood security. Citizen science is mapping grassroot climate risks, enhancing early warning systems for the community, sustaining local knowledge of appropriate cropping methods, resilient building architecture and material and climate proofing of infrastructure. Green jobs are emerging around the circular use of resources enabling closing the waste loop and distributed and decentralised renewable energy systems.

Despite the insane motorisation in metros, a majority of people still walk, cycle and use public transport. Building infrastructure for them can avert a massive carbon lock in. Most urban lifestyles are still based on adaptive thermal comfort with selective use of active cooling. Designing new buildings with thermal comfort requiring lesser air conditioned hours can prevent energy guzzling.

Climate change risk management is a poignant human story and complex governance challenge. Equity has to be the defining parameter to meet the survival and development needs of all.

Anumita Roy Chowdhury, Centre for Science and Environment (CSE) thrown around in conversations. However, developing new technologies is easier said than done.

Any new technology passes through various stages of experimentation. After millions spent on research and development, the prototype, even though market ready, may still not be suitable for mass consumption as it is costly to produce. It is also quite expensive to sell commercially. The people who buy such products are called 'Early Adopters', who do not mind paying a premium for products, that might come with a few glitches, as they value creativity and the leap in technology. A majority of the world's population is still unable to buy this product or technology. The second transition happens when the technology is refined and made affordable, which takes time.

When industries decide to transition to cleaner fuels, it is not easy on the workers. Take for instance the automobile industry. After decades of manufacturing Internal Combustion Engine (ICE) vehicles, the industry is making a slow shift towards electric vehicles. Transition of workers to newer technologies comes at a cost — both to industry, as well as to the worker. A worker, employed for decades in an industry might not feel confident in making the shift.

Conventional industries and technologies may be fuelinefficient and polluting, yet they provide livelihoods to millions of workers. While there are environmentally friendly options on the horizon, the question arises – what happens to the millions of working-class people whose lives are dependent on these technologies? Reskilling them is always a possibility, but it's not easy for people to start from scratch in a new field after investing years in mastering a specific subject. Will they be able to command similar salaries? These are social and economic issues, which accompany technology transitions in industries.

#### **Constant Challenge**

And of course, finally, there has always been the perennial challenge: human nature. Throughout history, and even in the present, humans have always craved more: a better lifestyle; a personal vehicle; air travel instead of train journeys; better clothes; the latest gadgets; bigger houses; a bathtub instead of a bucket; and an air conditioner instead of a fan. The list of demands never ceases. In fact, it grows longer and longer with each passing day.

In a somewhat philosophical sense, this has been one of the oldest problems faced by humankind and is at the root of many social inequalities. Various schools of thought have emerged to cultivate discipline in the mind against constant desires for excess. Similarly, in the context of combating CC, our ability to temper our desires and overcome our greed will play a significant role in its control.

All said and done, through the advancement of technology, globally, people will get richer and desire better standards of living. It is natural and inevitable. The demand for luxury goods is slated to rise as populations rise, economies boom and the standard of living goes up. Balancing sustainability with this booming demand is another key challenge we face today, and will continue to battle for decades to come.

## **Chapter 3: Effects and Impacts of Climate Change**



Climate change (CC) is now an undeniable reality. The multifarious effects of CC are slowly being documented with sufficient accuracy to enable climate scientists, disaster management experts and planners to design prediction models and establish rescue protocols. However, there continues to be a need to highlight and measure the newer combinations of CC effects that are emerging over time and to monitor changes in the climate, viz. temperature, precipitation, and unusual weather patterns. These CCs have catastrophic impacts on the health, survival, access and fair distribution of resources for urban, rural, and tribal communities. Monitoring thus becomes doubly critical when we throw in the positive and negative impacts of human actions and interventions. These impacts alter the frequency and scale of change. They give rise to newer impacts, which heretofore were not experienced nor recorded in known human history.

What makes this monitoring increasingly complex is that the impacts are often different in different geographies and can increase exponentially when combined with other impacts. While geographic and physical impacts can be tracked with the help of satellites and mechanical devices, the effects of CC on biodiversity, agro-ecologies and ecosystems of the planet are difficult to quantify. In addition, the impact of the same trigger can differ drastically, based on the existing vulnerabilities of biodiversity to diseases, extinction threats and their inherent breeding, feeding and migration behaviours. The problems caused by CC multiply manifold and spread across continents when they exhibit themselves as air, water, and vector-borne diseases or sometimes are zoonotic and transmitted by carrier humans, who have a large travel footprint. Animals, dispersed to unexpected areas because of cyclones, typhoons, and tornadoes, unintentionally spread zoonotic and vector-borne diseases. Animals that migrate intentionally, several times a year, with seasons and local climatic changes, also spread these contagious and infectious diseases.

It would be accurate to say that CC has set off a series of domino effects. Primary and catastrophic impacts of CC on biodiversity, natural landscapes, and ecosystems of the world are being observed. CC has devastated biodiversity stocks around the world. This is unwelcome news not just for all non-human living things, but for humans as well, as biodiversity provides many ecosystem services (Infographic 3.1) that humans cannot hope to recreate artificially. With many living organisms being threatened by rising temperatures, habitat loss, and human infringement, the world would not only lose out a lot economically but be a much poorer place, aesthetically.

In the following subchapters, we will delve into the direct, indirect, reversible and irreversible impacts that CC has on regional biodiversity and vulnerable (rare, endangered, endemic, or near-extinct) species. Nevertheless, before we proceed further, it is imperative to point out that biodiversity and human societies with their economies, industries, and resources are not mutually exclusive. Therefore, to achieve sustainability, it is essential to understand the umbilical link between biodiversity and the well-being of human communities.

Climate change has been a major factor responsible for inclement and unpredictable weather, which all continents have been experiencing in varied measures. There are major changes in worldwide weather patterns, viz. sea currents, wind flow patterns and rainfall patterns. These changes result in climaterelated disasters that take the form of cloudbursts landslides, floods, cyclones, droughts, snowstorms, wildfires and much more. Climate disasters when combined with COVID-like pandemics cause massive economic and ecological upheavals. Such catastrophes end up crippling entire cities causing immeasurable financial losses that lead to migration, marginalisation, and resource disparities, which catapult into increased warfare, political intimidation, and subjugation of poorer economies. These cumulative impacts on biodiversity, the economy, the climate and the increasing frequency of natural disasters may seem too large for any single person to do anything about. However, the collective actions of billions can mitigate and hopefully reverse these trends of climate change. This chapter aims to look at the big picture, understand the interconnections of climate impacts and actions, and provide climate actioneers with simple tips and tools to do their bit in making the world a more habitable place for generations of human beings and all other living things.

#### This chapter covers the following Sustainable Development Goals



#### 3.1 Biodiversity Conservation in a Changing Climate Scenario

Biodiversity is the bedrock of ecosystem functions. Claudine Schneider, United States (US) Representative, in her book, 'The Green Lifestyle Handbook', stated, "A healthy ecology is the basis for a healthy economy."

If we were expected to pay for the ecosystem services that Nature provides us, currently free, we would owe it to the tune of several billions of dollars. A few examples to elucidate the fact would be - bats function as the world's largest pest controllers and protect our farmers from locust raids; bees and butterflies pollinate flowers and provide fruits on our plates; bullfrogs and guppy fish are voracious feeders of mosquito larvae and are used extensively to reduce incidences of dengue and malaria, preventing widespread death and massive economic losses; many species of snakes feed on mice and rats, averting the destruction of nearly 30 per cent of crops, and thus

end up increasing economic stability in the agricultural sector. Such a list of ecosystem services can be endless. Infographic 3.1 explains how the structure and function of ecosystems and the services it provides results in the creation of exploitable resources and liveable conditions on this planet

Given these immense virtues of biodiversity, protecting it from going locally or globally extinct is important, especially as it plays a key role in achieving climate sustainability. Another important fact to be established at the outset is that the survival and well-being of biodiversity and human societies are deeply interlinked. Thus, if communities safeguard biodiversity from



the adverse effects of CC, and engage in its proper management, the physical process of ecosystems can help mitigate and easily reverse the impacts of CC.

But before we delve into details, let us first understand:

#### What is Biodiversity?

Simply put, biodiversity is the immense variation (genes, species, and ecosystems) of living things on Earth in any region at a given point in time.

What types of biodiversity exist?

**Genetic diversity:** These are the different genes contained in all plants, animals, fungi, and microorganisms. Genetic diversity is observed within as well as between the species in an ecosystem. It describes how closely related the individuals in a single species are. e.g. Alphonso, *Totapuri, Raspuri, Himsagar, Langda, Chausa,* etc. are all genetic variants of mango (*Mangifera indica*).

**Species diversity:** It represents the differences within the same species and between two or more species in an ecosystem. In other words, species diversity is the variety and richness of life in a habitat or ecosystem, e.g. Genus Panthera has many species, viz. tiger (*Panthera tigris*), lion (*P. leo*), leopard (*P. pardus*), and jaguar (*P. onca*).

**Ecosystem diversity:** Ecological diversity addresses the combined characteristics of biotic properties (habitats, biological

communities, and ecological processes) and abiotic properties (geodiversity) while considering its overall impact on human existence and the environment. E.g. freshwater lakes, estuaries, lagoons, coral reefs, mangroves, terai grasslands, coastlines, and riverine habitats, represent the diversity in aquatic ecosystems.

**Functional diversity:** Functional diversity deals with ecological niches, and the behaviour of species to get food and use available natural resources. Thus, it deals with aspects such as ecosystem dynamics, stability, and nutrient availability, e.g. vultures have thick beaks to crack bones and featherless heads to reach deep into the animal carcass, whereas hawks and eagles have sharp, hooked beaks to tear flesh and featherless legs and claws to pick up live prey.

Understanding and documenting biodiversity helps in the conservation or restoration of damaged natural ecosystems. Once repaired, ecosystem services and physical attributes of the ecosystems will help bridge the gaps and help in CC mitigation. This climate restoration by biodiversity is worth trillions of dollars, rupees, or dinars (pick a currency of your choice) and it can easily fuel the economies of many small and powerful nations.





#### Value of Biodiversity

Biodiversity has direct, indirect, and many other potential (supporting) benefits for humanity. It plays a vital role in regulating the bio-geo-chemical cycles and climate. Alongside the many economic benefits, the provisioning of ecosystem services and the aesthetics of biodiversity are intrinsically valuable. They contribute sizably to human well-being and cultural experiences.

The Gaia Hypothesis postulated by James Lovelock in 1972, suggests that living organisms or biotic components interact with their non-living or inorganic or abiotic environment to form a synergistic and self-regulating system (ecosystem functions), that, in effect, maintains the climate and biochemical conditions on our planet, and makes life possible on Earth. Thus, the Gaia Hypothesis states, "Diversity of life itself supports more diversity", e.g. plants provide the habitat and nutrients for other plants, animals, fungi, and microbes, and vice versa. Humans depend on biodiversity for harvestable resources to fulfil their basic needs (food, shelter, clothes, fuel, health and housing). Biodiversity not only provides pharmaceutically important compounds but also provides models (animals) for research, dealing with drug discovery, human health, and longevity.





Life on Earth has been evolving over the past 3.7 billion years, adapting to ever-changing conditions, just like an R&D laboratory. This knowledge is valuable in stimulating technological innovation (biomimetics), thus acting as a key contributor to CC mitigation and adaptation. Biodiversity is also a major provider of livelihoods. Over 200-350 million (≈20 per cent) people in India are entirely or partially dependent on forests and coastal ecosystems for their survival and livelihoods. Nature, biodiversity, and ecotourism, together, have emerged as important contributors to economic development. Although putting an absolute value on biodiversity is difficult, one can look at the economic contribution that it has made. The Convention on Biological Diversity (CBD) estimated the economic potential of biodiversity in the pharmaceutical sector to be about 640 billion US dollars (≈47,318 billion Indian rupees), while it estimated 1,250 million US dollars (≈92,417 Indian rupees)/hectare/year from coral reefs. Other tangible and intangible benefits of biodiversity include carbon sequestration, temperature regulation, formation of clouds and soil, aesthetics, mental peace and most importantly, habitat for an estimated 8.7 million species of plants, animals, and fungi.

#### **Co-operation is Conservation**

Everybody, who has a connection with biodiversity, is a stakeholder. Thus, it is everyone's responsibility to take action to conserve biodiversity. If you look at the CC angle, agricultural, pastoral and communities closely associated with forests or who permanently or temporarily live inside forests are the major stakeholders.

Very often, by declaring so many no-go zones (national parks/sanctuaries) and by taking a preservationist attitude towards wildlife protection, instead of an inclusive, conservation approach, we are alienating and displacing indigenous people, who are co-dependent on this biodiversity. We can preserve biodiversity components and have sustainable use, via good management practices, such as by establishing biosphere and community reserves.

Farida Tampal, State Director, WWF-India, Telangana

#### **Biodiversity as Carbon Sinks**

Contrary to common belief, grasses are better at fixing carbon than large trees. Trees sequester much of the carbon within their leaves and woody biomass, while grass stores most of its carbon underground. With the increased frequency of forest fires due to rising temperatures and drought, trees function as a carbon source, releasing tonnes of carbon instead of locking it up. On the other hand, when a fire burns through grasslands, the carbon fixed underground tends to stay in the roots and soil.

Oceans – especially phytoplankton – do not get enough credit for being the world's largest carbon sinks. Oceans sequester around 30 to 50 per cent of anthropogenic  $CO_2$  emissions, whereas forests absorb only 20 per cent.

#### Vulnerability of Biodiversity to the Impacts of Climate Change

Earth has experienced five great mass extinctions spread over millions of years, because of long-term changes in the concentrations of atmospheric  $CO_2$ , temperature, and/or precipitation. The current magnitude and rates of species extinction, far exceed those rates. Thus, the problem is not only the extinction of species, but the increased rate of extinction because of anthropogenic pressures.

Climate change is the dominant, direct driver of biodiversity loss. It causes distributional changes (migration), increased extinction rates, changes in reproductive cycles, changes in growth patterns, and changes in seasons. Many species that exist are unknown to science (approx. 8.7 million), so no discussion can happen about their extinction. The extinction of these unidentified species leads to the disruption of ecological linkages. These linkages are crucial for sustaining ecological food chains and maintaining the balance of energy pyramids. Breaking these bonds could destroy potential, future value to humans as sources of undiscovered medicines or food.

Rediscovering species that were considered extinct gives a glimmer of hope. However, many newly discovered species are probably on the verge of extinction. Endemic (range-specific) species have adapted to extremely narrow climatic conditions. Any minor or major changes in their microhabitat, like fragmentation or habitat destruction, for development projects, can mean losing these species forever.

#### **Importance of Citizen Scientists**

The Earth has a staggering amount of biodiversity, with 1.2 million distinct, already-described, species. Additionally, new species are being discovered all the time. The total biodiversity of the planet is estimated to be 8.7 million species.

Anthropogenic activities and lack of awareness are causing the extinction of many species that are vital in maintaining a balance in ecosystems. If a species is wiped out, humans will feel its ripple effect many years down the line.

Numbers of the charismatic Bengal Tiger have dwindled to about 3,000, a mere three per cent of the original 100,000 tigers. However, conservation efforts have boosted their population. But what about the lesserknown, non-charismatic species, say butterflies and dragonflies? Without data, it becomes difficult to understand threats and formulate conservation strategies.

Scientists use many ways to gather biodiversity data, viz. photos, camera traps, sound recordings, sketches, and field notes, and create a database. However, they can do only so much, given their physical limitations, and the paucity of finances to support such research. Thus, the need of the hour is more people collecting data or 'Citizen Science'. Citizen scientists can be students, wildlife enthusiasts, or anyone with a diary, smartphone or recording device, and interested in collecting data. They can record and upload their findings on several online portals such as inaturalist.org, bioatlasindia. org, indiabiodiversity.org, and many more. The ideal method of documentation follows the Primary Biodiversity Record model: What species, when, where and who recorded it? It is common for diligent citizen scientists to record rare species outside their habitats, discover new species, and find invasive species in an ecosystem. Additionally, this data can also be used in People's Biodiversity Registers (PBR) and for environmental impact assessment (EIA) considerations, and will be of great help to conservation and climate science.

#### Dr. Vijay Barve, Researcher in Biodiversity Informatics and Citizen Science

#### Documentation for Conserving Biodiversity

It is impossible to conserve things that we are unaware of. Hence, documentation plays an important role in conserving biodiversity. Biologists and conservationists research to understand biodiversity and the impacts of CC on them. Nevertheless, anyone can document and help in conservation, especially, urban biodiversity.

SPROUTS Environment Trust launched a citizen science initiative, Urban Biodiversity Project (UBP), on Facebook and Instagram in 2017. The posts use crowd-sourced data to highlight individual species inhabiting the concrete jungle. The postcard-like format of the UBP images gives information on the location and date of sighting, photo-credits, name of the creature and brief information. The project aims to encourage 'Citizen Scientists' to observe their surroundings and emphasise the fact that biodiversity is found in urban areas too.

#### **Policies and Biodiversity**

India has robust constitutional provisions, laws, and policies to further environmental conservation and sustainable use of natural resources. The Wildlife (Protection) Act, 1972, in theory, provides legal security and protection to scheduled plant and animal species. The 2002 Amendment strengthened the Act and imposed stringent punishments and penalties for offences. One of the most significant legislative steps has been the setting up of the National Green Tribunal (NGT), a dedicated and statutory court that deals with civil cases related to the environment, including biodiversity. In 2013, the Supreme Court of India also replaced the 'Forest Bench' with a 'Green Bench' to deal with environmental issues. On December 16, 2021, amendments were proposed to the Biological Diversity Act of 2002 by introducing the Biological Diversity (Amendment) Bill, 2021. Among other things, it imposed an 'Access and Benefits Sharing' fee for companies to use biological resources. Such policies and their diligent execution pave the way for biodiversity conservation. However, sustainable development choices can only be made by interlinking economic and ecological indicators.

There have been two new amendments – the Forest (Conservation) Amendment Bill, 2023 and the Biological Diversity (Amendment) Bill, 2023. These have been met with dismay from conservationists and citizens alike as they dilute the provisions of the

Green Roofs was an incentive-based programme funded from five per cent of the collections from energy bills of all the customers, and implemented in the Canton (District) of Basel-Stadt, Switzerland. It was a mitigation measure to save energy, reduce emissions, delay run-off, absorb rainwater, reduce flood risk, increase biodiversity (provide habitat for urban wildlife and as 'stepping stones' for migratory species), as an adaptive measure to lower indoor temperatures (by as much as 5°C), induce higher social benefits and create an aesthetically pleasing urban landscape.



Basel's Green Roofs (Credits: Danist Soh/unsplash.com)

original bills and open up India's flora and fauna to unprecedented commercial exploitaion.

Participation by citizens and effectively raising public opinion about these changes will be critical for longterm sustainability and security of our biodiversity.

#### Lost & Found or Lost Forever!

Four endemic species of epilithic plants, *Didymocarpusa denocarpus, D. lineicapsa, D. parryorum* and *D. wengeri*, were rediscovered in Mizoram, India, after 86-90 years.

The Bramble Cay Melomys (*Melomys rubicola*), the first mammal reported to have gone extinct as a direct result of CC (sea level rise), was endemic to the island of Bramble Cay in the Great Barrier Reef, Australia.
# **10 Climate Actions for Biodiversity Conservation**

- 1. Create urban food gardens, sow local plants and create habitats for urban biodiversity.
- 2. Collect seeds and form a seed bank, to create a local plant nursery for plantation drives.
- 3. Celebrate special days (birthdays, birth/wedding/death anniversaries, graduation, and environment days) by creating and nurturing a Sacred Grove and planting native, endemic or endangered species of trees, shrubs, herbs, climbers, grasses, orchids, ferns, etc.
- 4. Start rewilding and eco-restoration projects in private estates or community lands.
- 5. Make conscious choices and refuse wildlife products or any activities that cause habitat loss.
- 6. Organise lake, forest, beach and river clean-up drives with your friends or office colleagues.
- 7. Visit Protected Areas and opt for eco-tours and Nature trails over traditional luxury tourism.
- 8. Take part in citizen science documentation of urban biodiversity and create biodiversity registers of rural and tribal regions; also contribute to crowd-sourced wildlife databases.
- 9. Organise Nature and biodiversity festivals to educate people from all socio-economic strata.
- 10. Canvass your governments to declare new marine parks, national parks, wildlife sanctuaries, and community and biosphere reserves; create biodiversity parks and urban conservation centres.

This subchapter has covered the following Sustainable Development Goals



# **3.2 Changing Climate and Unpredictable Weather Patterns**



Adaptability is considered a major virtue in the sustainability discourse, be it in the corporate sector or among communities. However, Micro, Small and Medium Enterprises (MSMEs) and marginalised communities with limited resources find it difficult to adapt to drastic changes of climate or weather. It affects their livelihoods, and in extreme cases, even their chances of survival. One of the most visible effects of CC is the rising global average temperature, which results in widespread deviation in long-term weather patterns. Studies indicate an increase in the frequency and intensity of heat waves and large storms around the world. Similarly, global land-ocean temperatures have also changed significantly (Graph 3.2.1). Let us understand the causes, effects, and impacts of these extreme and sudden climate and weather changes on communities, economies, and ecological systems while looking at ameliorative measures.

Cyclones, torrential rains, droughts, ice storms and heat waves – are all examples of changing weather, which have a ruinous effect on urban transportation, energy infrastructure, healthcare systems and food supply chains. Extreme weather catastrophes have many contributing factors – including natural climate variabilities, such as El Niño and La Niña - which makes it difficult to attribute any particular extreme event only to humaninduced CC. The impacts of weather catastrophes continue long after the weather event has abated. They leave behind massive devastation, poverty, longterm health effects, and death, and trigger further cycles of deforestation, migration, and social disparities. Typically, colder regions are experiencing higher temperatures, while warmer regions are getting colder; wet areas are faced with droughts due to infrequent rains, while



Graph 3.2.1: Changes in the global land-ocean temperature with LOWESS curve

drier areas face heavy flooding, due to unexpectedly heavy rains. Climate accidents are also likely to disrupt the water cycle as warming global temperatures hike up the global rate of evaporation, which leads to higher precipitation (snow, rain, sleet, hailstorms, fogs, and cloudbursts), than average.

Increased temperatures (Graph 3.2.1) also boost the drying of organic matter, leading to more frequent wildfires. Normally, wildfires would help rejuvenate the ecosystem, by producing ash, which is rich in nitrogen and induces a flush of vegetation. However, the increased frequency of fires leaves minimal to no time for the ecosystem to revive. India, due to its higher average humidity and lack of oil-producing plants (such as Eucalyptus, in Australia), does not experience naturally occurring wildfires. Instead, the fires here are a result of anthropogenic factors, such as *jhum* (slash-and-burn) agriculture, crop residue burning, unattended campfires, irresponsible discarding of cigarettes/bidis and burning of leaves and garbage by villagers, urban people, or travellers. The most sensitive landscapes, viz. grasslands and deciduous forests have become susceptible to repeated humaninduced wildfires and it is a common occurrence in the Western Ghats and Western Himalavas, to see entire chains of hills and mountains burning. They add massive quantities of CO<sub>2</sub> to the atmosphere, cause local extinction of species and disturb local grazing patterns, and thus impact the climate resilience of the ecosystem.

Cities experience a phenomenon called the heat island effect, a multi-fold rise in absorbing and re-emitting the sun's heat by roads, buildings, and pavements. Thus making cities vulnerable to adversities of extreme heat.

#### **Changing Conditions of Seas**

Due to its geographical location, the Bay of Bengal in general, and Odisha specifically, has historically been prone to a much higher frequency of cyclones, in comparison with the Arabian Sea. However, in the last decade, multiple cyclones have annually ravaged the Arabian Sea. We are observing an increased frequency of low-pressure zones forming in the northwest, west and central parts of the Bay of Bengal (Odisha) and the Andaman Sea. With increasing unpredictability of coastal climate, providing reliable weather predictions for maritime activities along the 7,500 km long Indian coastline is becoming a challenge. These frequent and violent cyclones are a direct impact caused by global warming and CC. The changing temperatures and wave formations of the seas are a major cause of concern for fishing communities and the coast guard, too.

Dr. Anup Kumar Das, Meteorologist-A, Indian Meteorological Department

### After-Effects

Some of the recurring catastrophic after-effects of CC have been food and water shortages, the spread of contagious diseases and breakout of pandemics, disputes over resources, destruction of property, and a slew of climate refugees.

In the case of biodiversity, some species have a higher sensitivity to change, and climate extremes pose the risk of losing such specialist, endemic, and narrow-range species. Changes in the elevational and geographical distribution of species have been observed; species of lower altitudes have started to spread to higher altitudes, pushing the narrow-range species of the higher altitudes into a much smaller area. Some fish species prefer warmer currents to breed, and thus their distributions have shifted towards the equator, where they get warmer waters throughout the year. Such shifts in distribution cramp the native species in smaller areas and increase competition for resources, in turn affecting the richness of that region. Usually, exotic invasive species are adept at taking advantage of such extreme conditions and thrive, displacing the sensitive native species. The same impact is felt by indigenous crop varieties, which have evolved over centuries, in a very narrow range of temperature, rainfall and humidity. To overcome crop losses, infertile hybrids, and genetically modified organisms (GMOs) are pushed into the system. This creates a debt trap among farmers, who are dependent on loans from multinationals, for seeds, fertilisers, and pesticides.

# **Climate Resilience with Ice Stupas**

Climate change aggravates resource scarcity and Natural Resource Management (NRM) helps mitigate its effects. Wasting available resources will add to the severity of the climate crisis. Design thinking is the way ahead to bring in solutions that are simple and yet resourceful.

Ladakh is a cold desert in the trans-Himalayan region of India. With an annual rainfall of less than 50 mm, agriculture here is solely dependent on snow and glacial melt waters. CC has shifted the timing and quantum of precipitation, besides the volume of water provided by glacial melt. The region is also experiencing warmer summers, resulting in higher evapo-transpiration and acute water scarcity during the spring season. This affects cropping patterns and increases the migratory behaviour of locals, who are opting to either move higher to graze their livestock or quit farming and shift to other localities, resulting in the economic downfall of the region.

Replicating the freezing behaviour of local glacial streams, Sonam Wangchuk of the Students' Educational and Cultural Movement of Ladakh (SECMOL) conceived the idea of an 'Ice Stupa'. Ice stupas are artificial conical glaciers created by spraying, freezing, and thus storing the winter water in the form of an ice tower (stupa) that otherwise would have been wasted due to early melting and run-offs. With minimal and naturally available resources, ice stupas are irrigating all the cultivable land of the region, harnessing the wind, hydro and solar power potential of the Ladakh region, with no additional energy sources. By creating around 25 stupas in 2020, they facilitated the storage of glacial water. Farmers could use this water for cultivation during the following springsummer season, thus restoring their economy, and causing no harm to the local ecosystems.



Ice Stupa (Credits: Anand Pendharkar)

Thus, weather extremes not only adversely affect natural capital, but also damage crumbling public infrastructure, offshore energy platforms, public and environmental health, and agricultural assets, cause large-scale loss of life, increase the vulnerability of individuals and communities, and decrease economic well-being in the affected regions. Frequent weather and climate assaults exacerbate the existing socioeconomic inequities, further endangering marginalised communities (women, children, differently-abled, old and LGBTQIA+people) who already have the highest exposure to hazards, with minimal access to restorative resources.

### India's Global Commitments

A third of the 1.4 billion humans and 536 million livestock dwelling adjacent to India's coastline and 2,000 km of Himalayan ranges, and over 35 per cent of humans living in urban regions, are already facing the devastating effects of CC. The prevalent heat waves, heavy precipitation (rain, snow, and hail) events, with decreasing total precipitation, rising sea levels, frequent cyclones and the recent COVID-19 pandemic, have cumulatively caused an economic loss of over 87 billion US dollars ( $\approx$ 6,227 billion Indian rupees), in 2020 alone. To mitigate these impacts, serious financial and technological inputs will be necessary, including cutbacks on redundant or polluting technologies and encouragement of indigenous innovations.

Although not consistent with India's target for the Paris Agreement, India's climate commitment for 2030 represents a fair share of the global effort. The Climate Action Tracker rates India's Intended Nationally Determined Contribution (NDC) as '2°C compatible'. To achieve the commitment to net-zero emissions by 2070, India needs to severely cut back on coal and invest in non-polluting, renewable and non-finite energy resources such as micro-wind, geothermal, and tidal, and improve its biomass and solar energy commitments. Major investments in affordable masstransit systems and a regulation on our total human and livestock population are imperative. Additionally, increasing the total forest cover area of the country, which acts as a carbon sink, would be another significant means for India to walk the talk on the climate crisis.

# **12 Climate Actions for Equable and Stable Weather Conditions**

- 1. Reduce your greenhouse gas emissions and regional temperatures by installing solar-operated machines such as fountains, micro windmills, exhaust fans, energy-saving Light-emitting diode (LED) tubes and bulbs.
- 2. Map the heat island effect in your city or colony; create biodiversity parks and terrace gardens; restore avenue trees, mangrove forests in creeks and riverine grasslands, for resilient cities.
- 3. Employ design thinking to change the temperature in your house by adding small ventilators and windows (such as in Hawa Mahal, Jaipur) and covering roofs and balconies with climbers of food plants.
- 4. Practise rainwater harvesting; create multiple water fountains, cascades, and water bodies, to function as carbon sinks and temperature regulators, besides providing an aesthetic appeal.
- 5. Clean up coasts, oceans, lakes, forest streams, and other natural landscapes, and safeguard them from oil spills, volatile organic compounds (VOCs), petrochemical wastes, and surfactants, which damage their carbon absorption capacity.
- 6. Create a society, school and office policy document, which prevents burning of leaves or garbage and discourages creation of water-thirsty lawns or exotic plant landscapes, which are susceptible to wildfires.
- 7. Set up bird/animal drinking water baths, to help them cope with extreme weather.
- 8. Set up a micro-weather station and an information board with hydro-meteorological data for accurate forecasting and conduct regular training of citizens and staff for increased disaster preparedness.
- 9. Segregate wastes, reuse and recycle old items to significantly reduce your carbon footprint.
- 10. Place multilingual and multimodal books about CC in the nearest free community library.
- 11. Organise awareness programmes on how sea level rise will affect coastal communities.
- 12. Invest in better weather monitoring and information dissemination mechanisms.

# This subchapter has covered the following Sustainable Development Goals



# 3.3 Disasters Galore

With an increase in global surface temperature (Graph 3.2.1) and the resulting impact on regional climate, it is a near certainty that the frequency and intensity of calamities will vary stochastically and exponentially. Studies show that even with the strictest global emission standards, there will be a sea level rise from 0.4 to 1.0 m by the end of the century, endangering coastal areas and destabilising coastal economies. The most vulnerable and affected by these disasters would be the 2.4 billion, or nearly one-third, of the world's communities, largely from the coastal and mountainous regions. Every year, disasters such as



floods force people to migrate from their ancestral lands to urban or refugee centres, seeking financial, health, and political refuge. Governments and people are coping with this new reality by investing in early warning systems and improving housing and shelter for the displaced.

Let us understand what these disasters are, how bad they can be and what we can do about them.

# **All About Disasters**

Cyclones, typhoons and hurricanes: Although cyclones, typhoons and hurricanes are all large, swirling storms originating over warm ocean waters, their names differ depending on their place of formation. Hurricanes are formed over the North Atlantic and Northeast Pacific oceans, cyclones over the South Pacific and the Indian oceans, and typhoons over the Northwest Pacific Ocean. The rise in the ocean's surface temperature has increased the risk and frequency of storms. These storms create huge waves and dump exceptionally enormous quantities of water on reaching land, thus flooding large areas. They are also accompanied by exceedingly high wind speeds, which can cause extensive damage to property, infrastructure, and life, leaving behind devastation that can take weeks if not months for people to recover from. The gale-speed winds can cause short circuits leading to fires, electrocution, and blackouts, which lead to lawlessness and increased criminal activities. Damage to life-support systems such as transportation, electricity, healthcare, water supply, agriculture, and basic supply chains essential for normal functioning of civil societies compound the financial and social impacts of such disasters. When such disasters ravage urban centres, they affect big

# Human-induced Disastrous Development

If you think about it, all the 'so-called' natural disasters are mostly human-induced. Although natural in origin, these events turn into socioeconomic disasters, with heavy loss of life and property, due to lack of proper planning. It is not that our governance models are incapable of managing large-scale disasters, but they fail due to a lack of planning, resource commitment, red tape, and poor implementation of disaster management policies. We only provide minor, first-aid level support. Usually after the event has struck and left behind in its wake, largescale devastation. For example, in Mumbai itself, we know how the development of the Bandra-Kurla Complex on the plains of the Mithi River contributed to repeated flooding of the entire city. It pinched off the flow of the river to the sea and now we know what happens every time there are heavy rains along with incoming high tides. Thus, we need to think through the current impacts of past actions, and build-in safeguards for future extreme occurrences, while planning urban projects and related infrastructure.

Anil Hebbar, Chief Functionary, Helping Hands Charitable Trust, Mumbai businesses and bring down the Gross Domestic Product (GDP), resulting in economic instability.

Earthquakes: Earthquakes are usually related to the movements of tectonic plates. However, the reduced atmospheric pressure that causes devastating storms is also known to destabilise earthquake faults, resulting in their easy movement and release of the accumulated strain. Earthquakes can also be triggered by the weight of infrastructure, mega-dams, deep oceanic drilling, and nuclear testing, whose risks are especially higher in earthquake-prone regions. Earthquakes, however minor, can also trigger or escalate disasters such as volcanoes and tsunamis.

**Downpours and floods:** With the worrisome rise in sea levels and extreme weather, resulting from global warming, floodplains are predicted to grow by approximately 45 per cent by the end of the century. Heavy rains increase landslides and agricultural run-off, in turn increasing the pollutant and silt load in water bodies. This reduces the water-holding capacity of mega-dams and increases pressure on them, with the risk of failure or forced release of water in case of heavy downpours. This leads to floods downstream, and damage to

power lines, road, and rail infrastructure. Individual losses and forced migration are some of the common outcomes of such cataclysmic disasters.

**Droughts and famines:** Droughts and famines go together in regions with mainly non-irrigated agriculture. Poor precipitation results in poor harvests and little to no food and water for livestock. However, famines are largely considered human-made disasters. Higher temperatures lead to increased evaporation from water bodies, causing heavier downpours and floods in some regions and little to no rainfall in other areas, causing repetitive droughts. Long-duration droughts lead to the death of plants and crops, and severe wind erosion, causing exposed and reduced topsoil, making it infertile and leading to famines. These droughts increase the dependency of poor



**Graph 3.3.1:** Comparison of deaths caused across continents over the past 15 years due to climate disasters

communities on wild vegetation for food, medicines, fodder for livestock and fuelwood, leading to largescale deforestation. This futher exacerbates the loss of soil moisture, causing cyclic, longer, and more widespread droughts.

**Forest fires:** Most forest fires are caused by anthropogenic activities, such as accidental fires caused by graziers, crop residue burning intentional fires to induce growth of grasses and ash formation for enhancing soil nitrogen and extraction of Non-timber Forest Produce (NTFP) such as *Sal, Mahua* and *Tendu* leaves, and fruits. However, in a few places such as Australia, California and Indonesia, forest fires are experienced due to natural phenomena such as lightning strikes or friction in forests, grasslands or prairies having exceptionally low humidity and

volatile oils in their leaves. The frequency of forest fires is rising globally with increasing global warming which drastically reduces atmospheric humidity. The likelihood of extreme and catastrophic forest fires is estimated to increase by 52 per cent by 2100. Forest fires are the biggest cause of increased atmospheric  $CO_2$  and the prime destroyer of biodiversity, as they decimate seeds, eggs, and young animals, leading to local extinction of low-population species. The economic and ecological losses, and implications of forest fires on human health and infrastructure, are poorly documented.

# **Disaster Management**

The key steps in disaster risk reduction are preparedness, mitigation, and prevention. It is important to anticipate, forecast or warn against future disasters, to take preventive action and allow communities to respond to hazards with an educated approach. Setting up contingency plans and early warning systems, along with disaster-resistant infrastructure, resilience training and sensitisation sessions, helps minimise the impact of potential disasters. Design-thinking leading to disaster prevention in urban and rural areas is the goal.

Multiple-layered climate and disaster-resilience management systems need to be adopted to protect lives and livelihoods in case of disasters. Such disaster management systems need to be integrated into sectoral, community and policy-level interventions. Communication, co-ordination, monitoring and evaluation, and regional co-operation, are the key elements of such management systems.

# Overcoming Drought: The Djibouti Way

Djibouti, a country in East Africa, is located along the Gulf of Aden and at the southern entrance to the Red Sea. It is highly arid with nearly 90 per cent of the country being classified as desert, nine per cent considered as pasture and only about one per cent as forest. It faces extreme water scarcity because of only 150 mm of average annual rainfall and no perennial freshwater source, additionally exacerbated by population growth and CC. The increased risk of drought is prevalent but long-term projections are unable to provide clear trends, specific to an entire region or individual country. To reinforce the capacities of populations to face and adapt to recurring droughts, a community approach was developed after participative analysis of the risks. This involved identifying the capacities and vulnerabilities of the target communities.

Emphasis was also laid on understanding the history of calamities and the existing coping and adaptation strategies. Based on this, new plans were devised to overcome the limits of these strategies, and stakeholders were identified to bring in varied skill sets. Future strategies included effective water and agro-pastoral resource management, to be adopted and reinforced over short, medium, and long-term periods to build resilience from climate shocks.

In association with the Global Facility for Disaster Reduction and Recovery (GFDRR), the following strategies were successfully implemented to stem the recurrent drought and flooding threats plaguing Djibouti and its citizens:

- 1. Installation of new hydro-meteorological stations around the country for better early warning and weather monitoring.
- 2. Investment of 3 million US dollars (≈140 million Indian rupees) in a water project to better manage rural resources.
- 3. Investment of 5.2 million US dollars (≈242 million Indian rupees) in power access and energy diversification projects as a backup during times of disaster.
- 4. Conducting seismic and flood vulnerability assessments.
- 5. Improving existing emergency preparedness.
- 6. Djibouti refugees to monitor and protect water provisions.



Conditions in Djibouti (Credits: EU Civil Protection and Humanitarian Aid/Flickr/CC BY-NC-ND 2.0)

Local populations and communities have resilience strategies such as NRM, income diversification and infrastructure development (check-dams, wells, roads, markets, slaughterhouses, storage spaces), which can be replicated and implemented with value-added features during the post-disaster recovery phases. Research and use of regional and tribal languages are essential for proper understanding and effective implementation of these traditional resilience practices. There should be special provisions and attention to planning communication and outreach strategies. The facilities for climate and disaster resilience should take into account differently-abled (blind, deaf, wheelchair bound, ageing, underage, or illiterate) and geographically isolated persons. These persons may not be able to access standard public service announcements via radio, television, social or print media, due to poor infrastructure (no electricity or internet connectivity) or media illiteracy.

### India's Climate Response

Region-specific solutions are needed for a country like India with such a huge diversity in bio-geophysical, socio-economic, and political composition. Thus, to accommodate this demographic diversity and strive for social and economic justice, the Indian Constitution put forth the Directive Principles of State Policy (DPSP) in 1948, and later, multiple amendments were made to improve these directives. Additionally, with the increasing global climate crisis, it is important to formulate responses that are inclusive of all stakeholders, especially marginalised and vulnerable communities. The key issues confronted by the flagship programmes of the Government of India include ensuring equity and environmentally sustainable growth, fostering faster creation of jobs, and addressing environmental stressors.

Though a long way to go, adopting a National Action Plan on Climate Change (NAPCC) in 2008 has improved many development indicators in India. The other key document articulated is the 'Intended Nationally Determined Contribution (INDC)' submitted to the UNFCCC by India. As a developing country, India's main aim is to reduce emissions to combat CC by achieving a decline in its energy (carbon) intensity by 33-35 per cent (compared to 2005) by 2030. India will be hailed as a global leader, if it manages to empower its 1.4 billion citizens to mitigate the challenges of CC and energy security. This can be achieved by promoting outreach about resilience, entrepreneurship, and indigenous innovations in sustainable technologies. From a disaster management perspective, early-age and rural training to respond to early warning systems, will go a long way in preventing socio-economically paralysing accidents.

# **12 Climate Actions for Climate Disaster-Resilience**

- 1. Train communities in climate resilience skills, e.g. swimming, boating, and first-aid.
- 2. Strict enforcement of Coastal Regulation Zone (CRZ) laws.
- 3. Urban planners to adopt measures for climate-resilient cities, towns, and villages.
- 4. Invest in climate-resilient and eco-restoration projects that can withstand or protect citizens against natural disasters, e.g. mangrove, grassland, forest and/or coral restoration.
- 5. Strict implementation of existing environmental laws and formulation of amendments or new laws for building and construction, while considering the current climate scenarios.
- 6. Make disaster management plans to include all socio-economic, gender and disability groups.
- 7. As local and regional conflicts are exacerbated during disasters, leading to migration, conflict-sensitivity programme development is crucial.
- 8. Design public infrastructure and housing with built-in disaster warning systems. Train disabled persons to understand these warnings and act on them in case of disasters.
- 9. Have a personal and public financial plan (social security) in place for climate emergencies.
- 10. Invest in R&D for region-specific solutions to predict disasters and reduce their negative impacts.
- 11. Establish multiple regional and state-level early warning and disaster management cells.
- 12. Train people in flood rescue, arrange for inflatable boats and create a Climate Awareness App.

# This subchapter has covered the following Sustainable Development Goals



# **3.4 Economic Implications of Climate Change**

change (CC) affects Climate everything from geopolitics to socio-economics. Fluctuations in the health of our environment diminish the quantity and quality of available natural resources, affecting economic growth, social well-being and mental and physical health. Recurrent climate accidents, poor disaster planning at the governmental level and meager investments in disaster management have a powerful impact on the standard of living, quality of life and economic stability of a country. These challenges expose people to socio-political pressures and further widen the chasm of vulnerability among marginalised communities. Climate disasters lead to economic



losses, due to dwindling resources and health crises (such as the COVID-19 pandemic). These leave countless people disenfranchised. Without the means to earn a livelihood, they are forced into migration, suboptimal living, and even exposed to human trafficking. This results in a lowering of all the Human Development Index (HDI) indicators, and further economic despondency among affected citizens.

The economic strength of a nation is closely tied to the stability of its natural ecosystems, the well-being of communities reliant on them, the agroforestry sector, and the manufacturing industries dependent on these resources. For a stable economy and climateresilient society, large-scale and long-term changes in climate-related governance and economic planning would be necessary.

# **Financial Impacts of Climate Change**

Climatic factors affect economic output, investment, and productivity. Thus, it is necessary to understand the consequences that CC has on global economies, to better model and forecast macro-economic variables. There are many negative economic spillovers of CC, viz. pollution, migration, wars, famines, deaths, global debt, technological subjugation, and economic crash-outs. However, there are some positive spillovers too, such as the new knowledge gained from CC research. It has spurred many technologies that can control emissions, ethically transition to greener fuels, and shift from expensive private to affordable public transportation. It also can attract international investments and data-sharing with regards to early disaster warning and monitoring systems.

It is estimated that if surface temperatures rise by 3.2°C, up to 18 per cent of the world's GDP will be wiped off as an impact of CC, by 2050. The costs or benefits of CC are not localised, and effects are experienced across the globe. Regardless of the contribution of a region to the CC problem, it will suffer climate damages due to the actions of other developed nations across the globe. Regions with poor socio-economic status thus tend to face disproportionately higher risks per capita, due to their inherent resource crunch. Climate change can eventually wipe out countries with negative economic growth and expose them to internal social instability and dependency on global superpowers.

# Job Security in a Changing Economy

During the transition to a sustainable economy, there will be a massiive change in the nature of jobs, and some jobs would go over to experts. For example, if the Indian government agreed to phase out coal by 2030, millions of people dependent on the coal industry would lose their jobs.

Raju Kane, Journalist and Author

### India's Cost to Pay

India has been highly impacted by climate disasters. In 2020, Cyclone Amphan alone caused damages of over 13 billion US dollars (≈964 billion Indian rupees) in damages, besides affecting over 13 million people. According to the World Meteorological Organization's (WMO's) 'State of the Climate in Asia 2020' report, India is estimated to have lost 87 billion GB pounds (≈6,432 billion Indian rupees) last year due to damages caused by natural disasters, such as cyclones, floods, droughts, wildfires, earthquakes and other events (Graph 3.4.1 and Graph 3.4.2).

India is responsible for just 3.2 per cent of cumulative global emissions, despite having 17.8 per cent of the world's population. Yet India cannot achieve its development aspirations without considering CC. Domestic as well as international efforts to combat CC will be crucial to India's healthy economic future. Assuming even a 1°C rise in temperature, natural disasters, such as rising sea levels, unpredictable weather patterns, declining agricultural and resource productivity, and negative health



**Graph 3.4.1:** Comparison of economic damages across continents, with a focus on major Asian countries

outcomes are expected to cost India three per cent of its GDP.

Although 43 per cent of India's population engages in agriculture, it only contributes 16 per cent to the nation's GDP (as of 2019). The services sector and industries contribute much more, at 49.4 per cent and 24.8 per cent, respectively. Agriculture is not economically rewarding on a per capita basis. On the other hand, agriculture is the worst affected sector and is used as a prism to understand the ill effects of CC on the economy. This puts millions of small and midrange farmers in an economically vulnerable position.

The government must invest in studies and mechanisms to understand, plan and sustain many small and medium-sized industries for sustained, longterm, economic growth. Though these industries may

Climate Actioneers' Primer: A Beginners Toolkit

contribute only a small slice to the GDP of the country, they support a large section of the population. Therefore, in case of a tragedy, millions of unsupported communities and families will bear the brunt.

### Low-Carbon Economy

A Low-Carbon Economy (LCE) is based on 'green' energy sources, which produce low GHG emissions. Transitioning to an LCE model could be a part of countries' CC mitigation strategy. It is a step toward becoming a zero-carbon economy.

A low-carbon economy aims to integrate all its component sectors, such as manufacturing, agriculture, transportation, power generation, etc. around technologies generating as few GHG emissions as possible. This would necessitate efficiency in energy and material use by human communities, buildings, machines, devices and systematic waste disposal, engaging the principles of the '5 Rs' (Refuse, Reduce, Reuse, Recycle, and Recreate).

The advantages of adopting an LCE are ecosystem resilience, job creation, business competitiveness and improved trade policy. However, to make the transition to a Low-Carbon Economy viable, emissions of GHGs must be penalised via carbon trading and/or a carbon tax.

# Emissions Trading, Carbon Pricing and Carbon Tax

Carbon emissions trading operates on the principle that industries and other polluting organisations will need to purchase permits according to the amount of emissions they produce. The higher the emissions, the greater will be the cost of the permit. A central authority or governmental body will allocate a limited number of permits that will allow only a specific quantity of a specific pollutant to be discharged over a set period. Therefore, polluters cannot buy new permits if they

Name of Department/Statutory bodies/ Missions/Programmes/Plans	Allocated Cost 2022-23 (Indian rupees in millions)	Allocated Cost 2021-22 (Indian rupees in millions)
MoEFCC	30,300	28,700
Percentage of Annual Budget (India's Total Annual Budget)	0.076% (39,449,090)	0.082% (34,832,360)
National Mission for Green India	3,616.9	2,900
National Afforestation Programme	3,000	2,350
Pollution Control	4,600	4,700
Climate Change Action Plan	300	300
Commission for Air Quality Management (CAQM)	170	200
Project Tiger	3,000	2,500
Project Elephant	350	330
National Tiger Conservation Authority (NTCA)	100	100
Central Zoo Authority	100	110
National Coastal Mission	1,950	2,000
Regional Offices and Statutory Institutes (Wildlife Crime Control Bureau, Forest Survey of India, Zoological Survey of India, National Green Tribunal)	4,870	4,600
Environment Knowledge and Capacity-Building	786.2	700
Environmental Education, Awareness, And Training	580	771.3
Autonomous Bodies under Environment Ministry	2,874.5	3,055
Statutory And Regulatory Bodies	1,545	1,605

# **Table 3.4.1:** Budgetary Allocations for Ministry of Environment, Forest and Climate Change (MoEFCC),Government of India (2021-22 & 2022-23)

Although the absolute value of allocated funds for the MoEFCC may have increased, in terms of its proportion to the overall budget, its share decreased (stated in red font). In both budgets the share granted to the ministry is less than one per cent of the total annual budget of the country.

have higher emissions; they must buy from others willing to sell them. Thus, keeping the total emissions under the maximum permissible level as per the statutory body.

A pilot project in Surat in September 2019 implemented carbon trading, in which it reduced particulate matter pollution of participating industries by 24 per cent (with an eight per cent margin of error). GHG emissions put a cost on industries and incentivises the transition to lowemission or zero-emission means of production.

Carbon taxes penalise polluters by making them pay for the emissions they produce. Carbon tax is a way to quantify the indirect costs to human and environmental health and stability, caused due to carbon emissions. Lowerincome households, and poorer nations, tend to purchase high-emission goods and services since they are cheaper to get. However, they have a much higher environmental and health cost, leading to eventual economic losses. To combat this without penalising low-income groups, policymakers can try to redistribute the revenue generated from carbon taxes by lowering income tax or giving rebates to lowincome groups. As of 2021, 27 countries had implemented a carbon tax regime. However, India was not one of them.

# 0 - (0%) 0.1 0 (0.06%)7.5 (4.38%) 11.2 (6.54%) 8.4 (4.9%) 51 3 (29.95%) 92.7 (54.12%) 0.1 (0.06%)Droughts Earthquakes Extreme temperatures Floods Landslides Storms Volcanic activities Wildfires Mass movements (drv)

**Graph 3.4.2:** Percentage contribution of various climate disasters in global economic loss

# **Green Investments**

Green investments, such as green equities and green bonds, are created to ensure that investors' money is put into 'Green Businesses' and projects. Examples of this are pollution and fossil fuel reduction, conservation of natural resources, transition to green energy sources, maintenance of air, water and waste management technologies, or any other type of environmentally conscious practice.

Although a promising idea on its own, it is also biased towards the expectation of returns (profits), which is the most critical driving force behind any investment. This pushes fund managers and investors to deviate from the core motives of the fund and cut corners to secure financial growth. In effect, throwing the environment under the bus.

According to a 2012 European market analysis and report on 194 green funds, in more than 18 European

countries by Novethic (Sustainable Transformation Accelerator), only 38 per cent of the analysed clean energy funds were invested in clean energy. Fiftysix per cent of them had instead invested in water, waste management or CC companies, whereas six per cent had invested in sectors that had very little or no relation with renewable energy.

Nine years later in 2021, Novethic observed in its European market report that the green funds were hampered by their inability to demonstrate or quantify their environmental performance, or how it helped in transforming the economy. It also found a conflict of interest, with a few fossil fuel fund investment portfolios, which are reducing in the Nordic countries.

Green finance, hailed as the 'Promised Land' from an investor's perspective, is still a work in progress, but is getting better with time.

# Payment for Ecosystem Services

The need of the hour is restoration and regeneration of our natural ecosystems so that they continue providing us 'services' such as clean water, carbon sequestration, habitats for wildlife, and protection from disasters. Communities living in the proximity of natural ecosystems, as their traditional allies, need to be incentivised to ensure a transformational shift from exploitation to stewardship of natural ecosystems. Payments for Ecosystem Services (PES) provides the promise of a conservation approach that delivers poverty reduction through improved resilience of communities and increased land productivity simultaneously with environmental conservation.

The idea behind PES is simple – periodic and assured payments are made to the communities in return for measurable conservation benefits such as carbon sequestration, reforestation, wetland conservation, and watershed protection. By incentivising the sustainable management of ecosystems, PES also reduces the vulnerability of communities and exposure of landscapes to hazards such as floods, droughts, heat waves, cyclones etc.; the critical goals of eco-DRR (Disaster Risk Reduction).

#### Ashish Mehta,

Second Nature Sustainable Solutions, Mumbai

# **Low-Carbon Cities**

Professor Andy Gouldson of the Centre for Climate Change, Economics and Policy and his team have helped cities switch to low-carbon development paths around the world. Their work started in 2011 in their home city of Leeds, England. It is home to over three million people and has an economy of 52 billion US dollars (≈5,528 billion Indian rupees), of which 5 billion US dollars (≈531 billion Indian rupees) was spent on energy.

Their philosophy worked around the premise that instead of just reducing energy bills, the money would be better invested in lowcarbon infrastructure. This prompted the Local Enterprise Partnership to create a 20 million US

# Leveraging Green Investments through Good Governance

Organisations in the social sector are at an interesting stage of development. To achieve an impact in line with their mission, a structured internal governance mechanism is imperative. This will not only help them establish processes to measure and improve operations but also aid in setting up robust impact measurement tools.

Seasoned organisations need to step back and evaluate their internal processes and systems, identify gaps, prioritise them and take necessary steps to mitigate the gaps. While grassrootslevel programme delivery may be ingrained in such organisations, standardised governance and processes will further strengthen the delivery and help sustain the model. Several professional enabler set-ups also help in this process. Organisations also need to develop peer networks and lean in on their learnings.

As the sector is evolving both from the private and public sector lens, strong governance mechanisms will be looked upon favourably by green investment partners, be it funds, corporates or individuals.

Urmila Sampath and Kavita Gunderia, Co-founders, LTM Advisors LLP, Mumbai

dollars (≈1,282 million Indian rupees) fund to make improvements in the energy efficiency of the region. It also gave policymakers costeffective low-carbon options, helping them make informed decisions.

Low-carbon options used in various sectors of the township:

- 1. Transport: Smart ticketing systems for public transit; bus-route enhancements.
- Domestic: A++ rated appliances; cavity wall insulation; low energy lighting.
- 3. Commercial: Daylight and movement sensing lighting; solar and wind energy.
- 4. Industrial: Piping improvements of boilers and steam pumps.

Besides Bristol, Sheffield and Birmingham, similar research and work is being conducted all over the world. This revealed that low-carbon initiatives were much more effective in tackling fuel poverty, as also financing and delivering low-carbon projects even in tough economic times. Countries such as Brazil, China, India, Indonesia, Malaysia, Peru, and Rwanda have been the subjects of these studies, and some have agreed to invest in lowcarbon schemes.

The benefits of these interventions show that climate mitigation strategies are genuine tools for economic and urban development. The report estimated that the streams of revenue generated by the low-carbon interventions would be worth 16.6 trillion US dollars ( $\approx$ 1,377 trillion Indian rupees at September '23 values) by 2030. This is in addition to the numerous social and public health benefits

they will provide. However, it has been noted that even low-carbon infrastructure can be rapidly overwhelmed by urban development, even if the urban development is low-carbon itself. A deeper transition is required for a truly sustainable economy.



Low-Carbon Infrastructure in Heidelberg (Credits: Valentin Bachem/Wikimedia Commons/ CC BY-SA 2.0)

# **12 Actions for a Climate-Resilient Economy**

- 1. Eat seasonal, open-pollinated food, and purchase local produce from farmer's markets.
- 2. Rent or share rather than buy, wherever possible.
- 3. Buy produce grown following ethical practices and which have a strong community engagement.
- 4. Set up more small banks so that economically distressed communities can build businesses.
- 5. Start recycling, reusing, and rethink your buying patterns.
- 6. In general, buy less. And buy only from certified eco-friendly companies.
- 7. Companies should take Extended Producer Responsibility (EPR) to ensure sustainable Product Life Cycles (PLCs), involving a cradle-to-cradle approach.
- 8. Demand Corporate Social Responsibility (CSR) and government funds for ecosystem restoration and biodiversity conservation.
- 9. Invest in sustainable, reparable, reusable and well-made products, clothes, appliances, furniture, and things that do not have obsolescence built in, and end up in landfills.
- 10. Compost food waste as it is beneficial economically and reduces the waste being processed by private and municipal organisations.
- 11. Patronise small and micro-businesses, especially ecotourism outfits, which provide economic sustenance to many households and people of varied genders and age groups.
- 12. Develop regional micro-financing infrastructure from a climate disaster perspective.

# This subchapter has covered the following Sustainable Development Goals



# **Chapter 4: Social Environment**



Climate change (CC) amplifies threats globally: leading to biodiversity loss, damaged ecosystems, climate instability, and natural disasters. Its impact extends beyond Nature, affecting societies and triggering an economic collapse. Analysing how climate events affect marginalised communities and individuals is crucial. They often face socio-economic challenges as they are at the bottom of the social hierarchy and struggle to earn a livelihood. These seemingly benign local and global phenomena can disrupt entire economies and natural systems, and cause widespread biological, geo-political and economic damage, tearing apart the fabric of society and widening the resource divide between the haves and have-nots of the world.

Human societies are diverse, consisting of various communities, social classes, ethnic groups, urban, rurban and rural populations, tribes, migrants, governments, Non-Governmental Organisations (NGOs), and business leaders. Despite the pursuit of equity and equality, power struggles have historically divided societies along socio-economic fault lines, marginalising the minorities. The climate crisis further exacerbates the inequalities in our society. Differently-abled persons, women, persons belonging to other genders (LGBTQIA+), religious minorities or geographically isolated, tribal, and migrant communities have traditionally been denied a seat in the climate discourse. Their voices, needs, and

aspirations are overlooked in policy-making, resource allocation, and employment opportunities. There is a vast chasm between the social status of the cis-gendered, upper class and upper-caste men and all the abovementioned marginalised groups; the extent of which varies between urban and rural regions but exists universally across the globe. Urban areas partially bridge these gaps but still marginalise minority groups, treating them as social outcasts on the fringes of support networks.

Tribal and artisanal communities, including fisher folk, farmers, weavers, potters, and honey-tappers, rely on natural resources for survival. However, the climate crisis has led to declining natural stocks, pushing them to migrate, take refuge or settle in suboptimal urban areas in search of alternative

livelihoods. These migrants and minority communities sometimes face hostility from the original residents while trying to fulfil the aspirations of their younger generations. Persons with mixed physical disabilities, the most overlooked group in the climate dilemma, often face economic exclusion and social invisibility. This hampers their financial contribution to the GDP and leaves them resource-deprived and emotionally vulnerable, leading to issues such as suicide, violence, substance abuse, and various psychological disorders such as Post-Traumatic Stress Disorder (PTSD), Obsessive-Compulsive Disorder (OCD), schizophrenia, anxiety, and bipolar disorder.

The fluctuating climate scenario in India is threatening the burgeoning youth population and they will have to brace themselves to adapt to a bevy of fast-paced changes. Rapid digitalisation and automation will necessitate higher levels of education and mass skilling programmes. However, there will also be the threat of easy retrenchment, technological obsolescence, and low job satisfaction, the constant need to update skills to avoid stagnation, resulting in mass unemployment, financial redundancy, and social dissatisfaction. This results in aggression, anti-social behaviour, and increased criminality. Thus, the impacts of CC on various segments of society can vary drastically across the spectrum. This chapter examines the diverse challenges encountered by communities based on factors such as gender, age, resource accessibility, social status, literacy, and physical and intellectual abilities. Consequently, it necessitates a multifaceted approach to foster climate resilience, promote equity, and enhance social equality within communities and for individuals.

# This chapter covers the following Sustainable Development Goals



# 4.1 Community



Human communities are complex, dynamic, and unpredictable, as they have evolved over generations due to various socio-economic and political triggers. They may have formed due to their similarities of occupation, faith (religion), place of origin, values, customs, rules/norms, identity, and/or political ideologies. However, there is constant disintegration and realignment of community groups due to their intrinsic commonalities, differences, changes in local geographies as well as their basic needs for survival. Political or climatic disturbances play havoc with the very fabric of these communities, causing social upheavals and mass migrations.

Throughout history, indigenous communities have endured displacement, attacks, imprisonment, and disenfranchisement due to invasions and the ambitions of politicians, corporations, and nations. These humanitarian crises are further multiplied when essential projects such as mega-dams, railway projects, airports, mines, thermal and nuclear power

plants lead to forced displacements and flooding of ancestral and sacred lands. In some cases, these tribals and marginal farmers have been forced to migrate multiple times, losing access and rights to their traditional resources and lands. Even more distressing is the random fragmentation of communities, close-knit with clans, villages, or select families being sent to remote, hostile, and uninhabitable areas. This leads to social seclusion, harassment, anxiety, depression and often escalates into violent behaviour. Consequently, these circumstances contribute to high rates of suicide, substance abuse, and financial

insecurity, driving individuals towards illegal activities such as wildlife poaching, arms and drug trafficking, or the timber trade. Indirectly, this results in species extinction and a decline in the forests' carbon sequestration capacity.

Affected communities typically receive support to improve their quality of life, health, and sanitation through government schemes, as well as voluntary Community-based Organisation (CBO) and NGO programmes. Climate-related incidents also disrupt these communities, affecting livelihoods and family bonds, thereby contributing to social unrest and criminal activities. Consequently, climate action should prioritise stakeholder perspectives rather than solely focus on financial aspects and return on investment (ROI). This chapter adopts the viewpoint of marginalised communities enduring repeated climate challenges and highlights the urgent actions required to restore balance and equity. **Economic:** The International Labour Organization (ILO) published a report in 2019 titled 'Working on a warmer planet: The impact of heat stress on labour productivity and decent work'. The report claims that CC will cause losses in productivity of up to 2.2 per cent of all annual working hours by 2030, estimated at 2,400 billion US dollars (≈168,974 billion Indian rupees) worth of labour and employment. Similarly, McKinsey & Company issued a report in 2020 on the current and future economic impacts of CC, which estimated that by 2050, the socio-economic impacts of CC could increase by 2-20 times compared to today's level.

Global warming leads to warmer atmospheric temperatures, sea level rise, and extreme weather events, which strongly impact a region's economic drivers. Studies indicate that due to repeated climate accidents, by 2050, India may need to import more than twice the amount of food grains that would be required without these impacts. The damages caused to public infrastructure, private property, and human health indices diminish productivity, resulting in a severe drop in GDP. Extreme weather events also affect energy production, increase stress on potable water supplies, resulting in widespread disease outbreaks, disrupt global supply chains, and affect trade.

Various sectors including agriculture, forestry, fisheries, tourism, transport, heavy industries, and environmental goods and services witness significant impacts, affecting communities, individuals, and businesses. All these factors are liable to cause losses in employment, leaving large communities stranded without jobs. Maintaining even a basic standard of living becomes challenging in already impoverished environments, putting a strain on community resilience. In such circumstances, migration to larger towns becomes a common solution, despite the lack of basic living comforts. These towns offer labour markets and serve as trade and commerce hubs.

**Ecological:** India, with its massive 7,500 km coastline, faces higher vulnerability to sea level rise compared to landlocked countries. Rising sea levels place over 300 million coastal inhabitants at significant risk of displacement and drowning. Higher frequency of tropical storms and cyclones due to CC is an added threat.

Rising sea levels lead to saltwater intrusion in lowlying coastal areas, degraded groundwater quality, contaminated drinking water, reducing crop yields and fish catches, as well as increasing outbreaks of waterborne diseases (diarrhoea, cholera, typhoid, dengue, and malaria). This forces the people to move further inland and to safer high grounds. The water security of Central India, the Western Ghats, the Deccan Plateau, and the North-eastern states is highly threatened due to mining, mega-dams, and unsustainable, water-thirsty agricultural practices. This has led to most agriculturists abandoning traditional food crops and shifting to cash crops. They also sell their lands to developers and industrial establishments, and shift to cities or take up meagre jobs in factories.

Rising temperatures also threaten freshwater, marine, and terrestrial plant and animal species including keystone species that are essential to keep an ecosystem thriving. Local extinction, drop in critical numbers, a shift in home ranges or mass migration of these species cause ecosystems to lose their potential to provide ecological services to human populations living in its vicinity and force them to either migrate in search of healthier options or exploit ecosystems to unsustainable limits. Rising incidences of disasters, such as forest fires, floods, droughts, and pest infestations (locusts or mealy bugs) also destroy agro-ecological systems, leading to the widespread migration of dependent communities. Pastoralists or animal-rearing communities are forced to climb to higher altitudes or migrate to unfamiliar regions to survive increasing climate disasters, degraded ecosystems and dwindling natural resources, turning them into climate refugees.

# **Problems to Communities**

This raises the question, "Exactly how many climate refugees are there in the world?" The World Migration Report 2022 stated that in 2020, 30.7 million people from 145 countries and territories were displaced by climate disasters. droughts, floods, famines, political disturbances, wars, and related unemployment will also add to this number. India too has many climate migrants. According to the Internal Displacement Monitoring Centre (IDMC), approximately 14 million people in India have been displaced due to climate and environmental disasters. Of those, over 3.8 million displacements took place in 2020 alone. This number is 989 times more than the number of displacements caused by internal conflicts (3,900). Moreover, the number of climate refugees is expected to rise



Infographic 4.1.1: Impact of Climate Change on Communities

drastically in the future. Over 45 million people will be forced to migrate from their homes by 2050, to suboptimal living conditions. These places are usually far from the safety of their places of birth, leading to psychological trauma caused by leaving one's home, village/town/city and the safety net of one's family and community. Thus, community resilience and climate action are the urgent need of the hour.

# **Future Threats**

According to a report by Indian Network For Climate Change Assessment (INCCA), by 2030, four major regions in India will be most impacted by changing temperatures, viz. the Himalayas the Western Ghats, Northeast India, and the coastal zone. These regions contain some of India's most important economic sectors and industries, and coincidently house the largest number of tribal, pastoral, fishing, and agricultural communities, cumulatively accounting for over 50 per cent of the Indian population.

In the Himalayan region, increasing snowmelt will lead to landslides and floods, causing damage to crops and land as well as disrupting access to fresh water. As the snow cover diminishes and gets restricted to the highest altitudes, there will be local extinction of highelevation species. It would also result in pastoralists climbing to higher elevations with livestock, exposing them to attacks by carnivores such as snow leopards, wolves, or brown bears, and competition with wild herbivores such as yak, bharal, ibex or Himalayan tahr, which were earlier non-sympatric due to clear segregation of grazing meadows. Higher instances of forest fires will result in the massive destruction of timber, firewood and other materials used for heating and construction. Incidences of diseases such as malaria, dengue, and chikungunya, might increase over time due to warmer climates. It will also disrupt 'yatras' and tourism, which are the financial mainstays of these regions, besides breaking the back of orchard owners, who provide fruits such as apples, apricots, cherries, pears, plums, and peaches to the entire subcontinent.

The highly biodiverse Western Ghats, too, are expected to face climate disasters. They are home to a significant amount of India's tea, coffee, vanilla, and spice plantations. Affected crop yields will affect the farmers as well as the companies that depend on this supply chain. This could lead to distress migration. Farms could be progressively abandoned, with inhabitants finally seeking permanent resettlement in

# Educating Forest Communities about Climate Change

The State of Madhya Pradesh is unique as it has the highest area under forest cover (77,943 sq. km in 2021) and hosts the largest tribal population in the country. These forest-dwelling communities depend on firewood as their prime source of income. The state raises substantial revenues by selling *Tendu patta* (*tendu* leaves) for making *bidis* (Indian cigarettes). However, this economic benefit is not equitably distributed, as the communities' role in the supply chain is limited to being raw material providers. For these communities, illegally procured firewood, which causes deforestation, is the sole medium to earn a livelihood and fulfil their aspirations.

In the Amazon, I came across a project with the Brazilian Agricultural Research Corporation (Embrapa), which educated Amazonian tribal communities about the benefits of fruits and other parts of trees, leading them to conserve trees for their economic benefit. I think such a project can be undertaken in India.

People from smaller towns and villages lack awareness of critical issues such as CC, sustainability, single-use plastic, etc. However, they are closely bonded with Nature and are critical stakeholders in the climate resilience exercise. To remedy this lacuna, grassroots organisations such as *gram panchayats* and local NGOs must engage with tribals and send outreach teams to educate locals on the importance of trees and make them aware of the financial potential of NTFP over firewood and timber. Urban youth and policymakers must come to the grassroots-level and interact with the local communities, for there to be any meaningful change at the ground-level.

### Jaivardhan Singh, Former Union Minister (Urban Development & Housing), Madhya Pradesh

urban slums. A higher population in urban or semirural areas near to forests would result in humanwildlife conflicts, the spread of zoonotic diseases such as COVID-19, Kyasanur forest disease, Ebola, avian flu, and increased collection, trapping, poaching and consumption of wild plants, fungi, and animals, leading to their local or total extinction. High-density urban centres in the hills and valleys of the high-precipitation Western Ghats also mean increased incidences of landslides, cloudbursts and floods, resulting in massive economic losses.

Northeast India is one of the most densely forested regions, with many native forest-dwelling tribes who are heavily dependent on slash-and-burn agriculture. Over one million persons are employed in tea estates and any climate event can threaten their livelihoods, due to a drop in export figures and GDP, caused by reduced tea yields. These regions are also hubs of culture and wildlife tourism, drawing in revenue from a large number of international visitors, and floods, damaged infrastructure and zoonotic diseases can endanger this ancient stable economy.

India's coastal zones have many large coastal cities and other settlements with millions of people packed in small landmasses, with average densities crossing 25,000 persons/sq. km. Sea level rise and storm surges can destroy and cripple urban infrastructure, spread diseases, render farmlands infertile, and destabilise agro-based industries. Millions of people flock to India's coastal getaways supporting agro and ecotourism industries, providing residents and

# **Equality in Indigenous Communities**

In indigenous communities, there is this spirit of volunteerism that functions. So even now, for things such as marriages, funerals or building something for the village, it is never one family's issue, the contribution of labour comes from every family. In my village (Totapara, Tripura), there is a stipulated amount that every family must contribute. Be it two baskets of logs for a funeral, or 5 kg of rice for a marriage. Inequalities are not that high because every family has the same quantity of rice to make for the wedding or the same quantity of wood to burn for the funeral. There is so much to learn from indigenous cultures. Their proximity and ancient connection with Nature and forests make them ideal candidates and important stakeholders in the climate mitigation process.

### Hamari Jamatia, Adivasi Lives Matter (ALM)

migrants with jobs and livelihoods. These would be affected by sea level rise. Changing ocean currents and rising water temperatures reduce yields of fishery establishments affecting millions of fisher folk, leading to mass unemployment, frequent circular migration, and some permanent emigration.

Urban migrants are often exploited and have little legal protection in the unorganised sectors where they find temporary employment. Many of them will end up in the construction industry, which is one of the most hazardous sectors, especially for women and employs about 45 million people across India. Often, those who are incapable of finding suitable jobs as labourers end up in prostitution rackets, peddling drugs, or begging at highly polluted traffic signals. Even children are not spared this fate, leading to child labour and the vicious cycle of poverty, marginalisation, addiction, gambling, poor nutrition, and sickness or early death. Thus, what began as a climate crisis ends up as a socio-economic and humanitarian nightmare, which would need targeted interventions, to remedy and reverse the impacts and improve conditions for people.

# Local Governing Bodies and Community Action

Communities have a crucial role in governance, policymaking, and driving the transformation towards climate resilience. Local self-governments (LSGs), particularly the over 250,000 gram panchayats in India, can be particularly effective as they represent indigenous stakeholders with a vested interest in their region's well-being. These rural self-governments ensure fair representation of Scheduled Castes (SCs), Scheduled Tribes (STs), and women. Reservations for sarpanch (chairperson) posts and seats in the panchayats has increased women's participation in discussions and decision-making processes, leading to greater attention to issues such as fuel, water, health, crops, building materials, and social safety and security. Gram panchayats also hold authority over local-level decisions regarding forest clearances, diversions for mining, ports, and linear projects.

In 2022, Moorang Gram Panchayat in Kinnaur District, Himachal Pradesh, denied a No Objection Certificate (NOC) for an 804 MW hydroelectric power project due to extensive landslides in the area. Similarly, three mining projects in the Hasdeo Forests of Chhattisgarh have been indefinitely suspended following strong opposition and protests from villagers in Sarguja District. In 2013, village chiefs in Odisha's Niyamgiri Hills rejected Vedanta's bauxite

mining proposal leading to its denial by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India (Gol). Nationally, citizen protests successfully halted three major infrastructure projects in Goa, including the widening of the National Highway 4A (NH4A), double-tracking of the Konkan Railway line, and the laying of a 400 kV transmission line, which would have impacted Bhagwan Mahavir Wildlife Sanctuary and Mollem National Park. Additionally, the #SaveAareyForest movement in Mumbai involved over 60,000 citizens opposing the construction of a metro yard in the environmentally significant Aarey Milk Colony for more than a decade. These examples highlight the influential role of communities in shaping climate-friendly actions and India's development trajectory.

# **Towards an Inclusive Future**

Climate action must adhere to the principles of inclusivity and diversity. It is crucial to engage individuals with diverse gender identities (LGBTQIA+), socio-political ideologies, and those from areas with limited access to climate education, outreach channels, social media, or climate communication platforms. This inclusive approach ensures that the concerns and challenges of the most marginalised, economically affected, and socially vulnerable segments of society are given prominence and addressed effectively.

# Leveraging the Power of the Collective

Plaqued by repeated droughts, loss of employment and declaration of many districts as water-stressed regions, a collective of students and professors at the University of Rajasthan registered Tarun Bharat Sangh (TBS) as an NGO in 1975 (in Jaipur). It aimed to work towards water conservation in rural communities. TBS began its work by organising communities and mobilising them to focus on their water crisis, leading to reviving and revitalising johads, which are small crescent-shaped, mud and earthen ponds, owned by the community and were the traditional water management systems in Alwar District, Rajasthan. Johads, along with anicuts (check-dams) and bunds were built for harvesting the rainwater rushing down from the deforested hills of the Aravalli range.

To date, TBS has built over 12,000 *johads* involving villagers, who have provided both labour and financial contributions. These efforts of TBS have helped over 1,000 villages in 15 districts of Rajasthan improve their water table. The organisation has rejuvenated and revived 11 rivers in the state, such as Ruparel, Sarsa, Arvari, Bhagani, Jahajwali and Shabi. For this yeoman service, TBS was recognised and awarded the Stockholm Water Prize in 2015. Presently, the organisation focuses on three primary issues for the benefit of the local communities, viz. access to water by rejuvenation of water resources, tackling human and wildlife conflicts, and combating the mining mafia.

The Tarun Bharat Sangh has also established the Arvari Sansad (Parliament) which represents 72 villages and meets twice a year to deliberate about the integrated efforts of long-term safety and water management by communities in river catchments. The Sansad has also protected the local artisanal fishing community against exploitative fish harvesting by commercial contractors. TBS has also played a significant role in the 'Save the River Ganga' Campaign, besides establishing a 'Water School' to educate communities across the country about proper water management and revival techniques. All these efforts of TBS have been significant in the revival of local biodiversity, especially in the Sariska Tiger Reserve.

TBS is a perfect example of leveraging the power of communities to achieve climate and economic resilience among all their beneficiaries.



Johad in Rajasthan (Credits: Laxman Burdak/Wikimedia Commons/ CC BY-SA 3.0)

# Marginalised Persons as Climate Leaders

During extreme climate events, women, LGBTQIA+ and differently-abled persons are often the most exposed and brutally impacted sections. A majority of them face financial limitations and fall into the impoverished segment of Indian society. Hence, if such persons are designated as leaders, they are more likely to create policies that bring people of all socioeconomic classes, genders, and abilities, at par with privileged society.

A 2019 study found that increased female and LGBTQIA+ representation leads countries to adopt more stringent CC policies. Women have also been found to be adept at NRM, resource governance and conservation outcomes. Women and differently-abled people are known to be more sensitive towards the needs of their own as well as other impoverished communities, such as children, senior citizens and the homeless. Women smallholders should be given equal access to productive resources, as this would increase agricultural production and food security. Even in a corporate setting, there is increased transparency around climate impacts in the case of women leaders. Companies with a higher percentage of women on the board of directors have so far been more diligent in disclosing carbon emissions information.

### **Community Action**

Through self-governance and local action groups, communities should work towards making their regions

and societies climate-resilient. There are 4.5 million sq. km. of farms around the world that are owned by smallholders. These farms ensure the food security of over 2.2 billion people, while shaping local biodiversity and ecosystem services. The landholders play a key role in maintaining the livelihoods of their communities. We must create networks of smallholders, fisher folk, LGBTQIA+ persons, mixed-disability groups, women, and other marginalised communities. To ensure the long-term reversal of climate trends, it would be a best practice to impart climate resilience training among the smallest social units.

New-age technologies, such as apps, kiosks, websites, public announcement systems via cable television, regional and community radios and posters in all government offices, viz. primary healthcare centres, police stations, post offices, railway stations and bus depots, etc. would help leverage the power of community climate resilience networks. Such micronetworks would not only help those affected by severe climate events cope financially, but also socially, and emotionally. Such micro-communities will also be efficient in designing and adapting technology suitable to the local needs of specific community groups, keeping in mind their peculiarities and mind blocks. Any network is as strong as its weakest link, and the more one localises the protocols, the more effective it would be to secure communities from climate misfortunes.

# **12 Community-Based Climate Actions**

- 1. Build community farms in urban areas, for waste management and food security.
- 2. Create seed banks and nurseries for local plants.
- 3. Plant indigenous and evergreen trees along urban roads.
- 4. Build better disaster warning mechanisms for people living in mountains, valleys, and remote regions.
- 5. Provide boats, lifejackets to fisherfolk and people living in flood-prone areas. Build cyclone-ready houses.
- 6. Work with farmers to practise less water-thirsty and more open-pollinated agriculture.
- 7. Conduct awareness and outreach training for communities affected by frequent forest fires.
- 8. Advocate for more women and LGBTQIA+ leaders in governance and policy matters.
- 9. Develop apps or websites to provide accurate weather data in regional languages.
- 10. Reskill communities to provide local employment and prevent migration.
- 11. Establish local self-governments (Gram Sabhas), to involve communities in climate policy and action.
- 12. Develop capacity-building training curricula for communities.

# This subchapter has covered the following Sustainable Development Goals



# 4.2 Youth

Conservative projections indicate that the global human population is expected to reach 10 billion by 2050, representing a population increase of over 20 per cent from 7.8 billion in 2020. From Graph 3.2.1, it is clear, infants (0-4 years), children (5-9 years), adolescents (10-19 years), and youth (15-24 years) would make up much of that population. They will not only be the largest consumers of natural resources but also the most vulnerable to the impacts of the climate emergency. Governments should prioritise these age groups in climate policy-making, recognizing them as key stakeholders in our planet's future. Investing in research



and outreach is crucial to anticipate and address climate-related challenges such as unemployment, poor physical and mental health, lack of sanitation, limited access to education, and personal safety. Involving these age groups at every stage of the decision-making process ensures the development of an inclusive, forward-thinking, regionally adaptable, and robust model for climate resilience that benefits every individual, community and sub-region.

# **Planet for the Youth**

Over 85 per cent of the world's children and youth live in low and middle-income countries, with a Gross National Income (GNI) between 500-12,535 US dollars ( $\approx$ 36,965 -  $\approx$ 926,712 Indian rupees). These countries are at higher risk of CC impacts since they often lack the infrastructure and support systems necessary to mitigate these impacts. The resulting mass species extinctions and resource scarcity can trigger migrations and wars, putting youth in the actual line of fire.

The 0-15 year old age group is more adversely affected by both direct and indirect effects of CC. Due to their inherent social and outgoing nature, it is estimated that the younger population will suffer from over 80 per cent of all injuries, illnesses and deaths inflicted by CC. This high proportion can be attributed to a history of malnutrition, leading to underdeveloped immune systems, combined with economic and social dependencies on adults, leading to cyclic child labour, underage pregnancies, prostitution, gambling, addictions and substance abuse. Since children are completely dependent on their parents, any effect of CC suffered by parents also affects their children. The effect on parents' health and their ability to provide food or safeguard children and youth from resource shortages, local conflicts, and economic migration, can take a toll on the physical and mental health of children. Warmer temperatures and toxins from their immediate environment make children more susceptible to heat-related health emergencies, various allergies and infections, malnutrition, and deficiency disorders. Youngsters exposed to devastating cyclones, tornadoes, forest fires or political disturbances are predisposed to PTSD, anxiety, depression, loss of identity, learning problems, sleep disorders and even suicidal thoughts.

In poverty-stricken and emotionally challenging situations, communities often experience the repercussions of living in unsafe ghettos characterised by violence, crime, and high rates of early school dropout. Climate disasters could also damage school buildings and disrupt education, particularly for girl children who are more at risk of being removed from schools during long-term or repeated closures. The proportion of boys returning to the same or another school is slightly higher, even in rural parts. For instance, in the aftermath of the 2010 floods in Pakistan, 73 per cent of affected 10-19-year-olds exhibited high levels of PTSD, with girls being more significantly impacted than boys. This disparity further widens the existing gender inequality gap, limiting opportunities for better employment and financial security for girls and women. It is evident that climate-related incidents have complex and differentiated impacts on genders, even during adolescence and early stages of education.



Graph 4.2.1: Workforce in various age groups in India

Such traumatised children when they grow into youth lack experience, education, or skills to find employment which can provide them even a basic quality of life, as targeted by the UN SDGs. Poor financial literacy and entrepreneurial opportunities make it even more difficult for youth to navigate a world growing increasingly dangerous and inhospitable. As the primary working, earning and electorally active segment of society, youth will be posed with massive financial, ecological, health and safety challenges. Hence, youth need to be more aware and involved in deciding the future course of climate action, as key stakeholders.

### **Prepping for Climate Change**

According to the United Nations' Convention on the Rights of the Child (CRC), children and youth have the right to participate in matters concerning their lives. Granting them a certain level of agency would enable them to act more as agents of change, rather than being stuck as victims. Granting that power in the face of adversity can also help psychologically protect them from feelings of hopelessness and not being in control. In India, many urban, rural, and tribal youth are yet unaware of the enormity and widespread impact of CC on their lives. Climate Outreach and Mitigation Programmes should actively involve children and youth at all levels of

### Taking Youth Seriously

A key challenge that emerges when we look at the role of the youth in climate action, particularly in developing countries is the question of legitimacy. In India, a few of the first questions you will be asked are, "What will you do? Who will take you seriously? Why should we take you seriously?"

The key to learning is to demonstrate your skills and make people realise that youth have innovative ideas. It is not to say that older people do not. They have a certain perspective due to their varied experiences over time. However, the key difference here is that with CC, that is not the case. For the first time, we are seeing it change in front of our very own eyes, with many youngsters taking centre-stage in the climate discourse.

Abhiir Bhalla, Youth Environmentalist

society, be it local, national, or international. Youth are the best agents to help raise awareness and advocate for action against CC and its impacts. They can contribute through various outreach activities such as newsletters, street plays, workshops, and more. Disaster-preparedness training should become mandatory in every school and college, enabling them to face such situations calmly and effectively. They could also be trained in environmentally sustainable practices such as the development and use of renewable energy, waste segregation, recycling, and upcycling, and helping build careers in green sectors. The involvement of child development, mental health, education, and human rights professionals will be critical to developing holistic approaches. It is also necessary to thoroughly research the effectiveness of these programmes and interventions, to ensure equitable engagement of children and youth from all socio-economic segments.

Many urban children and youth, especially those with access to the internet, are growing increasingly aware of the climate crisis. This can lead to a general feeling of hopelessness over their inability to control their future aspirations. Building effective coping strategies and youth cohorts can reduce their mental stress regarding CC and help them become part of the solution by taking up leadership roles.

# Children and Youth for Environment

Many young persons around the world have wholeheartedly participated in the fight against CC. Many youths are filing Public Interest Litigations (PILs) seeking court interventions, with the hope that they can force governments to adopt and implement more climate-friendly policies. Others are protesting the lack of climate action by their respective governments or unsustainable development practices, which are endangering critical ecosystems and ancient livelihoods or usurping the traditional rights of indigenous communities. Some tech-savvy youths are effectively using social media to popularise the message of climate consciousness among their peer groups. Many youths engage in education, outreach, and research activities to encourage their peers and even adults to take informed actions to stem the degradation of our environment. Several youths, in India, have played pivotal roles in effecting policy changes and have raised guestions in their respective constituencies and even in both Houses of Parliament.



(Credits: Lëa-Kim Châteauneuf/ Wikimedia Commons/ CC BY-SA 4.0)

Greta Thunberg is the most popular youth climate activist of today. The Swedish girl was 15 when she began her 'School Strikes' in 2018. She would skip school to protest in front of the Swedish Parliament building, demanding better climate action. Her movement spread and was taken цр enthusiastically by

other students, culminating in the 'Fridays for Future' movement. She has become one of the most popular faces advocating for the environment and has received many global awards and recognition. She is hailed for her outspoken presentation in front of the United Nations General Assembly in 2019.



(Credits: Dilanlekamge/ Wikimedia Commons/ CC BY-SA 4.0)

Licypriya Kangujam from Manipur, India, is one of the youngest (11-year-old) global climate activists. Inspired by Greta, she used to skip school in 2019 to protest in front of the Indian Parliament building. She has spoken at several International

Conferences, such as the UN Climate Change Conference 2019 (COP25). She began her climate activism at the early age of 6 years and has started the 'Child Movement for Climate' in India. For her significant contribution to the field of climate action, she has been awarded some of the most prestigious global awards, especially the 'Rising Star' Award by the Earth Day Network in Washington DC, United States of America (USA).

For their actions, some of these youth have faced challenges in the form of police cases, legal and governmental backlash, arrest, detention and having their passports suspended. That has not dampened their spirits and with support from fellow citizens, legal redressal forums and human rights activists, these youth have kept their voices alive. These youth include tribal girls and school-going children. Their use of music, theatre, art installation, cartoons, photography, and videos as well as poetry has been innovative. Some have engaged in religious for tribal rituals of forest protection, to invoke the support of senior citizens and highlight the dangers to uninformed citizens.

Their spirit and zeal are missionary and remind one of the epic Chipko, Apikko, Narmada and Silent Valley Andolans (campaigns). Their positivism and dedication to the cause of Nature are infectious, roping in thousands of volunteers, including TV, theatre, movie and radio stars, social media influencers and in some cases, political leaders of opposition parties too. Here we spotlight a few such inspirational youth icons from across the globe, who have been significant in the CC movement in recent years.

# **Training and Skilling**

In contrast to previous generations who speculated and anticipated the impacts of CC, today's children and youth are facing them within their lifetimes. Thus, most of the current generation is at least marginally aware of the climate crisis. It is time to impart compulsory training and skills to the current generation in their early childhood, to sufficiently empower and motivate them to reverse and stop the increasing onslaught of climate disasters. The following 'Life Skills' will help them survive and revive after a climate accident, viz. survival training (swimming, building fires, rafts and temporary housing, rope-work, rockclimbing, abseiling, first-aid, fire-fighting, rescue, etc.); vocational training (waste recycling, cooking, tailoring, knitting, non-conventional farming, animal husbandry, industrial or entrepreneurship skills); and human resources training (peer counselling, resource management, leadership, team building, networking, fund-raising, and financial literacy).

# **Training Adivasi Youth**

Adivasi Lives Matter (ALM) was started in 2016 with the main objective of training and supporting adivasi youth to become 'citizen reporters' – filmmakers, journalists, and writers. Their stories might cover aspects such as poaching or mining while highlighting their lives and culture, which is harmonious with Nature.

Ashish Birulee, Co-founder, Adivasi Lives Matter



YashMarwahbeganhisforayintotheenvironmentandclimateactivismduringhishighschooldays(15-16 years).Hehasspokenat variousforumsand

highlighted the importance of involving youth and social media in spreading the message to large audiences.

He co-founded Let India Breathe, which has leveraged the power of social media, to spread awareness and incite action against destructive projects planned across India. Let India Breathe's significant campaigns include fighting against the destruction of Dehing Patkai (Assam), Dibang Valley (Arunachal Pradesh), Hasdeo Forest (Chhattisgarh) and Aarey Forest (Mumbai). Their multilingual infographics play a significant role in educating the rural masses and starting conversations among youth groups, at regional levels.

School teachers, natural resource specialists, climate activists, outreach professionals, and independent educators, along with parents and psychologists, will play a pivotal role in imparting the above-mentioned skills. Besides developing community and social responsibility, this training will equip youth with individual survival and people skills to become climateresilient. In addition to training, youth should be actively engaged in volunteering for tree plantation, waste clean-up drives, advocacy, activism, research, developing games, and Information, Education and Communication (IEC) materials. Attending regional climate conferences, lectures, seminars, and symposia organised by CBOs, NGOs, and academic bodies will help youth gain clarity about sustainable fashion, product lifestyles, climate-friendly choices, climate ethics, equitable transitions, and green businesses. Youth will be the largest consumer group and will influence the supply chain and market demand. By choosing to share or rent ethical products, they will support cyclicity rather than planned obsolescence, which is characteristic of the 'use-and-throw' era.

The most significant way youth and adults can help reverse CC is by electing leaders, political parties, and governments that put both equity and climate consciousness above development and profits. Since, in the coming decades, 80 per cent of the human population will be of voting age (youth, adults, and senior citizens), they can effectively demand leaders to follow stringent climate policies. With all these actions, the children and youth of today would be champions and stewards of the environment and compel society to follow the green path.

# **Plant for the Planet**

Plant for the Planet (PFtP) is an international organisation, inspired by the 'Billion Tree Campaign', initiated by Kenyan environmental activist and Nobel Peace Prize winner Wangari Maathai. German environmentalist Felix Finkbeiner with his fourth-grade classmates launched PFtP in 2007 when they were nine years old. Over the next three years, PFtP planted a million trees. Felix also had the opportunity to present his initiative in the European Parliament and the UN General Assembly.

PFtP teams of children and students conduct tree-planting activities. The organisation also has a global board, consisting of 14 children (8–

14 years old) and 14 youths (15–21 years old). As of 2022, PFtP spans over 75 countries, with 70,000 members. It has trained over 91,666 children and youth at its 1,608 academies. It is currently restoring 225 sq. km of forest on the Yucatán Peninsula in Mexico, at an average cost of one Euro per tree. PFtP's 'Stop Talking, Start Planting' campaign has involved many global celebrities to popularise tree planting. The youth of PFtP has also developed a mobile application to help individuals, corporations, and countries to support tree plantation drives to plant a trillion trees around the world.



Felix Finkbeiner (Credits:Victoria Kolbert/Wikimedia Commons/ CC BY-SA 4.0)

# **10 Climate Actions for Environment-conscious Youth**

- 1. Choose ethical, climate-friendly, earth-conscious, and sustainable brands.
- 2. Use social media to canvass for Nature-friendly actions following the '5R' principle.
- 3. Encourage and fund young entrepreneurs to build sustainability-oriented businesses.
- 4. Vote for a climate-conscious leader, politician, or political party.
- 5. Redesign workspaces around natural lighting, water harvesting, carbon sequestration, waste recycling, minimising furniture, and work-from-home policies.
- 6. Donate used electronics for reuse and upcycle waste that can be reused differently.
- 7. Form a Youth Group to train others in sustainable practices and climate resilience.
- 8. Conduct poetry recitations, street plays, and exhibitions of art, photos and videos for awareness.
- 9. Form a mental health support group to help climate refugees cope and revive.
- 10. Teach youth financial literacy, micro-finance, and fund-raising to invest or support sustainable and selfled self-help groups (SHGs), CBOs, NGOs and MSMEs.

This subchapter has covered the following Sustainable Development Goals



# 4.3 Gender

As of 2022, globally, the ratio of females to males is 100:101. Despite this relatively equal ratio, economic disparities and social inequalities between genders are glaring. Women and other gender minorities together constitute more than half of the global population, but often lack access to basic resources and recognition. There is a significant bias towards prioritising the well-being and interests of the male working population, while others are excluded from participation in policy-making and climate mitigation initiatives. This leads to myopic policies, side-lining critical aspects of equity, parity, and equal

access to all genders. This subchapter aims to focus on the nuances and ramifications of gender vis-à-vis CC.

# Varying Impacts of CC on Genders

All genders are not equally affected by CC. Physiological and age-old social differences result in variable impacts of exposure to pollution and hazardous chemicals among men, women, and trans-persons. There are very few quantitative studies on these aspects.

**Impact on men:** Men are highly susceptible to vehicular, industrial, and occupational pollution. They also face greater psychological traumas and pressures, due to migration, displacement and separation from their families and peers. Inherent social biases also burden men with the responsibility to bear most of the financial load to run the household. Those men afflicted by disease, disability, or injury, can lose their morale and slip into depression. This is reflected in the higher incidences of alcoholism, substance abuse, suicide and violence. Physiologically, too, men have higher rates of heart disease and even the percentages of deaths registered during the COVID-19 pandemic were significantly higher among men.

**Impact on women:** Women of all ages are most affected by poor sanitation, lack of sexual hygiene and malnutrition in early childhood. Elderly women and underage pregnant girls are far more affected by climate-related diseases and lack access to medical resources. This can force them into illegal activities or become victims of corrupt practices. In developing countries, about two-thirds of the female labour force is engaged in agricultural work. This number is as high as 90 per cent in some African countries. These are

often the only sources of income for rural women. Agriculture is severely affected due to CC and when a harvest fails, food becomes scarce. Female health has also been found to decline more drastically during food shortages. Rural women spend anywhere from 2-20 hours per week in the physically challenging manual jobs of collecting fodder, dung, firewood, water and other resources. Women are typically expected to balance this with their domestic duties, leaving them powerless to pursue education or more financially beneficial ventures.

Long-distance migration involving shifting from one's domicile is sometimes necessary in case of droughts, famines, and water-source contamination. Typhoons, cyclones, and tsunamis also result in the salinisation or leaching of hazardous heavy metals and minerals in mined areas, making them unliveable. Deforestation and mining force women to travel increasingly large distances to gather fuel and resources, increasing the chances of sexual harassment, physical injury, and interactions with dangerous wild animals. Humanwildlife conflict studies near protected areas show that a higher percentage of women are injured, mauled, and killed by bears, tigers, or elephants. Besides these physical safety issues, both rural and urban women struggle with access to financial resources. Many rural women do not have independent finances. Those who have access, often suffer from 'gender pay gap' issues.

Although global female literacy is improving, men still overwhelmingly dominate the field of green technologies, and conduct most of the research. Only the countries of Chile, China and Korea have more women than men in collaborative research. According to a study by the Organisation for Economic Cooperation and Development (OECD), women were less sceptical or cynical about environmental issues and more likely to support environmentally favourable policies. Surveys among people above 45 years, revealed that nine per cent more women favoured public transportation over private transportation, in comparison with men. This denotes an overwhelming need for women to be included in policy and research teams.

Even after 75 years of independence, women in India have little redressal and lack opportunities to shape environmental choices and practices even in their communities and regions. This has led to several 'gender-blind' policies that do not address some crucial factors that should be considered while fighting CC.

Impact on gender minorities: Gender and sexual minorities, such as transgender people, non-binary persons, and same-sex couples, who already face economic and social disadvantages, will suffer more from CC impacts. During climate calamities, policies and governmental-support networks fail to support transgender persons living on the fringes of society, often in unhygienic slums. Gender-transitioning individuals may face compromised access to necessary medical care, which can result in disorientation and severe identity crises for some. Religion also plays a significant role in suppressing and marginalising women, trans-persons, and gender-fluid persons, segregating them and exploiting them even during crises. Gender minorities face difficulties in obtaining social and physical goods, education, jobs, legitimacy, and emotional security.

After disasters, gender minorities are at a higher risk of receiving inadequate healthcare. This is more pronounced in countries where there are greater gender inequalities. They are at higher risk of being placed in unsafe shelters and might avoid using them due to fear of sexual violence, making their situation worse. They typically have access to few financial or physical assets to their name in times of emergencies. Additionally, they may not be welcome as refugees in some regions they seek shelter in, due to their gender or sexual orientation. In the case of aid spearheaded exclusively by men, there is a chance of administrative oversight while provisioning sexual hygiene products. This can lead to secondary health issues and death in the case of People Living with HIV (PLHIV) and persons with terminal diseases, such as cancer.

### Women are Bigger Climate Victims

As per a United Nations Development Programme (UNDP) report, 4 out of 5 persons most affected by CC are women. This is due to historical patriarchal norms, which have impoverished women by preventing them from having access to humane livelihoods. Globally, the energy sector is male-dominated, making women more susceptible to energy poverty and the effects of indoor pollution. Traditional roles of firewood collection, drawing water, farming, or tending to livestock, which are attributed to women, make them inherently dependent on natural resources. However, they lack any ownership, access, or decision-making powers on its distribution, sharing, leasing, or selling. This further affects their leadership and marginalises them.

Thus, women are one of the largest and yet most impoverished stakeholders in society. So far, only financial policies have been made to help women gain parity. To rationalise and balance this inequity, gender-specific strategies and interventions are urgently necessary to empower them to combat CC. Greater regulation and societal transformation are required to truly help women, by including more assessments of the impacts of policies on various genders.

### Yagna Parmar, Project Director, Vacha Charitable Trust (Mumbai)

Gotelind Alber, Co-Founder, GenderCC–Women for Climate Justice

Gender minorities find it especially hard to access resources that are their constitutional right. They cannot easily relocate or migrate, since property owners are reluctant to rent out properties to them. The lack of legal recognition of gender minorities also leads to their criminalisation. They are usually isolated and excluded by society, which limits their ability to gather relevant climate information and have timely access to evacuation or relief operations. Moreover, gender minorities are more likely to rely on informal employment, which is often the first to be lost in climate disasters. Same-sex couples may also face discrimination and receive inadequate aid compared to heterosexual couples during such events. To ensure equitable distribution and access to governmental



Graph 4.3.1: Comparison of mortality rates for different genders based on their exposure to pollutants and hygiene conditions

aid, CBOs, NGOs, and individuals must improve awareness and outreach programmes targeting these minority groups. Establishing climate networks for LGBTIQA+ individuals is an important step towards self-empowerment and addressing the climate crisis.

### **Gender-based Climate Future**

The current level of knowledge is insufficient to help make policy-level decisions on bringing about gender parity concerning CC. Research is also necessary on the varying impacts of CC across genders and especially on gender minorities. Data on air pollution exposure, migration due to economic or ecological reasons, number of deaths due to disasters, and loss of livelihoods due to CC are some examples of this. Gender-based patterns of water and energy consumption, waste recycling, and the role of gender minorities in industries could be studied. Such research

#### **Solar Mamas**

Barefoot College, in the village of Tilonia, Rajasthan, is a unique institution founded by Bunker Roy, in 1972. Barefoot College trains illiterate village women to fabricate solar panels, lights, and photovoltaic circuits. It only accepts women over the age of 35, especially grandmothers, residing in remote inaccessible areas of any country. The training is not dependent on spoken language but only relies on sight and sound.

The reason for choosing older women from villages is that there is a much smaller chance

of them migrating from their villages to cities in search of employment after obtaining the training. This ensures they stay in the villages and electrify them. The current model of depending on a government engineer living in the nearest city for a village's power grid maintenance is not feasible. Bunker Roy and Barefoot College believe in the Gandhian philosophy that the skills (in this case, to maintain energy systems) should lie with the people on the ground.

The college has gained worldwide recognition and Cultural Ministers from all over the world have sent women from their countries for the training programme. There have been countless stories of helpless, 'down and out' old women leaving their villages for Tilonia and six months later returning to their villages full of confidence and skill. They have gained the admiration and respect of their village communities by electrifying their villages. They are thus, affectionately and respectfully called, 'Solar Mamas'.

Barefoot College celebrated its 50<sup>th</sup> anniversary in 2022 and to date has trained over 15,000 women from 83 countries.

Bunker Roy, Founder, Barefoot College, Tilonia, Rajasthan could also gauge their preferences and understanding of CC policies.

Undertaking such in-depth research would necessitate large corporate and governmental investments to engage the maximum number of people, from diverse gender identities. Financing should be made easy and flexible for women and gender minorities. One way to do this would be to include them in the development of funding criteria and resource allocation itself. Budget analysis according to gender is required to facilitate this. This will lead to gender-sensitive policies, disaster mitigation plans and capacity-building programmes, being adopted by governments. Women leaders have made a considerable difference in natural disaster responses, be it emergency rescue, evacuation efforts, reconstruction after a disaster or management of resources. Denying opportunities to women or gender minorities will effectively deny them the chance to propel data-driven climate policies.

Indigenous communities and particularly the women in them play a vital role in biodiversity conservation as they act as stewards of natural resources. Their inclusion in development plans ensures a comprehensive approach that recognizes the value of their traditional knowledge and practices. Technological advancements could also be made using this knowledge as a base. An increased rate of such participation in research

# Gender-inclusive Waste Management System

Paradeep, a port in coastal Odisha, is considered one of the cleanest small cities in India. It boasts of a unique waste management system, which has integrated transgender people, women, and rag pickers, giving them the dignity of labour and making them self-sufficient.

Before 2019, solid waste management was scarce in Paradeep. Door-to-door waste collection systems were irregular and people dropped off their household waste into community bins, roads, drains and vacant spaces. Due to a lack of proper segregation at the source, the city was filled with mixed waste, which was of little use. In 2019, the Paradeep Municipality introduced quick and drastic changes in the city's waste management system. The city introduced a modern model based on socio-economic sustainability. The Municipality roped in SHGs who were first entrusted with the responsibility of visiting every urban household to spread awareness about the advantages, disadvantages, and process of proper waste disposal. This outreach campaign was an enormous success, ensuring that citizens segregated their dry and wet wastes.

### **The Process**

- 1. Waste collectors or *swachhakarmis* manage a daily door-to-door collection of segregated waste from across the city. The *swachhakarmis* are overseen by a supervisor called *Swachha Saathi*. Together they are all members of a women's SHG.
- 2. A group of transgender *swachhakarmis* take the wet waste to a micro-composting centre, where it is converted into compost. Women members of the SHG sell this compost at stalls they manage. The profits help with the salaries and upkeep of the centres
- 3. Other transgender swachhakarmis take the dry waste to a material recovery facility, which recycles plastic into granules, which can be used by industries to make new products. Other recyclable materials are also suitably managed.

Local SHGs have played a critical role in this operation run by the Paradeep Municipal Corporation. This project has not only handled climate-hazardous mixed waste and turned it into eco-friendly products but has also provided dignity, inclusion, and employment to transgender people. This is a perfect example of mainstreaming gender minorities while providing them with an opportunity to be a part of global climate action efforts.



Paradeep Waste Management System (Credits: The New Indian Express)

and technological innovation will drive local skill development. Their participation in technological development can ensure, sustainable, efficient and accessible technologies. To achieve globally assigned SDGs and biodiversity conservation goals, it is crucial to invest in research on low-carbon and resourceefficient technologies. However, it is equally important to study access, affordability, attitudes, and demand for these climate-friendly technologies across the gender spectrum.

# **10 Climate Actions for Women and Gender Minorities**

- 1. Start a Queers for Climate Action (LGBTQIA+) group in your locality to work on local climate-related outreach, discussions, networking, and actions.
- 2. Raise awareness among people to include gender minorities in mainstream climate, energy, transportation, and education policy conversations.
- 3. Provide skilling and vocational training to women and gender minorities to increase their employability and entrepreneurial capabilities.
- 4. Provide reservations to women and gender minorities and facilitate their taking up jobs to combat CC.
- 5. Organise green menstruation workshops for all and encourage women to shift to menstruation cups instead of non-biodegradable and disposable sanitary pads.
- 6. Conduct research into the varying impacts of CC on different genders.
- 7. Provide plots/shops and funding to gender minorities to undertake urban farming and eco-restoration, and sell eco-friendly, upcycled or recycled products.
- 8. Organise festivals to provide women and gender minorities with an opportunity to express their concerns through art, music, dance, poetry, science, or other creative forms.
- 9. Provide tax incentives to women and gender minority co-operatives and encourage corporates to showcase and buy products produced by marginalised communities.
- 10. Demand for third-gender washrooms in all public places, including refugee homes.

# This subchapter has covered the following Sustainable Development Goals



# 4.4 Disability

The Centers for Disease Control and Prevention (CDC) defines disability as a condition of the body or mind that makes certain activities more challenging for individuals and hinders their interaction with the world around them. There are various types of disabilities, including those related to vision, hearing, cognition (thinking, memory, learning), communication, movement and mobility, mental health, and social relationships (Duchenne muscular dystrophy, Down syndrome, rubella, autism spectrum disorder, Attention-Deficit/ Hyperactivity Disorder (ADHD), traumatic brain injury or spinal cord injury, diabetes, muscular



dystrophy, limb loss, multiple sclerosis). Disabilities can be congenital or acquired later in life and can be temporary, permanent, or progressive. The impact of disabilities can vary in severity and affect individuals, their families, and society to different extents.

People with disabilities are not a homogeneous group, as their needs and experiences vary greatly. Factors such as location and socio-economic conditions can significantly impact the way disabilities are experienced and the level of support available. It's important to recognise that disabilities can be both visible and invisible, and individuals may have multiple disabilities that further compound their challenges.

The World Health Organization (WHO) identifies three dimensions of disabilities: impairment, activity limitation, and participation restrictions. Impairments refer to the effects on an individual's body structure or function. Activity limitations arise from difficulties in performing specific tasks or actions. Participation restrictions affect a person's ability to engage in various activities and roles in society. Disabilities can impact a person's safety, social interactions, and economic status. By recognising their unique needs, we can strive for inclusivity and equal opportunities.

WHO published the International Classification of Functioning, Disability and Health (ICF) in 2001, which estimated that globally, some form of disability debilitates over one billion people. This number is expected to rise to nearly two billion by 2030. The distribution of disabled people is not uniform across the world; two-thirds live in low and middle-income countries. Thus, there is a higher possibility of a disabled person being poor as well.

### **Surviving Climate Crisis on Crutches**

Persons with disabilities are often economically, socially, and medically dependent; some require permanent caregivers. Even if a person with disabilities gets employment, they rarely have access to high-paying or secure jobs. Disabled people are twice as vulnerable to poverty. Many also incur high health-related expenditures and, in case of recurrent medical emergencies, are at risk of losing their jobs. In urban areas, there are more opportunities, facilities, and educated disabled persons, and corporate employers are bound by legal policies to provide concessions to bring about equity to such people. However, the situation is extremely grim with rural and tribal people with disabilities, who are affected by crop failures

caused by drought, floods, pest attacks, fires, hefty loans, and small landholdings, forcing them into financial and social despondency.

Many congenital disabilities affect the human body's capacity to regulate temperature. If an individual cannot afford to install good temperature control systems in their places of residence, they will suffer immensely due to the urban heat island effect, a general rise in temperatures and heat waves. Similarly, individuals with breathing disabilities will be sick due to dust, Suspended Particulate Matter (SPM) and ground-level ozone caused by construction, industries and vehicles running on fossil fuels. Many persons suffer seasonally from pollen allergies, which are compounded by reduced immunity due to CC. Disabled persons are additionally challenged as they face unequal access to healthcare due to poverty, social stigma, discrimination, policy-level exclusion, and a lack of healthcare programmes designed to cover persons with specific disabilities.

### **Disabled People as Representatives**

There are very few people with disabilities in global politics and unfortunately, in India, the situation is the grimmest. We have observed a vacuum in political representation for persons with disabilities to be the biggest challenge in inclusive governance.

In 2012, we were part of a conference held by the European Union. At the inauguration ceremony, Helga Stevens, a deaf and speechimpaired Member of Parliament (MP) from Brussels, Belgium, addressed us. Despite her multiple disabilities, she is not only holding an extremely high political position as an MP of a European Union state but is also influencing public policy. During the conference, one could find Helga walking around with interpreters and getting her job done. It is high time we do something similar here in India as well. The inclusion of disabled persons into the mainstream is the urgent need of the hour.

### Dhananjay Bhole, Blind Entrepreneur, Pune

Dr. Jayant Mahajan, Asst. Prof., Christ University, Pune During climate accidents, persons with disabilities are either incapable or find it difficult to manage self-care tasks. They cannot convey their challenges, access modes of mobility, secure finances, employment, housing, or re-engage in education, community, and civic life.

In the case of a mega-disaster, disabled persons might lose life-support equipment such as wheelchairs, canes, hearing aids, and inhalers, or can be separated from their family, caregiver, or trained companion animals. This can spell doom for them as disaster relief packages do not typically include such equipment or support facilities. Disabled individuals find it difficult and, in some cases, impossible to adjust without such equipment for extended periods. If a disaster forces them to relocate to another country, they are less likely to be granted asylum due to the perceived burden on the host country's resources. Even for migrations within a country, they will have to deal with new surroundings, poor facilities while in transit and the daunting task of searching for disabled-friendly employment and housing.

The activities and participation of persons with disabilities can be made easier during climate crises by improving environmental factors, technology, support infrastructure, healthcare, safety services, and policies. Designing inclusive infrastructure as well as social structures will enable them to enter the mainstream and contribute to society. Similarly, it must be ensured that this vulnerable chunk of the population can successfully fend off the negative effects of CC.

Despite the odds being stacked against them, many persons with disabilities have contributed significantly towards society, viz. Albert Einstein (scientist with dyslexia), Frida Kahlo (painter with spinal and pelvic damage), Helen Keller (deaf and blind author, disability rights advocate, political activist, and lecturer), Vincent Van Gogh (painter with manic depression), John Nash (mathematician with schizophrenia) and Stephen Hawking (theoretical physicist with amyotrophic lateral sclerosis). Including such illustrious persons with disabilities in the redesigning discussions and climate actions will provide a massive boost and pertinent direction needed to rationalise global efforts in inclusive climate justice.

# Are Our Surroundings Disabled-friendly?

Someone who is not familiar with the challenges and limitations faced by persons with disabilities, may not comprehend the scope of the problem. A one hundred per cent disabled-friendly infrastructure is a pipe dream even in developed countries. Developing countries, such as India, might consider investing in such facilities an unnecessary luxury. This thinking stems from the misconception that the proportion of disabled persons is exceptionally low, which is reflected in the one reserved seat in a bus or half a coach in a suburban local train even in major metros.

# **Creating an Eco-learning Centre**

Although I am a deaf person, I feel like any other normal person. I am self-sufficient and do not feel like I am disabled in any way. This is the story of how I started the Shikha Eco-Learning Centre (SHICOL), a school for deaf children.

I was working in the corporate sector in the United Kingdom. I had a stable job and a good salary. I could have settled there, but I wanted to do something for the environment. Therefore, I moved back to India in 2016 and started SHICOL Village on a patch of land on the banks of the Mahanadi River, in Odisha, which was mostly barren with a few shrubs. I set to work planting trees and now the land is full of greenery and biodiversity. I feel that my journey has just begun and there's plenty to be done.

At SHICOL, we have two primary streams of work. The first stream is alternative learning. We teach deaf children in a natural environment. We also have international partnerships with professors and even conduct research. The second stream is working on the ecological restoration of the region. We combine traditional knowledge with modern technology such as solar energy and water harvesting systems and use them for tree-planting and eco-farming. We are working on different concepts of regenerative agriculture.

We learn from the children as much as they learn from us. We have created a community, where knowledge-sharing and mutual support are possible. It is my personal goal to become a net zero person in the next couple of years and once I accomplish this, to even turn SHICOL into a net zero campus. In this journey, my deafness has never been a disability, but has opened up more opportunities than challenges.

### Sibaji Panda, Founder, SHICOL, Odisha

Graph 4.4.1 shows how the number of disabled people in India account for around 2.67 per cent of India's population, making up 37 million people. In addition, one in every eight persons has some form of permanent or temporary disability, which may need specialised facilities. Most would not even include pregnant women, old persons, those suffering from cancer, those undergoing dialysis, and persons with physical injury in the disabled category. This results in scanty, insufficient, and improper infrastructure, considering the wide diversity of disabilities that people may possess.

According to the UN's World Population Prospects Report 2022, by 2050 the number of people aged 65 or above will amount to 16 per cent of the total global population. This will be more than twice the number of children aged under five in 2050. Senior citizens face increasing disabilities with vision, hearing, speech, mobility, memory, and cognition, making them highly dependent on personal and governmental care and facilities; some poorer countries lack financial resources and their governments do not provide social security. With women, the lack of ownership regarding property and bank accounts can make them very vulnerable. To ease the plight of such senior citizens, disabled by age-related disorders, their inclusion in the disabled category and suitable policy interventions are necessary.

It is of utmost importance that major changes are implemented in skeletal public facilities. These changes should encourage comfortable travel by public transport, and provide disabled-friendly footpaths and road crossings. Elevators and public transport must have multilingual and signage-based messaging, besides training for evacuation during a natural disaster. These are not privileges for a select segment of society, but benefits that every person, disabled or otherwise, beyond 65 years of age will have access to. Accessible surroundings will reduce the disparity in times of crisis or natural disaster.

# The Future is Enabled

Including persons with disabilities in policy-making and governing bodies often ensures that policies are more inclusive, especially in terms of employment, financial security, and disaster relief. This makes the community better informed about CC. These policies should be based on data-driven research focused on issues of persons with disabilities, which are lacking in most countries. National data collection systems should also

# The City of Blind

Marburg, a town in Germany, is historically famed for being a hub of accessibility. Called *'Blindenstadt'*, the entire city is designed to accommodate the needs of visually impaired and blind persons.

The *Blindenstudienanstalt* (or *Blista*) was founded during World War I as an educational institute for the blind. It provided opportunities to young men blinded in the war.

The town has beeping traffic lights and pavements and floors with ridges and bumps, which are used by blind people to navigate. Major sites and buildings have raised maps and floor plans, while Marburg's Castle and Town Square have detailed miniature bronze models to allow blind visitors to touch and feel the entirety of each landmark.

The institute has created several inventions for blind people, such as a tactile mathematical font. The town also has many sporting facilities customised for blind persons, such as a horseriding school, rowing, football, rock-climbing, and skiing clubs. The town's university has the highest proportion of blind students in Germany gaining the widest range of degrees received by blind persons. The credit for this goes to Blista.



Blind-friendly Model of Uranus (Credits: Ludwig Micheler/Wikimedia Commons/ CC BY-SA 4.0)

make persons with disabilities a focal group to plan inclusive risk and capacity assessments.

Their participation in the design or redesign of climateresilient infrastructure would ensure buildings with easier access, multimodal information, and warning systems, as well as freely available support services.



Graph 4.4.1: Percentages of types of disabilities in India

They should also grant disabled people leadership positions in these undertakings. Youth with disabilities should be especially encouraged to take part in climate movements and conferences. Such disabled youth leaders can train aid workers in disability sensitivity. Similarly, disabled people can receive vocational training in green jobs, through capacity-building programmes, incubation, and social capital funding. Disabled engineers, architects and designers can create houses, products and public services that can be used universally, irrespective of their abilities. Fortunately, in India, the National Disaster Management Authority (NDMA) in 2019, started a National Disaster Agency, based on their draft guidelines on disability and disaster. This agency will focus on coordinating, managing, and monitoring the integration of persons with disabilities into the disaster risk management and CC action plans of every state, by region.

# **10 Climate Actions for Persons with Disabilities**

- 1. Organise climate awareness programmes for engaging disabled persons.
- 2. Design disabled-friendly infrastructure with multimodal communication systems.
- 3. Implement multimodal disaster warning systems and conduct training sessions for varied disability groups to prepare them for emergencies.
- 4. Provide skilling, suitable job opportunities and marketplaces to disabled persons.
- 5. Create inclusive and equitable opportunities in educational institutions and make it easy and comfortable for persons with disabilities to pursue higher education.
- 6. Set up sustainable, easily operable, and disabled-friendly transportation, temperature control, and safety systems in homes, offices, and public areas.
- 7. Install open-air gymnasiums in green spaces for ease of access to disabled persons.
- 8. Encourage early-career teachers to teach specially-abled children, especially those who can engage them in environmental protection and restoration activities.
- 9. Provide reservations to persons with disabilities to facilitate encouragement, support and equal opportunities.
- 10. Include persons with disabilities in policy discussions on transportation, health, education, climate, employment, and disaster management.

# This subchapter has covered the following Sustainable Development Goals


## **Chapter 5: Human Environment**



Today, over half of the world's population lives in cities. This number is expected to only go up in the coming decades. There are certain inevitable outcomes when a large number of humans congregate to live together in small places called cities and towns. They consume a great number of resources, such as food and energy, while also generating high levels of pollution and waste products. This human environment immensely affects and gets affected by climate change (CC). Every city management is under enormous pressure to put together disaster-prepared infrastructure while maintaining affordable and equitable access to all strata of society.

Cities and towns are urban environments which are centres of human activity. They are characterised by built-up structures and crowded centres of commerce. Multimodal vehicular traffic mills in and out of streets, emitting tonnes of Suspended Particulate Matter (SPM) and oxides of carbon (COx), nitrogen (NOx) and sulphur (SOx), as they transport millions of humans across hundreds of kilometres per day. Industries churn away, producing goods, and fuelling our economy, while emitting GHGs, aerosols and chlorofluorocarbons (CFCs) which affect cloud formation and their waterholding capacities. These urban environments thus play a major role in driving CC and are the root cause of global warming.

These places also generate a wide variety and copious amounts of wastes, which need to be rerouted to a safe location for disposal. More often than not, this ends up in a landfill on the outskirts of cities, destroying a thriving wetland or grassland ecosystem. As the landfill slowly releases GHGs and leaches heavy metals into the soil and groundwater, the surrounding communities face the consequences of living in its vicinity, causing severe health impacts. These landfills attract scavenger species, such as kites, rats, dogs, pigs, flies, termites and mosquitoes, which cause disease outbreaks (dengue, malaria, cholera, typhoid), lead to humanwildlife conflicts (leopard attacks, snake bites), cause aeroplane accidents due to bird hits and compromise the strength of buildings by leaching of fluids. The COVID-19 pandemic of 2020-22 exacerbated the waste problem by generating enormous volumes of biomedical wastes. These hazardous wastes either ended up in landfills or were incinerated, adding to the already dangerous levels of pollution. The medical industry and waste management infrastructure has been forced to work overtime as their wastes tremendously affected people's physical and mental health, in urban hubs. As CC makes its presence felt in ever-increasing ways, the health parameters, guality of life and SDGs of a city could take a serious dip.

As droughts are expected to increase in frequency in both urban and rural regions, they will cause a drop in food production, resulting in global food scarcity and 'hunger islands' in these landscapes. Despite this, due to wasteful consumption, cities are increasingly seeing large quantities of edible food land up in garbage bins and eventually landfills. To add to the urban carbon footprint, globalisation has ensured that the food we eat can be imported from halfway across the planet. Exotic foods such as coffees, dragon fruits, asparagus and avocados, are shipped across continents causing tonnes of GHG emissions before they even reach our plates. This causes massive disparities among local farmers, who are tempted to shift from openpollinated, heirloom food crops to non-indigenous, hybrid and GMO cash crops, which once again cause drainage of critical foreign exchange.

Tourism is one of the highest GHG-emitting sectors. Most of the tourists prefer to travel by aeroplanes and private Sports or Multi Utility Vehicles (SUVs/MUVs), stay in air-conditioned hotels, drink bottled water, and consume packaged snacks and unseasonal foods. Lured by an 'exotic' tag, they wittingly or unwittingly support the illegal consumption of or trade in endangered wildlife. Cities tend to be transit points to exotic tourist destinations. Eventually, both end up covered in non-biodegradable trash, which can plague locals and damage local ecosystems for centuries. They are also exchange portals for communicable diseases. Tourism-centric cities, although very upscale and modern, get highly impacted in case of a climate disaster or political disturbance, causing massive loss of livelihoods. Rich tourists drive up the cost of living and the pressure on public infrastructure affects small businesses and local women, children, disabled persons and seniors. Climate disasters push the already marginalised locals out of sight, as most efforts are focused on rich visitors. Climate-resilient cities would remedy this, with suitable policies and plans to support the most marginalised communities, while retaining the tourism-friendly identity of the city.

The interplay of all these sectors drives the daily lives of urbanites. There are huge impacts to be considered on the well-being of the citizens and the national economy too. This chapter will look at each sector in detail and look at ways to improve the urban environment, right from around our homes, schools, and workspaces and up to our Tier 2 and Tier 3 cities.

## This chapter covers the following Sustainable Development Goals



## 5.1 Pollution



Pollution is an unwanted change in the physical, chemical or biological components of our surroundings, which includes changes in temperature, chemicals in the air, water and soil, levels of light, smells and noise in the environment, changes in the

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flora and fauna and spread of pests or germs. These changes could be induced by human activities or they catapult as a response to natural phenomena, such as seasons, cyclones, droughts, famines, floods or forest fires. Some of these changes are small in nature and can be controlled with minor interventions and mitigation measures. However, some pollutants can take monstrous proportions or have a habit of biomagnifying as they are passed on higher up in the food pyramid, causing long-term and sometimes irreversible disasters. Controlling them and in some cases, completely banning their production, use and sale, is the only way out. CC adds a certain level of unexpectedness to these pollutants which generally work in tandem and have an amplified effect on the creatures they impact.

A blanket of air pollution traps heat from the sun's UV rays in the earth's immediate atmosphere and is the prime cause of global warming. This pollution arises from vehicular and industrial emissions, domestic sources, burning of wastes, construction and fossil fuel-based power plants. Industries, vehicles and anthropogenic activities also cause noise pollution, which is another serious, but less recognised form of pollution. Indian cities are among the noisiest cities in the world, with noise levels reaching over 110 db. In some cities, noise levels up to 130 db (equivalent



Graph 5.1.1: Global CO<sub>2</sub> emission from fossil fuels and land use changes for the past 170 years

to a jet plane taking off) have been recorded, which can be damaging to the eardrum, cause anxiety, loss of appetite, sleeplessness and in extreme cases, even nervous breakdowns.

**Pollution and its Climate Impacts** 

Graph 5.1.1 shows the emissions generated by fossil fuels, industry and polluting land use patterns. It can be observed that land use emissions have remained relatively flat through the decades but industrial emissions have been increasing exponentially.

Three-quarters of total world emissions come from energy use (electricity, heating, cooling and transportation), followed by agriculture and land use (approx. one-fifth) and the remaining eight per cent from industry and waste. The emissions from the agriculture sectors increase by one-quarter, when food processing, packaging, transport and retail are considered. Livestock rearing adds nitrous oxide and methane to the atmosphere due to decomposition of manure under hypoxia or anaerobic conditions. Though pollution is not prioritised as a health hazard, it invariably leads to compromised quality of life and severely and permanently affects the health of humans and the ecosystem. Asthma, various types of cancers, and waterborne diseases are just a few examples of the damage it causes.

#### **Bhopal Gas Tragedy**

The Bhopal Gas Tragedy (BGT) occurred on the intervening night of December 2-3, 1984 in Bhopal, Madhya Pradesh. A pesticide plant belonging to Union Carbide (India) Ltd. malfunctioned at night, releasing toxic Methyl Isocyanate (MIC) gas on unsuspecting townsfolk living around the plant. The final death toll is estimated to be as high as 20,000 people, with 500,000 survivors left with respiratory problems, blindness and other severe health issues.

Even four decades later, one can see the effects of the MIC gas on unborn foetuses, children and youth who survived the tragedy that night. Most of them are either infertile or have produced babies with multiple deformities. This makes BGT the worst air pollution disaster not only in India, but also across the globe. **Air pollution:** Chemical pollutants such as methane, CFCs, black carbon, ground-level ozone and sulphate aerosols have significant impacts on the climate. After  $CO_2$ , black carbon and methane are among the top contributors to global warming. According to WHO, more than 90 per cent of people globally, breathe potentially harmful air. Vehicles, industries and construction, which are prime sources of air pollution, also contribute to other forms of pollution. Air pollution is also characterised by changes in atmospheric temperatures in the form of the urban heat island effect, heat and cold waves, cyclones, blizzards, cloudbursts and wind tunnels in urban areas.

Volatile Organic Compounds (VOCs), aerosols, CFCs and Hydro-chlorofluorocarbons coolants, (HCFCs) from air-conditioning and burning of farm wastes and plastics are also major contributors to air pollution. Plastic burning releases dioxins, furans, mercury and Polychlorinated Biphenyl (PCBs) which, besides affecting the quality of ambient air, are carcinogenic and teratogenic compounds. Combined with other near-surface atmospheric substances, they can wreak havoc and result in smog, which can cause asthma, eye irritation, bronchitis and in extreme cases, pneumonia and permanent lung damage as well as road and air traffic accidents. When these pollutants rise to the higher reaches of the atmosphere (stratosphere), they damage the ozone layer and affect the moisture-holding capacities of clouds, resulting in the entry of UV radiation, heat waves, cyclones and cloudbursts. Higher levels of UV radiation in the atmosphere can increase incidences of sunburns, skin cancers, immune-deficiency disorders and cataracts.

Foul odours emanating from waste bins, landfills, polluted creeks and open defecation areas cause huge discomfort to residents. They also attract biological agents of control, such as scavengers and decomposers. If the decomposition is anaerobic, the situation is aggravated by increased release of methane and therefore greater stench. Other biological sources of air pollution can be excessive pollen grains, and pest insects such as mosquitoes, flies, midges and locusts, which can cause allergies, spread diseases and destroy crops. CC also intensifies the frequency and spread of certain diseases and viruses, causing conjunctivitis, chicken pox, Ebola, Zika, SARS, MERS, etc. In extreme cases, air-borne creatures such as anthrax can be used as biological warfare agents (bio-terrorism) and cause large-scale loss of life.

Noise pollution: Though noise does not directly affect climate, most sources of noise are also sources of CO<sub>2</sub> and other GHGs. Examples include unregulated activities such as recreation, construction and vehicular traffic. In India, the celebration of festivals, marriages and religious processions and cultural activities contribute to high decibel levels in urban areas. The beating of drums, the use of electronic soundamplification devices and firecrackers add to loud noises, which can cause severe damage to human systems. There is also a lot of white noise within our households from refrigerators, mixers, grinders, fans, washing machines, music systems as well as vacuum cleaners. There are also the noises of aeroplanes, trams, metro and railway trains, trucks and buses, as well as heavy machinery and generator sets used in places with regular power failures.

To add to this chaos, despite regulations, foreign and Indian car manufacturers compete with each other to install extra-loud horns. Driving schools teach people to honk to avoid running over people or animals that jaywalk and disrupt the flow of vehicles. Although there are strict norms and suitable signage, honking at signals is rampant and traffic police do not implement laws or take action against defaulters. The impacts of climate accidents will be compounded in areas where noise levels are high. It will affect the mental health and general well-being of people, with noise increasing their anxiety and stress levels. Traffic noise can be reduced by restricting the decibel levels of horns, ensuring strict implementation of anti-honking rules, creating more silent zones and controlling vehicular sound emissions through regular servicing of vehicles.

Water pollution: Deforestation, heavy precipitation, landslides and floods exacerbate soil erosion, while also increasing the run-off into water bodies. Increased water temperatures create conditions suitable for eutrophication and algal blooms. This makes the water unsuitable for drinking as well as, to support life, by destroying energy pyramids and food chains in these wetlands. Landfills and wastewater from homes, farmlands and industries contain organic matter, residues from animals, plants and humans, oils and many hazardous chemicals. If left untreated, they produce methane and NO, and increase the risk of eutrophication or soil contamination. In certain cases, the contaminated water sources end up being toxic or result in widespread diseases such as cholera, typhoid and Minamata disease. It is estimated that there is a

nine per cent reduction in agricultural revenues and a 16 per cent drop in agricultural yields, downstream of polluted river stretches in India.

Indian and global rivers serve as channels for plastic and other non-biodegradable waste, which ultimately find their way into the oceans. This has contributed to the formation of the 8th continent or the Great Pacific Garbage Patch. Furthermore, the discharge of oil residues and surfactants into freshwater bodies has implications for their evaporation rates, affecting cloud formation. The warming of oceans, along with the release of untreated warm water from thermal and nuclear power plants, is causing significant biodiversity losses in rivers, lakes, seas, and oceans. These warm waters also disrupt air pressure patterns, leading to an increase in the frequency of cyclones and low-pressure zones. Consequently, these environmental changes have resulted in millions of people becoming homeless and widespread property damage amounting to billions of dollars. Moreover, contaminated water has altered electrical conductivity and diminished oxygenholding capacity, posing threats to biodiversity and hindering its utilisation in various sectors such as industries, homes, and farmlands.

Polluted and clogged waterways affect over-water transportation, due to the growth of weeds, such as Water Hyacinth (*Eichhornea*), *Pistia*, or *Lemna*. Such choked waters along with warmer temperatures become ideal breeding grounds for mosquitoes and prevent the survival of ecologically important species, such as water plants, dragonflies, damselflies, fishes and frogs. In cyclone and tornado-hit areas, salinisation of drinking water and crop fields leads to famines or droughts, and large-scale human and livestock deaths. Protecting wetlands in urban, rural and wilderness areas will thus help improve the quality of life by providing potable water, increasing the levels of sequestered carbon, controlling atmospheric temperatures and also providing a habitat for biodiversity.

**Soil pollution:** It is caused by unsound agricultural practices such as the use of chemical pesticides and fertilisers, which leach into wells, wetlands and the soil. Poor waste disposal and the use of non-degradable materials also contaminate soil, by lying dormant for centuries or interfering in biogeochemical cycles. The continuous decline in soil moisture increases the need for irrigation and leads to reduced crop yields, and also desertification. This dramatically impacts food production and availability to the local poor

populace. Soil pollution also affects the soil's capacity to sequester carbon, further snowballing during climate accidents. When crop yields reduce, tribal and local communities shift their focus and fulfil their food and fuel needs by harvesting natural biodiversity, thus promoting poaching and diminishing ecosystem services. They also practise shifting and slash-andburn (*Jhum*) agriculture, which leads to severe mineral leaching, deforestation and soil erosion.

Soil pollution inevitably leads to water pollution, as groundwater reserves are affected by the pollutants in the soil. Indiscriminate plastic, polystyrene (thermocol) and Styrofoam disposal leave microparticles for centuries in the soil, making it infertile and uncultivable. Excessive soil extraction for creating baked bricks also causes huge losses of topsoil, while adding to air pollution. Dumping of urban mixed solid waste in and around rivers and lakes, causes the spread of these materials into cultivable land, via canals, and

### **Managing Urban Air Pollution**

Construction and Demolition (C&D) waste is another source of dust pollution rampant in Indian cities. In Delhi and Thane, construction was temporarily halted by court orders when the Air Quality Index (AQI) exceeded safe limits. Air pollution in Mumbai needs to be checked using international standard equipment and control at sites during construction. Recycling of C&D waste is mandatory under the C&D Rules 2016, but urgent implementation is needed.

Instead, Waste-to-Energy (WtE) plants are proposed near Delhi, and at the Deonar landfill in Mumbai. However, these WtE plants burn waste and release highly toxic fumes, which spread pollution across very large areas. For this reason, they are widely opposed by residents and by scientists who opine that mixed wastes in Indian landfills do not have sufficient calorific value to make them viable.

As a palliative measure, smog towers are installed in Delhi, but have not significantly reduced air pollution. Nevertheless, the Brihanmumbai Municipal Corporation has proposed air filters at traffic junctions.

Sumaira Abdulali, Convenor, Awaaz Foundation, Mumbai pumps, during tornadoes, cyclonic squalls and floods. The increasing number of prawn farms along paddy fields and the spread of the exotic mesquite (*Prosopis juliflora*) tree are causing the salinisation of fertile soils. Oceanic cyclones and tsunamis also blow large volumes of seawater inland turning highly productive ancestral farms into infertile famine bowls. Strong policies for the prevention of soil pollution, segregation of wastes at source and recycling of non-biodegradable materials will help protect our precious soils. It is imperative to prevent soil pollution, salinisation and erosion, as reduced crop yields can multiply the impacts of climate accidents and skyrocket death figures.

Light pollution: Excessive streetlights, signage and other artificial light sources have proliferated in cities, towns and villages. They tend to disrupt ecosystems and obscure stars, by brightening up the night sky. They also contribute to CC by adding excess heat, carbon emissions and in some cases localised heating. Light pollution confuses natural circadian rhythms and disturbs sleep, leading to anxiety and stress. Wild and pet animals are also affected by light pollution; it disorients migrating birds, disturbs the sleep of diurnal creatures, affects the hunting success of nocturnal creatures, interferes in mating rituals of bioluminescent creatures, and swarming patterns of moths, beetles, bugs and bees. Lights along coastal areas also disorient sea turtle hatchlings, which end up piled up against beach resort walls.

The sure and sustainable way to control light pollution would be to install long-life, low-carbon, diffused and passive lighting such as LEDs, Compact Fluorescent Lamps (CFLs) and rechargeable bulbs and tube lights. Using bioluminescent creatures (algae, bacteria, plankton) in glass tubes as the lighting in foyers of buildings, hotels and malls is an idea that is growing popular. Motion-sensitive lighting combined with dimmers, regulators and diffusers is a way to reduce ambient light.

**Radiation pollution:** Radioactive wastes arising from nuclear power plants are a major cause of radiation pollution. Radioactive wastes cannot be degraded, or treated chemically or biologically. The only options are either to store the wastes in tightly closed containers shielded with radiation-protective materials (such as lead) or to dilute them until background radiation levels are achieved. It can also be contained by storage in remote areas with little or no life, such as remote caves or abandoned salt mines, protected by

barriers or shields. Exposure to radiation or radioactive particles can adversely affect plants and animals, by causing bioaccumulation among creatures of higher trophic levels in the food pyramid. When atmospheric radioactive substances react with nutrients in the soil, the soil is rendered infertile and toxic. Irresponsible disposal of radioactive wastes from industries, construction, agriculture and the energy sector leads to contamination of water and soil. The leaked radiation can cause cancers or mutations among terrestrial or marine creatures. Globally, nuclear power plants are being phased out, especially following the accidents in Chernobyl (Ukraine) and Fukushima (Japan). Thus, the best way to reduce nuclear waste would be to not produce it and instead shift to environmentally harmless, eco-friendly and renewable energy sources.

## **India's Pollution Status**

Indian cities are among the most polluted in the world and feature regularly among the annual top ten most polluted lists. In 2019, it emitted 2.88 gigatonnes (Gt) of CO<sub>2</sub> and was criticised as the world's thirdhighest polluter, placed below China (10.6 Gt) and the USA (5 Gt), which are higher CO<sub>2</sub> emitters. While the government acknowledges this, there is a lack of implementation of policies. From every angle, global targets to reduce carbon emissions need to be considered, so that it is not just a challenge for India to achieve but also for the world to follow suit.

## Pollution Control, Mitigation and Policies: The Way Ahead

The very first step towards preventing severe CC is to lower global GHG emissions rapidly. Major mitigation projects are designed to effectively reduce emissions on all continents. Cities and metropolises are beginning to take innovative steps to improve their quality of living by mitigating pollution levels. They are implementing ultra-low emissions zones, no car zones and creating more naturalistic green urban spaces.

Since emissions arise from a range of sectors and processes, a single solution will not help us reach net zero emissions. Many interdisciplinary innovations for decarbonising the economy need to be devised, with a focus on energy, transportation, agriculture, industry and biodiversity. Switching to environment-friendly business strategies may alter overall job profiles, with more people engaging in green entrepreneurship. Hence, it is necessary to invest in building skill-sets along with sustainability ideas, for a smooth transition, without disrupting the economy. After Denmark's greenhouse gas emissions reached an all-time high in 1996, it steadily reduced coalbased energy production and focused on shifting to renewable energy. As of 2021, 48.6 per cent of its total electricity is produced from wind, which is a nearzero emission source. It is thus possible for a country to leverage ever evolving technological innovations, begin its transition to a greener economy, and complete the shift before 2050.

Electric Vehicles (EVs) are a priority area for the Gol as they are not only aligned with the goals of the COP26 but are also projected to reduce air pollution significantly. However, coal is the primary source of power generation in India. Sadly, to meet the everincreasing needs of India's energy sector, rampant deforestation is the norm when establishing new coal mines or reopening formerly closed mines. If EVs are powered by coal-generated electricity, they will not be environment-friendly as it merely transfers the emission load from the transport sector to the power sector. A better solution would be to reduce the dependence on private transport by restricting the building of private-vehicle-only roads and investing heavily in a larger network of affordable mass transportation systems. Increasing wheelchair, cycling and walking tracks would also help achieve some reduction in GHG emissions, besides increasing the fitness of citizens.

To mitigate indoor air pollution and reduce the dependency on coal-based energy for household needs, the use of gas-based and solar cooking stoves is encouraged. As part of the WHO-Urban Health Initiative, this switch was implemented in Accra, Ghana, but can be used worldwide. WWF-India also works with tribal communities who depend on forest resources, by providing fuel-efficient cooking stoves that work on alternate energy options. The Slow Food Movement encourages eating more raw, hand-ground and uncooked food, closer to its source, which eliminates the need for energy-based tools and transportation. Transporting food across large distances adds a large carbon footprint and farmers' markets are the solution to this problem. Eating local and seasonal foods drastically reduces GHG emissions.

Oceans, grasslands and forests are the major ecosystems that maintain the net balance of carbon losses and gains from the biomass or soil. If these systems are degraded and polluted, their ability to sequester carbon is reduced. Hence, it is of utmost importance to prevent the pollution of oceans, grasslands and forests, and restore and conserve them. Creation and restoration of allotments, urban biodiversity parks, sacred groves, reserved and community forests and the establishment of new

#### **Combating Urban Air Pollution**

In Paris, most polluting vehicles have been barred from entering the city centre and the Seine River quayside, and road space has been reclaimed for trees and pedestrians. Also, to improve upon the drop in pollution levels due to COVID-19 pandemic lockdowns, the city expanded its bike lanes and is setting up infrastructure to make Paris a 'walkable' city.

Similarly, to retain the lowered air pollution levels, during the pandemic, Bogota – a city in Colombia, aims at imposing strict emissions standards on trucks and other heavy-polluting vehicles. They are going to develop a fully electric metro rail system to carry almost 8 million residents. They are also planning to expand their 550 km bicycle paths by 60 km.

The state-of-the-art campaign against air pollution in Seoul (Republic of Korea) assesses air quality using robots and satellite monitoring systems. The city also plans to create the first 'wind path forest' by planting trees along rivers and roads. This would channel cool breeze into the city centre while absorbing SPM.

New York's megalopolis is going green with the Governor's efforts to bring down carbon emissions. The state has committed 1.4 billion US dollars (≈95.7 billion Indian rupees) towards funding renewable energy projects, which encourage solar plants and wind farms, aimed at reducing emissions by 1.6 Million Metric Tonnes (MMT).



Walking & Cycling Paths in Paris (Credits: Chabe01/Wikimedia Commons/CC BY-SA 4.0)

protected forests are sure ways to create carbon sinks and reduce regional pollution. Fountains, cascades, and urban water bodies such as ponds, lakes, streams and rivers can also absorb atmospheric  $CO_2$ ,  $SO_x$  and  $NO_x$ , control dust and SPM levels and cool local temperatures, besides providing microhabitats for residents and migratory wildlife. The aesthetic, cultural, social and mental health advantages of such unpolluted natural landscapes are immeasurable and add to the quality of life that the SDGs are trying to achieve.

Stringent legislation for environmental protection has been laid down in India, viz. the NGT Act, 2010; Air (Prevention and Control of Pollution) Act, 1981; Water (Prevention and Control of Pollution) Act, 1974; Environment Protection Act, 1986; Hazardous Waste Management Regulations, 2016; and the Wildlife (Protection) Act, 1972. Their objectives are to provide for the protection and improvement of the environment. The Central Pollution Control Board and State Pollution Control Boards (CPCB and SPCBs), have been established to empower the execution of enacted policies. Citizens must be watchful that these boards and their powers are not diluted and that they exercise control over polluting industries. Suitable PILs, legal interventions and redressal are the rights and responsibility of the active citizenry of a democratic republic such as India.

Noise pollution, which is an increased nuisance in urban regions, can be kept in check through better implementation of laws and the use of alternate technologies such as distributed sound systems, mobile phone messages, time indicators at traffic signals and time restrictions for the use of heavy equipment or noise-creating devices. More 'Silent' and 'No Honking' zones need to be established and strictly regulated, for citizens to reap their benefits. Some European countries also enforce a no-night flight policy to provide peace and quiet to inland residents, permitting only over-theocean take-offs during the night.

To effectively control and move towards net zero pollution, India will have to put together a medically sound and comprehensive pollution control policy. This will have to be complemented by short-term and long-term action plans at local, regional and national levels. Finally, the entire responsibility will lie with the CPCB and SPBCs, for effective implementation as the primary regulatory agencies. It is important to realise that the varied pollutants arise from critical industries, small businesses, construction, households and traffic sources. Hence, any unreasonable clampdowns or bans can affect the country's socio-economic position in the global hierarchy. Therefore, while achieving SDGs, improving our GDP is also an imperative, to maintain social equity and economic growth.

## **10 Climate Actions to Control Pollution**

- 1. Create and maintain an urban park, window or terrace garden and compost leaves, garbage or other biodegradable material instead of burning them and use them to enhance the biotic diversity of the soil.
- 2. Shift to mass public transportation and carpool when using private vehicles.
- 3. Rather than gifting cut flowers or bouquets, gift live plants or plant saplings of indigenous trees and climbers to celebrate birthdays, special occasions and festivals.
- 4. Reduce honking, loud music, drums, sound amplifiers and firecrackers during festivities. Establish silent zones in your area and time restrictions for the use of heavy equipment.
- 5. Say no to chemical floor cleaners/disinfectants with dangerous phenols. Shift to plant-based cleaners.
- 6. Do not wash clothes or vehicles using phosphate-based detergents near natural wetlands. Shift to organic alternatives and safeguard and clean lakes, rivers, ponds and mangroves.
- 7. Set up low-voltage, diffused, groundward-looking, glare-free LED bulbs and tubes, to minimise artificial brightening of the night skies.
- 8. Use natural insect repellents, e.g. citronella instead of pesticides or insecticides to curb bioaccumulation.
- 9. Prevent mixed garbage being utilised by a WtE plant and ensure segregation at source.
- 10. Service vehicles (getting Pollution Under Control certification, cleaning air-conditioning (AC) filters) and maintain devices or gadgets in non-polluting, working conditions.

## This subchapter has covered the following Sustainable Development Goals



## 5.2 Tourism

Tourism is the single largest sector in the world economy and accounts for nine per cent of global expenditure while directly employing over 200 million people, and supporting millions of families indirectly. Tourism employs a large diversity of people in allied sectors, viz. transportation, hospitality, food, health and handicrafts, to mention a few.

While tourism is the financial placeholder for many countries and regions, it is also a highly vulnerable sector. A lot of the families that depend on tourism for their survival are also affected by interruptions to it.

Tourism comes to a grinding halt due to environmental changes, be it disease outbreaks (COVID-19, Ebola, monkeypox, H1N1), socio-political upheavals (Ukraine War 2021, financial or petroleum crises) or climate extremes (Amphan Cyclone in 2020, Europe heat wave in 2021 and cold waves, blizzards, typhoons,

#### **Change in Priorities**

I have been involved with tourism in the Sunderbans for quite some time now and from what I have seen within the last 10 years, the most challenging aspect of sustainability is the change in the behaviour of local people. They are giving up traditional agricultural processes and are planting trees such as eucalyptus, which are cash crops. They are directly going forward with buying boats and forming homestays. They are trying to cope with the growing tourism sector.

So, as more people are indulging in tourism, local people are adopting an urban culture, such as using more plastic and ready-made food. They are forgetting their traditions. These lifestyle changes can be detrimental to both the communities and the landscape or ecosystems that they have co-evolved with for centuries. Serious and urgent interventions are needed to stem this shift to an unsustainable lifestyle and the decay of traditional customs.

Prosenjit Dawn, Associate Professor, Kolkata, West Bengal



Kedarnath Cloudburst in 2013). This not only leads to the displacement of local communities but also destroys the livelihoods of those who are not displaced. It, in turn, results in a lack of resources, which triggers social insecurities, impatience, intolerance, increased exploitation and conflicts, and the possibility of wars. India's revenue from international tourism decreased from 30 billion US dollars ( $\approx$ 2,112 billion Indian rupees) in 2019 to less than seven billion US dollars ( $\approx$ 518.9 billion Indian rupees) in 2020. With this drop India is ranked sixth among the Asia-Pacific countries, in tourism-earned revenues.

All forms of tourism help connect people and bridge cultural divides through interactions, exploration, exchange of ideas and exposure to social diversity. However, it is crucial to understand that the interrelationship between tourism and climate goes both ways. Climate, too, is heavily affected by tourism. To safeguard both tourism and the interests of its beneficiaries amid CC, we must invest only in sustainable tourism. This will help people around the world understand the global climate crisis and put up a united front.

### Impact of Tourism on Climate

Tourism, directly and indirectly, contributes to CC through travel emissions, extravagant lifestyles, use and disposal of single-use, non-biodegradable goods, and extensive resource use at tourist destinations. Additionally, unregulated human activities such as trampling, wildfires, and soil extraction can lead to habitat loss and desertification.

Tourism also contributes about eight per cent to overall  $CO_2$  emissions, and this value keeps rising annually, by approximately four per cent. Through the COVID-19 pandemic in 2020, the tourism sector had shown a seven per cent reduction in global GHG emissions, due to the lockdown and a major reduction in vehicular and tourism-related emissions. However, the figures rose back to old levels, once travel restrictions were withdrawn. To meet the goals of the Paris Agreement (2015), there is a need for a similar reduction in emissions annually, over the next decade.

## Impact of Climate Change on Tourism

Responding to global challenges, a United Nations World Tourism Organization report states that CC will affect tourist destinations, their competitiveness, and sustainability. Impacts will be largely seen directly because of increased climate calamities, or indirectly on mobility policies and the reduction of tourism. Poorly-managed tourism systems may cause social change and severe loss in revenue, leading to a fall in GDP.

With rising global temperatures, tourists are expected to shift to higher and cooler

destinations, in turn making warmer, tropical and equatorial countries, vulnerable and financially unstable. Alongside, heat stress adds to cooling costs, causes changes in distribution, densities and local extinction of sub-populations of flora and fauna and increases the chances and range of infectious diseases.

### Types of Tourism and their Vulnerabilities

Adventure sports: In recent years, adventure tourism is getting popular in India. It involves exploring areas to engage in adrenaline-packed outdoor activities such as trekking, rappelling, rafting, rock-climbing, skiing, river crossing and more. Since these activities are conducted in places tucked away in remote locations, the risks faced by adventure tourists get doubled, when we add the element of climate accidents. Organising rescue and relief operations in such areas become doubly challenging, given the remoteness and in several cases, the lack of early response systems. It would make sense to train all adventure enthusiasts and operators in first-aid and rescue and invest in robust disaster management protocols.



With rising global temperatures, tourists Graph 5.2.1: Carbon footprint of different sectors related to global tourism

Beach and coastal: India's vast coastline of 7,516.6 km allows tourists to enjoy the scenic beauty of the landscape while also enjoying the biodiversity. Andaman & Nicobar Islands and Lakshadweep Islands, though smaller, attract many tourists for funpacked activities such as scuba diving and snorkelling. Goa, Gujarat, Karnataka, Kerala, Maharashtra and West Bengal earn a sizable fortune through coastal tourism and have invested heavily in coastal tourism infrastructure. Repeated cyclones, coastal erosion and changing winds are affecting the biodiversity of these areas and community-run set-ups are failing to attract the numbers of tourists, which made their investments viable. Greater incentives should be provided to smaller, home run or community-owned ecotourism outfits, which have a low impact on the environment, in terms of waste generation, carbon footprint and economic fluctuations. Smaller operations are easier to fund; they fuel local economies and can help in reverse migration towards rural regions.

**Cultural or heritage:** India provides many opportunities for local and international tourists

to experience our rich cultural heritage through monuments, heritage sites, fairs and festivals. However, disease outbreaks and fears of landslides, floods and cloudbursts are affecting the revenues generated by these traditional sources of livelihood. Most ancient cultural and heritage sites, such as forts, temples, churches, mosques, caves, palaces and towers, host large sprawling fig trees with massive honeycombs, colonies of insectivorous and fruit bats, and roosting birds. Many of these heritage sites also have semiwild landscapes, which harbour pollinators such as butterflies, moths, bees, flies, wasps, birds, and small mammals. Besides the earnings through tourism, higher green carbon investments in these traditional infrastructures can lead to biodiversity conservation, carbon sequestration, improved health and regional economic security, via ecological restoration of the talaos (tanks/lakes), baudis (wells), meadows, microforests and the heritage structures itself. However, there lies the risk of losing all these advantages, if such sites are converted into luxury destinations with sound and light shows and 5-star hotels, which bring along with them synthetic and manicured landscapes, with exotic plants. However, the use of a lot of climate-harming materials, such as floor cleaners, Persistent Organic Pollutants (POP) cement concrete, ACs (CFCs/HCFCs), synthetic chemical-based air and water purifiers, phosphate-based detergents and an endless flow of plastic packaging. Small-scale ecotourism is the way to revive and protect these ancient and sacred spaces.

**Educational:** This type of tourism offers possibilities to explore heritage, wildlife or culturally important locations with the intention of research, hobby studies or enhancing one's general understanding. The climate crisis brings psychosis along with fear, resulting in outdoor education being curtailed and funds for field research diverted to religious, laboratory, simulative, predictive, and secondary evidence-based studies. The impacts of CC must be studied, documented, popularised and taught through academic, extramural and informal media. Nature festivals, board and online games, storytelling, puppetry, theatre, music, dance, art installations, science and climate museums and educational walks, will go a long way in highlighting and mitigating causes, effects and impacts of CC on communities and businesses.

**Culinary:** Deeply connected to agro-rural resources, culinary tourism focuses on various delicacies and regional food traditions. Tourists get to experience

different cuisines and authentic delicacies. However, it also tends to be a highly climate-unfriendly tourism format, as a lot of the exotic foods, fruits, vegetables, alcohols and beverages are transported across oceans by aeroplanes or ships. Also, increased pressure from GMOs, hybrids and non-heirloom seeds brings food insecurity among local and tribal communities. Encouraging regional food festivals and buying local grains, fruits, local products or preserves such as jams, jellies, wines or pickles, would sustain local economies while reducing the carbon footprint of culinary tours.

**Medical:** This type of tourism enables people from all over the world to avail advanced, cost-effective, healthcare and medical attention, in countries such as India, which are much cheaper for both surgery and post-operative care. Across India, several medical institutes have specialised in catering to this business requirement and imparting top-quality healthcare. On one side, climate accidents could increase the numbers of medical tourists, but on the other side, visitors act as vectors and spread diseases far more rapidly, increasing the probability of pandemics. Prioritising the needs of rich customers over that of poor, local, marginalised and minority communities would cause social anxiety, segregation and major economic losses.

Religious or pilgrimage: With numerous temples, mosques, gurdwaras, churches, and monasteries across India, tourism for religious activities or pilgrimages are common. The industry is worth millions of US dollars, although the per diem expenditure is usually very low. The large volume compensates for low price points. Climate accidents cause havoc and severely impacts government infrastructure and it's ability to handle enormous numbers of pilgrims. These pilgrims also are the cause of extensive habitat degradation by road widening, dynamiting, and cutting of forests for expressways and linear infrastructure and lodging facilities. The increasing trend of cloudbursts, and landslides, along with mounting non-biodegradable garbage, renders this form of tourism highly disastrous for local economies and ecosystems.

Wildlife: India's immense biodiversity across various biogeographic zones and ecological realms supports many rare and endemic creatures. These are enough to attract millions of local and international tourists to far-flung regions of India. Every state government is engaged in boosting wildlife tourism, as it is an important source of revenue which employs tribals, artists, artisans, farmers, vehicle operators and rich, resort and business owners, too. Commonly, the infrastructure is ill-equipped to respond in case of climate emergencies. However, with its increasing popularity and patronage from influential people, more safety, rescue and relief facilities have been established. Due to its high price point, large funds are available for climate and habitat mitigation. Wildlife tourism would truly become eco-friendly, if it goes hand-in-hand with rural ecotourism and agrotourism, and cuts its carbon footprint.

**Ecotourism:** It deals with the ecological development of regions that have tourism value while knittingtogether culture, natural resources and employment opportunities for local communities. Ecotourism entails sustainable utilisation of natural areas and is most significant in today's era of the climate crisis. This is the direction in which the world will need to progress, to be able to sustain local economies while ensuring ecological systems, ecosystem services and socio-economic security.

### **Conventional Tourism vs. Ecotourism**

The key difference between conventional (mass) tourism and ecotourism lies in their impact on Nature. Mass tourism concentrates more on the profitability of touristy, cultural, heritage and adventure activities, ignoring the well-being of local communities and the explored landscapes. As the name suggests, mass tourism involves an inordinately large number of tourists, and consequently puts immense pressure on local resources, generating large transportation emissions and disturbances, which are highly deleterious to natural ecosystems. Mass tourism is popular, as it is often cheap, but when its ecological impacts are taken into account, we accrue huge economic costs. The volume of waste generated is often impossible to be managed locally, and it changes the dietary habits of local fauna, resulting in attacks and injuries to visitors. Garbage also degrades the aesthetic value of the location, pollutes water sources, and exacerbates the risk of disease spread. Conventional tourism may also widen socio-economic gaps, as luxury tourists have little to no interaction with the local communities, who hardly get any monetary benefit. Additionally, locals are employed in the lowest positions, as porters, waiters, laundry staff, security guards or drivers. While dignified and lucrative posts of managers, chefs, guides, tour leaders, and the ownership of hotels and resorts lie vested in the hands of non-locals. This prevents locals and indigenous people from having any equitable stake or say, in the type of tourism practiced in their area.

On the other hand, ecotourism, with a smaller footfall, tries to achieve a symbiotic interaction, by highlighting the socio-cultural, historical, and ecological backgrounds of the destination. This automatically results in minimal impacts, while being alive to the aspirations of local communities and sensitive to regional traditions and environmental challenges. Ecotourism being small-scale allows customised and personalised experiences for individuals and groups. It involves local communities, preserves agro-ecological traditions and supports local economies. The small group sizes reduce the pressure on natural resources and enhance ancient skill sets and traditional knowledge. Ecotourism also facilitates the development of sustainable and climate-friendly infrastructure, even in remote areas.

Some hallmark features of ecotourism include:

- Small tourist groups;
- Use of reusable cutlery, bottles, and tools, to ensure zero littering;
- Staying in rural homestays and experiencing local, seasonal cuisine;
- Placing minimal stress on resources;
- Respecting Nature and local customs;
- Documenting and preserving local biodiversity and health traditions.

Irrespective of whether it is mass tourism, its subtypes, ecotourism, or its allied industries, each segment of tourism should shift toward environmentally friendly practices. The ideas practised in ecotourism are not exclusive and can be easily replicated in other types of tourism to ensure optimal utilisation of available resources, while maximising revenues for locals and the country at large, without the risks and negative impacts inherent to this industry.

## **Transforming Tourism**

Sustainable tourism seeks to find a balance between environmental, economic, and socio-cultural aspects, which add to a comprehensive view of long-term gain. For the tourism sector to survive, it has to rapidly evolve, adapt, and respond to CC. The UN has an evolving framework to aid progressive reduction in GHG emissions. This framework also focuses on the concept of sustainable tourism development, which incorporates the externalities emanating from CC. As a side event at COP26, 'The Glasgow Declaration: A Commitment to a Decade of Climate Action in Tourism' aimed to catalyse awareness around the urgency to accelerate climate action in tourism. It emphasised the necessity for global tourism emissions to be halved over the next decade, and reach 'Net Zero' before 2050. The framework has defined actions based on five pathways: Measure, Decarbonise, Regenerate, Collaborate, and Finance.

Fortunately, sustainable tourism is picking up in niche travel circles. To further accelerate and catalyse the trend, tour operators, influencers, famous travel bloggers or vloggers, and travel ambassadors can write articles, post pictures, reviews (of locations and homestays), and vlog, to popularise and highlight the need for sustainability in tourism. While advocating for ecotourism, they can shine a spotlight on unique experiences and services provided by local communities. Once word gets around, more people will automatically be encouraged to follow suit.

One needs to remember that the keystones of ecotourism are the optimal use of environmental resources, not to disrupt ecological processes, and to conserve natural heritage and biodiversity. Ecotourism is hailed for its inclusive approach and respect for the socio-cultural authenticity of host communities. It helps conserve traditional knowledge and contributes to raising tolerance towards intercultural diversity. In ecotourism, the socio-economic benefits are evenly, democratically, and equitably distributed among all the stakeholders.

In conclusion, one cannot overemphasise the value of sustainable tourism in instilling an increased sense of climate urgency and action. It sustains

## Transforming Jabarkhet into an Ecotourism Site

The Jabarkhet Nature Reserve (JNR) in Mussoorie (Uttarakhand, India) is a privately owned patch of land. Five years ago, when I visited this place after returning to India, I was shocked by its condition. The forest was degraded, filled with trash, and suffering from uncontrolled cattle grazing, weed infestation, hunting and cutting of trees for firewood.

I found the owner, who was a businessperson from Mumbai and convinced him to set aside

100 acres of his land for us to conserve. His requirement was for it to be a viable business model, capable of running on its own. He gave me five years to prove that the model works.

I got to work. The local communities living on the land were sceptical of the enterprise as they were used to cutting trees for firewood, but I convinced them to give conservation a try. We cleaned up 800 kg of trash from the premises, performed de-weeding and restored springs and other water sources. We also created watering holes for wildlife and trained local people as guides. The first year was tough.

We started conducting paid Nature trails. Contrary to what sceptics believed, people started turning out in increasing numbers and enjoyed their experience with the local guides. There was no trash on the trails, water sources became perennial and the canopy became lush again. To date, we have observed over 70 species of ferns, 100 species of fungi and mushrooms, 400 species of vascular plants and flowering herbs and 160 species of birds on the premises. Wildlife is returning and even venturing out in the daytime in proximity to humans. There have been no human-wildlife conflicts so far.

Jabarkhet Nature Reserve has transformed the lives of the local communities. The local *dhabas* (eateries) have been converted to homestays. People who used to wash dishes in restaurants are now bird watchers, leading groups of tourists and conducting Nature trails. Virendra Singh Panwar, a local youth, who works as a birder and guide, has won several awards, including Sanctuary Asia's Award for the Best Nature Guide, in 2016.

The place required no external funding and is now self-sufficient. It has become one of the top ecotourism destinations in Mussoorie. We might even make a training centre on the premises to train people from other villages, to set up similar projects in their hometowns.

Dr. Sejal Worah, Programme Director, WWF-India, Delhi local communities, and maintains the health of local ecosystems and the human environment, while also maintaining a high level of tourist satisfaction, via meaningful experiences. Sustainable tourism lends itself to being the cornerstone of the future of the tourism industry.

## Sustainability in Tourism Yuksam Village, Sikkim, India

Sikkim is a trekker's paradise, with a trek to Mt. Khangchendzonga Base Camp or the Dzongri-Goecha La Trek, being one of the most popular travel plans. To reach this mountain, one has to arrive at a small village called Yuksam in West Sikkim. Yuksam is experiencing growing tourist numbers, which can affect the culture, aesthetics, hygiene, ecological environment, natural resources, infrastructure, and ecotourism potential of this village.

Being a small village, there was a shortage of resources; primarily sufficient tourist accommodation. To plan for this increase, Khangchendzonga Conservation Committee (KCC), a grassroots non-profit, was formed in 1996. It brought about several changes to facilitate ecotourism in the area.

The KCC promoted homestays, providing the local community with extra income and tourists with a cultural experience. They have been organising regular training for homestay operators, local guides and porters, making them aware of environmental issues, such as garbage reduction, segregation and its impact on the local ecology. They increased the kerosene supply to trekkers so they would not burn firewood and cause local wildfires or endanger wildlife. Check-posts were established where non-biodegradable items were counted and trekkers had to bring back the same number upon returning from the mountain. They also developed an elaborate multi-level garbage segregation and disposal system. Specialised young wildlife guides were trained about local flora and fauna, to encourage bird-watching and nature-based tourism.

All these changes have controlled and brought down the quantity of waste, thus ensuring the protection of the natural environment in and around Yuksam Village, while providing lucrative financial opportunities to its residents.



Sustainable Tourism Model in Sikkim (Credits: ejatlas.org)

## **10 Climate Actions to Achieve Sustainable Tourism**

- 1. Opt for sustainable tourism options, supporting local ecotourism outfits.
- 2. Help local agro-tourism businesses to connect to urban markets, via apps and websites.
- 3. Avoid flights, and use mass public transport such as trains/buses to travel between places.
- 4. Gift local foods, handicrafts and tours to family members, to sustain traditional skill sets.
- 5. Avoid disposables, clean the toured regions, and leave with minimum disruptions.
- 6. Prefer local homestays or inns over luxury resorts, which reduces your carbon footprint.
- 7. Do not venture into restricted areas to prevent biotic disturbances.
- 8. Explore low tourist-dense sites; be aware of their resource and human carrying capacity.
- 9. Explore hyperlocal, seasonal and traditional cuisines, versus imported foods.
- 10. Encourage travel vloggers and brand ambassadors to endorse sustainable tourism.

## This subchapter has covered the following Sustainable Development Goals



## 5.3 Urban Environment



The urban environment or cities are characterised by high standards of living, vis-à-vis safety, health, mobility, resources, employability, affordability, gender parity and economic opportunities. The quality and diversity of affordable public infrastructure are superlative in first-world urban hubs. Cities try to be inclusive and are multi-layered as far as socio-economic strata are considered, providing space and possibilities even to the poorest of the poor. Cities are the centre of economic activities and are also educational hubs and socio-cultural melting pots. Due to these inherent traits, cities tend to attract migrants and draw large number of residents from the hinterlands who are in search of a better life.

The UN estimates that around 55 per cent of the world's population lives in cities today. The urban population in Africa and Asia is expected to double by 2030. The number of global urban dwellers is projected to rise to 68 per cent by 2050. This means that by 2050, a staggering 6.34 billion people would be living in cities while leaving rural areas vacant and turning them into economic dead zones. Around 190,000 people will have to find new homes every day. And housing will not be the only deficient resource in these overcongested urban hubs.

Add the climate crises to this scenario and there would be major issues of food, health, sanitation, sewage disposal, transportation and energy. This will be compounded in case of severe accidents, and the safety of citizens, public infrastructure, and other facilities, characteristic of urban comfort, will be compromised. It will bring down the liveability index, increase the cost of living and diminish the quality of life. Additionally it will also undo years of urban development and push them to the days of poor infrastructure, that the rural and tribal populace suffers from regularly.

## What Causes Urbanisation

The swell in urban population has three main factors:

- The lack of jobs and infrastructure in rural areas for the growing population prompts people to move out of their homes to seek employment. Urban areas have the infrastructure to handle large amounts of people and hence attract large numbers of migrant workers.
- 2. There is a promise of a better life in big cities, which causes ambitious individuals to migrate to them to boost their careers or secure a higher standard of living.
- 3. Birth rate is high and the death rate is lower in cities (due to the medical infrastructure), hence the population is naturally increasing.

This places a renewed focus on city planning, as waste, pollution, health, infrastructure, transport facilities and urban zonation must be done thoughtfully to mitigate impacts of climate change.

But how would one define a city? What would be the distinction between urban, rural and 'rurban' areas?

### Terminology

Rural regions are places where there is a low density of people, as well as built-up structures. They are typically outside of towns and cities and consist of a few settlements. They may lack modern goods and technology but offer ample natural resources and public facilities, unlike urban regions burdened by scale-related challenges. As people migrate from neighbouring villages its boundaries increase and urbanisation begins.

Rurban areas are a transition stage between rural and urban areas. A cluster of villages bordering or surrounded by a city, demonstrating growth potential, can be classified as 'rurban'. By providing economic stimulus, basic services and facilities are enhanced to urban levels, while still retaining their rural characteristics.



Graph 5.3.1: Population of India living in urban areas from 1960-2020, compared to other countries

#### The Problems of Poor Planning

Cities are massive sprawls, often housing millions of inhabitants. This takes a toll on the environment. Seventy per cent of the world's GHG emissions come from cities. As cities continue to grow, they have to deal with mutliple issues, as discussed below.

Eutrophication in water bodies in the city is common. Since the air around the cities is often loaded with  $CO_2$  and other GHGs, rainwater filters down these chemicals into the ground and finally into a local water body. This damages aquatic ecosystems. The ocean itself absorbs a quarter of the  $CO_2$  produced by humans. As cities and their emissions grow, ocean acidification has also increased.

By 2050, it is expected that 80 per cent of all food will be consumed in cities. An increase in food waste is one big challenge faced by cities. Besides produce, these also include food products that can no longer be used due to disuse, expiration, or spoilage. Food waste leads to increased production of methane and attracts disease-carrying vectors.

Urbanisation can also cause a division of habitats, leading to the alienation of species. This is known

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as habitat fragmentation. Since the species' habitat is broken apart by construction such as roads and railways, it finds it difficult to sustain life as food and shelter are not easily available.

Urbanisation has also led to an increase in lifestyle diseases, including heart disease and cancer. Poor residents of urban areas especially suffer from diseases and have higher mortality.

#### **Heat Islands**

Urban structures such as roads, buildings and other infrastructure absorb and re-emit much more heat than natural elements such as trees, ponds and streams. This causes urban areas to have higher temperatures than surrounding non-urbanised areas. This effect is called the 'heat island' effect and these areas become 'heat islands', which can be 3-4°C hotter than surrounding areas.

As a result there is increased energy consumption by air-conditioning and cooling systems, leading to greater GHG and CFC emissions. This affects human health as well as the health of urban biodiversity. Controlling the urban heat island effect is a major challenge for urban planners and architects.

#### **Green Spaces**

To combat the heat island effect, green spaces in urban environments are crucial. Studies show that these spaces can bring down the temperatures of surrounding areas by anywhere between 1-6°C, depending on location, architecture, seasons, etc.

Creating green roofs by adding a layer of vegetation to rooftops has proven to reduce the urban heat island effect. The soil and plants present on the roof will reduce surface temperatures and insulate the structures below from the surroundings. This will reduce energy consumption for heating and cooling. Green roofs also help in rainwater regulation by trapping and filtering rainwater as it falls on them.

A 2008 study in the medical journal, The Lancet, revealed that in rural areas with plenty of access to green spaces, the life expectancy of those with the highest and lowest incomes was roughly the same. However, it was vastly different in urban environments. People having the lowest incomes were expected to live 10 years less than those having the highest incomes. This was mostly because rich urban people typically have access to green spaces whereas poor people typically live in heavily concretised and congested areas.

However, green spaces cause the prices in neighbourhoods to rise, leading to 'Green Gentrification', where poorer residents move out to more affordable, often-concretised neighbourhoods and wealthier citizens take their place, causing the cycle to repeat. City planning needs to account for this migration and ensure it does not happen or is limited.

## The Advantages of Smart Cities in Combating Climate Change

Cities host a majority of the world's population and thus play an outsized role in causing CC. They also come with a great opportunity. Well-planned cities can massively reduce the carbon footprint of millions. Smart cities, which use technologically advanced methods to optimise the efficiency of city operations and services and connect to citizens, are one possible way to improve resource use and mitigate CC.

Some fantastic improvements to traditional modes of living are already underway. In Singapore, an app called Beeline collects data from consumers and suggests new travel routes to regional transport operators, based on consumer demand. The app debuted in

## **Technologies for Urban Environment**

The three basic tenets of economics are allocation, distribution and scale. We have seen the first two being done, but the third is often ignored. With new efficient technologies, we can hope to scale eco-friendly practices to larger populations.

Orbin is a company manufacturing composters. The composters come in two variants: 2 kg and 40 kg, which are appropriate for households and housing colonies, respectively.

Radix Lifespaces is a company manufacturing high-volume waste plants. They take in as much as 1.7 MT per day, which undergoes biomethanation. This waste is then converted to Bio-CNG, which can be sold to companies such as Indian Oil. They will then sell it as natural gas. A by-product of bio-methanation is the production of liquid slurry, which is useful as a fertiliser. Organic manure is also produced, which can be used in farms and gardens. The Bio-CNG industry is still nascent and there is great potential in these plants.

RCube Plastics is a company making upcycled plastic products that include tiles for pavements, floors and roofs and also boats.

EcoSTP is a company specialising in wastewater and sustainable sewage treatment plants. Their plants were not affected even in the 2015 Chennai floods. Septic tanks, which are commonly used for waste treatment, are susceptible to floods. The waste mixes with the flood waters, causing microbial activity and spreads diseases. EcoSTP plants do not have high levels of bacteria and are thus safer. Additionally, they can be installed under parking lots, playgrounds and walkways, saving urban space. They require no human operators, no minimum load and produce no odour.

Such technological innovations can be used in urban environments to facilitate a more sustainable society.

Prof. Lawrence Surendra The Sustainability Platform (TSP) Asia

## Housing Societies for Garbage Mitigation

Zero garbage is something that is talked about by all municipal corporations. So tying up societies with NGOs which are working with waste recyclers, is something that has worked very well in some communities in Mumbai. A system can be adopted where a local recycling community can join a society and participate in recycling as well as take care of non-biodegradable waste. This has been done successfully in Godrej Colony and in Bhabha Atomic Research Centre by an organisation called Stree Mukti Sanghatana which is a cooperative of women activists.

I think all housing societies, hawkers, market places and other garbage-producing establishments can join hands with this effort and be brought into the gamut of this ecosystem. Together we can resolve our garbage issues.

#### Dr. Vaijayanta Anand, Head of Department, Nirmala Niketan College of Social Work, Mumbai

2015 and has led to more efficient public transport, reducing private car usage and making Singapore one of the best smart cities in the world.

National Smart Cities Mission is an urban renewal and retrofitting programme by the Gol. So far, 100 existing cities have been nominated to be made into smart cities, making them citizen-friendly and sustainable.

Hydroponic farming can be practised in densely packed urban areas with limited room for traditional farming.

By controlling the plant's nutrient intake and environment, hydroponic farming can increase yield up to 10 times per hectare. It can also use resources much more efficiently compared with traditional farming methods. This will reduce waste, water usage, pesticides and fertilisers, while also enabling people to grow crops close to where they will be consumed.

Abu Dhabi is planning a variant of this method, creating a massive indoor vertical farm of over 8,200 square metres for growing vegetables locally. It is estimated to consume 95 per cent less water.

## Floating Community of Schoonschip

In Amsterdam, the Netherlands, there exists a floating community. Houses in Schoonschip are built on steel foundational pillars, rising with the water level and descending to their original positions once sea levels recede.

Usually connected to the local sewer system and power grid, they also have hulls that act as counterweights. Apart from these features, they are quite similar to land houses. Special waterproof cords and pumps connect these houses to services on higher ground.

These townhouses are often built offsite with conventional materials, viz. timber, steel, and glass. Floating homes are a potential solution for urban housing needs *vis-a-vis* climate change and sea level rise.



Sustainable Floating Township (Credits: Wojtek Gurak/Flickr/CC BY-NC 2.0)

## A 15-minute City

A new (or should we say old) school of thought is gaining popularity among urban planners: '15-minute City'. This is a concept in which a citizen can avail of most of their daily necessities (such as schools, offices, shops, parks, clinics and hospitals) within 15 minutes of leaving their home.

Each neighbourhood can be complete in and of itself and all major locations will be reachable by walking or cycling. This idea was proposed by scientist Carlos Moreno and is gaining traction, with the Mayor of Paris who aims to turn it into a 15-minute city, Melbourne is testing 20-minute neighbourhoods and Milan is piloting a project in the Lazzaretto area to make it a '15-minute City'.

## **10 Actions for a Sustainable Urban Environment**

- 1. Use private transport judiciously.
- 2. Support local businesses.
- 3. Do not waste food.
- 4. Grow rooftop, windowsill or community gardens.
- 5. Ask government representatives to create more green spaces.
- 6. Set up community gardens and parks populated with locally grown flora.
- 7. Install chlorine-free bio-filters in swimming pools.
- 8. Involve children in conservation through group activities such as Nature trails in urban areas.
- 9. Encourage long walks and visits to local conserved areas like National Parks.
- 10. Plan eco-cities that have ample green spaces and cyclist lanes.

## This subchapter has covered the following Sustainable Development Goals



## 5.4 Agriculture and Food

The invention of agriculture, along with the discovery of fire and the Industrial Revolution, has been one of the most pivotal points in our evolution as a species. It brought an end to our ancestors' nomadic lifestyle and gave rise to human settlements, ownership of natural resources such as land, inheritances and much more. Thus on a historical scale, even though agriculture shaped our modern society and made us free to engage in intellectual pursuits, it also became the origin of our desire to accumulate possessions, a trait that continues unabated to this day.

#### In the modern world, agriculture,

alongside animal-rearing and fishing serves to feed the billions of people inhabiting the world. As medical advancements increase birth rates, decrease death rates and raise the average lifespan of humans, the population is expected to swell even further in the coming years. This will place stress on agriculture and related food industries to provide for this growing world population. Being naturally resource-intensive sectors, they emit GHGs and cannot be made infinitely efficient. There are only so many nutrients that a single crop can provide.



### **Terms Associated with Agriculture**

**Crop agriculture:** In this type of agriculture, crop plants are grown and harvested extensively for profit or to meet the needs of the farmers and their families.

**Subsistence farming:** When the farmers practise growing crops and raising livestock-only enough to meet their needs without any surplus for trade, it is called subsistence farming.

**Pastoralism:** It is also known as animal husbandry. It involves herding animals, such as goats, chickens, yaks,

camels, sheep, and bovines. Livestock are not only a great source of protein, milk, eggs, leather, fibre and manure but also provide labour in agricultural fields.

**Shifting cultivation:** It involves the rotation of croplands. Farmers destroy the natural vegetation and use the land for cultivation. The ash produced by 'slash and burn' adds to the potash content of the soil. This method is not sustainable today, as the burgeoning food needs do not give older lands time to rejuvenate and restore.

**Crop rotation:** It is a system of growing different crops each season in a cyclical manner. This adds economic and environmental benefits, as well as helps in long-term soil management.

**Intensive farming:** This farming method focuses on reaping high yields, often with land exploitation and extreme inputs. Its main benefit is sufficient food at affordable prices.

**Aquaculture:** It is farming in water and deals with breeding, raising and harvesting fish, shellfish, and aquatic plants. It is a promising field for responsibly sourced food and commercial products, if effluent discharge, pathogen spread and other drawbacks are taken into account.

**Agro-based industries:** These industries are based on raw materials or activities that are directly or indirectly dependent on agriculture. Agro-based industries cover a variety of industrial, manufacturing and processing activities and services.

**Genetically modified Foods (GMF):** Foods are altered at the genetic level to attain disease or pest resistance, enhance their nutritive value or increase their shelf life.

**Open-pollinated:** Open-pollinated flowers are largely fertilised by bees, moths, birds, bats, and even the wind or rain. They sometimes are also self-pollinated. Supporting open pollination also helps the natural diversity of pollinators to thrive.

**Hybrid seeds:** Hybrid seeds are formed because of intentional cross-pollination. They are disease resistant, have a faster growth and perform better in terms of yield – more fruits flowers and vegetables produced. However, farmers cannot use the seeds from the next generation as they may not inherit the same desired characters as the parent plants.

The output of the agricultural sector is extremely vulnerable to changes in seasons, weather patterns or temperatures. Agriculture is the basis for human livelihoods and well-being. Thus, impacts of CC are ultimately food and financial security.

Half of the world's habitable land is under agriculture. The primary threats to local species' survival are intensive crop farming and logging. The expansion of agricultural land is a leading driver of deforestation. Approximately 40 per cent of tropical forests are cleared to create pastureland for beef production; 18 per cent for palm oil and soybean farming; and another 13 per cent for paper and timber. More than 28,000 species have been threatened, such as the Nicobar Shrew, the Bornean Wren-babbler, and the Myanmar Snub-nosed Monkey. Increased proximity of livestock and wildlife puts them at risk of competition and transmission of diseases. These diseases may also enter the human population.

The global food system contributes to over a quarter (21-37 per cent) of annual emissions. Alongside emissions and land use changes, the pesticides and insecticides used add to the nutrient load of oceans and freshwater bodies, which is the cause of 78 per cent of all eutrophication events. Food production and associated industries deplete approximately 70 per cent of global freshwater.

Progress on food security and nutrition has slowed down. In 2019, the numbers of undernourished people were 48.8 million in Southeast Asia, 305.7 million in South Asia and 42.3 million in West Asia. Tackling food scarcity is the key to solving the issues of CC impacts, reducing water stress, restoring croplands and protecting biodiversity. Only if fossil fuel and other non-food emissions are eliminated drastically, the 2°C Paris Agreement target can be achieved with lessambitious changes to agriculture and food systems.

## **Crop Diversity**

To feed the maximum number of people per unit area of cultivated land, while simultaneously reducing emissions generated per crop, high yields per unit of area can be targeted. However, the drawback of this overwhelming focus placed on maximising yield is that only a few varieties of crops are cultivated in the modern age. Many uncultivated varieties and species are on the brink of extinction since they are being made to give way to popular crops.



Graph 5.4.1: Average global greenhouse gas emissions of various major food products

However, this might not be a good decision. CC causes changes in soil quality, salinity, available water and excess or deficit of rainfall. The few varieties in use today might not be able to handle these fluctuations, and as we have seen, often fail during times of unpredictable climate.

Thus, the diversity of crop varieties needs to be maintained and encouraged to combat these crop failures. Many hardy indigenous varieties exist, which are drought resistant and tolerate salinity. Initiatives such as Navdanya, exist to save these varieties.

Farmers also need to be educated and trained in modern and sustainable agricultural practices.

Graph 5.4.1 clearly shows the outsized impact of rearing cattle for beef production on  $CO_2$  emissions. This is because of two main reasons:

- 1. Cattle consume as much as 7-43 pounds of feed to produce one pound of beef.
- 2. Cattle manure and flatulence release large quantities of methane. Although it seems improbable, the combined effect across billions of cattle has a great impact on the environment.

Overall, beef production is one of the major producers of GHGs (nine per cent of all anthropogenic emissions as of 2010) and needs to be worked around. Similarly, other meat industries are inherently more carbonintensive than vegetable farming, due to the resourceintensive nature of animal-husbandry practices. This is worst in case of ranch-bred animals raised for consumption, as they are usually fed on corn and crops that can feed human beings.

### So, is Veganism the Way Ahead?

Apart from the moral reasons – primarily, animal rights – people are drawn to veganism for environmental reasons and it has been iconified by animal rights activists and some environmental activists. However, the question arises, is going vegan always green?

Historic data shows that if the *Homo sapien* diet depended on any vegetation and fruits or berries, then it was only a supplement to meat. Anatomically, humans are designed to have an omnivorous diet, which can handle both meat and plant-based foods. Thus, evolutionarily speaking, we should not necessarily be vegetarians or vegans as we have evolved to also eat animals.



Graph 5.4.2: Levels of risks for different forest management approaches

Being vegan is not as simple as just cutting out meat, dairy and eggs from the diet. The balance of nutrition coupled with eating organic requires a lot of time and money. While it may have health benefits, it necessarily is not always green.

### **Problems with Agriculture**

The problem is that we are depending a lot on chemical-based agriculture, with policies such as buying seeds, chemical fertilisers, insecticides and pesticides from the government. These are taking a toll on the environment.

We are clearing more forests to feed more people. All the food that's produced is stacked in a few places, like the Food Corporation of India (FCI) godowns/warehouses. If this food is not properly taken care of, it gets infested. People who need this food are deprived due to such wastage. Moreover, other illegal practices like black-marketing food grains, is a problem.

Agroforestry is a possible solution, where people do not cut trees, and local people and consumers are stakeholders.

Production of meat, particularly beef, makes an unsurpassable contribution to global GHG emissions, while also requiring more land and water. In turn, causing more environmental damage than any other single food product. But not all plant-based foods have a small environmental footprint. Air-transported fruits and vegetables account for more emissions per kilogram than poultry meat. The average water, land and carbon footprint of growing and transporting perishable fruits and vegetables means a much larger environmental impact than expected. Also, to get the required daily nutrients, the vegan diet depends considerably on processed foods and supplements.

Individuals adapting to vegan or vegetarian lifestyles have to be mindful of everything they consume. It is essential to consider where the food comes from and how it is grown. Reducing or eliminating meat intake can be a sustainable solution to meet food demand and support specific agricultural practices.

One would wonder if there exists a way to obtain proteins from meat without raising GHG levels or overspending on natural alternatives. Modern science may just have an answer.

### **Artificial Meats and Substitutes**

With advancements in technology, companies have made breakthroughs in synthesising lab-grown meat. This meat has the structure, composition and characteristics of traditional poultry/cattle meat, but has been grown carefully using the cells of actual meat. Although much less carbon-intensive than traditional animal husbandry, it faces two major roadblocks on its way to acceptance.

- 1. Acceptance by people concerned about taste, safety and authenticity.
- 2. The high price of development.

Once these factors are taken care of, this invention could pave the way for a culinary revolution that would help keep GHGs in check.

Similarly, food companies are also researching and developing vegetarian substitutes for meat products, which aim to taste the same. As they perfect their formulas, people will have a greater choice in the food they eat. However, considerations of nutrient value and authenticity will always be something people will think about.

#### Food from the Oceans: Present and Future

More than three billion people (44 per cent) rely on the ocean for their food and livelihoods. With the increasing world population, food from marine sources may be a solution. It can be sustainable if the high oceanic biological production potential is utilised.

Current commercial fishing techniques are not sustainable and irreversibly damage marine ecosystems. Destructive fishing practices, including shark finning, blast fishing, and bottom trawling, are generally illegal, although enforcement is often inadequate. Commercialising a certain species of seafood makes the species overfished, beyond reasonable recovery limits. Risks from ghost nets also exist, which cause physical damage to coral reefs, sea turtles, dolphins and many other creatures.

Wild fisheries, finfish mariculture and bivalve mariculture can fit sustainability criteria and become the main food-producing sectors in the seafood domain. This will depend upon ecological, economic, regulatory and technological constraints.

Additionally, being mindful of which species to eat adds to the sustainability of food. 'InSeason Fish' and

## **Rice-Fish Farming**

The system of rice-fish farming is believed to have originated somewhere in continental Asia, in countries such as (southern) China, India, Thailand and (northern) Vietnam.

A rice-fish farming system is a polyculture practice based on a mutually beneficial symbiotic relationship between rice and fish (typically freshwater) that is developed when introduced into the same ecosystem.

Rice crops cool the water, while also providing shelter to the fish. Rice also reduces the concentrations of ammonia and nitrogen in the soil. Fish feed on herbivorous insects found in paddy fields and protect the crop by reducing insects, pests (such as brown planthoppers, and rice sheath blight), diseases and weeds. The crop also uses the CO<sub>2</sub> released by the fish.

Rice-fish farms are over 50 per cent more profitable economically than rice monocultures, while also reducing the labour and cost of deweeding and pest control. The land used for rice-fish farming ends up having higher yield, greater biodiversity and lower concentrations of mosquito larvae.

With global warming, there are increased chances of waterlogging in fields, as well as pest outbreaks. However, these farms are climate-resilient and can survive both.

As a result, this practice was one of the first to be considered a 'Globally Important Agricultural Heritage System' according to Food and Agriculture Organization of the United Nations-Global Environment Facility (FAO-GEF).



Rice-fish Farm (Credits: WorldFish/Flickr/CC BY-NC-ND 2.0)

'Know Your Fish' are two organisations that provide monthly recommendations for safe seafood choices, taking into consideration the reproductive cycle of the fish and their susceptibility to over-exploitation.

## Adapting Agriculture to Climate Change

To address agricultural challenges and develop a sustainable food system, the world is headed towards a holistic approach that includes regenerative agriculture, getting away from mono-cropping and balancing with Nature. Graph 5.4.2 outlines the risks for different forest management approaches when exposed to certain factors. It is essential that changes are made in classical forest management approaches. Crop rotation or mixed forest techniques are more beneficial than monoculture, to combact climage change.

Many potential adaptation options need to be

undertaken by integrating CC related issues, climate variability, market risks, and other policy domains (e.g. sustainable development). The solutions cannot be general. They need to consider regional variations of the existing climate.

For a marginal change in existing agricultural systems, a comprehensive and dynamic policy approach is required that covers a range of scales and issues. Farmers must understand the change in risk profiles so that they can facilitate response strategies and establish efficient markets. While dealing with the reduction of the impact of agriculture and food systems on climate, it is important to have a multidisciplinary focus and strengthen the interface with decision-makers. For this, relevant adaptation assessment frameworks need to be created, which can be used by everyone, viz. stakeholders, corporates, practitioners, policymakers, and scientists.

## **10 Climate Actions for Sustainable Agriculture**

- 1. Be mindful of your food's source and how it is grown eat locally-sourced food.
- 2. Start a community garden.
- 3. Encourage mixed-crop farming.
- 4. Choose seasonal fruits and vegetables.
- 5. Limit dairy and meat consumption. Try meat alternatives.
- 6. Allow natural pollinators to thrive by planting local varieties of flora.
- 7. Set up small herb gardens.
- 8. Choose seafood based on the season.
- 9. Encourage farmers to go chemical-free by choosing organic produce.
- 10. Donate to farmer funding schemes.

## This subchapter has covered the following Sustainable Development Goals



## 5.5 Health and Sanitation

We know that CC is responsible for extinction of species on a global scale. It is obvious that it also harms the health of all living organisms, including humans. Globally, reducing forests and rising temperatures cause epidemics, disasters and health emergencies.

Conversely, our healthcare sector is also heavily reliant on technology to function. It guzzles resources and leaves

behind vast quantities of biomedical waste. Poor sanitation again exacerbates CC and environmental degradation.

This subchapter will look at both sides of the equation.

# Environmental Damage due to the Health Industry

**Emissions:** Health Care without Harm, an NGO working towards environmentally responsible healthcare, conducted a study in 2019 on the emissions of the global healthcare sector. If it were considered a country, the sector would be the fifth-largest emitter on the planet. The United States was the greatest emitter among countries, both in absolute and per capita emissions. Per person, it emitted 57 times the emissions as compared to India, which had the lowest per capita health sector climate footprint, and the seventh largest overall.

Other activities contributing to emissions include:

- 1. Agriculture, for food at health facilities, growing cotton for surgical gowns, etc. (nine per cent);
- 2. Transport (seven per cent);
- 3. Pharmaceuticals and chemicals, not including the energy used to produce them (five per cent); and
- 4. Waste treatment (three per cent).

The use of anaesthetic gases (0.6 per cent) and metered dose inhalers (0.3 per cent) alone is responsible for an estimated 4MMT (an additional one per cent) of healthcare emissions.

**Biomedical waste:** By their very nature, biomedical products are made to be used once and disposed of.

This leads to an unavoidable production of waste in the sector. Even before the advent of the COVID-19 pandemic, India produced 615 tonnes of biomedical waste per day. After the pandemic began, an additional 84.61 tonnes of biomedical waste were generated per day from May 2020 to February 2022. These are staggering numbers. Improper segregation of different medical waste streams at the point of origin can lead to greater environmental damage that will endanger people, animals and natural resources such as soil and water.

Medical waste is often incinerated to avoid depositing hazardous waste in landfills. But it comes with its own set of problems. Incineration produces toxic ash residue as a by-product, which is often deposited at landfills. From there, the toxins can leach into the groundwater and find their way to human settlements. Incineration of plastic waste also releases toxic gases, leading to long-term breathing and health issues in humans and animals. Pollutants released by the incinerators deplete the ozone layer, causing crop and forest damage, accelerating CC and increasing the possibility of cancer in humans. Exposure to such toxins also leads to bioaccumulation, causing certain fruits of trees in the vicinity to contain toxins. In extreme cases, the trees themselves might get killed.

### **Environmental Damage due to Sanitation**

Over 1.7 billion people across the world lack access to basic sanitation services. Of these, 494 million defecate in the open. Sanitation (or lack thereof) has implications for CC and environmental health.

**Emissions:** Organic matter produces emissions during its breakdown. Additionally, treating sanitation discharge and wastewater requires large energy

inputs. Around 80 per cent of global nitrous oxide  $(N_2O)$  emissions (one tonne is equivalent to 298 tonnes of  $CO_2$ ) are from uncollected human waste. This is most prominent in regions where the majority of the population is not connected to a sewage system with wastewater treatment. An estimated 80 per cent of wastewater generated by humans flows into the natural ecosystem without being treated or reused.

Roughly, 1.77 billion people around the world were estimated to use pit latrines in 2013. The number is sure to have gone up since then. Around one per cent of global anthropogenic methane emissions can be attributed to pit latrines. Providing people who lack access to basic sanitation services with pit latrines could more than double the GHG emissions.

Aerobic technologies such as properly operated composting toilets are much better from an emissions perspective. Management of septic tanks and wastewater are added requirements to combat CC.

**Cleaning agents for sanitation:** Not just waste emissions, cleaning agents such as soap water and detergents are also harmful to the environment.

Detergents are responsible for a large amount of polluted water globally. Many laundry detergents contain approximately 35 to 75 per cent phosphate salts, which tend to inhibit the biodegradation of organic substances. This reduces the effect of wastewater treatment, as non-biodegradable substances cannot be eliminated. As of 2021, an average Indian consumes 2.7 kg of detergent per year. The number was around 3.7 kg in Malaysia and the Philippines and 10 kg in the USA. Phosphates can also lead to eutrophication. This chokes the phosphate-enriched water body with algae and other plants. The plants consume the available oxygen in the water, killing other organisms.

Detergents contain harmful pesticides, herbicides and traces of heavy metals such as zinc, lead and cadmium. These turn the water murky, blocking out light and disrupting the growth of plants and clogging the respiratory systems of fish species. Such water bodies also give rise to pathogens, which cause diseases in humans and animals. When mixed with drinking water, it is especially dangerous. Eco-friendly and biodegradable detergents are encouraged to lower our laundry footprints. **Sanitary products:** Indians do not have a toilet paper habit. This is probably for the best, since making a roll of toilet paper uses 1.5 pounds of wood, 37 gallons of water and 1.3 kilowatt-hour (kWh) of electricity. It would be better to use water directly. Similarly, one sanitary napkin is equivalent to four plastic bags. Sanitary napkins are burnt, disposed of in open surroundings, or even buried. Menstruation cups are a better option, sustainability-wise. Similarly, cloth diapers and compostable diapers can be much better for the environment than traditional disposable diapers.

## Impact of Climate Change on Health and Sanitation

Climate change is causing increasingly frequent extreme weather events, such as heat waves, storms and floods leading to the disruption of food systems, increase in zoonotic as well as vector, food or waterborne diseases and epidemics or pandemics,

## Perils of Urban Life

The health of the people living in cities has to be at the core of all planning. This has to be supported by a good environment, good infrastructure, and amenities such as healthcare, education, and open spaces. The positive fallout of living in such an environment would be a boost to the economy because you are increasing the productivity of the people who are living there.

But unfortunately, this is not what we are seeing in many of the cities, presently. Moreover, it is sad to say that 16 of the most polluted cities in the world are in India.

There is a complete lack of planning for health infrastructure. Crowded city living leads to an immense amount of stress. And the stress is not only because of social instability, but also financial and mental. Crowded living spaces, long commuting hours, lack of privacy, lack of leisure time, lack of open spaces as well as certain lifestyle choices that people make, have an immense negative impact on their health.

### Dr. Sharda Kulkarni, Gynaecologist and Obstetrician, Mumbai

and mental health issues. These severely impact health, leading to death and illness. CC also impacts health indirectly. By affecting livelihoods, access to healthcare, and social support structures, as well as causing migration of communities away from their homes, it puts the health and lives of people at risk. Vulnerable and disadvantaged communities or sections of the population, such as women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those with underlying health conditions are the worst affected.

Climate change affects sanitation systems by creating instability in water cycles, decreasing water quality and making water availability irregular.

The world has been reeling from the impacts of the COVID-19 pandemic, one of the worst global health crises in modern times. It is widely believed that the disease originated from a bat (although there is widespread consensus that bats do not carry or transmit COVID-19 to humans). Diseases that originate in animals and then 'cross over' to humans are called zoonotic diseases. There are over 200 known zoonotic diseases, of which COVID-19 is one. CC and the unfolding environmental crisis play an important role in their spread.

Anthropogenic land use changes, such as deforestation, and agriculture have brought humans increasingly in contact with animals that used to live separately in their habitats. This has also led to the domestication of animals, as well as wild meat consumption. Both these factors have increased the transfer of zoonotic pathogens from animals to humans. Similarly, human diseases also spread to animals. Chimpanzees and gorillas in African countries have been severely affected by Ebola in the past.

Climate change is also affecting general health and well-being in subtle ways. Crops that used to thrive a few years back might not be doing so well as temperatures steadily climb. The increasing quantities of  $CO_2$  in the atmosphere also hamper plants' growth and nutritive value (experiments have shown that higher levels of  $CO_2$  in the air result in lower zinc and iron levels in wheat, rice, barley and related crops). This leads to lower food security as well as poorer nutrition among human societies, ultimately leading to starvation, deficiency disorders and decreased life expectancy.

Ultimately, CC also leads to mental health issues among populations struggling with the loss of livelihoods, lack of employment, migration from their homes and worries about death.

#### **Open Defecation in Bangladesh**

Using a 'Community-Led Total Sanitation' (CLTS) model, Bangladesh managed to reduce its Open Defecation-Free (ODF) rates from 42 per cent in 2003 to 3-5 per cent between 2010 and 2015. By 2016, the rate had fallen to one per cent. By 2017, Bangladesh was almost Open Defecation-Free.

CLTS aggressively used shaming techniques to create stigma around open defecation. Some techniques used to bring about this change in people's mentality included calling village meetings in public spaces where open defecation was practised and using local words for faeces repeatedly during the meetings. Children were also made into 'whistleblowers' to warn the citizens about the dangers of open defecation.

These shaming campaigns required facilitators to first build a healthy rapport with the villagers to make them understand the message and not think of the activities as an insult to them. The campaigns were effective and having a toilet has become a social symbol now.

Bangladesh's successful sanitation campaign was supported by 25 per cent of the country's overall development budget.



CLTS Model (Credits: Development Organisation for the Rural Poor/The Third Pole)

#### **Future Health and Sanitation Systems**

Sanitation and wastewater systems emissions could potentially be reduced through the recovery of energy and nutrients contained in waste (for example, human excreta generated worldwide consists of enough phosphorus to fulfil 22 per cent of total global phosphorus demand). Toilets can capture waste, collecting them in a treatment tank and it can later be treated and disposed of properly.

Emissions of treatment plants could be reduced by using the excreta to produce renewable energy and additionally, reduce dependency on fossil-based chemical fertilisers. Agriculture will be boosted by the supply of treated water and recovered nutrients. Cleaner water will also provide benefits to the people through food and energy security.

Unfortunately, a detailed study of sanitation is often overlooked in national assessments of CC impacts, hampering regular data collection and reporting. Developing efficient and accurate information systems will ensure that sanitation workers have access to relevant and reliable data, which will help them make informed decisions in their field.

Healthcare organisations can design a climate resilience programme to fulfil their immediate needs as well as overcome the systemic challenges the organisations face. An organisation's GHG emissions and generated biomedical wastes could be reduced by implementing proper mitigation strategies, such as using renewable energy and proper waste segregation. To better prepare for future demand, the organisation's resiliency should be improved (e.g. financial incentives for health systems to pursue sustainability activities, and investments in climate-resilient infrastructure). By conducting research and enabling innovations in new products, services, technologies and business models, organisations can better meet future healthcare needs.

Finally, an active lifestyle with good exposure to the natural environment is recommended for increased health and vitality. As urban planners, architects and governments around the world realise this, we can expect to see more towns and cities shifting towards public transport, cycling and walking paths, green spaces and renewable energy. These interventions will have the added benefit of boosting mental health and resilience among populations, as the presence of natural surroundings has been shown to positively impact the mental state.

With the conservation of forests and resident biodiversity, zoonotic diseases can be expected to be kept under control. As we become more judicious in our resource use and develop proper sanitation infrastructure (aided by the authorities), we can expect to live a far healthier and more peaceful life.

## **10 Actions for Better Health to Combat Climate Crisis**

- 1. Adopt an active lifestyle (walk, jog, cycle).
- 2. Push for greater sanitation facilities.
- 3. Utilise public restrooms instead of urinating or defecating in the open.
- 4. Dispose of household medical waste like lancets and bandages separately.
- 5. Opt for biodegradable and reusable sanitary pads, menstrual cups and diapers.
- 6. Install fountains in sewage treatment plants and local waterbodies that receive its outflow. This increases the oxygen content in the waterbodies and thereby its biodiversity supporting ability.
- 7. Prefer non-phosphate-based detergents to reduce eutrophication.
- 8. Participate in beach/park/public place cleanliness drives.
- 9. Demand cleaner and closed roadside *nalas* (sewage drains).
- 10. Avoid toilet paper, and use water directly.

## This subchapter has covered the following Sustainable Development Goals



## 5.6 Waste



Waste generation is inevitable for most human activity and thus, the waste sector has a huge negative impact on climate. With economic development and rising living standards, the volume and complexity of waste keeps escalating. Waste often lingers in our environment, leaching into soil and water bodies if left undisturbed, or polluting the air if burnt. Even biodegradable wastes release CO<sub>2</sub> and methane as they sit in landfills.

#### Sources and Types of Waste

Waste is characterised based on its source or nature.

**Liquid waste:** Often called wastewater, it includes all grease, oil, sludge, detergent run-off and greywater. They are hazardous to the environment as they contain numerous toxic chemicals, found in industrial and domestic sources.

**Solid waste:** It is found in industrial and commercial locations and is of four major types: glass and ceramics, metals and tins, plastic and paper scrap. This waste can be readily recycled but the catch is to dispose of it correctly.

**Organic waste:** The waste that can be decomposed and turned into manure is termed organic waste. It includes garden and food waste, found in homes.

**Recyclable waste:** Discarded items such as metals, glass, ceramic, furniture, organic waste and others that can be recycled fall under this category. Segregation from non-recyclable waste is the key.

**Hazardous waste:** Flammable, corrosive, toxic and reactive materials are hazardous and should be responsibly disposed of.

**Domestic waste:** All the waste generated as a result of various household activities such as cooking, cleaning, etc. is known as domestic waste. It includes both organic and inorganic waste, some are even recyclable or maybe hazardous.

**Agricultural waste:** Various wastes produced in the agricultural field are known as agricultural wastes. e.g. cattle waste, weeds, and husk.

**Industrial waste:** Industries are sources of various toxic, persistent and non-hazardous solid, liquid and gaseous wastes, besides immense noise and heat.

#### Waste Disposal and Management

Developed countries tend to generate higher quantities of waste per capita, as compared to developing countries. At times, the volume of waste generated is so humongous that managing even the smallest quantities of waste is a significant challenge.

With the amount of waste generated, newer landfills or open dumping areas are set up on the peripheries of many cities, which degrades the quality of the land and groundwater resources. Further, it adds to longterm environmental and human health risks, as landfills release huge amounts of methane, contributing significantly to GHG emissions. With rising heat and irresponsible waste disposal, these sites might catch fire, adding significantly to urban air pollution. Biomedical waste, if not segregated beforehand, can potentially lead to the transmission of diseases or the spreading of pathogens. Plastic waste, on the other hand, has a very high nuisance value both for how ubiquitous it is and how easily it is spread everywhere due to its light weight. Most of it is also hard to recycle.

These risks emphasise the need for proper waste segregation. Every individual should segregate their



**Decomposition Rates of Types of Wastes** 



waste and responsibly discard hazardous substances or materials. It is also essential that policies be made to monitor waste segregation and disposal. Similarly, regulations should be enforced for the discharge of untreated industrial effluents. While policy-level changes are needed, it is equally necessary that citizens bring in changes toward better waste management.

### Waste-to-Energy Plants: Pros and Cons

Ever wondered what happens to the waste you generate? It can end up in one of two ways: dumped in a landfill or incinerated to ash. In the second case, the heat generated from burning waste could be used to power turbines to generate energy, getting something positive out of the situation. That is the concept of WtE Plants.

'Waste-to-energy' plants do have some benefits. They generate energy, thereby reducing waste that would have otherwise ended up in a landfill. Landfills are considered worse for the environment as the waste keeps piling up and polluting the environment in ever-increasing ways. They release CO<sub>2</sub> and methane, whereas WtEs release only CO<sub>2</sub>. In addition, WtE ensures the recovery of metals from waste (as they are

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not burnt), which would otherwise be very difficult. Additionally, the ash generated can be reused for construction purposes.

However, there are several disadvantages to WtE as well. The WtE plants do not guarantee proper disposal of heavy metals, organic and inorganic pollutants and other toxins and thus pose an increased risk of cancer, neurological and developmental disorders as well as damage to the environment and communities. The noxious fumes produced by these plants contaminate the environment across a broad expanse, as the gases disperse over extended distances. Incinerators are higher contributors to CO<sub>2</sub> and other GHGs than coal-fired power plants. Emissions also include carcinogens such as dioxins. WtE plants also end up burning many materials that could otherwise have been salvaged, including minerals, wood and plastics. Finally, WtE plants deter recycling, by providing greater monetary benefits to the burning of waste. They also directly compete with recycling set-ups, diluting their impact.

It is important to note that these plants are a better option than incineration and landfills, but cannot

act as substitutes for proper waste management, recycling and policies that encourage the reduction of waste and reuse of materials. Prevention of waste, reuse and recycling rank higher in priority respectively and cannot be compromised. To achieve zero waste goals, the Global Alliance for Incinerator Alternatives report recommends staying away from traditional WtE options or other incineration technologies.

The correct path for waste management would be careful procurement, the use of recyclable packaging and a decreased dependence on single-use products. When businesses receive incentives such as cost savings and an increase in revenue, they readily shift to better waste management practices and choose better products and packaging. This brings to our notice that a circular economy is the need of the hour.

#### **Circular Economy**

Policies such as plastic bans are the end of pipeline solutions. If the product is already made, it will eventually be a part of waste, so just restricting it at the consumer (take-use-dispose system) level is not enough. What we need is a transition from a linear economy to a circular economy and to stop the production of waste altogether.

A circular economy occurs when 'waste', or endproducts of one process, serve as the inputs for the next process. An example would be composting. If you were to generate compost from your organic waste and later sell the same compost to farmers or home

## E-waste: The Current Situation and Chintan's Work in the Sector

E-waste is one of the fastest-growing waste streams in the world. Globally, over 52.2 MMT of e-waste was generated in 2021. India itself generated over 100 thousand tonnes in 2019-20. Currently, India stands behind only China in e-waste production.

To make matters worse, there is 'West-to-East' dumping of e-waste being practised globally. India often receives waste from Western countries, predominantly cooling equipment and computers. This waste cannot simply be dumped in a landfill.

This is because e-waste falls into the hazardous waste category. It can be injurious if:

- 1. One comes in direct contact with it;
- 2. One inhales toxic fumes coming from it; and
- 3. The chemicals contained in it seep into the soil or surface water or groundwater.

There are many chemicals involved in the making of electronics, for example, cadmium is found in printers and toners, which may cause bone cancer and bone-related infections; mercury or lead found in batteries cause brain damage in children. Similarly, to extract the trace amounts of gold or copper used in electronics, extremely dangerous chemicals such as cyanide are used.

In India, there are laws such as, the Hazardous Waste Management Rule 2008 (further updated in 2016), which prescribe how e-waste should be handled. Though there are laws to discuss, manage and handle e-waste, they are not implemented properly. A recent Comptroller and Auditor General of India (CAG) report found that 75 per cent of states in India have failed to implement these rules.

This keeps a majority of waste treatment industries in the informal sector. Although people working in this sector are skilled, they might not be granted access to job benefits, good equipment, safety measures and healthcare. Children between 11 and 16 years of age also work in these plants to make a living for their families.

'Chintan', an NGO, runs an e-waste collection and recycling centre recognised by Delhi Pollution Control Board. Waste pickers are trained so their jobs become greener, work hazards and pollution are reduced, and children are kept out of the industry. It trains individuals and institutions in e-waste and its management so they can make responsible and informed decisions. Chintan also houses the 'Safai Sena' secretariat in its office. Safai Sena is a registered association of over 12,000 waste pickers across three states in North India; advocating for the recognition and rights of its members and fighting against their social exclusion.

Shruti Sinha, Manager, Policy and Outreach, Chintan gardeners, you would have a circular economy, as it would be a closed loop. Innovative thinking is required to shift existing linear economies to circular patterns.

A circular economy is reinforced by shifting to renewable energy and materials. It discourages the overconsumption of finite (non-renewable) resources. This framework tackles global challenges such as climate crises, biodiversity loss, waste, and pollution; thus is considered a sustainable system for economies, people and the environment.

A circular economy is supported by design-oriented ideas and based on three principles:

- 1. **Elimination of waste and pollution:** Waste and pollution can be treated as design flaws rather than inevitable by-products. Harnessing new designs can curb waste creation at the source.
- Circulation of products and materials: Materials ending up in landfills are a waste of resources. Thus, it is important to design products that can be reused, repaired, recycled or remanufactured; beyond just making them last longer.
- 3. **Regeneration and restoration of Nature:** There is no concept of waste in Nature. Everything has a circular life cycle whereby the one uses the others' waste and the material never leaves the system.

Imbibing principles of a circular economy should be part of a businesses' CSR. Furthermore, it is also important that the consumers take responsibility for changing their mind-set from a throwaway culture to a more sustainable way of life. Implementing changes in product manufacturing will be an incentive that will promote a circular economy.

## The Fate of Organic Waste: Composting

Organic waste can be repurposed to make manure for your urban or kitchen gardens. Letting it reach landfills is like throwing away valuables. Composting is the way forward to best manage organic waste. It is even better if it can be undertaken by individuals.

Generally, composting is considered a time-consuming and energy-draining activity, which is not true. The simplest way of practicing composting is to take an old plastic bucket and keep dumping the kitchen waste into it. The key to an odourless composting experience is making sufficient holes in the bucket's walls and having a lid to cover its wide opening. One can use a broken terracotta pot, but avoid buying new ones, as terracotta is not an environmentally-friendly material. Community or society-level composting set-ups though a good start, are not advisable. Composting at the individual level helps sensitise people about the amount of waste they generate and brings in positive

## South Korea Food Waste Management

Each South Korean generates more than 130 kg of food waste each year, which is more than Europeans and North Americans. However, over the past few years, the Government of the Republic of Korea has ensured that wasted food is recycled, with a series of measures.

In 2005, it banned dumping food in landfills and by 2013, food waste recycling using biodegradable bags was made compulsory. The cost of the bags encourages home composting and meets 60 per cent of the costs of running the scheme. The amount of food waste that was composted increased from two per cent in 1995 to 95 per cent today. This recycled food waste then becomes fertiliser and animal feed.

In Seoul, 6,000 bins are equipped with weighing scales and Radio Frequency Identification (RFID), which charges residents based on their food waste weight. The machines have helped reduce food waste in the city by 47,000 tonnes in six years.

Urban farms or community gardens in Seoul have multiplied six-fold in the last seven years, and cover more than 1.7 sq. km. Between 80 per cent and 100 per cent of the start-up costs are provided by the city government.



Food Waste Collection Units (Credits: Q18919 food waste box A01.jpg/Revi/ Wikimedia Commons/CC BY-2.0-KR)

lifestyle changes. Also, personal composting set-ups are easier to monitor and maintain.

There are many other ways of creating compost, such as vermicomposting using earthworms and wet composting using pulped organic matter. Whichever composting method you use, the amount of waste disposed of in one's household will drastically reduce.

Once the composting system is working, people can cultivate their own food using the resulting compost. Urban gardens provide green spaces, right at your window or terrace. The plants will also attract butterflies and birds, who come for food, egg-laying, shelter or nesting. So if you do not have a compost bin yet, get one now.

## **Bioremediation**

With rapid urbanisation and industrialisation, the need for efficient waste management and treatment methods is necessary. Bioremediation is catching up as a sustainable waste treatment method as it helps deal with persistent pollutants, such as heavy metals, which otherwise would biomagnify and bioaccumulate in the environment. But its potential is not optimally used.

Bacteria (*Streptomyces* sp.), Cyanobacteria (*Anabaena variabilis, Lyngbya majuscula, Nostoc muscorum, Oscillatoria salinas* and *Spirulina* sp.), fungi (*Aspergillus* sp.), *Phanerochaete chrysosporium, Trametes versicolor*) or plants (*Eichhornia* sp.) accelerate the natural degradation rate of contaminants by aiding with nutrients, sources of carbon, or negatron donors (biostimulation).

Remediated systems also help in carbon sequestration by remediated ecosystems. Waste can be used as growth media for mass production of some organisms; further, biomass can be a source for extracting bioactive compounds or food supplements and animal fodder.

## Self-Control

Ultimately, we can save a lot of waste from being generated by practicing restraint in our purchases. Carrying a reusable bag for getting groceries will ensure you do not need to get single-use plastic bags from the grocer. Carrying a spoon and fork set while on a trip will ensure you do not have to use the disposable variety. Straws can be avoided altogether; they do not help you do anything, which you cannot do on your own. Using a single fountain pen prevents you from running through hundreds of plastic pens and refills in your lifetime. Controlling yourself from purchasing more clothes, more shoes, and more gadgets can also help. Ask yourself: do you need this?

And probably the most important: Do not waste food. Here are some shocking statistics:

- Roughly one-third of global food gets wasted; and
- Even if just one-fourth of the food currently lost or wasted globally could be saved, it would be enough to feed 870 million hungry people in the world, as per the UN.

Take small portions and if you are dining out, carry a container with you to ask the restaurant to pack the remaining food in.

## **11 Climate Actions for Waste Management**

- 1. Start with reusing things to reduce waste.
- 2. Compost organic waste to support urban gardens.
- 3. Practise waste segregation.
- 4. Bring about lifestyle changes. Refuse single-use packaging and reduce waste generation.
- 5. Recycle or upcycle things.
- 6. Opt for thrifting instead of fast fashion.
- 7. Implement principles of a circular economy.
- 8. Opt for brands practicing waste management policies.
- 9. Use biodegradable fabrics, viz. cotton and linen instead of polyester and nylon.
- 10. Use products sold without excess packaging (that does not contribute to quality maintenance).
- 11. Segregate and dispose waste responsibly, with the help of waste recycling groups.

#### This subchapter has covered the following Sustainable Development Goals



As we have realised so far in this book, knowing about climate change is one thing, and acting on it is another. We can actively work to bring down our personal carbon footprint. However, it will not be enough in this uphill battle. What we need is to be able to influence a large number of people to reduce their carbon footprint.

Research is one of the foremost tools to not only understand the truth but also influence people. It is an empirical science, meticulously conducted, and reviewed by experts. Conclusive research serves to shape opinions and help decide courses of action. Since it is backed by science, individuals and nations accept it, irrespective of their personal biases. source of our information; we also listen to podcasts, watch documentaries, and share social media posts. Additionally, we are influenced by songs, movies, video games, and much more. 'Media Influencer' has become a full-time job; that is how effective media is, in shaping peoples' lifestyles and opinions. Therefore, it is of utmost importance to understand the power of the media, be aware of its pitfalls, and use it to spread the message of climate consciousness and

create movements to influence

Media is prevalent in every sphere of life. We consume media daily. News is not the sole

decision-makers to make 'green' resolutions.

Thus, with a combination of scientific consensus and weighing in opinions of citizens, policymakers and those in governance, existing policies can be amended or new climate-friendly policies can be introduced. Policies too are a mode of influence, as they set rules for behaviour, including rewards for positive behaviour (subsidies, discounts, rebates) and punishments for negative behaviour (fines. imprisonment). Policymakers are also influencers, just as much as they are influenced by public demands. Climate-conscious leaders can be expected to formulate policies and guidelines that would encourage the masses to adopt climate-friendly lifestyles.

This chapter covers the following Sustainable Development Goals



## 6.1 Research



Research involves collecting information, analysing collected data, and drawing conclusions based on the results of the analysis. It is conducted in every single field of human inquiry. Research is a very potent mode of influence. Technological progress and major policy decisions are all made based on information gathered through research. It also serves to understand the effectiveness of various policies and interventions. It is a weapon in every policymaker's arsenal.

Climate change (CC) research has picked up in the latter half of the 20<sup>th</sup> century. It is already one of the most important research fields in the world. With recent studies constantly revealing more information, it becomes important to not only share the findings with policymakers and convince them to formulate climate-friendly policies but also to regularly update oneself on the latest research.

#### **Research on Climate Change**

Understanding the implications of CC is crucial for mitigating it. Research in technology, policy, or on natural resources such as biodiversity, forest use and rainfall prove to be essential. Directly or indirectly, they all play a role in analysing CC impacts and the effectiveness of our responses to them.

**Technology research:** Technology research might not be directly related to CC but is important, to curb its effects. Progress in efficiency is often the result of technological research.

Take the case of light bulbs. In earlier times, wood was burnt to produce light. This light lasted only for a few hours and involved great human effort. Nowadays, an LED light can produce much better lighting at a fraction of the energy cost. This is also much better for the environment than if we were still using firewood.

Similarly, recent technologies are reimagining the way we interact with the environment and use its resources. Advances in fields such as biomimicry are paving the way towards a sustainable future.

**Policy research:** Several public policies are implemented every year in countries around the world. Some famous ones include China's one-child policy and Delhi's odd-even car policy. Often such policies are implemented to reduce overpopulation, reduce congestion, increase green cover, etc. Nevertheless, how does one know if the policy was a success?

That is where research comes in. Policy research is extremely critical as it determines how effective policies have been across various parameters. Skilled policy researchers are the need of the hour, as the research needs to be framed adequately and with rigour. How would you define success of a policy? If people benefit but the environment suffers, how would you rate it on the success scale? These and many more such questions need consideration by policy researchers during the research and while drawing conclusions.

**Biodiversity research:** There has been a rise in species extinctions in recent years. We know this because scientists and researchers are continuously monitoring species' habitats and their numbers.

However, biodiversity research goes beyond just monitoring numbers. It also includes inter-species interactions and their roles within ecosystems. What species eat, who eats them, their behaviours and how they benefit the environment, and the impact of CC on species are all important, to better plan human activities and projects. A happy outcome of such research is that sometimes, species thought to be



**Graph 6.1.1:** Percentage of articles published from 2006-2015 – A) Terrestrial habitat; B) Marine habitat; C) Freshwater habitat; D) Other Habitats; E) Number of articles published that contain more than one driver of CC
extinct have been rediscovered several years later in the same, or in some cases, wildly different locations.

#### **Funding and Industry Control**

A major requirement of any research project is adequate funding. The last two decades have seen a rise in industry or corporate funding over government or non-profit funding. This comes with its own set of problems. Problematically, big corporations and governments (being the funders of research), tweak CC research to suit their narrative.

This puts undue pressure on the quality and outcomes of the research. Any adverse findings of the project are likely to be suppressed and the recommended changes or improvements will never be implemented. Results that indict the products, made by that industry, as harming users' health or damaging the environment will not be acceptable. As long as the product is making profits for the companies, it will not be discontinued even in the face of results that report its negative impacts. The profitability of a product is likely to be given preference over the effect it has on the environment.

A well-funded stream of CC research that has gained traction in the past decade denies the existence of CC. This is primarily funded by industries that are accused of causing maximum damage to the environment. This is confusing to laypersons, and they tend to choose the side that supports their comfortable lifestyle. As a result, increasing the number of CC deniers.

Therefore, it becomes the responsibility of researchers, academics, and their institutions to protect themselves against industry interference in research. Funders should not be allowed to control the design, protocols, and publication of the research. Rather, funding for research must be 'no strings attached'. Many universities have begun protecting their researchers against funder control over research publication, but it is not universally practised yet.

#### **Other Problems**

**Uncertainties:** Because CC research has gained traction relatively recently, research is still figuring out its causes and effects. Since it has global impacts, the extent proves to be difficult to quantify.

One instance is sea-level rise. Between assorted studies, rise in sea-level is estimated to be 2 cm to 2 m by 2100. This is quite a wide range and is because

of uncertainty regarding the speed of glaciers melting, especially the Greenland ice sheet. Another problem is the lack of climate models to understand the role of clouds in CC. This affects long-term predictions. So far, most climate models cover large areas – countries and continents. Regional climate models also need to be developed for more accurate assessments of threats.

Access to data: Data access in CC research is another big barrier. Vast amounts of socio-economic and physical data are not readily available. Distinct groups collect data for their experiments or research. Thus, the format of data might be incompatible with needs of CC researchers. This leaves them to collect their data, a time-consuming process that slows them down.

Besides data collection by humans, there is also a need to use technology or artificial intelligence to collect and collate data. Better aggregate satellite and remote sensing technologies can help in accurate research.

**Challenges in communicating CC science:** In recent times, there has been increasing interest among people in CC. However, the viewpoints of sceptics and CC deniers has also gained traction.

High-level advisors to politicians and industrialists have formed lobbies that actively campaign against CC. Large oil companies back think tanks that publish scientific papers refuting the existence or impacts of CC. Due to their power and influence, they persuade laypersons that CC does not exist, or even if it does, that its dangers are vastly overstated.

# Can Renewable Energy be 'Cheaper' than Conventional Energy?

Yes, thanks to consistent research and innovations. In 2021, renewable energy (solar and wind energy) was cheaper than coal, according to an International Renewable Energy Agency (IRENA) report.

Often fossil fuel industries get benefits from government policies (subsidies) that artificially bring their costs down. However, with research, renewable power generation is becoming increasingly economical. In addition, renewable energy bypasses the steep operation and transport costs of fossil fuel-based energy. The challenge among the scientific community is not only to inform people about the facts of CC but also to do so convincingly. Extremely detailed papers such as IPCC reports exist. However, the willingness to read and sift through the reams of pages to glean easily understandable insights cannot be expected of everyone. Even executive summaries for policymakers are sometimes not read in detail. It is essential to disseminate this information in a language that even non-scientists understand.

#### **Citizen Science**

There is only so much data that a single scientist or a small team can gather on their own. What would help them if there were a way to outsource this data collection across geographies to a large number of people? This is where citizen science comes in.

Citizen science is 'crowd sourcing' of data. It is when ordinary citizens make observations and contribute their data to a common repository for everyone to use. An online portal, eBird, developed by the Cornell Lab of Ornithology, is a good example of this. Users can make lists of birds spotted in their area, including the number of individuals, time of observation and exact location (using a phone GPS). Any other individual interested in visiting that area could open the eBird mobile application or website and look up sightings in that area. Such crowd-sourced data-sharing platforms make it easier for researchers to access the ad-lib or secondary data.

Social media (Facebook, Twitter, Instagram) not only communicates climate science but can also be a fantastic source of information that people intentionally or unintentionally upload. Social media posts may not be dead-end information but can help in relevant data collection that researchers need.

Citizen science can be a potent tool for research. It is a collaborative effort and depends entirely on common people being honest and fastidious about their observations and measurements. Although citizen scientists are not expected to be on par with trained researchers in their methods, contributors putting in wildly inaccurate readings (either out of malice or due to oversight) have a possibility of disrupting research or leading researchers to wrong conclusions. Participating in citizen science projects will help researchers but it is necessary to be wary of submitting wrong observations. Wrong observations are worse than no observations at all.

Interested readers can search the internet for interesting citizen science projects and start contributing.

# Geographic Information System (GIS) Documentation

GIS documentation involves mapping of data. It consists of three phases: data collection, analysis and interpretation, and visualisation.

Data collection can be primary or secondary. Primary data is data that researchers collect on their own. Secondary data is data already collected by someone else which researchers then use for their study. GPS is an excellent tool for primary data collection. Smartphones too are accurate in their location measurements. Several apps can be used for GIS. Locus Maps and Locus GIS are two particularly good examples. For secondary data collection, Google Earth Engine is an excellent and powerful remote sensing tool.

Data analysis and interpretation involve making sense of all the data one has gathered. Here, tools such as Q-GIS, Google Earth Engine, and programming languages such as R and Python can be useful. An example of where this can be useful is wind farms. Wind farms do not typically require an EIA to be done, but they still follow certain rules and regulations. Using the tools mentioned, one could map the sensitive receptors in an area, such as water bodies, protected areas, etc. One can also map critical bat and bird areas using their distribution maps. Superimposing them with the map of wind turbines will reveal which turbines are likely to disrupt local ecosystems and species. Similarly, a map of cryptic species' sightings can be made using online tools. Such maps become useful in planning projects in areas where cryptic or rare species live.

Data visualisation involves making people understand the maps one has created. The visual maps can be either static or dynamic. An easy-to-understand map is key to influence policymakers and facilitate informed decisions.

#### Rohit Pansare, Environmental Planning Consultant, Thane

#### **Future Technologies**

Biomimicry is the design of objects inspired by Nature. Creatures have evolved over millions of years, developing characteristics suited especially to their environments and lifestyles. Humans can mimic these characteristics to achieve comparable results.

For example, the kingfisher's aerodynamic beak breaks water with minimal disturbance. This helps the bird in catching fish. The design for the Japanese *Shinkansen* bullet trains was inspired by this; helping them noiselessly cut through the air at extremely high speeds – saving energy and reducing noise pollution. Likewise, termite mounds helped efficiently model the ventilation systems at the Eastgate Centre, Harare, Zimbabwe. The design made it naturally cooler without the use of an air-conditioning system. This reduced energy consumption by approximately 10 per cent of a traditional building its size. This has also brought down the rents of the tenants.

Such designs require research on biodiversity and natural systems, among other things. In the future, we can expect these sustainable solutions to be more widely used.

#### Awareness

People are becoming increasingly aware of CC. Mobile apps, games and podcasts can become mediums for disseminating CC information. However, one major hurdle toward public knowledge of CC is misinformation campaigns. Even today, biased articles and research pieces are often seen in popular media. As the grip of social media tightens around our everyday life, we can expect contradicting claims and news to be shared on social media platforms.

Educating children from an early-age is one of the most critical things that can be done to combat this. School curricula must have a greater emphasis on CC. However, even if they do not, parents must take it upon themselves to inculcate inquisitiveness among children to ensure that they are not misled by false or biased information.

#### Funding

A 2019 study on the funding for CC research found that of all the research funding allocated between 1990 and 2018, only 0.12 per cent was spent on the social science of CC mitigation. Everything else was devoted to research projects on natural and technical sciences. A balance is necessary to disburse the allocated funds in the future. Finally, there needs to be greater funding from sources without stakes in the CC conundrum so that the funder's motives do not drive the narrative.

#### **Myco-Leather**

MycoWorks, a biotech company based in California, USA, has successfully produced a material that looks and feels like leather but is sourced from mushrooms. The material consists of engineered mycelia, which are thread-like roots of mushrooms.

The engineered mycelia were grown into 3-D structures, becoming densely intertwined and eventually forming a tough material that has the strength, durability, and performance of traditional leather. This growing process takes at least a few weeks.

Such innovations in research and technology hold the key to sustainable products. Traditional leather is produced from bovine skin, causing more environmental damage than any other fabric. It is even more harmful than plasticbased leather. The process of mass-producing leather causes deforestation and gas emissions associated with animal-rearing.

High fashion brands, and consequently other brands, are actively looking for innovations of this kind. The material, dubbed 'Fine Mycelium', has debuted as an exclusive Hermès handbag. However, to be truly sustainable, the material needs to be affordable to the common person. Research and standardisation will successfully achieve that.



Myco-leather (Credits: Tom Mesic/Flickr/CC BY-NC-ND 2.0)

# **10 Climate Actions for Climate-focused Research**

- 1. Use your niche of expertise to understand and interpret the effects of various aspects of CC.
- 2. Employ multidisciplinary approaches to comprehend the impact on the environment.
- 3. Incorporate CC phenomena in research programmes of all types.
- 4. Make scientific literature available to everyone through outreach programmes.
- 5. Set up official forums to answer public questions on sustainability.
- 6. Conduct short, thought-provoking, seminars on CC and its effects by professionals, at mass gatherings like Republic or Indepedence Day.
- 7. Participate in citizen science projects (viz. eBird, iNaturalist, MapIt, etc.) and ensure proper data collection, data logging, analysis and dissemination of the information.
- 8. Encourage experts to run for important positions in government.
- 9. Engage in regional biodiversity research. Make people aware of the local flora and fauna and the impact of the changing climate on biodiversity.
- 10. Set up a simple weather station and collect climate-related data to monitor changes in local weather.

#### This subchapter has covered the following Sustainable Development Goals





# 6.2 Media

Contrary to what many people believe, the concept of 'media' does not stop at newspapers, radio, and TV channels. Media now has expanded to include websites, social platforms (Facebook, Instagram, Twitter), films, books, and video games. This book itself is a form of media.

Media has not only pervaded every aspect of our life but is now responsible for actively manipulating our thoughts, moods, and perceptions towards several issues of importance. The Cambridge Analytica scandal involving the use of Facebook to influence American voters to vote for Trump in the 2016 US Presidential elections made global headlines. Many previously independent media houses are now acquired by corporations and thus cannot be expected to remain impartial in certain matters.

Media is a valuable tool to amplify your voice, spread information and make a change. Similarly, one must be careful to consume reliable information. Information and narratives, irrespective of their validity, spread rapidly in today's interconnected digital age. This also makes modern media one of the most vital tools to create climate awareness.

#### **Importance of Mass Media**

Media, especially mass media, fulfils some key functions. They are:

**Spotlight:** Media acts as a spotlight by bringing environmental problems that could adversely affect people and threaten humanity, to the forefront of public discussion. Statistics, expert opinions, onground photographs, and panel discussions help broaden the public's understanding of issues. This is especially important because many laypersons cannot grasp the severity of sweeping global changes such as the depletion of the ozone layer, the melting of polar ice caps, the acidification of oceans and the extinction of biodiversity. It also brings attention to environmental movements such as the Chipko Movement, the Narmada Bachao Andolan, the Save Aarey Movement, the Dibang Dam controversy, and many more. In rural areas where penetration of TV and internet media is still low, radio acts as a potent medium for information dissemination.

**Truth to power:** Media also shoulders the responsibility of speaking 'truth to power'. It must serve as the voice of the common people and pose uncomfortable questions to politicians, business tycoons, and other influential individuals. This is extremely critical in the democratic process and ensures that people in power do not take their influence for granted. It holds them accountable for their actions. However, the media has its own set of problems to deal with.

#### **Balanced News**

Humans like us manage mass media outlets. Although the greatest efforts are taken to present an unbiased opinion based on facts, sometimes certain details or perspectives of an event can be ignored.

Another crucial point to understand is that media companies are, at the end of the day, businesses. Their revenue directly depends upon user engagement. Therefore, they are bound to display news or content which are sensational, or which caters to their readers' biases. They promote news that will get eyeballs. Similarly, some media companies might be owned by other companies or business people and hence might not be completely impartial in their operations.

One must therefore obtain and crosscheck and factcheck news from multiple sources to understand various points of view and be certain of its veracity. This will help develop an overall understanding of subjects and guard against biases and distortions.

#### **Common Media Distortions**

Reporting, without due diligence by journalists, can lead to falsities being published or broadcasted. They can also choose to focus more on the story or narrative than the science of global warming. This causes politics and blame games to become the focus of attention, rather than facts and solutions. Moreover, incorrect viewpoints and opinion pieces are published in the interest of 'balanced reportage'. These incidents cause facts to become distorted.

The media often prioritises personal trials and triumphs of individuals over broader, large-scale events because human-interest stories tend to garner a larger audience. This puts CC at the risk of being under-reported in its impacts and used as a narrative prop. The media also favours publishing or broadcasting controversial or polarising opinions, thus giving a larger dais to CC sceptics and doubters than they should be getting. There should be no room for 'alternative opinions' in science-backed journalism. If there is no evidence to support a claim or opinion, it should not be allowed to be aired.

The tendency of the media to seek controversial or polarising inputs also makes it more likely to amplify the bleaker projections of CC. This leads to another problem: alarmism. Alarmist reporting conveys urgency in language, imagery of doom, and a feeling of helplessness. This can seriously hurt the understanding of CC as a genuine long-term threat by instead painting it as a doomsday scenario, and lumping it with other ideas such as the '2012 Doomsday' myth and the 'Global Cooling' myth.

These common distortions occur knowingly or unknowingly in mainstream media, specifically news outlets. However, news outlets and TV channels are not the only forms of media. Books, movies, and video games are incredibly engaging and have been successfully used as a medium to get the message of CC across to audiences.

#### **Books, Movies, and Video Games**

An Inconvenient Truth came out in 2006, becoming the most popular CC movie of its time. It is a prime example of how successful media can illuminate the critical issue of CC, reaching millions of people and leaving a lasting impact.

Other forms of media are also picking up the cause. Disney Pixar-animated movie *Wall-E* was extremely well received and highlighted Earth as a wasteland, destroyed by corporate greed. New video games such as *Beyond Blue* and *Endling* have incorporated themes of CC, deforestation, and the importance of saving wildlife in their gameplay.

It is safe to say that artists and storytellers alike are awakening to the powerful and moving effect of CC and incorporating them into their work to create art relevant to today's times. Greater visibility and appreciation for such forms of media could help push the message of CC to more people. This also helps children and youngsters develop an interest in the topic of climate change and to take action.

#### **Down to Earth Magazine**

Down To Earth (DtE) magazine aims to deliver news, perspectives, and knowledge to inspire positive changes in how people manage their environment, safeguard their health, and secure livelihoods and economic well-being for all.

Environmentalist Anil Agarwal, the founder of Centre for Science and Environment (CSE), started it in 1992 to 'fill a critical information gap' rather than 'capture a share of the information market'. He also founded the research, analysis, and documentation efforts of CSE in 1980. Indian environmentalist Sunita Narain, Director General, CSE, is the current editor. The magazine's reportage and analysis is aimed at young Indians, focusing on less-covered areas like villages, fields, factories, and labs.

It also publishes two annuals: State of India's Environment and State of India's Environment in Figures, which are annual environmental surveys. In October 2016, DtE launched a Hindi edition of the magazine, to reach a large Hindi-speaking audience in India and to begin a conversation on environment, development, and sustainability concerns with them.

The magazine won the Green Accord International Media Award in 2013 and the Ozone Award in 2017. Its writers have won many national and international fellowships.

#### **Social Media**

Social media has exploded in use and popularity in the past decade. A glance at Graphs 6.2.1 and 6.2.2 will show how social media use boomed over the years and now users' numbers are in the billions worldwide. Social media offers a great platform for information sharing, community building and even emergency warnings and alerts.

Many NGOs and green organisations are present on social media, communicating about their work, and spreading awareness about CC and its impacts. Climate actioneers can support their work, by interacting with them on their channels and driving up engagement so that they gain more visibility.

However, users must exercise caution when it comes to unverified social media posts sharing unsubstantiated information. Social media is often teeming with fake posts and propaganda, and users must be aware and well-informed to discern between genuine posts and fake posts. When in doubt, it would be responsible to always check for factually valid sources, to see if the news is true or fake.

Social media can also lead to the rise of echo chambers: online interaction groups, communities, or forums

# Media as Public Relations (PR) for Corporates

The media is highly funded by the same corporations that pollute the environment, making it next to impossible for us to get them to be honest about CC.

Public relations crisis management has become crucial for corporations in the last few years since bad publicity can bring a corporation down to its knees. So, in the public eye, through advertisements, corporates are highly commited to the environment. While the reality is often quite different. This leads to greenwashing and misleading the public.

It is important to recognise such industries and formulate policies, which will put a check on their practices. For example, the World Bank has committed to not funding very polluting industries. Such kinds of policy changes and political commitments will be effective.



Graph 6.2.1: Trend in the active users of various social media platforms for the past 17 years





where each person agrees with a common ideology or opinion. These echo chambers block smooth discourse among differing parties and lead to the radicalisation of opinions; those opinions strengthening and growing ever more rigid without any opposing thoughts to keep them in check.

#### Local Reporting and Sharing Your Story

Many news portals encourage citizen reporting. If you have something to report within your immediate vicinity that is related to CC, you can contact the news portal and ask them to share your story. This helps in highlighting issues, which would have otherwise gone under the radar. You can also leverage the power of social media. Many official government bodies are present on big platforms such as Facebook and Twitter. They can be directly tagged in your post and there is a good chance they will make a note of what you have to say.

### **12 Climate Actions for Media**

- 1. Use celebrity endorsements to promote sustainable brands.
- 2. Cross-verify news from various sources.
- 3. Organise live debates by panel experts on the effects and mitigation strategies for CC.
- 4. Put up statutory warnings in scenes showing pollution, deforestation, oil drilling, overconsumption, etc.
- 5. Promote and produce documentaries.
- 6. Become a citizen reporter and amplify local issues.
- 7. Trust only credible sources for data on CC.
- 8. Encourage scientific journalism.
- 9. Use social media to build outreach.
- 10. Spread awareness in as many local languages as possible.
- 11. Share and donate educational books about climate change.
- 12. Use advertisements to engage people.

### This subchapter has covered the following Sustainable Development Goals



# 6.3 Policy

Citizens of every country are subject to that nation's laws and policies. We often get so used to living with a certain set of rules that we rarely question the legitimacy of those rules and the rationale that goes behind formulating them. Often, a region's laws and policies reflect the local mind-set. For example, Germany's drinking age is 16 years whereas, in Maharashtra, India, the drinking age is 25 years, while the voting age is 18.

When mind-sets or opinions change, laws can be amended. One notable Indian example is the abrogation of Section 377 (which considered homosexual relations illegal) in 2018, reflecting a shift in attitudes befitting the 21<sup>st</sup> century.

So, what are India's environmental policies like? And what is their perception among the public?



#### Are Environmental Laws or Policies Red Tape?

'Red Tapism' is when too many rules and regulations slow down 'development' work or even stop it completely. It can include issues like applying for licences, taking approval from certain committees, filling out endless paperwork, etc. Unfortunately, environmental laws and policies, including CC laws and policies, are still considered unnecessary 'red tape' in many countries in the world, including India.

This means that governments and industries are on the lookout to reduce or bypass these 'pesky, timeconsuming' laws so that business can be 'conducted smoothly'. There is no appreciation of the importance of the environment. Adhering to environmental laws is considered merely a token gesture, something companies implement for 'ease of doing business'.

In India, this has brought about a negative perception of environmental laws. Even though awareness is spreading these days among urban youth, people still celebrate the dilution of environmental laws as the cutting of red tape. For 'ease of doing business', the Gol has already diluted or is planning to dilute, several laws such as the CRZ Act and the EIA law.

#### The Story of Coastal Regulatory Zone

The story of CRZ remains, to this day, the saddest example of great laws diluted over time by the governance machinery. This should serve as a cautionary tale for people and encourage them to take environmental policies seriously.

The Gol first issued the CRZ Notification in 1991, recognising the ecological importance of coastal regions and the requirement to control development activities occurring in these sensitive areas.

The areas were accordingly divided into these zones: **CRZ-I:** Ecologically sensitive areas such as marine sanctuaries and national parks. No development is allowed within 500 m of the High Tide Line (HTL).

**CRZ-II:** Developed areas close to water. Construction and reconstruction are allowed according to local laws and architecture.

**CRZ-III:** Rural areas close to water. 'No Development Zone' till 200 m from the HTL. Agriculture, parks, salt manufacturing and related activities are allowed. Hotels and resorts are allowed from 200 m to 500 m. **CRZ-IV:** Small islands such as Lakshadweep, Andaman and Nicobar, etc. Restrictions up to 200 m from the HTL. Using sand or coral from local beaches for construction, dredging and underwater blasting is banned.

The CRZ Notification had two major amendments in 2011 and 2018. The 2011 amendment mandated the formation of the Coastal Zone Management Authority (CZMA) at the national and state levels to monitor

and implement CRZ rules. The 2011 amendment thus strengthened the existing CRZ laws. The 2018 amendment, unfortunately, undid that progress and diluted the CRZ rules, making economic development and environmental destruction easier. Densely populated rural areas could have development projects within 50 m of the HTL instead of the earlier 200 m. In addition, temporary installations such as toilets, shacks and change rooms were allowed within 50 m of the HTL, even in 'No Development Zones'. The amendments were widely panned by environmentalists.

Overall, the CRZ rules have been modified around 35 times in their lifetime, making CRZ India's most amended law ever. Currently, they no longer serve the purpose of their establishment.

#### **Environmental Impact Assessments**

An EIA is a comprehensive study of the effects and impacts a proposed project will have on the environment around it. It includes an all-season study and covers environmental, social, and economic aspects of the project. Once an EIA has been conducted, a report is made, and certain alternatives are suggested when the impacts on the environment

#### **Aim of Environmental Policies**

Apart from ensuring that there is a monetary ROI in every project, we must also ensure that there must be a public ROI on every project in which the government invests. And in that initiative, the government would ensure that livelihoods, right-of-ways, and people's security are not harmed or damaged. Starting with the Wildlife Protection Act in 1972, many other legislations were enacted to further protect the environment viz. the Environmental Impact Assessment Act, National Environmental Policy Act, Biological Diversity Act, Public Liability Insurance Act, National Green Tribunal Act and many more.

But somehow those assurances of the safety of water, the safety of food quality, the safety of air quality, making sure that the locals are not harmed by any project, have not been met. Things have been worked around, and that is a major element of concern.

Divyesh Sharma, former Director, CUTS International are considered unacceptable. The local people are typically consulted after this, and their input is taken.

The screening process decides if a project requires a public hearing. This typically includes observations and comments by people who live in the vicinity and whose lives would be directly impacted by the project. Projects below one billion Indian rupees currently, do not require a public hearing.

Once the EIA is formulated, the project developers need to incorporate the changes suggested by the report into their venture. The project cannot go ahead without an EIA report.

In the EIA Amendment of 2006, the government introduced a category of projects (called B2) which do not require 'Environmental Clearance'. However, this was not the final amendment. An amendment was proposed again in 2020, giving rise to controversy.

#### **Draft EIA Notification 2020**

Some of the proposed changes in the draft EIA Notification 2020 were as follows:

- 1. Post facto clearance: The project can be started before EIA is conducted.
- 2. Reduced public hearing time: From 30 days to 20 davs.
- 3. Project exemption: Several types of projects such as small hydroelectric projects (<25 MW), cement plants, oil, and gas exploration projects, as well as projects deemed 'strategic' in nature, will be exempt from getting an EIA done.
- 4. Compliance report to be submitted annually instead of every six months.
- 5. Public reporting for non-compliance with EIA suggestions would no longer be valid. Only reports made by the project developer would count. This effectively means the project developer would have to report its non-compliance for the government to act against it.

Thus, it is evident that if left unchecked, there is a tendency among governments to push towards ease of business at the cost of environmental protection. So how do we, as citizens, make our opinions heard and bring about change legally?

Table 6.3.1: Major Environmental Laws and Policies in India		
	<b>Environmental Laws and Policies</b>	Key Features
1	Amendment in Article 48A of the Indian Constitution	To include protection and improvement of the environment
2	Amendment in Article 51A (g) of the Indian Constitution	To include protection and improvement of the environment; to have compassion for all living creatures
3	The Wildlife (Protection) Act, 1972	Protection of wildlife and their habitat; declaration of Schedule Species List
4	The Water (Prevention and Control of Pollution) Act, 1974	Prevent and control water pollution; maintain & restore water resource
5	The Air (Prevention and Control of Pollution) Act, 1981	Prevent and control air pollution
6	The Environmental (Protection) Act ,1986	Umbrella legislation; response to the Bhopal Gas Tragedy; to protect and improve environment for humans and biodiversity
7	National Forest Policy, 1988	To maintain the ecological balance; to protect the interests of tribals & people depending on the forest
8	National Action Plan on Climate Change, 2008	Eight missions for clean energy, ecosystem protection and sustainable development
9	National Green Tribunal Act, 2010	Judiciary body for cases relating to environmental protection
10	Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016	Regulations for safe handling, disposal and treatment of hazardous wastes

#### **Raising Concerns as a Citizen**

The Pre-legislative Consultation Policy of 2014 mandates that any proposed bill must be placed in the public domain for 30 days for feedback. Parliamentarians are required to explain in simple terms the need for the bill, its implications, and financial considerations, with the impact it will have on citizens' lives.

Platforms such as Civis (<u>https://www.civis.vote/</u>) and MyGov (<u>https://www.mygov.in/home/discuss/</u>) provide a list of drafts currently up for public feedback. Individuals can read about them and give their comments and suggestions on the same site. These websites have been useful in letting the public comment on drafts such as the EIA Notification 2020 and other proposed bills. Parivesh (<u>https://parivesh.nic.</u> <u>in/</u>) is another website where the drafts can be viewed.

Widespread public feedback and comments on drafts such as the EIA Amendment 2020, let policymakers know if the people they represent consent to these laws. It also guides them on the changes to make in the proposed laws to make them more acceptable to citizens. The NGT is responsible for enforcing environmental laws and for holding offenders accountable.

#### **PILs and Green Tribunals**

The NGT, formed in 2010, is a specialised judicial body set up solely to preside over and resolve environmental cases in India. Any person seeking relief and compensation for environmental damage can approach it. The NGT has a presence in five zones: North (Delhi), Central (Bhopal), West (Pune), East (Kolkata) and South (Chennai).

The NGT concerns itself with cases related to Schedule I of the National Green Tribunal Act, 2010:

- The Water (Prevention and Control of Pollution) Act, 1974;
- The Water (Prevention and Control of Pollution) Cess Act, 1977;
- The Forest (Conservation) Act, 1980;
- The Air (Prevention and Control of Pollution) Act, 1981;
- The Environment (Protection) Act, 1986;
- The Public Liability Insurance Act, 1991; and
- The Biological Diversity Act, 2002.

Any citizen of India can approach the NGT with a grievance. A lawyer is not required to apply to the

NGT. It can be done individually by applying in the required format. This can be done at <u>https://ngtonline.</u> <u>nic.in/efiling/mainPage.drt#</u>

#### **Climate Change Policies**

Policies are sets of guidelines, laws, plans or ideas that are used to regulate behaviour. These are often agreed upon by governments, corporate organisations, public or social institutions, or even individual collectives.

There are two different thoughts regarding policies. One believes that governments are the key actors in strategising and implementing CC policies. The other believes that governments should only set policy frameworks; citizens and consumers will drive the efforts. However, we at Friedrich-Ebert-Stiftung believe that governments need to step up and play a key role in policy formation.

While formulating policies to address CC, it is important to ensure that alongside ecological responsibility, social responsibility should also be considered. Take the example of phasing out coal power and using more green forms of energy. Although ecologically responsible, if coal workers' jobs are not catered for, the policies will fail.

Similarly, policies need not be rigid for all but are variable based on the geographical and social context. Polluting countries must have stricter policies than non-polluting countries, based on their contribution to emissions.

Policies must also be as inclusionary as possible. Often, policymakers are men of certain economic backgrounds. This leaves out other sectors of society from making their voice heard and contributing solutions to the climate crisis. An example: during a disaster relief effort, aid distributed to survivors did not include female hygiene products. This was because the body that decided which items would be distributed were all men. It simply did not occur to them. Thus, everyone needs to be on board while formulating policies.

Julia Behrens, former Project Director, Climate and Energy in Asia, Friedrich-Ebert-Stiftung, Vietnam Office

#### **Gamification of Boroughs**

Hounslow, a London borough, launched an initiative called 'Beat the Street', which ran for six weeks from September 18 to October 30, 2019. Over 28,219 people (9.6 per cent of its population) participated in this project. It was done to encourage residents to walk to their destinations instead of using private vehicles.

To achieve this, a game was developed. Physical boxes were placed throughout the borough. Players were granted points when they tapped special cards given to them on consecutive boxes, indicating they had walked between them. Hounslow Council arranged for prizes for the highest-scoring individuals and teams.

Results: Participants collectively travelled 96,849 miles throughout the game.

There was a 53 per cent reduction in cars and vans travelling through Cambridge Road in Hounslow between 7-9:30 a.m. and a 34 per cent reduction in cars and 20 per cent reduction in vans along the road between 2-4:30 p.m.

Children played a leading role in encouraging adults to play the game.

Beat the Street was funded by Hounslow Council and delivered by Intelligent Health.



'Beat the Street' (Credits: Intelligent Health Ltd.)

#### Feed-In Tariffs in Kenya

Kenya is heavily reliant on traditional biomass energy to meet the energy needs of its rural, peri-urban and tribal population. For urban economic needs, it uses imported petroleum. To reduce the unsustainable use of traditional forms of biomass and protect against high and unstable oil import prices, Kenya's Ministry of Energy adopted a Feed-in Tariff (FIT) Policy in March 2008.

The FIT has made it mandatory for energy companies that operate the national grid to purchase electricity from renewable energy sources at predetermined prices. These prices would be sufficiently attractive to stimulate new investments in the renewable sector. This ensures that renewable energy producers have a guaranteed market and a good ROI for the electricity they produce. Other encouraging aspects for renewable energy producers include grid access, long-term power purchase agreements, and a set price per kWh of consumption.

The power purchase agreements have a minimum span of 20 years. It is expected that the FIT policy in Kenya could stimulate about 1,300 MW of electricity generation capacity. FIT is also expected to boost rural employment as the biggest potential to generate renewable energy is found in rural areas.



Energy Transmission (Credits: CT Cooper/Wikimedia Commons/CC BY 3.0)

#### Future

Many studies have shown that diversity among policymakers leads to better policy decisions, not just in governments, but in businesses and industries too. Diversity ensures that an extensive evaluation of the matter takes place, and several aspects of solutions are considered before arriving at a mutually agreeable course of action.

This diversity should include senior citizens, linguistic minorities, persons with disabilities, women, and other gender minorities. People who have not received access to formal education will also require a platform for understanding the proposed policies and for voicing their comments regarding them.

Policies must be based on evidence, lending prime importance to good, peer-reviewed research. Policymaking based on individual ideologies will not work for a global issue such as CC. Carbon or energy taxes, removal of subsidies on fossil fuels, rebates for the purchase of renewable energy products (such as electric vehicles and solar panels) and carbon permit schemes are all ways to reduce the widespread use of technologies and practices that exacerbate CC. Likewise, coal and other fossil fuelbased plants can be phased out by limiting emissions from existing plants and stopping the construction of new ones.

As we move ahead, we must both expect and demand greater co-operation between societies and nations to come up with policies on the lines of The Montreal Protocol (1987), the UN Framework Convention on Climate Change (1992), the Kyoto Protocol (2005), and the Paris Agreement (2015). With the correct blend of relevant research, climate-conscious and responsible leaders, a citizenry aware of its rights, and the human will to mitigate CC, we can expect many more such policies to be drafted, and be implemented, in the future.

#### **11 Climate Actions for Policy**

- 1. Set up directives for subject-matter experts to engage with civil society groups, via public hearings, before deciding on critical issues relating to CC.
- 2. Look up, understand policies in action, and take steps to observe their implementation.
- 3. Propose strategic measures (e.g. waste disposal and rainwater harvesting) at a local level.
- 4. Create a local think-tank to implement an integrated resource management strategy.
- 5. Start small. Follow small rules at home that distribute the actions as well as implement mitigation strategies directed at CC.
- 6. Employ purchasing power to encourage companies with climate-friendly policies.
- 7. Demand policies for a cradle-to-cradle approach towards a sustainable lifestyle, fashion and fast-moving consumer goods (FMCG) products.
- 8. Evaluate current policies and demand changes in those that are no longer relevant.
- 9. Encourage sustainable companies by generating policies that provide incentives, e.g. tax benefits and subsidies.
- 10. Participate in draft policy comments and make your opinions known.
- 11. Bring environmental transgressions to the notice of authorities, viz. the municipal corporations or the NGT.

#### This subchapter has covered the following Sustainable Development Goals



# 6.4 Governance

Climate policies are doubtless great tools to encourage green behaviour. However, proper governance is required to envisage and implement these policies and clearly define the outcomes. This becomes a trickier proposition, as it depends upon diplomacy, cooperation, and shared vision among leaders of varied backgrounds and nationalities to mutually agree upon a global plan of action. However, with the threat of CC looming large, leaders have no choice but to do so, which has resulted in some momentous and truly noteworthy global protocols and agreements.

Infographic 6.4.1 shows stakeholder mapping for climate action in (A) 2022 and (B) 2030. This stakeholder mapping is conducted as part of a method called Transformative Change Making. It uses development cleavages in a society – cultural (x axis) and material (y axis) – to determine stakeholder positions. This helps in visualising and comprehending their current interests. As seen commonly, an interest based alliance, does not necessarily result in change. At best it brings different interest groups together on a common platform. However, by understanding the developmental orientation, a broader societal alliance for transformative change can be formed.

#### **Montreal Protocol**

To date, the Montreal Protocol remains the only UN treaty to be ratified by all countries on Earth. Adopted in 1987, it regulates the production and consumption of Ozone Depleting Substances (ODS).

It specifies plans and timelines to phase out ODS, with developing and developed countries having different responsibilities. Commitments are binding, timebound, and measurable. The treaty has been amended in the light of new scientific evidence, as well as economic and technological improvements.

It established Substances that Deplete the Ozone Layer to help developing countries realise their goals according to the agreement. The fund has helped support over 8,600 projects worth over 3.9 billion US dollars, including industrial conversion, technical assistance, training, and capacity-building.

To date, there have been two amendments: The Montreal Amendment and the Kigali Amendment. The decisions to phase out HCFCs and HFCs were taken at these summits, respectively.



The Montreal Protocol has been one of the big success stories for CC as the signatories to the protocol have phased out over 98 per cent of ODS compared to 1990 levels.

#### **Kyoto Protocol**

The Kyoto Protocol was an international climate treaty adopted in 1997 and enforced in 2005. Currently signed by 192 countries, it is based on the principles and conventions of the UNFCCC. It recognises that the more developed countries are the ones responsible for the high amounts of GHGs in the atmosphere and therefore should take greater responsibility in tackling CC. This approach is called 'Common but Differentiated Responsibility'.

The Protocol laid binding emission reduction targets for 37 industrialised countries, adding up to a five per cent reduction in emissions for the years 2008-2012, over 1990 levels. It had also introduced the Global Emissions Trading and Clean Development Mechanism (where developed countries implement emission reduction projects in developing countries). It also rigorously monitors emissions. In 2012, the Doha Amendment extended the commitments made by countries from 2012 until 2020. It also updated the list of GHGs.

#### **Paris Agreement**

The Paris Agreement, signed in 2015, legally binds countries to limit global warming to below 2°C, preferably to 1.5°C, compared to pre-industrial levels (circa 1850-1900 AD).

Each country is required to submit a nationally determined contribution (NDC) in which it will outline the steps it intends to take to fulfil the requirements of the Agreement. Countries are also invited to submit long-term low greenhouse gas emission development strategies (LT-LEDS).

Countries are given financial, technical, and capacitybuilding support by other countries, which are a part of the Paris Agreement. Starting in 2024, performance will be monitored via an Enhanced Transparency Framework (ETF), where countries will report on actions taken. So far, low-carbon markets and carbon neutrality have picked up following the Agreement.

Such global agreements pave the way for countries to reach an understanding of the severity of CC and decide on a collaborative roadmap for the future. However, national and state governments too can do their part to ensure climate-friendly behaviour among industries and populations. One such governance move is to declare national and state symbols.

### New Zealand: Governance to Combat Climate Change

When we talk about CC, we talk about where we are coming from, and what we have done and not done. A few decades back, people were questioning whether CC exists. Now we have conferences to decide the level of responsibility we can take for CC impacts. Therefore, I feel we have come a long way.

We in New Zealand (NZ) have taken many steps towards sustainability and climate-conscious business. We declared a climate emergency in the NZ parliament and included the 1.5°C threshold in legislation. We have stopped new oil and gas exploration projects and are instead exploring the 'Hydrogen Economy'.

We are revamping all public transport fleets to electric models and are committed to making the country run on 100 per cent renewable electricity by 2030.

We have introduced additional taxes for fossil fuel-based vehicles and rebates for electric vehicles. Similarly, we are advocating for the removal of fossil fuel subsidies. In business, we have overhauled our emissions trading scheme and put a cap on emissions. We have also passed a law requiring all financial institutions to disclose climate risks and opportunities.

Our parliament is inclusive, with great indigenous representation. We have indigenous ministers, ensuring the voices of their people are heard, making them equal stakeholders. While passing laws, there is always bound to be some disagreement with stakeholders. Businesses and industries are often concerned with the impact of CC policies and laws on the economy and jobs, whereas common people will be more concerned about the environment and quality of life. Ultimately, consulting with businesses and making them understand the importance of the laws is the key.

There are currently two major things, which are of concern to me. First, is minimal research being done on climate refugees. Tuvalu and Maldives might well have some parts of their country underwater in the coming decades. What will happen to the resultant climate refugees is something that has not been studied adequately. Secondly, there is a lack of global planning to increase the surge capacity of healthcare systems. As the COVID-19 pandemic has shown us, our healthcare systems can get overwhelmed during times of crisis. During times of disaster, the influx of refugees will overload existing healthcare systems whose surge capacities are undeveloped.

The younger generation is becoming increasingly aware of CC. This is a good thing. They are counting on us to do the right things for the future of the planet.

Dr. Gaurav Sharma, Member of Parliament, New Zealand



Infographic 6.4.1A: Stakeholder Map for the World's Climate Action in 2022

#### **Declaration of National and State Symbols**

India has a national animal (Bengal tiger), national bird (Indian peafowl), national flower (lotus) and national tree (banyan). Similarly, all 29 of India's states have a state animal, bird, flower, and tree, which are specific to that region.

The decision to declare such state symbols was made in the Wildlife (Protection) Act, 1972. The idea behind the move was to unite the people under the common symbols of their state and inculcate love and pride for the symbols in the minds of the people.

State symbols also function as 'flagship species'. These charismatic species act as the focus points of conservation efforts and are ambassadors of the local habitats and ecosystems, which will prompt people to contribute resources towards their conservation. These conservation efforts using popular state and national

Climate Actioneers' Primer: A Beginners Toolkit

symbols also end up helping the less charismatic but equally important flora and fauna of the region to survive. These include flowering plants, butterflies, other insects, reptiles, birds, and small mammals.

#### Forest Rights Act, 2006

For a long time, Indian forest policies did not recognise the symbiotic relationship of forest-dwelling tribes with forests. These Scheduled Tribes not only depend upon forest resources for their sustenance and livelihoods but also conserve the forest using knowledge passed down for generations. The Forest Rights Act (FRA), passed in 2006, recognised the rights of these forestdwelling communities on forest resources.

The FRA allows communities to inhabit, cultivate, as well as use forest resources for grazing, fishing and even conservation. It recognises traditional knowledge as intellectual property and hence has provisions to



**Climate Action 2030** 

Infographic 6.4.1B: Stakeholder Map for the World's Climate Action in 2030

safeguard this knowledge. It also protects the tribal community against eviction without rehabilitation or settlement of dues. In addition, it compels the gram sabhas and other rights holders to conserve and protect the forest environment and safeguard the rights of the tribal people, as well as give them a say in determining local policies and schemes.

The FRA thus conserves forests, protects the rights of tribal people, and provides development facilities to them such as education, healthcare, and livelihoods.

#### **Protected Area Network**

The central government can declare a specific area as a 'Protected Area' if it is satisfied by the conditions in that area. Protected areas include national parks, wildlife sanctuaries, conservation reserves, community reserves, and tiger reserves.

National parks and sanctuaries are thus areas of ecological significance, created to conserve, propagate, and develop biodiversity and ecosystems. The key difference between the two is in the rights of the people living within the areas. In sanctuaries, certain human activities are permitted. A newly formed sanctuary might not interfere with all the existing rights of people living within the area. In a national park though, people are not allowed in for any activity except ecotourism.

Conservation reserves are typically regions around national parks or wildlife sanctuaries, which can link two protected areas. These function as buffer zones or corridors for wildlife. Community lands are declared as community reserves when the local people offer to conserve wildlife and its habitat. In both conservation and community reserves, people living inside the reserve retain their rights.

As of July 2016, protected areas covered 4.9 per cent of India's total geographical area. These consisted of 102 national parks, 515 wildlife sanctuaries, 47 conservation reserves and four community reserves.

#### **Subsidies**

Another key tool in any government's arsenal is subsidies. Subsidising certain segments of industry provides a boost, due to increased economic incentives. Subsidies, when done right, can do a world of good. Most public transport systems are subsidised, enabling citizens to use these services at extremely cheap rates, thus driving down GHG emissions. Similarly, the ration system is effectively a subsidy for poor people to help them afford essential goods, thus ensuring a minimal standard of living.

However, this is a powerful tool, to be used with caution; subsidy money is taxpayers' money, and subsidised industries have a massive advantage over unsubsidised ones.

This is one of the reasons why fossil fuel industries are still thriving despite solar energy being cheaper

#### **Transformative Change Making**

The Transformative Change Making (TCM) tool is useful to create a narrative that helps you position your project as desirable among people with different interests. It is used to unite 'Transformative Allies' (spoilers) and the 'Natural Allies' (already convinced) under a common narrative. More often than not, 'Transactional Allies' (fence sitters) also join the narrative once enough momentum is generated.

We used TCM to great effect with our RIVERse project, which focused on reversing the transformation of Mumbai's rivers from 'nalas' (sewage drains) to healthy ecologies that positively affect the lifestyle of the people living along its banks. A good change narrative has five elements: threat, hope, opportunity, confidence, and ethical imperative. TCM helped us understand the opportunities in the project, enabling us to strategise at various levels and move from an exclusive to an inclusive narrative.

#### Vikram Pawar, Kimaya Keluskar, Ajay Nayak, Water Environs

#### **Bhutan Forest Governance**

Bhutan's forests absorb nearly three times more CO, than the country emits annually.

Before 1969, much of Bhutan's forests were governed locally and managed under customary rules and traditional forest management practices. Bhutan's National Forest Policy (1974) centralised forest governance and established forest management regulations based on scientific forestry. Efforts were made to return some forest areas to local communities. Through local governance of forests, forest cover was increased. Currently, almost all of Bhutan's forests are held under public administration, with half of their area (51 per cent) designated as protected. Less than one per cent of forest land is held privately.

This has helped the Government of Bhutan to protect the fragile mountain ecosystem while providing a continuous supply of forest resources to residents and businesses. Forest conservation has been balanced with the sustainable use of forest resources. Stewardship of land by onsite resource users is necessary for continued well-being of offsite, downstream residents and water users. Restoration and reclamation of degraded lands are done using reforestation and watershed development programmes. This is possible via plantations (timber and tree crops), enrichment planting, and support for community and private forestry. Rural residents are also involved in these programmes as their use of land is affected.

These interventions make Bhutan one of the few carbon-negative countries in the world.



Trongsa, Bhutan (Credits: Jean-Marie Hullot/Wikimedia Commons/ CC BY-SA 2.0)

to produce. Some industries successfully lobby government officials, often through corruption or bribery, to get subsidies even when they harm the environment. They sometimes even manage to get laws bent to favour them. The result of such actions is subsidies for soy production in the Amazon and palm oil plantations in Southeast Asia. Both these actions are causing untold harm to native forests and habitat loss for many threatened species.

#### **Threats: A Divided House**

The greatest threat to climate governance is the asymmetrical nature of CC. In most facets of governance, an incorrect decision by a country's government has repercussions on that country itself. However, in the case of CC, a country might adopt the best ecological, social, and economic practices and yet sink under the ocean if large countries halfway around the world do not curb their emissions. This threatens to cause a massive 'every man for himself' scenario across the world.

Northern countries, which are currently some of the coldest inhabited places on Earth, stand to gain a lot economically by the onset of GW. A lot of their land would become habitable, and trade would boom if

their waterways were not so clogged with ice. How does one balance this approaching boom with an effort to save small island nations from completely disappearing underwater? Climate governance, international understanding, and diplomacy will play a key role in finding the path forward.

Another threat is the long-term nature of CC. Since governance is a function of an elected body, they are often forced to prioritise the 'now' over the 'future'. This leads to them taking decisions, which would harm the planet in the long-term but would secure public appreciation in the short-term (read, the next election).

#### Accountability

People, as citizens and voters, can demand better climate strategies from their elected representatives. Matters of great public interest are seldom ignored. All citizens should wholeheartedly participate in elections and choose candidates that match their vision for a sustainable future. Citizens must leave comments on proposed bills and Acts that do not uphold the spirit of ecological and environmental conservation. Ultimately, governance is not insulated from the masses as they have the power to decide the direction of steering the ship of policy.

#### **10 Climate Actions for Governance**

- 1. Vote for thinkers and decision-makers.
- 2. Write to governing bodies about the unsustainable practices around you.
- 3. Encourage corporate governance to take a stand to address CC.
- 4. Form panels with scientists, policymakers, media persons and youth, to generate innovative ideas.
- 5. Demand for an expert poll before tree cutting, reclamation or any such activity.
- 6. Spread awareness in local self-governing bodies about the perils of CC.
- 7. Ask the government to sanction funds for mitigative measures.
- 8. Demand widespread electrification of vehicles and trains, as well as other such clean energy initiatives.
- 9. Petition the government for more public transport services with better connectivity.
- 10. Try to implement daylight-saving practices in offices using innovative technology.

#### This subchapter has covered the following Sustainable Development Goals



How does one decide how well a country is doing? One could look at how well the country is doing in sectors like education, infrastructure, industries, transportation, and energy. We could also look at the living standards of the citizens and their access to food, water, and shelter – the most basic requirements.

Indians traditionally have been known to worship Nature and understand its importance, but that does not mean education cannot improve their perspectives on climate change (CC). Educational qualifications are critical in modern society to gain employment and thus stave off the financial debilitation that accompanies CC. Children educated about the climate crisis will be more appreciative of natural resources and use them frugally. This will hopefully also inspire their families to follow suit and join in climate mitigation action.

This can lead to much 'greener' practices being followed at homes, such as responsible resource use and waste disposal. Families might go a step further and design their homes to cause the least harm to the natural environment. Indeed, many architects are designing such 'green houses' that use natural systems for their functioning.

One important factor while building green homes, or any form of green technolo)gy, is the type of energy that will be used. Over the years, rampant and unchecked use of fossil fuels has led to the increase of GHGs in the atmosphere. To wean off our dependence on fossil fuels, we need to introduce greener forms of energy, such as solar, wind, geothermal, and many others. These could be used to power buildings, transport, and industries.

Transportation is an important facet of life, which is largely unavoidable. People travel all the time. All this travel releases great amounts of GHGs into the atmosphere. Along with adopting greener vehicles, it is also important to embrace public transport once again. That, along with reducing the need to travel, would have a net positive impact on CC.

Industries should focus on shifting to greener forms of operation. Consumers need to be cognizant of the various forms of greenwashing and ensure that industries walk their talk. Since so much power and money are concentrated in the hands of large industries, responsible steps taken by them will make a positive impact in the fight against CC.

Finally, our infrastructure needs to be used properly and updated wherever required. Certain requirements such as access to water and sanitation facilities are the basic rights of individuals and we need to ensure that they are available to all. Similarly, future infrastructure should be set up in a way that ensures continued climate resilience.

This chapter will look at all these sectors and understand the problems that plague them. It will look at the Indian perspective and discuss possible actions to work towards sustainability in each of them.

#### This chapter covers the following Sustainable Development Goals





# 7.1 Education and Outreach

We now know that CC is a relatively recent phenomenon but it is gaining widespread understanding among people. A large part of the credit for this acceptance can be attributed to modern education.

Education is not just about learning certain subjects; it is also about learning how to learn. The educational process aims to train students to consume various forms of media, process and analyse that information, and form their own opinions. Education actively shapes students' beliefs and perspectives by providing a solid foundation of study materials and fostering critical, analytical,

and inferential skills. It is thus very important that the education received during a child's formative years adequately covers the threat of CC.

Similarly, outreach activities are crucial to spread the word about CC. They can also be used to educate people about biodiversity, green practices, and social evils, among many other things.

#### The State of Education as a Whole

According to the 2011 Census, about 73 per cent of the Indian population was literate. Eighty one per cent of the total male population and 65 per cent of the total female population were able to read and write. The National Statistical Commission revealed the literacy rate to be 77.7 per cent in 2017–18, 84.7 per cent for males and 70.3 per cent for females. In comparison, in 1981, the respective rates were 41 per cent, 53 per cent and 29 per cent. This is a huge improvement that keeps getting better with time.

As per Fig. 7.1.1, we can see the disparity between male and female literacy levels. This is something that is a 'Work in Progress', as we move toward a more inclusive and balanced society.

#### The Play School

We started The Play School in 2002, to create a child-friendly school. It is called 'The Play School' because children are encouraged to play right from Nursery to Tenth grade. It is located in a slum area and serves over 600 children.



Over the years, people have started to realise that there was something different about the school; here children could play freely, draw, paint or share their stories. Children who are late to class are not punished, as this is a slum area and sometimes there are hindrances in coming to class. Relatives are allowed to come over to the school to meet the child.

The management as well as the teaching staff is extremely passionate about their work and there are lots of donors and research people supporting the school. Even people from overseas come to visit us and ask us how they can contribute to our cause. We have officials from all strata visiting the school and providing opportunities to the children. For example, children are encouraged to become 'Mangrove Officers' or help in collecting plastic waste in the area. Students of Standard 11 and 12 have experienced farming with the Hariyali Organisation. We also have exchange programmes where students get to experience education abroad.

The children have also participated in Poster Competitions, Street Play competitions, Clean Aarey Drives and Afforestation Drives. This has led to them, the teachers, and the school, winning several international awards as well.

Jayashree Raveendran, former Headmistress, Vidyadhiraja High School & Junior College



#### Graph 7.1.1: Total literate population in India as of 2011

#### **Envirnmental Studies as a Subject**

One of the major challenges in teaching Environmental Studies (EVS) as a subject in India, is the lack of importance given to it. Since subjects are primarily given importance based on how they help in one's career, EVS often ends up on the low-priority list, below high-priority subjects like mathematics and science. This is also because environmentalists and biologists are considered niche professions with limited opportunities and earning potential. Compared to engineering, medicine, and law, these professions are seen to be lower in social reputation, earning potential, and consequently, parental approval.

Another worrisome fact about EVS being taught as a subject is that very often EVS teachers themselves do not have a degree in Environmental Sciences. Teachers trained in mathematics, geography, the sciences, and English, double up as EVS teachers.

Persons Males Females

Institutions such as Pollution Control Boards, Environmental Impact Assessment Committees, or Research Universities, do not prioritise hiring professionals with a background in EVS. Even the Indian Forest Service entrance exam has EVS only as an optional subject.

Additionally, the information about EVS is taught to students in an exam-centred manner. No effort is made to inculcate attitudes and outlooks that favour environmentally conscious living. As a result, even though educated individuals know the importance of sustainability, they do not incorporate it into their daily lives. Efforts need to be made to inculcate the values of climate consciousness and sustainability into the daily lives of students. This can be achieved by demonstrating sustainable lifestyle choices. using environment-friendly resources in classrooms, and addressing social and human impacts of CC. This requires training and skilling of educators, which is not a common practice in India.

#### **Environmental Jobs**

Environmental jobs traditionally used to be relegated to the side-lines. While ageold, culturally and socially accepted roles were the main occupational choices in

the environmental sphere. For intellectuals, a role in academia or government bodies used to be considered good in terms of 'Green' jobs. However, this field was not typically associated with the corporate or industrial sector, where most of the lucrative jobs existed and to which the upwardly mobile population looked at for their livelihoods.

Contrary to public perceptions, environmental jobs are seeing a rise. With the recognition of CC as a real threat and the rise of Environmental, Social and Governance (ESG), Corporates have increasingly adopted a more 'Green' stance in their operations. This has also led to the creation of new jobs in corporate and industrial sectors that did not exist a few decades back, such as Chief Impact Officer, Chief Sustainability Officer, Environmental Consultants, Sustainability Managers, Urban Gardeners, and many more. There has also been a new thrust on sustainability in disciplines that have existed for a long time, such as architecture, urban planning, and engineering. With proper education and skill building, even today's working-class will be able to enter the 'Green' sector. They would not only make a decent living but also work towards betterment of the environment.

#### **Skilling and Training Programmes**

Although environmental knowledge and skills should ideally be inculcated among children from an early age, it is never too late for anyone to learn them.

Individuals can participate in workshops on gardening, permaculture, teachers training, recycling, Nature photography and documentation, and many more, to gain valuable new skills. These 'Green' skills would be carried into their jobs and lifestyles to bring in more climate-friendly practices.

#### **The Marigold Creative**

I first set up the Marigold Creative Library to ensure children get access to literature and experience the joy of reading, and it has grown organically from those beginnings.

In India, a lot of focus is put on textual knowledge. But what we try to do at Marigold Creative is to get children in touch with Nature. We encourage them to walk barefoot, feel the soil, and go for Nature walks in parks and forests. We bring in experts who can help guide and inform them about the things they do outdoors or the things they see. Our activities include making collages from fallen leaves and collecting stones and flowers. We have also encouraged them to grow microgreens to understand how food comes to our plates and to inculcate the joy of harvesting.

Another interesting project I did was with an NGO called Tree of Life, that involved setting up butterfly gardens in the city museum and at a school. The museum now has activities such as tree hugs and storytelling under the trees. It is an immersive experience.

Smitha Nair, Teacher & Founder, Marigold Creative

#### Outreach

It is extremely important to educate the public about the dangers of CC, the importance of climateconscious practices, sustainability, and the importance of ecosystems and habitats. However, this is not an easy task, as rapid scientific progress, the growing footprint of Information Technology and archaic

#### VIDYA

VIDYA is a 35-year-old pan-Indian grassroots organisation. It aims to bridge the gap between children of economically disadvantaged backgrounds and children who are economically privileged. Thus, we work with a lot of firstgeneration learners.

Literacy can save children's lives and provide them with the means to earn a livelihood. We encourage reading at VIDYA. In all the programmes VIDYA runs, there are libraries. These days children's literature is vast, and more books are being published every day. All it takes is affordability, access, and availability of books for everyone. Community reading programmes are not only skill-building programmes but also programmes for conversations with (and among) children about the story, the art, the poem, and the song. It is about giving the child a voice.

We also inculcate life skills in children. We want to make them empathetic, compassionate, respectful, and socially responsible as well as employable. We encourage them to celebrate festivals in a socially responsible manner. We also collaborated with Humsafar Trust to help adolescents grappling with their gender identity. We conduct sensitisation programmes for the entire organisation and have incorporated anti-bullying modules as well.

We faced several challenges in slums – such as lack of resources, toilets, ventilation, and budget constraints. But our teachers are very determined and remain in high spirits. That is how we have been able to make so much progress, despite limited resources.

Jayshree Murali, Freelance Educator & Teachers' Trainer methods of teaching about the environment are proving to be impediments.

Scientific and academic research must serve as the foundation of wise decision-making. Thus, the latest and most accurate information must be made available to everyone in society, most of all to policymakers. Additionally, citizens must also be trained to understand the information and make conclusions based on the evidence presented. This makes scientific outreach extremely necessary.

Outreach can be done by conducting community meetings, canvassing door-to-door, holding rallies, and having workshops. This outreach can focus on environmental education, healthcare, or basic requirements. During times of distress, such as pandemics or disasters, outreach activities can supply shelter, food, water, sanitation products, medical supplies, links to physical and mental health resources, as well as counselling, thus aiding relief efforts.

Readers are encouraged to volunteer at local outreach efforts by associating with NGOs and volunteer organisations. To plan successful outreach, the following guidelines are helpful:

- Identify goals and objectives of your programmes: What do you want to achieve through the programme? Your objectives must be SMART: Specific, Measurable, Achievable, Relevant and Time-Oriented.
- Identify the target audience: Whom do you want to impact? What do these people do? What are the issues they care about the most? What are the things that affect them?
- **Draft a message:** Factsheets or videos must be brief and concise.
- **Message distribution:** Choose how to distribute the message and select which media or format to use.
- **Events:** The actual event could be a workshop, rally, community meeting or even door-to-door canvassing.
- **Survey and feedback:** Let participants fill up a short feedback form to understand what went right and what could be improved.

#### Nature-based Education

I started Rishi Valmiki Eco School (RVES) in 2010, after meeting with slum dwellers in Goregaon. I was shocked that people living in urban areas were deprived of education. I interacted with the children living in the area and realised that it wasn't just education, they were also deprived of love. I decided to remedy that with RVES.

RVES operates out of a Brihanmumbai Municipal Corporation (BMC) school building, with just four classrooms. We teach children from Nursery to 10<sup>th</sup> grade. The four hallmarks of the education we provide are activity-based learning, extracurricular activities such as sports and music training, special needs education, and Nature-based education.

Our Nature-based education incorporates wildlife into every part of the syllabus. We make efforts to ensure that every child falls in love with Nature. All aspects of the study have Nature-based examples. For instance, VIBGYOR colours are taught by giving examples of birds that exhibit the mentioned colours. Maths problems involve the Tiger Census and Great Indian Bustard numbers.

Similarly, we teach life skills using examples of animals. A story about a black panther teaches how being dark also has advantages and how one should accept oneself as one is. Such stories have opened children's minds and enabled them to discuss their insecurities with their peers, which leads to greater understanding.

We have made Nature into a way of life. Students of the secondary section can conduct Nature trails on their own and often teach students of the primary section about wildlife. The students of our Nature Club, when visiting their native places during the COVID-19 pandemic, sent us images of wildlife around their hometowns. This is what we have inculcated in our students, and we are very proud of them.

Nikita Pimple, Founder & Principal, Rishi Valmiki Eco School (RVES), Mumbai

#### **Climate Reality Project (CRP)**

Founded by former Vice President of the United States of America, Al Gore in 2005, The Climate Reality Project (formerly the Alliance for Climate Protection) is a non-profit organisation devoted to solving the climate crisis. It focuses on CC education and advocates for climate solutions available today.

Training is provided through grassroots leadership sessions, global media events, digital communications, and issue-based campaigns. Participants are informed about the current CC scenario, and given access to talks by regional experts, with a focus on public health, environmental justice, green communities, and transitioning to clean energy.

It has also created a network of CRP trainees around the world, who discuss the pressing problems of our time and find solutions too. Climate Reality Project also hosts an annual event called 24 Hours of Reality, which is a 24-hour live broadcast about the climate crisis and its solutions. There is an hour-long segment in every time zone, featuring celebrities, musicians, elected officials, and thought leaders from around the world. In 2017, the broadcast reached about 400 million people.

In 2021, CRP was active in 170 countries, running ten branches world-wide, with over 31,000 climate leaders. The India branch supports over 1500+ Climate Reality Leaders from India and South Asia.



Reality Leaders from The CRP Logo India and South Asia. (Credits: Climate Reality Project)

Reality Project

#### **10 Climate Actions for Nature Education**

- 1. Demand greater focus on Nature and environmental education in school curricula.
- 2. Help set up Nature clubs in schools and colleges where students can learn and brainstorm about CC.
- 3. Get school boards to make Nature camps (with trained naturalists) a compulsory part of the curriculum.
- 4. Volunteer/conduct Nature trails or teach underprivileged kids about CC.
- 5. Spread information about laws and policies through talks, videos or podcasts to increase awareness.
- 6. Create Information, Education and Communication (IEC) material in different media that talk about CC in age-appropriate ways. Do this in multiple languages for greater reach.
- 7. Create board games about CC and its impacts.
- 8. Have kids design games about the interconnectedness of all living things and the impacts of CC.
- 9. Develop climate museums as learning laboratories to learn about CC.
- 10. Create resource libraries to access information on CC.

#### This subchapter has covered the following Sustainable Development Goals



# 7.2 Energy

Global energy consumption has exploded dramatically over the past few years. This is 'fuelled' by the overall production and consumption of goods, which has skyrocketed and continues to grow unchecked.

Almost everything we do requires electricity or some other form of energy, be it manufacturing goods, building homes, or travelling from place to place. All these activities generate carbon emissions on their own, in addition to GHGs released while producing the energy powering them. Even if a process is made carbon-neutral, it will not amount to much if the energy driving that process is carbon-intensive, for example, electric vehicles running on coalpowered electricity. This makes the



energy sector the first place to kick-start any carbon neutrality strategy.

For that, it is important to understand the various sources of energy currently in use.

#### Types of Energy Sources

**Biomass and biofuels:** Biomass is the most primitive form of energy. Biological matter is used to create energy. Logs of wood used to create fire are one example of biomass. It is often processed into pellets or briquettes for ease of use.

Biofuels are produced from biomass and are typically in liquid and gaseous states. Biogas, Ethanol, Methanol, Biodiesel, and Vegetable Oil are some examples of biofuels. Although naturally available and easy to produce, biomass and biofuels release  $CO_2$  and methane in large quantities on combustion.

**Coal:** One of the most popular fossil fuel (nonrenewable) energy sources, it accounts for 55 per cent of India's total generated energy. Coal is burnt and releases heat and  $CO_2$  in the process. This heat is used as energy.

Besides being non-renewable and releasing large amounts of  $CO_2$  into the atmosphere, coal mining and coal preparation plants cause other forms of environmental damage too. Surface mining destroys

natural habitats. A type of surface mining, known as 'mountaintop removal mining', dramatically and irreparably alters the topography of the area. Coal and rock waste are often dumped indiscriminately in nearby streams, which can become clogged with sediment. Toxic elements, which leach out from the exposed coal and adjacent rocks, when released into the environment, have the potential to contaminate groundwater supplies.

The burning of coal is the single largest contributor to anthropogenic CC. Most climate scientists advocate a global transition in favour of renewable energies such as solar and wind power, away from coal.

Currently, coal is the chief/primary energy source in India. The demand is projected to go up as population increases. India, sitting on rich coal reserves, is expected to continue using this indigenous, affordable, and easyto-procure energy source. This makes transitioning to cleaner forms of energy a huge challenge.

**Oil (petroleum) and natural gas:** Petroleum or crude oil, natural gas and bitumen – which in a viscous or solid form is found in tar sands – are common burning fuels. Crude oil (10.34 per cent in 2017-18) and natural gas (8.7 per cent in 2017-18) are the second and third largest sources of electricity generated in India. Burning natural gas generates half the emissions of coal and one-third the emissions of petroleum.



Graph 7.2.1: Global primary energy consumption by source

However, methane (the primary component of natural gas) has a global warming potential 21 times higher than  $CO_2$  over 100 years. On the other hand, while  $CO_2$  stays in the atmosphere for many decades, methane remains for only a dozen years or so.

**Nuclear:** Nuclear energy is generated from splitting atoms of radioactive elements and utilising the heat generated during the process as energy. It is a stable form of energy (independent of external conditions) and generates minimal greenhouse gas emissions during operation. It is also as much as 8,000 times more efficient as compared to traditional fossil fuels. The list of benefits begs the question, why is nuclear energy not mainstreamed yet?

The answer is that although nuclear plants do not generate the same level of emissions as coal or oilbased plants, they are extremely expensive to build and hence not that commonly used. Uranium mining and enrichment are harmful to the environment. Nuclear power plant accidents in Chernobyl and Fukushima, are infamous for their large casualty lists and long-term effects of radiation. This radiation not only affects the people exposed to it, but also the surrounding area. Nuclear waste and its disposal is also a grave issue. Contamination or disposal zones present high health risk to resident wild species and humans. **Hydropower:** Hydel power is a major energy source in India. As of March 31, 2020, India's installed utility-scale hydroelectric capacity was 46,000 MW or 12.3 per cent of its total utility power generation capacity.

Hydropower is a renewable resource as flowing water is used to generate energy. The most common types of hydropower plants use a dam to store river water in a reservoir. Water is then released from the reservoir onto a turbine that spins, to produce electricity.

However, this kind of plant has adverse impacts on the surrounding environment. It disturbs the natural flow of rivers, causing large-scale human and animal migration and relocation. It is also dependent on hydrology and affected by droughts. The damming of rivers results in siltation and shortens the lifespan of these mega-infrastructure projects.

**Wind:** As of 30 November 2021, India had the fourthlargest installed wind capacity in the world. Nearly four per cent of the total electricity generated in India is wind powered. Seventy per cent of India's annual wind energy is produced from May to September, in the southwest monsoon season. Clean, renewable, and non-polluting energy is produced when naturally flowing wind rotates wind turbines. However, wind energy is held back as it relies on strong wind velocities. Seasonal inconsistency and threats to the local biodiversity, especially birds, are added hurdles in the path of wind energy.

**Solar:** Most parts of India expereince bright sunshine for the majority of the year. Solar energy can be generated throughout the year, except during monsoons. Therefore, wind and solar energy complement each other, and are effective at different times of the year.

# FES REBOOT Programme, The Phillipines

The Philippines is located in the 'Pacific Ring of Fire', an area along the Pacific Ocean characterised by active volcanoes and frequent earthquakes. It imports coal, which is its main energy source, from Australia and Indonesia. Two million Filipinos do not have access to uninterrupted electricity.

To help facilitate the transition to renewable energy, FES Philippines launched the Renewable Energy Bootcamp (REBOOT) Programme in 2016, to train young energy ambassadors. The programme selects applicants from diverse backgrounds and trains them in technical, socio-economic and policy aspects of renewable energy, creating a network of ambassadors in the process (Youth for Just Transitions Network).

So far, there have been three batches consisting of 29 participants and they have implemented Solar and Micro-Hydro power plants, Biocharcoal production set-ups using yard and farm waste, and solar-powered facilities for coco coir, coco sugar, and fish sauce production.

REBOOT is also planning to collaborate with local partners in the Philippine islands of Luzon, Visayas and Mindanao to train more local youth in renewable energy.



Solar is popular, renewable, and rapidly being adopted. Solar panels typically last upwards of 15 years. A Solar Photovoltaic (PV) system can generate electricity for that duration at minimum maintenance costs. Additionally, subsidies and the option to sell energy back to the grid gives consumers extra incentives to go for solar.

# Problems with the Transition to Perpetual Energy Sources

The initial cost of installing solar panels is quite high. Additionally, solar panels are imported (China manufactures almost 70 per cent of the world's solar panels), further driving up their price. This ends up being a roadblock for many middle-class citizens who cannot make such huge upfront investments. The energy is also dependent on the sun, making a backup source necessary during times when sunlight is low. Finally, the manufacture of solar panels emits a lot of carbon and recycling them is also a pressing issue since they contain cadmium and lead, both carcinogenic elements.

#### **Energy Accidents**

One aspect which is often overlooked by common people when it comes to energy is the potential for energy disasters. Nearly 279 major energy accidents occurred from 1907 to 2007 alone. They have caused 182,156 deaths with 41 billion US dollars in property damages.

Although public memory might be limited to nuclear disasters, it is far from the only source that has given us trouble. The Deepwater Horizon oil spill (2010) was the largest oil spill ever, with 180,000 sq. km of ocean affected. The Fukushima nuclear disaster (2011) was the biggest nuclear disaster since Chernobyl (1986) and affected around 32 million people. In India, the Jharia Coal Field in Jharkhand has a fire that has been burning uninterrupted since 1916 (over 100 years), having consumed 37 million tonnes of coal in the process. The Banqiao Dam failure in China, in 1975, caused a devastating flood which affected over 10 million people.

Energy disasters tend to be so environmentally destructive, that developing higher safety standards and reducing their incidence rate would itself be a major boost for Climate Action.

However, the biggest drawback of solar, or even wind energy, is technical. Due to their dependency on weather conditions and even seasons (energy produced in winters can be less than half the energy produced in summers), it becomes crucial to store the excess energy produced for lean times. While wind and solar energy can only be produced when these natural phenomena are in action, storing them is difficult.

Batteries are so prohibitively expensive, that they are currently unviable to be used extensively. In case of natural disasters, diesel generators are used as

#### The Challenges of Clean Energy

In India, the energy sector predominantly uses coal. Coal can make or break our ambitions to limit the extent of the climate crisis: phasing out coal was identified as the single most vital step in the run-up to COP26.

However, India's commitment to COP26 was restricted to 'phase down' coal to achieve net zero by 2070, nearly 50 years in the future. No commitment to a clear start date was made. In the meantime, India continues to intensify its coal reliance by giving environmental clearances to more coal mining projects, many situated in biodiverse forests.

These challenges become even more complex when placed in the context of another COP26 goal to which India has committed – to increase the use of electric vehicles (EVs). While EVs have been found effective in reducing pollution in most parts of the world, they lose effectiveness when their electricity supply is dependent on a coal-based power grid. EVs dependent on coalfired electricity merely transfer the problem from the transport sector to the energy sector.

The situation in India presents both challenges and future opportunities. Accelerating and mainstreaming renewable energies, especially solar energy and wind power are highlighted on the website of the Ministry of New and Renewable Energy (MNRE).

Currently, India is fourth, globally, in renewable energy capacity with a share of 26.53 per cent of

total installed capacity and has plans to increase capacity considerably. India has led the world in solar energy production and distribution using participatory community models like the Barefoot College.

However, import dependence on components for solar energy generation in India makes it an expensive option on a large-scale. Land availability for the installation of large-scale generation is also a concern for both solar and wind energy.

Other types of renewable energy including waste-to-energy plants are proposed and are being pushed through policy and budgetary allocations. However, given the low calorific value of Indian biodegradable waste in landfills, these may not be effective in their stated function of limiting CC. Waste-to-energy plants are also highly polluting activities and are opposed by numerous scientific and other communities.

Energy loss in the distribution network of India is among the highest in the world and is more than double the world average. Reducing distribution loss is a vital but often overlooked part of coal phase-down efforts. Unfortunately, we lack the expertise to meet international standards, and it is not a priority in national policies or budgets.

Generating more solar energy, investments in research and development to produce indigenous technologies and models for solar power to fuel EVs, and industry and domestic requirements are key to our success in meeting our COP26 commitments to phase down coal by 2070.

Reducing distribution losses is a key strategy to ensure the optimisation of generated power and an overall reduction in our energy needs.

Sumaira Abdulali, Convenor, Awaaz Foundation backups in case the local grid fails. The cost of back up for an entire city will run into billions if batteries are used instead of diesel generators. Thus, as technology currently stands, even if renewables increase in capacity, they will always have to be backed up by conventional sources of energy.

In this regard, 'Green Hydrogen' has become the new buzzword for green fuels in recent times.

#### Green Hydrogen

The key reason why this form of fuel is preferred to solar is simple: Hydrogen can be stored. Hydrogen, when burnt, only releases water as a by-product, making it a clean source of energy.

The problem lies in the production of hydrogen. The traditional method of splitting it from methane or coal produces what is called 'Grey Hydrogen'. Green hydrogen on the other hand, is produced by electrolysing water using renewable energy, making the whole process completely carbon-free.

The one major technical downside to this process is that producing green hydrogen from the electrolysis of water requires a great deal of electricity. This would again require vastly increasing solar infrastructure to produce green hydrogen, taking us back to the solar problem.

#### India and Energy

India's energy consumption was not even 1,000 Terrawatt hour (TWh) in 1970. In 50 years it has risen beyond 8,000 TWh. India's rapid development as well as its exploding population are some of the reasons for this massive growth in demand.

Even though India's energy production and consumption have skyrocketed, the share of lowcarbon sources (nuclear, wind, solar, hydropower, geothermal, biomass) has reduced over the past 40 years. Their share was as high as 14.61 per cent of total energy production in 1978. By 2019, it had fallen to just 8.96 per cent. This is an anomaly as other countries have displayed a trend of a steadily increasing share of low-carbon sources. India's energy use boom, though, is being driven by oil and coal.

#### Indian Laws for Cleaner Energy Transition

What if one wants to transition to clean energy on their own? The Gol does have a set of incentives for

individuals to make the switch to renewable energy systems. As of 2021, the average cost of installing a solar grid came to 75 Indian rupees per watt. To offset this high cost of installation and encourage consumers to install solar grids, GoI pays 30 per cent of the cost of installation of rooftop photovoltaic systems to people in most states. For the Andaman and Nicobar Islands, Himachal Pradesh, Jammu & Kashmir, Lakshadweep, the North-Eastern states, Sikkim and Uttarakhand, the subsidy is 50 per cent.

Consumers with grid-connected rooftop solar PV systems can also sell excess energy produced by them to the government and private players, although rates vary statewise. There are laws for other renewable sources of energy, such as biogas and wind. Similarly, India is currently working towards building a green hydrogen infrastructure. To that end, the Government of India has announced a waiver of transmission fees for 25 years for any green hydrogen generating plants commissioned before 2025.

#### **Future Energy**

Coal, oil and gas are still the most used sources of energy throughout the world. Even though solar energy has become cheaper to produce, the high initial costs of installation, the storage dilemma and the formidable oil and petroleum lobbies make it difficult for solar to be widely implemented. Similarly, green hydrogen is still in its nascent stages and requires significant technological and efficiency breakthroughs to become commercially viable for the common citizen.

Citizens must consciously demand clean and green sources of energy, pressurising governments to increase subsidies and trigger policy changes that favour the use of renewables. This is especially important due to the presence of a strong political lobby for non-renewables all over the world. Additionally, people must consciously decide to use less energy in their day-to-day activities.

This may include changing lights, fans, and other electrical appliances to include more efficient variants, taking public transport over private, walking and cycling where feasible, and taking stairs instead of an elevator. Needless energy wastage must be avoided. Moreover, people should be aware of the type (renewable or non-renewable) and source of their electricity supply.

#### **10 Climate Actions for Energy Efficiency**

- 1. Do not waste energy: switch off appliances when not in use.
- 2. Be aware of the power plants from where your energy is sourced.
- 3. Clean or change air filters for ACs and air purifiers regularly. Keep the Heating, Ventilation, and Air-Conditioning (HVAC) system at peak performance to save energy and lower carbon emissions.
- 4. Embrace natural ventilation and lighting take advantage of daylight and cool breezes.
- 5. Opt for daily use appliances which use renewable energy, e.g. solar powered lights, solar cookers, solar chargers, biogas cooking ranges, etc.
- 6. Get a home energy audit done A simple home energy audit can show how much energy is consumed and provides tips on changes that can make consumption efficient. Most assessments help home-owners save between 5-30 per cent on their energy bills, and audits can significantly reduce a home's carbon footprint.
- 7. Switch to LED lamps. They are extremely efficient as compared to other commonly available bulbs like incandescent and compact fluoride light bulbs.
- 8. Go for ENERGY STAR appliances. These rated energy-efficient appliances save loads of energy over their conventional counterparts.
- 9. Invest in smart power strips to help manage energy load. Smart strips can turn themselves off when the devices plugged into them go into standby mode.
- 10. Install solar panels at your home or place of work.

#### This subchapter has covered the following Sustainable Development Goals



# 7.3 Housing

Housing might just be the single biggest variable individuals have control over. Our house is a place where we spend an extraordinarily large chunk of our life. Incorporating sustainable elements into it will have an outsized effect in lowering our lifelong carbon footprint. So, how can we start making a change?

# Construction is a Polluting Exercise

The modern process of construction is incredibly resource-intensive and polluting. Roughly, five per cent of all global air pollution happens during the exercise of extracting raw

construction materials from the ground. Large machinery and vehicles are used on construction sites to transport raw materials and build structures, causing fossil fuel emissions and the release of particulate matter. The construction sector is also responsible for nearly half of the world's daily energy consumption.



A typical house requires several different kinds of materials, such as reinforced steel, concrete, cement, ceramic tiles, Polyvinyl Chloride (PVC) pipes, etc. All these materials have great Global Warming Potential (GWP), as seen in Graph 7.3.1. As noted earlier, cement and steel fall into the category of 'Red Industries'.

These are industries, which emit carbon as a part of the processes used to make the products. There is no way around these emissions, other than stopping their use altogether. Similarly, ceramic tiles and 3-D panels also pollute the planet.

The use of these materials is almost unavoidable. In such a case, what can be done? Adaptive Reuse is one answer to that dilemma.

# Old Homes and Redevelopment or Adaptive Reuse

Adaptive Reuse is when an old building is repurposed for something it was not originally intended for. The advantages to this are plentiful. Quality building materials are present in old structures. The process is green since the construction materials are already produced and transported onto the site. Additionally, culture and history are preserved by saving the old structure.

In India, some of the most famous examples of Adaptive Reuse are the 15<sup>th</sup> century Neemrana Fort near Jaipur, the 18<sup>th</sup> century Lake Palace in Udaipur and the 19<sup>th</sup> century Falaknuma Palace in Hyderabad, all now ultra-high-end hotels.

Similarly, new residential spaces can be created using old ones, renovating, retrofitting and upgrading them to fit the style and sensibilities of modern times. It includes making them environmentally sensitive by incorporating natural lighting, renewable energy, efficient devices and appliances, and smart waste and sanitation systems among many other things. This would be far greener than simply purchasing or building a new home.

# Recycling Construction and Demolition Waste

Considering that 70 per cent of India's urban infrastructure by 2050 is yet to be built; recycling or upcycling is imperative in a climate and resourcethreatened future. According to a study done by the Centre for Science and Environment (CSE), in 2020, India generates an estimated 150 million tonnes of Construction and Demolition (C&D) waste annually, of which the official recycling capacity is only 6,500 tonnes, or one per cent. Despite the notification of



Graph 7.3.1: Global primary energy consumption by source

C&D Waste Management Rules 2016, and the Bureau of Indian Standards allowing the use of C&D waste in new construction, its on-ground uptake is singularly lacking. A huge portion of C&D waste includes concrete, bricks and metal waste from construction.

Construction and demolition waste recycling is a sunrise green industry. Effective recycling of C&D waste will play an important role in reducing air pollution as well as mitigate causes of flooding due to unauthorised dumping resulting in blocking of natural hydrological drainage channels. It will also reduce significant adverse ecological impacts of extracting natural aggregates like sand, stones, top-soil (for burnt bricks), etc., that are key raw materials for the construction industry.

A few architects, builders and entrepreneurs around the country have begun to play a pioneering role in this sector. A vibrant small and medium enterprise (SME) ecosystem for recycling C&D waste in the country can prove to be a game-changer creating convergence among flagship efforts by the government like the Swachh Bharat Abhiyaan, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Pradhan Mantri Awas Yojana (PMAY), etc., with a potential to create thousands of new skilled, semiskilled and unskilled green jobs across the country.

#### House vs. Apartment

One would be tempted to assume that the fast life and copious use of resources while living in cities is detrimental to the environment. Surprisingly, highdensity living, such as living in an apartment building, and shared housing can have its plus points too.

High-rise buildings are typically located near public transportation and commercial centres, so people can use public transport to get around. Often, when people live in independent houses, they are far away from their place of work and must travel by personal vehicles to reach them. City homes are compact, and resources are often shared, making overall resource use lower than what would have been if each family lived in a separate house.

On the other hand, there is a greater degree of control a homeowner can exercise over a standalone house, leading to better insulation, solar supply, rainwater

#### **Problems in Rehabilitation**

Rehabilitation should be done in a manner such that the standard of living of people improves from their existing living conditions, for example, settlements in bastis. In our experience, their living standard has gone down whenever they have been rehabilitated. We can take examples of rehabilitation sites, like Mahul, Malvani or Mankhurd in the Mumbai Metropolitan Region.

The layout of the rehabilitation building is so bad that living there is pathetic. There is limited ventilation and the provision of basic amenities, such as water and electricity, is absent. In the case of Mahul, the water pipeline and the sewage water pipeline were mixed at some point.

Bilal Khan, Activist and Campaigner, Ghar Bachao Ghar Banao Andolan (GBGBA) harvesting and other green modifications that can be exercised at the homeowner's discretion. Such a level of customisation is not possible for someone living in an apartment in an urban housing colony without mobilising all homeowners to change.

In either case, some basic rules can be followed by individuals living in both types of housing to ensure that their carbon footprint remains as low as possible.

#### **LEED Building**

Leadership in Energy and Environmental Design (LEED) is a globally accepted 'Green Building' rating. It provides a framework for healthy, highly efficient, and cost-saving green buildings. It has been developed by the United States Green Building Council (USGBC).

Leadership in Energy and Environmental Design has a third-party certification process, which is in demand all over the world. Property owners and tenants often insist on this certification. LEED v4.1 is the current standard of the certification. Categories of certification include Location and Transportation, Sustainable Sites,

# Rethinking Assumptions: Using Candles instead of Bulbs (Earth Hour)

Each year during earth hour, we demonstrate our commitment to Nature and conservation by turning off our lights for an hour. However, as a substitute, we burn candles.

Most candles are made of paraffin, a heavy hydrocarbon derived from crude oil. Burning a paraffin candle for one hour will release about 10 grams of CO<sub>2</sub>.

This is vastly preferable to an incandescent bulb, but not preferable to an LED bulb. If you were to burn one candle for each LED light in your home, you would end up releasing more carbon into the atmosphere.

This just goes to show that what might seem eco-friendly on the surface might not be the best option under all circumstances. Technology has become very efficient and we, as conscious consumers, must make full use of the varied options available to us in our housing designs. Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation. Discerning customers can insist on their prospective homes having a LEED rating.

#### Electrification

Rather than using electricity generated by traditional coal-powered plants, solar panels can be installed in houses, housing societies and residential colonies. This helps in bringing down the cost of electrification. Any excess energy requirement can be fulfilled by using grid electricity.

Solar panels can be bought at subsidised rates and excess energy generated can even be sold to energy-providing companies.

#### **Technologies**

There are several new environment-friendly technologies, which are gaining popularity.

**Cool roofs:** These roofs keep a building cool by reflecting a high amount of solar radiation away from the structure. They also help emit the heat retained by buildings. This leads to a lower requirement for air-conditioners and other cooling systems, as well as lower electricity demands. If many buildings in a locality use this technology, it can even act against the heat island effect.

# Upcycling of Debris into a New Construction Material: The Case of Port-au-Prince, Haiti

I want to share details a project we did in Portau-Prince, Haiti after an earthquake devastated it. It began with a theoretical study of what happens to the people and their housing arrangements in a disaster area.

Whenever there is a natural disaster, a pattern is followed regarding the relocation of affected people. First, rescue teams come in from various locations and rescue the affected people from the disaster site or area. Then, the rescued people need to be housed in some temporary shelter since their homes are destroyed. This causes their relocation and often they are housed in tents or low-quality, cheap housing. The main intention of this housing is to locate them easily so they may receive aid. Meanwhile, the clearing of debris begins at the affected site. This can be a very expensive operation. The US Government spent an estimated 300 million US dollars ( $\approx$ 13,719 million Indian rupees) in dumping the debris from Port-au-Prince in Haiti into the sea. Finally, new housing was built in the cleared area. This is economical but repetitive in design. Additionally, the displaced people find themselves inserted in new neighbourhoods and feel out of place. This leads to social issues.

We partnered with a Dutch client and took a technology-focused approach to this problem. We planned to use smartphones to track people and provide them with aid. However, the affected people had already organised themselves since rescue efforts had not penetrated that deep into the city. We interviewed the people and made notes, getting their expectations from the project while planning and discussing it with them.

Our Dutch client and partner in this project was a technology innovator. We involved the community to sift through the debris of their old homes and separate stone, bricks and concrete from glass, metal and wood. All this was to be ground down to make new concrete. Essentially, we were recycling debris to make concrete for their new homes.

To avoid using mortar, the bricks made were inspired by Lego, with notches and grooves on them. People could also fix poles or sticks in the grooves. We encouraged people to design and build their own houses, to establish a sense of community and ownership in the new homes. We used a very easy-to-understand manual to help communities understand the process of making concrete from debris and building their own homes.

It took several years to develop this process. We recently completed our first house and a few more are currently under construction.

Andrea Bertassi, Practising Architect, XCOOP, The Netherlands

Limestone wash, reflective coatings, reflective tiles or paints, earthen pots and green roofs are all possible options that can be explored as Cool Roofs.

**Electrochromic or smart glass:** These glasses make windows tinted when required, at the push of a button. When completely dark, they reflect almost all the light incident on them (as much as 98 per cent), causing the room to cool down. They consume very little energy to operate and can save a great deal of energy by reducing heating.

**Cellulose insulation:** This insulation material is used to pack walls and floors. It is made up of 80-90 per cent recycled paper and recycled denim. It is treated with boric acid, borax, or ammonium sulphate to make it fire retardant. It helps to keep the home cool and insulated from the outside heat.

#### **Rainwater Harvesting**

Rainwater falling on the roof of a house or building can be collected and reused to avoid wastage. This not only reduces the water demand but also helps prevent flooding in the area. The collected water can also be used to recharge groundwater.

A typical rainwater harvesting system consists of the following components:

- 1. A catchment area from where the water is collected. This could be the roof of a house.
- 2. A system to transport this water to the collection area. This could be a stormwater drain.
- 3. A first flush that will clear the initial spell of rain.
- 4. Filter to remove impurities.
- 5. Storage tanks or recharge structures.

#### Appliances and the Star System

The Bureau of Energy Efficiency (BEE), which comes under the Ministry of Power (MoP), gives star ratings to electrical appliances, ranging between one and five. Appliances often have several features that make them eco-friendly, and the ones that meet BEE's criteria get the highest (5-star) rating. The difference adds up over time. For example, a 5-star 1.5-tonne AC will consume 1.5 units of electricity. A 3-star variant of the same will consume 1.6.

Prolific users can choose to spend a little extra in buying a 5-star rated appliance, saving electricity and money for years after the purchase.

#### Laurie Baker

Lawrence "Laurie" Baker was a British-born Indian architect, who moved to India in 1945. From 1969 until he died in 2007, he resided in Thiruvananthapuram (Trivandrum), Kerala.

He is renowned for his cost-effective, energyefficient architecture, which maximises space, ventilation, and light. He would avoid clearing building sites, instead choosing to incorporate the local topology and the needs of his clients, most of them poor, into his design.

He used natural objects such as mud bricks from local clay, bamboo and lime made from clamshells. His roofs were typically Indian, sloping with vents and gables. *Jalis* were another hallmark of his style, as they would encourage a cool breeze as well as diffuse the rays of the sun in beautiful patterns. He even reused broken bricks, door and window frames, often creating beautiful pieces from articles found in junk heaps.

Although his architecture was focused on environmental sustainability and lowcost housing for the poor, many well-to-do individuals also commissioned him to design their houses. For his work, Laurie Baker received the Padma Shri in 1990 and was nominated for a Pritzker Prize (informally called the Nobel Prize for Architecture) in 2006. He served as the Director of Centre of Science and Technology for Rural Development (COSTFORD), an organisation to promote low-cost housing that continues to carry forward his legacy.



A Vernacular Structure by Laurie Baker (Credits: Mahesh Idupulapati/Wikimedia Common/ CC BY-SA 4.0)

### **Lifestyle and Living**

Having a window or balcony garden could bring muchneeded greenery into the home and provide a haven for small fauna like butterflies, moths, bees and bugs. Having a feeding bowl and nest box on the windowsill will invite birds to rest and even breed in the home. A homemade composting set-up can be extremely useful in disposing of organic waste and generating nutrient-rich compost for plants. Conscious usage of electricity can be practised. Lights, fans and all other electrical appliances should be switched off when not in use. Air conditioner timers can be set to switch off after a couple of hours, rather than making them run all night. Mealtimes can be shared to avoid reheating food repeatedly, while also spending quality family time. Regular servicing of air conditioners and applianes will also help in reducing electricity bills.

# **11 Climate Actions for Housing**

- 1. Use a renewable grid to power your house in parts or entirely.
- 2. Practice rainwater harvesting.
- 3. Segregate household waste and compost wet waste.
- 4. Invest in appliances that have a 5-star rating and reduce the use of CFC-emitting appliances.
- 5. Choose bucket baths over showers as they consume less water.
- 6. Try and have common mealtimes for the entire family.
- 7. Avoid buying a new home; renovate an old one the greenest home is the one already built.
- 8. For new construction, use recycled products made from construction and demolition waste.
- 9. Ensure proper insulation and ventilation. Simply making our homes more efficient can substantially cut the energy needed to heat and cool. Adding insulation, weather stripping, and caulking around your home can cut energy bills by more than 25 per cent.
- 10. Refurbish old furniture to increase its lifespan; buy pre-used furniture; upcycle other materials to make new furniture.
- 11. Hang up your clothes to dry instead of using an energy-guzzling dryer.

#### This subchapter has covered the following Sustainable Development Goals



# 7.4 Infrastructure

The Oxford Dictionary defines infrastructure as "the basic physical and organisational structures, and facilities (buildings, roads, and power supplies) needed for the operation of a society or enterprise." Infrastructure is, thus, the backbone of our modern society. Governing bodies, energy companies, and housing facilities are all a part of the infrastructure.

This subchapter will focus more on the intermesh of elements that make up what is urban or rural infrastructure. It will attempt to show readers how the infrastructure of their cities or towns is affecting the environment.


#### Water

Forty-seven per cent of Indian households have a water connection terminating in a tap in their homes today. Although that is a figure in need of improvement, it is important to note the source of water for those households, which do have a water connection.

Take the case of Mumbai – besides Tulsi and Vihar lakes, which are present inside the city perimeter, all other water sources are far away from the city. The furthest, Upper Vaitarna Dam is 150 km from Mumbai.

As a climate actioneer, one exercise worth performing is to verify how far the sources of water are from your house. Do you get water from over 100 km away? If yes, a huge amount of wastage has already happened in getting the water to your house. For instance, it is estimated that around 40 per cent of Mumbai's piped water is wasted on the way to the city, owing to leakages, thefts, and inaccurate measurements by faulty water meters.

Consumers do not have control over where the city gets its water from, but this knowledge serves to instil the need for water conservation and encourage conscious use of water. Societies and houses would be better served by digging wells and compulsory rejuvenation of aquifers via rainwater harvesting. This has dual benefits of prevention of transmission losses and optimal use of surplus rainwater.

Similar exercises of measuring distance can be performed for waste disposal (how far are landfills), sanitation and energy.

# Sanitation

According to the Faecal Sludge Management Report (2016) by Water Aid, a safe-water and sanitation advocacy group, about 17 million urban households lacked adequate sanitation facilities in India, while 14.7 million households had no toilets. The number of people without adequate sanitation facilities in India is roughly equivalent to the population of Germany. No wonder, sanitation is one of the most pressing problems in urban planning.

The 2019 data from the National Sample Survey Office (NSSO) stated that only 71.3 per cent of households in rural India have toilets. The remaining engage in open defecation. A behaviour shift is being observed but 'open defecation-free India' is still a long way ahead.

Women often have health problems when using public toilets due to poor sanitary conditions. In addition to not being used by people because of their filthy conditions, the toilets also emit foul odours and harbour disease-causing organisms, lowering the quality of the surrounding area.

#### Waste and Sewage

According to an IndiaSpend report published in 2016, no more than 30 per cent of sewage generated by 377 million people in India flows through treatment plants. The rest of it is randomly dumped in rivers, seas, lakes, and wells, polluting almost three-fourths of the country's water bodies.

Currently we have 816 treatment plants to treat 37 per cent of total sewage (if all were working). Of those, only 522 work. That drops efficiency further, leaving 70 per cent sewage untreated.

Most of the time, the landfill site or dumping yard for waste is in an impoverished village on the city outskirts, several kilometres from the city centre. The people living there must deal with the fallout of the ever-increasing waste and the adverse effects it brings.

#### Energy

As of 2019, the per capita (kWh per person per year) average electrical energy consumption for India was 935, versus the global average of 3081. India is doing well in terms of per capita electrical energy consumed. It can be further improved by reducing the 20 per cent loss in transmission.

#### **Aspirations and Infrastructure**

Almost all of us aspire to have a better livelihood and lifestyle. Would you want to live close to nature or in a big mansion with 40 rooms and a 300-acre yard? Humans would want to enhance their lifestyles. Unfortunately, in trying to meet those aspirations, governments worldwide have to inevitably provide the required infrastructure. It is a law of economics, and that is now coming up against the law of Nature. We have caused so much harm that all of us might die in the next 50 or hundred years.

Raju Kane, Journalist and Author

As a consumer, it would be worthwhile to think – How far away is the energy we receive, being produced? Moreover, how is it produced? Is it from a coalpowered thermal plant 100 km away? How much coal is used to produce the amount of power we consume personally? Where is it sourced from? Answers to these questions would give you a true appreciation of your consumption.

#### **Green Construction Site**

In September 2019, construction work began on Olav Vs Gate, a street in Oslo, Norway, to convert a hectic turning zone for the city's taxis into a new pedestrianised area. This was the first zero emission urban construction site in the world.

Almost all the equipment used in the project (excavators, loaders, diggers, etc.) was electric. The source of the electricity was Norway's electric grid, which is based predominantly on renewable energy (98 per cent hydropower). Additionally, there was less disturbance to the surrounding inhabitants due to the quieter nature of the machines. Workers reported being able to better communicate with each other due to the lack of disturbance which is typically associated with diesel-powered machines.

Since 2019, the City of Oslo has awarded public tenders for construction work only to those contractors who build with zero-emission machinery and trucks. Another concept used during construction was modular construction, where parts of the project were completed offsite in a factory and shipped to the location. This improves efficiency and safety while reducing waste.



An Electric Excavator (Credits: Climate Agency, City of Oslo/ https://www.klimaoslo.no/)

### Connectivity

In the past decade, India has seen a boom in mobile usage, driven by affordable internet and a competitive market that brought down prices for connectivity

#### Mannu Vaddars of Bengaluru

In Renuka High School, Bangalore, water tankers travelled from 4 km away, along busy roads to supply 1,000 litres of water every week. Not only was it cumbersome, but the quality of the tanker water was also doubtful. Therefore, in 2013, Renuka High School engaged the services of traditional well-diggers called *mannu vaddars* to dig a 4.2 m deep open well.

The open well supplies 1,000 litres of water each day – equivalent to the tanker load. The well refills within two to three hours of pumping and is further assisted by a rainwater collection system from the school's terrace.

It takes around three days for a team of seven or eight *mannu vaddars* to dig a 9-12 m well. Families of *mannu vaddars* work together and profits are shared equally among them.

Digging a well fetches anywhere between 30,000-150,000 Indian rupees depending on the depth of the well. Each well-digger earns 1,200 Indian rupees per day, which is more than twice the average daily wage for a male urban worker in India.

Today, the city relies on water piped from miles away. The nearest water source is the Cauvery River, which is 101 km to the south. Biome Environment Trust, a Bengaluru-based NGO, is helping the well-digger community find work. It aims to dig 1,000,000 wells in Bangalore to make it self-reliant in water.



Mannu Vaddars in Action (Credits: Deccan Herald Photo/ SK Dinesh)

This connectivity has several uses. Not only does it help in communication between individuals and businesses, but it also helps government and relief services contact distressed persons and provide them aid. It also helps in outreach activities and raising funds for social causes.

However, there is still work to be done. Around 55,000 villages in India still do not have mobile phone network coverage. These include villages in the Northeast, which is a sensitive region facing a lot of environmental upheavals, including flooding and landslides. It is thus imperative to ensure good connectivity for all.

#### **Green Infrastructure**

Green infrastructure employs the philosophy of building with Nature focusing on climate adaptation, stormwater management, increasing biodiversity and food production, sustainable energy production and clean air, water, and soil. This would ultimately lead to a better quality of life in towns and cities.

It incorporates the ethos and functions of ecosystems and natural landscapes as environmental regulators. For example, it emphasises planting trees and restoring wetlands to obtain clean water, rather than building a water treatment plant.

Some 'house- or building-level' components of green infrastructure are green roofs, rain gardens, rainwater harvesting systems, trees, and tree boxes. At a block or town level, green infrastructure components include entire forests, wetlands, or floodplains.

Green infrastructure is a multipurpose solution. It often boosts plant cover and biodiversity, and brings along a host of ecosystem services alongside its main intended benefit. Additionally, on a large-scale, it saves millions in maintenance over the long-term, as forests, wetlands and floodplains are ecosystems that have an element of self-regulation. It also employs a variety of people, especially in plumbing, landscaping, engineering, building, and design.

Low-Impact Development is a stormwater runoff management technique that involves green infrastructure. It includes rain gardens, cisterns, green roofs, porous pavements, bioswales, and tree pits. These have the added benefits of being autoregulating, providing habitats for local biodiversity, improving groundwater levels, and lowering the urban heat island effect.

#### Future

In areas with less infrastructure, the building of basic, quality infrastructure could make a huge difference in improving the quality of life as well as climate resilience. In such cases, fancy new technology might not even be required. For example, building proper toilet blocks rather than just open-pit latrines will help proper disposal of tonnes of waste generated every day, which would otherwise collect in a pit and release foul odours and GHGs. If you come across a public toilet in your area that is in dire need of maintenance, you can contact your local representative. Similarly, collection and disposal of solid waste segregated at the household level can increase chances of recycling or composting of waste matter.

Building proper and efficient pipelines for transporting water over distances, as well as making electricity grids more efficient, will save significant amounts of resources and help in the fight against CC. Properly managed communication mediums such as WhatsApp groups can be used to broadcast and disseminate critical information and alerts, especially in times of disaster. Commonly available public Wi-Fi or connectivity hotspots at railway stations or popular tourist locations could help in this matter.

Urban landscapes are often overcrowded with concrete and metal structures such as buildings, roads and other infrastructure. These can be interspersed with public parks, terrace gardens, roads with broad footpaths and tree cover to encourage pedestrians to walk more. Fountains could also be made more prominent features of cityscapes to counteract the urban heat island effect. The combined effect of all these choices will include cooler cities with less pollution and greater biodiversity. Some ideas for green and inclusive infrastructure include designing buildings and public spaces for climate resilience and accessibility, particularly for disabled and elderly individuals. This would also comprise establishing government-run, climate-resilient, multi-specialty, healthcare facilities to reduce emissions and enhance affordability and promoting organ donation to ease pressure on healthcare infrastructure, fostering the development of better medical facilities. Similarly, reducing the birth rate and destigmatising adoption contribute to a more sustainable and inclusive society.

# **10 Climate Actions for Green Infrastructure**

- 1. Map a two-mile circle around your house and walk everywhere within it. You will eliminate unnecessary vehicle trips that make emissions and congestion worse.
- 2. Take public transit. Public transportation not only helps reduce the gridlock and carbon emissions but also saves time.
- 3. Just ride a bicycle. Yes, riding a bicycle really can save the world.
- 4. Incorporate climate resilience in infrastructure development plans.
- 5. Build towers and skyscrapers with wood. Building with Cross-Laminated Timber (CLT) and other emerging wood technologies allows future cities to 'grow' with carbon-sequestering resources and connects urban growth to rural economic development.
- 6. Explore mud and bamboo as options to build new houses.
- 7. Prefer LED lights as they use less energy and last longer.
- 8. Turn off and unplug appliances and devices when not in use.
- 9. Demand that the city provides separate cycling lanes.
- 10. Use tap aerators to reduce the required flow of water while maintaining pressure.

#### This subchapter has covered the following Sustainable Development Goals



# 7.5 Industry

As of December 2021, The World Economy was estimated at a whopping 94 trillion US dollars ( $\approx$ 6,949 trillion Indian rupees). A significant portion of this wealth can be attributed to industries. Industries can be defined as organisations involved in the business of producing goods or offering services, in exchange for money. The complex interplay between industries is how we have food on our plates, water in our homes, and medical care, among several other things.

Post the Industrial Revolution of the 18<sup>th</sup> century and the birth of capitalism, industries have been a dominant force in the modern world. They generate wealth, provide jobs, fund election campaigns and shape modern life. The names of many famous products or organisations, such as Xerox or Colgate, have become synonymous with the products they sell (photocopying machines and toothpaste, respectively). It is difficult to avoid buying some branded item or the other.

All lives are intertwined with industries and their products. Marketing gaffes by industries cause an



uproar across society. Large industries consume natural resources at a record pace and devastate the environment. Nevertheless, many industries also conduct social and environmental programmes and give back to society. Thus, industries are a force for change; it is up to people and governments to give them a more climate-friendly direction.

As we can see in Infographic 7.5.1, the Energy and Agriculture, Forestry and Land Use sectors contribute the lions share of GHG emissions. This will inevitably increase as populations continue to expand and consumption rises.



Infographic 7.5.1: The Contribution of Various Industry Sectors to GHG Emissions

#### **Current Scenario**

In India, pollution is increasing rapidly, due to the free rein given by governments to polluting industries, to boost ease of business.

Between 2015 and 2017, SPCBs exempted 146 of 206 classes of polluting industries from routine governmental inspections and audits. Instead, these industries has the option to self-certify or obtain 'third-party certification', which has been found in the past to cover up instances of industry negligence. Centre for Policy Research, a public policy think-tank, found that self-regulation has so far not led to any reduction in complaints or legal cases, nor has it improved industrial compliance.

Many 'Red' or 'Orange' industries have also been recategorised as 'Green' industries. This is important to note, as 'Green' industries are exempted from compliance monitoring inspections. 'Orange' industries can have inspections conducted by thirdparty agencies. 'Red' industries are not exempt from governmental inspections.

Thus, it is a tricky proposition to balance ease of business with environmental sustainability.

#### **Red Industries**

Several key global industries that are inherently polluting and bad for the environment are called 'Red Industries'. These include plastic manufacturing, oil and gas, power plants, cement and construction, transport, mining, etc. It is important to note that no matter how many efforts are made to make them carbon-neutral or eco-friendly, these industries are extractive by their very nature and definition. Thus, any effort can only serve to reduce their already large carbon footprint. It can never turn them climate neutral.

Efforts are on to find alternatives to these Red 'industries' or to reduce our reliance on them. Orange, Green and White industries are progressively less polluting by nature. However, a naturally low-pollution industry is not necessarily good for the environment. Often, unethical and morally ambiguous business practices turn an industry into a more environmentally damaging entity than that it should be.

#### **Planned Obsolescence**

Planned obsolescence is an example of an unethical business practice. The idea of planned obsolescence originated in the 1920s in the USA right after the Great Depression. To boost sales of their vehicles, General Motors began making stylistic and cosmetic changes to their vehicle models every year. These changes prompted consumers to buy the latest model, even though the changes made every year were neither significant nor did they result in any performance improvement. This catapulted General Motors' sales to the top of all automobile companies of that era. By 1950, many major companies had adopted this tactic. This practice continues to this day.

There are several ways products can be made obsolete. A common technique is designing a particular component of the product to break down after a specific number of uses. The faulty component then makes the entire product unusable. These components are often not sold separately in the market and even if they are, they are too expensive to make repairs economically viable. These components are often permanently encased into the product bodies, requiring consumers to destroy the product body to gain access to them; making them irreparable.

In the case of electronic devices, software updates sometimes make the device perform slower rather than faster. Alternatively, the manufacturers withdraw software upgrades or support for devices older than two years. This would prompt users to buy the latest device to stay up to date with the technology.

Currently, governments have begun taking notice of this practice and are demanding that manufacturers do better. In 2015, the French National Assembly recognised planned obsolescence for the first time by introducing a fine of 300,000 Euros and jail terms of up to two years to all product manufacturers who planned the failure of their products. The European Union has also recognised Planned Obsolescence and is working towards reducing the same.

#### **Corporate Social Responsibility**

The exploitative and anything-for-profit-making nature of most industries has prompted governments to hold businesses and industries more accountable towards the environment and society. Corporate Social Responsibility (CSR) is a type of self-regulating business model, which was made mandatory for large businesses in India in 2014. The key goal of CSR is to make companies behave in ways that better the economy, society, and environment around them. These programmes are mostly conducted by organisations large enough to give back to society, although medium and small-scale industries also have their CSR programmes. The Godrej Group is a 125-year-old Indian conglomerate operating in real estate, consumer products, industrial engineering, appliances, furniture, security, and agricultural products. It has very strong CSR initiatives.

The Group has conserved and maintained a significant stretch of mangrove forests in Mumbai for decades; they function as a second pair of lungs for the city. The group has also supported the Udayachal Pre-Primary and Primary Schools, which focus on children's overall development and even received an International School Award from The British Council. The Godrej Memorial Hospital attempts to deliver high-guality treatment at a low cost.

Godrej also has two main projects through which it trains young people:

- 1. Salon-i beauty and hair care training,
- 2. Beauty-preneur (BP) and Home-preneur (HP) platforms for nano and microentrepreneurs in the beauty industry.

As of March 2021, the company has partnered with social enterprises and non-profits to train over 451,342 young people in skills that will enhance their earning potential.

In Guwahati, Assam, the company is working with social enterprises to convert plastic waste as well as forest and agri-residue into fuel. In drought-prone Siddipet, Telangana, Godrej has a watershed development project.

Since its inception in 2009, Godrej Consumer Products Limited has been supporting Teach for India, where college graduates and young professionals commit two years to full-time teaching in under-resourced schools to bring about equity in education.



Adding Beauty to Lives (Credits: Godrej Hospital Website/Salon-i)

Corporate Social Responsibility helps the company as much as it helps society. A well-run and well-publicised CSR programme increases brand reputation and brand loyalty among customers. Employees also feel proud to be associated with these organisations, boosting company morale.

In the Indian landscape, Tata, Godrej, Infosys, Wipro and ITC are just a few of the many companies, who are known for their CSR activities. Some of the activities that come under CSR include the protection of national heritage, the establishment of clean drinking water facilities, the conservation of flora, fauna and natural resources, and providing education or livelihoods for marginalised communities, etc.

#### **Extended Producer Responsibility**

Another proposed strategy that industries and businesses can adopt is Extended Producer Responsibility (EPR). This strategy adds all the costs associated with a product in its entire life cycle to its market price. These costs include environmental costs as well. It would thus make manufacturers responsible for the costs of the product even after its sale, such as the costs required to process and dispose it. This would encourage manufacturers of products to achieve higher environmental standards in their products.

Extended Producer Responsibility is often implemented in the form of reuse, recycling, or buyback programmes. Industries also come together to form or finance an organisation that handles these programmes. The Packaging Recovery Organisation, Europe, is an example of an umbrella organisation that conducts packaging waste recovery and recycling schemes on behalf of member organisations.

Another benefit of EPR is that it is a possible solution for planned obsolescence, by putting the burden of recycling and disposal on the manufacturers rather than governments. This also reduces the financial strain on governments in running these programmes. Additionally, it pressurises producers to develop infrastructure for the processing of old products, rather than simply exporting waste to other countries.

One major downside of EPR is that it would make many products very expensive, causing them to be unaffordable. Another argument against EPR is that it would slow innovation by making any form of experimentation very expensive. Industries are following or at least considering approaches such as CSR and EPR. As the world enters a more environmentally conscious and responsible business climate, an increasing number of businesses will be expected to incorporate sustainability and social responsibility into their operations. Environmental, Social and Governance (ESG) is the new buzzword among industries.

# Greenwashing

Consumers have also begun to grow climate-conscious in recent times, favouring companies that sell products or services that are climate-friendly. However, this has led to the rise of 'Greenwashing', an advertising tactic that paints products and services as eco-friendly when, in reality, they are not.

Some telltale signs of greenwashing are:

**Vague language and unverified claims:** Companies might claim their products to be 'good for the planet', '100 per cent eco-friendly', 'ethically-sourced', and 'best in efficiency', but fail to provide relevant sources or certification. Even if they do provide those supporting links, a quick internet search on the veracity of the certifications would reveal the truth behind such claims.

**Focus on the small picture:** This is especially true of fashion brands and plastic manufacturers. Often eco-friendliness is claimed by these brands based on infinitesimally small changes, such as replacing the plastic name sticker or price tag on a water bottle with a paper one. However, inherently 'red' industries can never be eco-friendly.

**Use of carbon offsetting:** Companies can claim to be 'carbon-neutral' in their operations while using the argument of carbon offsetting. This should not count as carbon neutrality, as it enables companies to continue with their polluting practices without improving them.

**Limited disclosure:** Companies might only provide the positive details of the manufacturing process and hide the negative details to make the process seem 'greener' than it is. For example, Starbucks banned their straw and lid combo in favour of only a lid. However, this new lid ended up using more plastic than the combination.

#### **Climate Pledges**

Industries have also begun to make Climate Pledges, much like governments. These pledges

include becoming carbon-neutral by a certain year and transitioning to clean energy by a certain year (prominently noticed in the case of oil companies). Typically, this year is 2050, which is still a long time away. Companies must complement this long-term goal with a short-term goal as well, typically before 2030, to be more credible.

We also need to look at the scope of the operations that these pledges cover. Has the company promised to make only its own operations carbon-neutral? Or is it also going to reduce emissions in its supply chain? These are important distinctions to make, as many oil and gas companies have maximum emissions due to suppliers and consumers. Climate Pledges must also be evaluated on the type of commitment. If the commitment is absolute, the company is focused on bringing its emissions down to zero. A net commitment simply means the industry will continue polluting, while offsetting emissions through funding carbon sequestration or similar projects. Therefore, it may not be a particularly robust pledge. An even worse pledge would be a commitment to reduce 'carbon emissions per unit', which simply means that the company has pledged to improve efficiency.

Finally, industries which claim lofty climate goals for the year 2050 but do not have concrete steps towards achieving the said goals, should not be trusted.

#### **10 Climate Actions for Environment-friendly Industries**

- 1. Mandatory waste and effluent treatment plants in every factory.
- 2. Refine processing procedures to reduce waste and toxins generated.
- 3. Reduce GHG emissions by using renewable energy-based heating and cooling systems.
- 4. Reduce processing units' dependence on animal-based products.
- 5. Hold regular audits to ensure that coolant water is not directly released into water bodies.
- 6. Organise intra- and inter-institutional competitions to bring out the best ideas for sustainable product development.
- 7. Support or buy more from industries that follow green norms.
- 8. Disinvest from carbon-heavy industries. Ensure your financial portfolio matches your beliefs. Many mutual funds and retirement accounts offer clean energy and carbon-free options, and groups such as Carbon Tracker help demonstrate the risk of carbon-heavy investments in the light of a worldwide shift toward cleaner energy.
- 9. Reduce manufacturing of plastic-based products, wet wipes, sheet masks, and blotting sheets.
- 10. Adopt principles of a circular economy over planned obsolescence.

### This subchapter has covered the following Sustainable Development Goals



# 7.6 Transportation



Transportation is one of the most popular CC issues, probably because it is universal. Serpentine queues of cars stuck in a traffic jam, engines running, and emitting rhythmic honks, is a picture every urban resident has seen in their day-to-day life. Contrast this with industry, where factories churn out pollution in industrial complexes, far away from the daily lives of ordinary citizens. Transportation not only captures the imagination; it is something which citizens can directly choose and influence.

Greenhouse gas (GHG) emissions from the transportation sector account for about 16.2 per cent of total global GHG emissions, making 'it' a prime 'venous blood' gas contributor. As seen in Graph 7.6.1, a sharp increase was experienced in rapidly developing countries such as China and India at the turn of the millennium. This coincides with the rising fortunes of the middle-class and the growing wealth available to them for consumption. As the sale of private vehicles booms, commercial flights increase to cover every major city on every continent across the world and cargo and shipments criss-cross internationally from one port to the next, we can expect GHG emissions from transportation to increase even further.

Individual citizens have little control over international trade movements, but we do have the direct power to choose our modes of transport. As our city roads overflow with ever-new kinds of vehicles, we are confronted with multiple transportation choices.

But how did we end up here in the first place?

# Why Cities End Up Congested? The Case of Mumbai

Historically, about 49 per cent of all trips made in the city were motorised trips. Mumbai has always had a strong public transport system – the suburban rail and buses. They are so widely used that in the decade of the 1990s, about 70 per cent of all motorised trips made in the city were by public transport. Every 10 years, the number of private cars in Mumbai doubles. In 1998, it had roughly 250,000 cars. In 2008, it was half a million. In 2018, it was one million and it is growing at a faster pace now.

Public spending in Mumbai on transportation is heavily focused on freeway construction and metros. The amount spent on bicycle tracks, buses, pedestrian infrastructure, etc. is insignificant in comparison. Clearly, policy priorities show an objective of increasing reliance on private transportation.

Transportation is also very closely linked to land use change. The infrastructure expenditure on the metro and freeways results in the opening of new parcels of land, especially in the peripheries, for real estate. This also drives up the cost of living for residents, ultimately forcing them to move even further from their places of work, increasing the commute. New roads are built to alleviate traffic jams caused due to these commuters and the cycle continues.

A similar pattern is observed in cities across the globe.

#### **Roads and Traffic**

A car on a congested road produces almost thrice the amount of  $CO_2$  as the same car travelling at a steady speed. Traffic snarls cause a lot of pollution in the environment and frustration among citizens. Therefore, it is important to design urban infrastructure and demand roads that minimise traffic congestion. Public transport such as local trains, metros and buses will also serve to reduce congestion and decrease  $CO_2$ emissions. Robust, smooth roads without potholes, with good drainage allow smooth systems, movement of vehicles without traffic bottlenecks. Accidents and stalled vehicles often block the flow of traffic. This can be reduced if authorities install better signages citizens and practise disciplined driving.

Concrete roads are a better alternative to tar or asphalt roads. This is because it needs a lower amount of energy to be produced, requires fewer repairs throughout its lifetime and has higher albedo (heat reflection). However, all said and done, building more roads has proven to be ineffective in reducing



**Graph 7.6.1:** Country-wise comparison of total CO<sub>2</sub> emissions from the transport sector

congestion as more vehicles turn up to make use of the new roads. Car-pooling and ride-sharing are being touted as possible solutions to congestion.

#### **Ride-sharing Apps**

Currently, shared mobility is being facilitated via ridesharing apps. Applications such as Uber and Ola are popular in this field. Shared mobility has had a positive environmental impact by reducing the ownership of cars. It has also reduced the total number of trips, and in the case of EVs, reduced dependence on fossil fuels. But is it an effective solution?

The problem with these solutions is that they are specifically meant only for a certain group of the population, the rich or upper-middle-class, digitally literate with access to smartphones. They are not for everyone.

Thus, even though they have a positive impact, shared mobility initiatives are not touching all layers of society. There is not enough research into gender mainstreaming and the gender smartness of smart mobility. Whatever evidence researchers have, is mainly from Australia, North America and the developed countries of Europe. Unfortunately, there is insufficient evidence from developing countries to determine, for example, if women are also using these services as much as men.

There are various other roadblocks to ride-sharing apps. The poor cannot use them because they might

#### **Reducing the Need to Travel**

Indian urban planning has traditionally been based on an American model, where land uses have been separated. This bifurcates residential land use areas, commercial land use areas, and industrial areas. Thus, people have to travel long distances every day, from their residences to work.

One way in which we can create an impact through urban planning is to mix the land uses together. Like the European model where shops are on the ground floor and houses on the upper (other) floors in the city centre. As you move away from the centre, workplaces, commercial places, residences, and schools are situated in every neighbourhood. In such a system, the need to travel reduces.

#### Dr. Yamini Jain, Urban and Transport Planner

find the system of online payments and ride booking with the aid of maps hard to follow. The elderly cannot use them because they require one to be digitally literate and know how to use smartphones. Many women face difficulty in using these apps as they lack financial resources. This casts a question about the social or economic sustainability of these solutions.

This renders these apps as little more than business models and in the end; it is difficult to rely on these methods of changes in transportation to tackle CC.

#### **Electric Vehicles**

Electric Vehicles (EVs) are indeed considered more environmentally friendly compared to vehicles with internal combustion engines (ICE). They offer several advantages such as reduced fuel consumption and a smaller carbon footprint. So, does that mean you should switch to an EV as soon as possible?

The ecological cost of making a vehicle is quite high due to the resources consumed during manufacturing. The emissions produced in manufacturing a car typically rival the exhaust pipe emissions produced over its entire lifetime. So, if one has a perfectly working ICE vehicle, they would be better off extracting every kilometre from its lifespan, rather than prematurely shifting to a brand new EV.

# Transitioning to Electric Vehicles: Things to Watch Out For

When one talks about e-mobility, one only talks about electric cars. The talk does not generally cover waste generation as well as the charging infrastructure to

#### **Hidden Costs of Transition**

When we transition from an ICE ecosystem to an e-mobility ecosystem, what happens to the skilled workforce, which is required to effectively transition that way? What happens to the millions of automobile sector workers, whose lives and livelihoods are critically dependent on the ICE system? This is also a question of social sustainability, and these considerations are 'as' important as emissions and waste management.

Sarthak Shukla, Independent Public Policy Professional

# Decarbonisation of the Transport Sector

Of all the GHG-emitting sectors, the transport sector has proved to be one of the biggest challenges to decarbonise. The only significant drop in this sector's emissions came during the COVID-19 pandemic, after which the emissions promptly rose again. The International Energy Agency (IEA) estimates that global emissions due to the transport sector need to drop by 3.2 per cent every year until 2030 to be in line with the long-term health of the planet. This is why so much focus at COP26 was on this sector; they even had a 'Transportation Week'.

Of all the emissions in the sector, road vehicles are responsible for over three/fourth of them. In India, 80 per cent of recent investment has been in car-centric infrastructure, which makes it a big challenge. Private vehicles have seen an unprecedented boom in India over the last few decades. It took 60 years for the sale of the first 100 million road vehicles. The next 100 million took only seven more years. Private transport will overtake public transport by 2040, if we continue with the 'Business as Usual' mind-set.

India requires an aggressive agenda to fulfil its promise of reducing one billion tonnes of carbon from the air by 2030. It has promised to increase the electrification of its transport sector to 30 per cent by this time, from the one per cent it is, currently. This is just a verbal promise made by India, with no legal mandate to enforce it.

Additionally, decarbonising the entire transport infrastructure is not sufficient to make transitions. It is also crucial to place deterrents to emissions and private vehicle use. Include taxes, parking charges, and other fines in the overall cost of owning a private vehicle to account for its carbon footprint in its price. Better urban planning and reclamation of roads back into the hands of cyclists and pedestrians is required, such as what was done with Ajmal Khan Road, Karol Bagh, New Delhi. Travel distances also need to be reduced. All this needs urgent taking of decisions.

Anumita Roy Chowdhury, Centre for Science and Environment support the transition to EVs. The pollution that is generated to produce the electricity needed for these vehicles to run is also not factored in. Some pertinent questions that need to be asked are, 'How is lithium going to be mined?', 'Where is it coming from and where it is going to be dumped?', 'What happens to old batteries?'

It is important to note that cobalt another important element used in EV batteries, is overwhelmingly sourced from only one country in the world: The Democratic Republic of Congo, accounting for over 60 per cent of global cobalt production. The absence of alternatives will cause a bottleneck in EV manufacturing.

There is a connection between transport and waste, but the discussion on this topic is still at a very nascent stage. Besides, lithium and cobalt mining is extremely damaging to the environment – it pollutes soil, air and water alike – as well as devastating poor African and South American households living in the ore-rich region. Around 40,000 Congolese children, some as young as six years old, are forced to work in cobalt mines to provide for their poor families. EVs should not become the transportation equivalent of African blood diamonds.

# How much better is Travel using Physical Energy for the Environment?

Walking or cycling to your destination is considered good for the environment. One error in thinking

#### The COP26 Irony

We know private jets are the worst mode of travel, environmentally. But it is important to note just how damaging they are to the environment. A Cessna Citation XLS – one of the most popular models – burns 857 litres of aviation fuel an hour on average. Considering 2.52 kg of  $CO_2$ e per litre of fuel, this amounts to a whopping 2,159 kg burnt per hour.

A Mumbai to Delhi flight (2h 10 minutes will then cost 4,677 kg  $CO_2$  environmentally. Moreover, it can only seat 10 people. That amounts to 467.7 kg  $CO_2$  per person at best.

Bear in mind, there were hundreds of private jets carrying world leaders to Glasgow for COP26 (2021).

here is in viewing cycling or walking as 'zero carbon emitting' modes. Carbon is emitted in growing the food consumed by pedestrians or cyclists to power them on their journey.

For example, take the case of cycling for 1.6 km. The carbon footprint will vary wildly based on the food (fuel) you consume:

- 65 g CO<sub>2</sub>e: Bananas
- 90 g CO<sub>2</sub>e: Cereals with Milk
- 200 g CO<sub>2</sub>e: Bacon
- 260 g CO<sub>2</sub>e: Cheeseburgers
- 2,800 g CO<sub>2</sub>e: Air-freighted Asparagus

In the last case, you would be better off travelling in a car. Bottom line: Avoid imported food.

It is thus evident that no aspect of being 'green' is independent of other aspects. One needs to look at all the possibilities before deciding upon a truly 'green' option or lifestyle.

# What is the most Environmentally Friendly mode of Transport?

One might argue that if one sticks to low-carbon sources of food such as bananas, cycling or walking would be the most climate-friendly modes of transport. While that is true for short distances, it stops holding true over larger distances.

Assume you have to decide between cycling 30 km vs. taking a train across the same distance. Assume you use bananas to fuel your cycling. That amounts to 65x30/1.6 = 1,218.75 g CO<sub>2</sub>e. Meanwhile, if you travel by train: 1,000 g CO<sub>2</sub>e. That is roughly the same, give or take.

Trains generally win out over long distances over all other forms of transport, mainly because of their amazing passenger carrying capacity, making CO<sub>2</sub> emissions per person low. Similarly, a flight also becomes less carbon-intensive over longer distances. This is because the cruise phase of a flight consumes less fuel as compared to take-off and landing. And long-distance flights have a lot of cruising.

Consider a long drive from Mumbai to Delhi (approx. 1,400 km by road). A solo drive with a small petrol car will emit 329 kg of  $CO_2e$ . A direct flight by economy class? 112 kg of  $CO_2e$  (per person). It is thus important

to note that often the modes of travel, which instinctively appeal to us as climate-conscious, might not be the best options after all.

Ultimately, effective and climate-conscious transportation depends upon many factors such as budget, distance and viability of time. Having a general knowledge about the carbon emissions of various modes of transport and how they change as the distance increases will stand you in good stead while making climate-conscious transportation decisions.

#### Conclusions

An approach to reduce transport GHG emissions would be to make as few trips as possible. The COVID-19 pandemic has given us a brilliant insight into this, by making organisations realise that there is a huge opportunity in working from home. Due to the work-from-home culture, the demand for transport has greatly reduced. But for trips that do have to take place, public transport is the way to go.

Citizens should demand investment in public transport and use these modes to commute as much as possible. To avoid the rampant privatisation of transport, transport planners advocate taking away road space from private transport. By building dedicated lanes for bicycles and public transport, more congestion is created for private transport, which encourages people to use public transport. Another policy change that could discourage private transport owners from using their vehicles would be high parking charges, which are guite common in Western countries. These charges could vary based on congestion. Similarly, congestion pricing could ensure more people travel during nonpeak hours by making them pay a surcharge for using congested roads during peak times. Finally, some cities have tried the courageous experiment of reducing the number of roads, and found that commuters adjust their behaviour accordingly, increasing public transport ridership and keeping traffic levels roughly the same. The land reclaimed from roads can then be used to build parks or other urban infrastructure.

Additionally, for the times and places, private vehicles are truly necessary; use EVs and Hydrogen Cell vehicles. However, to be truly eco-friendly, they should run on renewables (EVs get their charge from solar and hydrogen vehicles are filled with Green Hydrogen). Else, they will just drive up demand for coal in thermal power plants, defeating their purpose. EV batteries,

#### **China's High-Speed Rail Network**

China currently has the world's largest highspeed rail network (37,900 km), comprising two-thirds of the entire global high-speed rail network. It has plans to double the size in just the next 15 years. In little over a decade, the country has built enough high-speed lines to almost circle the globe and the system welcomed 1.7 billion passengers in 2019 alone. By 2035, the network is projected to grow to 70,000 kilometres.

The network has drastically shortened travelling time, improved safety, reduced carbon emissions, and allowed many rural Chinese people access to its massive cities.

China's airspace is congested. The rail network is much cheaper and more reliable. It is helped by a few factors: the state-owned China Railway Corporation controls China's entire rail network. This ensures that high volumes of materials can be ordered and/or produced at once.

Construction has been standardised. This lowers construction costs, enables offsite manufacturing and cuts build times. As a result, high-speed rail costs in China are up to twothirds lower than in other countries.

Finally, high-speed rail fares are kept low – a quarter of the cost of other nations. Rather than turning a profit on these lines alone, China sees their social and wider economic impact as more valuable.



A High-speed Train (Credits: Fabio Achilli/Wikimedia Commons/CC BY 2.0)

in their current state, are non-recyclable and their disposal is shaping up to be a major headache in the coming years. However, there are some vehicles and technologies that are striving to make a difference.

For instance, Lightyear is an EV manufacturer that is developing a car with solar panels embedded in the body. It promises to increase the vehicle's range by up to 70 km in a single day via solar charging alone, reducing the need to charge it from an outlet, and possibly enabling the car to run for weeks before requiring a charge. Being a new technology, the car is expensive, but advancements and commercial success might prompt other manufacturers to enter the market and drive prices down. Similarly, hydrogen vehicles such as Toyota Mirai enjoy the benefits of using hydrogen as a fuel (better storage, fast refuelling). These vehicles can be expected to run on Green Hydrogen in the future, leading to completely green vehicle operations. Note: Vehicle manufacturing will still be carbonintensive, so a working ICE vehicle should not be prematurely replaced by a greener variant. Additionally, 'green' vehicles will be expensive as the technology strives to become mainstream, thus remaining out of the budget of the common citizen for now.

Finally, you can refer to the calculations made in this chapter to inform yourselves on the mode of transport to use when making long-distance journeys. Trains will usually win out over other forms of transport, but as journeys become longer, the viability of aeroplanes increases. In the case of local and short-distance commutes, walking and cycling should always be the preferred choice; but But that works out only if the consumed food is local and not resource-intensive.

The calculators used to make these calculations are present on our resource page. You can use them to plan your next trip.

# **10 Climate Actions for Sustainable Transportation**

- 1. Walk and cycle as much as possible (while consuming locally grown food).
- 2. Use public transport and demand greater investment in its development.
- 3. If your current ICE vehicle is functional, do not hastily transition to an EV or Hydrogen vehicle.
- 4. Demand public policies, which would reduce congestion on roads.
- 5. Take a train instead of a flight wherever possible.
- 6. Travel less. Work from Home.
- 7. Buy good quality second-hand vehicles.
- 8. Drive less or carpool.
- 9. Make sure your tyres are properly inflated, or else they might consume more fuel.
- 10. Opt to work-from-home whenever possible.

# This subchapter has covered the following Sustainable Development Goals



# **Chapter 8: Paths to Sustainability**



Throughout the Climate Actioneers' Primer, we have seen how climate is affected by anthropogenic activities, as well as what the effects of climate on various segments of society and the environment are, and vice versa. We have also seen case studies where innovative solutions were applied to resolve problems sustainably. In this chapter, we discuss these solutions and the various cumulative, cyclic, and exponential challenges that we have to overcome, to envision a greener future. These are important markers to set us on the path of sustainability.

The recent surge in extreme weather events and resulting social disruption has exposed the negligent attitude of governments and citizens towards Nature. It is concerning to see certain business communities and wealthier segments of society believing that Nature will always prevail, regardless of human actions. This amounts to living in a fool's paradise, and it is crucial to shift towards a more comprehensive and culturally embedded approach to foster climateresilient communities and preserve biodiversity. Supporting local innovations and promoting green entrepreneurship, even on a small scale, are the first steps that will contribute to building sustainability from the grassroots level. Financing drawn from green public, private and alternative sources need to be committed to further this crucial third step.

Lastly, no conflict is resolved unless collaborations are forged. Building coalitions and gaining allies are critical for garnering a civil mandate, economic power and political capital. It is important to recognise that climate change (CC) is a conflict that affects every individual, organisation, industry and government, however big or small. Only by bringing together the collective wisdom and strength of every actor, can we hope to manage the present climate crisis.

#### Sustainable Development Goals:

#### Framework for Combating Climate Change

Sustainable Development Goals are transformative targets that encompass every domain in development. They have a holistic approach to development plans that focus on environmental, social and economic aspects with sustainability at their centre.

Though the SDGs have targets aimed at combating CC, stakeholders must make strong commitments to achieve those targets. Collaborations as described in the Primer will be the way ahead. The SDGs promote inclusivity and equality in their 169 targets. Hence, no country must back out from its responsibility to take action, and share benefits.

#### Design Thinking

Design Thinking is about using innovative approaches to arrive at solutions. This involves looking at the application of existing technology from a new lens – innovatively reusing or repurposing the same technology. This approach prioritises reducing the carbon footprint through a human-centered approach.

In sustainability, materials efficiency, environmentally preferred materials, efficiency in use and disposal or recycling are the important factors to be considered before resolving a problem. Examples of design thinking for sustainability include upcycled jewellery (waste metal, wood, plastic), wildlife overpass or underpass, and rain gardens. Design thinking tackles climate change complexities, turning seeming deadends into clear paths.

#### **Repurposing and Upcycling**

A key aspect of sustainability is to slow down the rate at which we use products. Most products end up thrown into the trash after their use. This waste keeps piling up, causing problems such as soil, air and water pollution, as well as affecting the lives and livelihoods of people living around garbage dumps and landfills.

Cleverness and ingenuity can be applied to make some or several of these products work as something else after their primary use is over. This can be as small as using old Android smartphones to make a seismograph network or as large as repurposing old industrial mills to house cafes or bookshops.

Old objects can also be upcycled. This means improving old and tired products to make them useful again. This is most notably used on old furniture. Even though individuals can do this, many brands have grown in recent years, which sell upcycled products, proving there is a market for them.

#### **Bishan-Ang Mo Kio Park, Singapore**

Bishan-Ang Mo Kio Park, Singapore is a perfect example for understanding the impact of design thinking while dealing with CC. The Kallang River was revived and an interactive park was built around it. The multi-layered and holistic design of the park enables people to connect with the river. Apart from recreation, the green cover around the revived river helped in replenishing the groundwater resource. The people are thus sensitised to participate in climate action.



Urban Green Spaces (Credits: Wirbel1980/ Wikimedia Commons/CC BY-SA 3.0)

# Equitable Architecture

The difference between equality and equity is that while equality focuses on equal opportunity, equity focuses on equal outcomes. It is very important to design spaces that will distribute their benefits to all occupants. One small example of such architectural design would be windows at different heights in a kindergarten so that all kids get sunlight. Or it can be a playground with multiple entry points.

Equitable architecture strives to ensure that each design incorporates daylight, outdoor views, transparency and ventilation so that the quality of life of people inhabiting a structure is improved. For community housing projects, it can mean including the community for their views and opinions on the design of the project. This often leads to architects designing something they would not have thought of on their own.

Public spaces aim to be inclusive, offering comfort to all genders, people with disabilities, and those with lower incomes. They should provide essential amenities and have excellent transportation access, fostering a sense of community.

# Climate-resilient Urban Spaces: Preserving Urban Biodiversity and Ecosystems

To shield the community from the effects of CC, urban spaces need to undergo a green makeover. Urban sprawl should include green spaces that nurture communities by offering relaxation, recreation, and a connection to nature, promoting resident well-being.

Public parks and gardens will provide much-needed greenery, drive down surrounding temperatures and boost urban biodiversity. Community gardens can be incorporated into the concrete jungle at regular intervals too. In areas recognised for their tendency to flood, rain gardens can be developed to mitigate the impacts of floods

On a much larger scale, mangroves can be protected along the coast, providing a valuable buffer against rising sea levels. Similarly, the protection of coral reefs would help against tall violent waves during stormy weather. Restoration and rewilding of riverbanks will help protect against flooding of rivers during monsoons. The best part about all these actions is that they require humans to just leave Nature undisturbed as it does its job. The difficulty lies in the implementation of policies that would ensure that this happens. Stringent implementation of undiluted CRZ norms also figures among these interventions.

As we move toward a promising but equally uncertain future where more than half of the world's population will live in cities, public urban spaces may well turn into battlegrounds in our fight against CC. How we design and use these critical bits of commonly accessed infrastructure will go a long way in keeping us safe.

# Sustainable Fashion, Circular Economy and Business Models

The clothing industry, by design, is a guzzler of resources. It takes an estimated 2,700 litres of water just to make a single t-shirt. However, what makes this industry truly an exercise in excess is public perception and aspirational purchasing.

'Fast Fashion' brands can trend a certain 'look' for periods as short as a month, after which they move on to the next 'in' thing. This leads to an endless purchase cycle for fashion-conscious consumers. Influencers and celebrities, the spokespersons of fashion in modern society, famously, never repeat their outfits. This perpetuates a belief that fashion inherently has to be new all the time. When the public at large buys into this lifestyle of excess, helped along by brands that sell cheap 'in' designs that do not survive the year, we are left with heaps of waste clothing in places, which had nothing to do with the crisis in the first place. A case in point: Chile's Atacama Desert becomes home to more than 39,000 tonnes of discarded clothes from all over the world, each year.

Fashion is an inherently resource-intensive industry. But, it is also clearly plagued by rampant consumerism. To combat this, several approaches can be used.

The industry could be made into a 'Circular Model', incorporating longer-lasting designs and materials, developing supply networks, scaling circular business models and designing online platforms to connect with users. Rental or resale models will also help. In addition to encouraging reuse and slower consumption of fashion products, new technologies can reduce the high environmental cost of manufacturing clothing.

Similarly, circularity can be implemented for a wide range of businesses, from electronics to food distribution, to encourage the use of long-lasting, durable and high-quality products.

#### **Reversing Migration**

As an ever-increasing stream of migrants floods our cities, the infrastructure cannot keep up. Overcrowded public transport systems and poor public sanitation are pushed to their limits, and the cityscape is always under construction. This and more can be observed

# Ecologically Sustainable Economic Growth

Instead of the prevailing 'Grow now, pay later' approach, we need to practise the 'Grow now, protect now' approach. It is a falsehood that 'Environmentalism' is the pastime of select NGOs and the rich elite. It has now trickled down to the commonest of commons, as seen from various environment movements, viz. the Chipko and Appiko Andolans, Save Silent Valley or the Save Aarey Movement.

In the next 15 years, we will see every major sector of the economy - transport, energy, agriculture, or industry – transition towards more ecologically sustainable models. As technology advances, the cost of implementing sustainable solutions also comes down. If it weren't for digital infrastructure, we would have even had environmental conferences in airconditioned auditoriums, with people travelling from different cities. The remotely organised 2<sup>nd</sup> International Sustainability Conference (ISC 2021) is an excellent example of significantly reducing our carbon footprint. Thus, if done correctly, technological advancements play a vital role in facilitating sustainability. The Mumbai Coastal Life App developed by SPROUTS is another noteworthy example of using technology for biodiversity conservation.

Transitioning to 'green' models will take time, as it is unrealistic to expect coal and oil consumption to stop overnight. However, by understanding the current scenario, sustainable lifestyles can be slowly inculcated. Over time, we can reduce the carbon footprint of our population to achieve 'Ecologically Sustainable, Economic Growth'.

Shri. Jairam Ramesh, Hon'ble Member of Parliament, Former Union Minister, Gol in some of India's biggest metropolises. No city can develop fast enough to keep pace with the rate of increasing migrant inflow we are seeing today. With an increase in CC migrants in the coming years, that number stands to inflate even further.

A possible solution to this would be to create innovative opportunities in smaller cities and villages so that people living there do not feel the need to leave their homes in search of better economic opportunities. Economically strong and climate-resilient villages, towns and cities will ensure that their populations stay safe and secure, encouraging individuals and families who left those places to return. This would effectively distribute the population in villages, towns and cities.

#### **Nature-based Solutions**

Nature-based Solutions (NBS) include the use of natural features and processes to provide social and environmental services. This can include the use of mangroves as green buffers, using aquifers to maintain groundwater reserves, or planting green roofs to capture rainwater and preserve biodiversity. It could also mean looking at Nature for inspiration in designing new technologies.

#### Fair Trade Marketplaces

Fair trade agreements and marketplaces are tools to reduce poverty among farmers and workers. They have the following tenets:

**Fair price:** Fair trade ensures that farmers will be paid a fixed price, regardless of the quality of the product. This helps protect them against seasonal irregularities and incentivises them to stick to farming.

**Humane conditions:** Fair trade agreements ensure that farmers do not employ children or other kinds of forced labour in their activities. They have to maintain safe and healthy working environments.

**Direct trade and communication:** Fair trade rules out the intermediary, by making deals directly between farmers and consumers. Farmers earn more profits in this manner. There is direct and open communication between farmers and consumers, with large consumers also providing key information to farmers such as best practices and technological advances to build good long-term relationships.

# **Ecosystem Services**

Ecosystems provide many 'services' naturally, which humans would otherwise have to pay for. They can be classified into four general categories. **1. Provisioning services:** These include fruits, vegetables, livestock timber, fish, natural gas, firewood and medicinal plants. They can be extracted from ecosystems for human use and are often sold in the market.

**2. Regulating services:** These services include filtering water, removing pollutants from the air, decomposition of wastes, pollination of flowers, and providing stability to soil. These services are provided by various organisms as part of their regular life functions and act as valuable actions to maintain the health of ecosystems. Artificially performing these functions costs humans a lot of money, time and energy.

**3.** Cultural services: Nature and ecosystems have a part to play in the history of a region and the culture of that place. People owe a lot of their spiritual and cultural development to the influence of Nature. This is something that cannot be quantified in terms of money but has to be included in ecosystem services. Cultural services may include local deities, diets, customs, traditions and art.

# Applied Environmental Research Foundation

Applied Environmental Research Foundation (AERF) is an NGO formed in 1994 and based in Pune, India. It works on biodiversity conservation by involving local communities in natural resource management, thus creating beneficial outcomes for all stakeholders. It has implemented projects in the northern-Western Ghats in India, which is a biodiversity hotspot and home to several endemic species. Also, AERF works on research and capacity-building training across the country.

This research is used to develop means to use resources sustainably, alleviate poverty and conserve biodiversity using community participation while continuing development. It also strives to protect indigenous knowledge and practices, and effect on-ground conservation.



AERF Logo (Credits: www.aerfindia.org)

# Navdanya (Seed Bank)

India has a staggering diversity of wild and cultivated crops. After the Green Revolution, the focus in agriculture shifted increasingly towards yield rather than diversity. The few genetic varieties that gave the highest yields were increasingly used, to the exclusion of other varieties. This has caused several of these other variants, including many traditional varieties, to reach the brink of extinction.

To conserve these genetic varieties, Navdanya started the Community Seed Bank Programme. They encourage local communities to identify, cultivate and ultimately conserve important traditional crop varieties. The farmers, themselves, manage the seed banks.

A group of farmers collects the seeds of the local varieties of crops and brings them to the seed bank. The seed bank thus consists of a collection of various seeds from the region. The farmers can then take some of the varieties for cultivation and return the seeds with interest (25 per cent of seeds) once the season is over. Farmers also receive training in cultivation, pest management and raising seeds.

Over the last 30 years, Navdanya has set up 150 seed banks in 22 Indian states, while training over 7,50,000 farmers. It has set up a fair trade and marketing network around the country that the farmers can benefit from. Conservation and training centres have also been established. Many of the seed banks which originally started under Navdanya can run independently now. This project has helped conserve over 4,000 varieties of rice, as well as several millet, pulse and pseudo-cereal varieties.



Seed Preservation (Credits: Navdanya Website www.navdanya.org)

**4. Supporting Services:** They sustain the ecosystem itself. These are planet-building services that have helped life grow over the world. They include photosynthesis, biodiversity balance, the creation of soils, the cycling of nutrients and the water cycle. These are the basis of life.

#### **Heritage Conservation**

Built and cultural heritage are vulnerable to climate change, often suffering collateral damage as communities are impacted. However, traditional knowledge, embedded in cultural heritage, aligns with local climate conditions and available resources. This heritage enhances resilience, offering society options to mitigate and adapt to climate change through ecosystem benefits.

Traditional or Indigenous knowledge is one of the important aspects of achieving the targets of SDG 13 (Climate Action). It emphasises the fact that this knowledge will help in developing region-specific climate action plans. Rekindling some climate-conscious practices will not set us back but instead, add effectiveness to our path of combating CC.

Traditional weaves and materials are a way forward to ethical fashion. They are best adapted to the region's weather conditions and also support the local artisans. This will not only support the goals of sustainable fashion but also bridge the adaptation gap and reduce migration.

# **Bridging the Adaptation Gap**

With numerous treaties and protocols in place, many stakeholders have developed adaptation plans to meet targets for a climate-resilient future. However, the major problem lies in the lack of funding for such

# Traditional Knowledge to Help in Research

It is important that we look at traditional knowledge and that traditional communities are given the research know-how to be able to document their ecological knowledge. For example, in Eaglenest Sanctuary, Arunachal Pradesh, the Bugun tribe is involved not only in ecotourism but also in the conservation of birds, insects, king cobras and elephants.

Anand Pendharkar, Ecologist and CEO (SPROUTS)



Infographic 8.1: Climate Action Primer for Combating Climate Change

ventures – known as the 'Adaptation Finance Gap'. The way ahead will be about meeting the financial needs of the promises made for adapting to CC.

# Time to Think Globally and Act Locally!

The holy trinity of negative carbon – Bhutan, Panama and Suriname – also face adversities of CC even when they do not contribute to it. This just goes to show that the action of one country is not limited to its political boundary but has a far-fetched effect on the world.

Hence, it is necessary to bring climate dialogues to the international forefront. A global perspective of the climate crisis gives a well-rounded approach to setting NDCs. It is essential to design mitigation and adaptation plans that work best for regions or countries to better respond to climate disasters. Such specificity will ensure efficient implementation of Early Warning Systems (EWS) and climate disaster plans.

Srengthening community ties and provisioning for disaster relief funding, and training first-aiders will ensure self-reliance in times of adversity. This will be the ultimate long-term measure of climate resilience.

# Actioneers' Challenge...

Any number of books, films, websites, conferences, campaigns or public hearings (public outcry) cannot reverse the impacts of climate change. Every individual, be it a common citizen, an industrialist, an artist, a politician, a worker, needs to step up for co-created, coordinated and focused action, involving households, communities, governments, industries and more. The ball is in the reader's court now, to take these 600 plus 'climate actions' and attempt a change for the planet.

# **Chapter 9: Resources**

Over the last eight chapters, the Primer has mentioned several websites and tools that can enable readers to understand more about sustainability. These tools might include carbon calculators, biodiversity lists, open source data aggregators, or even repositories of successful climate action across the world. This chapter aggregates these resources for easy access.

Readers are encouraged to not let the conclusion of this book stop them from continuing on their sustainability journey. With these resources, they will be empowered to conduct their own research and



understand sustainability more deeply. This chapter acts as a gateway into the open world of Climate Action. There is a vast treasure trove of information and a profusion of key resources, such as books, websites and databases around the Scan QR to get links of Resources.



And finally, we entrust you with the '366 Days Climate Action Planner', which is the most loaded ammunition in the Primer, that will empower you on your climate action journey...

#### Websites and Mobile Applications

- 1. Biodiversity Atlas India https://www.bioatlasindia.org/ a powerful natural history web platform for speciesbased bioinformatics. Most data are contributed by amateur citizen scientists, photographers and professional scientists, and peer-reviewed and curated by advanced amateurs and professional biologists.
- 2. BlueMAP-India https://bluemapindia.org/index.php An initiative of Wildlife Conservation Society-India, is a glimpse of the vast marine biodiversity of India with insights on threats and conservation strategies.
- 3. Climate change: Vital Signs of the Planet https://climate.nasa.gov/ Satellite images showcasing the impact of climate change on Earth over multiple years.
- 4. International Sustainability Conference 2021 Exhibition Gallery- https://sproutsllp.com/isc-2021-exhibitiongallery/ - Photos, films, art and posters by the participants and collaborators of the International Sustainability Conference 2021. These contain original thoughts and perspectives on the beauty of Nature, the climate crisis, as well as the things we can do to fight it.
- 5. IUCN Red List https://www.iucnredlist.org/ A list of species currently threatened with extinction. The IUCN Red List is a critical indicator of the health of the world's biodiversity.
- 6. Our World in Data https://ourworldindata.org/ A free resource consisting of data in the form of charts, graphs and other graphics. Topics include climate change, economic growth, the use of renewable energy, and much more.
- 7. Sustainable Development Goals https://sdgs.un.org/goals Information about the United Nations' 17 Sustainable Development Goals, adopted by all member states in 2015.
- 8. The C40 Knowledge Hub https://www.c40knowledgehub.org/s/ Cutting-edge insights and practical resources from leading climate cities.
- 9. The Centre for Research on the Epidemiology of Disasters (CRED) https://www.cred.be/ By providing a wealth of data on health issues arising from disasters and conflict, CRED seeks to improve needs-based preparedness and responses to humanitarian emergencies.

- 10. The Intergovernmental Panel on Climate Change (IPCC) I Case Studies https://www.ipcc.ch/site/assets/ uploads/2018/03/SREX-Chap9\_FINAL-1.pdf Case studies of various projects in the field of climate mitigation, providing experience, insights and success stories in our fight against climate change.
- 11. UN Biodiversity Lab https://unbiodiversitylab.org/ Extensive database containing data on biodiversity, carbon density, vegetation, and several other parameters, sorted by geographic regions.
- 12. Mumbai Coastal Life https://play.google.com/store/apps/details?id=com.sproutsllp.mumbaicoastallife&hl=en\_ IN&gl=US (Android): A handy smartphone app containing a ready reckoner list of coastal organisms inhabiting Mumbai. A highly recommended tool for learning; you can use it the next time you go to the beach.

#### Articles, Research Papers, and Reports

- 1. Assessment of climate change over the Indian region: A report of the Ministry of Earth Sciences (MoES), Government of India (eBook) https://doi.org/10.1007/978-981-15-4327-2
- 2. Council on Energy, Environment and Water: Preparing India for Extreme Climate Events https://www.ceew.in/sites/default/files/CEEW-Preparing-India-for-extreme-climate-events\_10Dec20.pdf
- 3. Director of National Intelligence: India: The Impact of climate change to 2030 https://www.dni.gov/files/ documents/climate2030\_india.pdf
- 4. National Institute of Disaster Management: Mapping Climatic and Biological Disasters in India https://nidm. gov.in/PDF/pubs/GIZNIDM\_21.pdf
- 5. Publications & Data, UNEP https://www.unep.org/publications-data
- 6. Report of the Western Ghats, Ecology Expert Panel (Gadgil Report) https://ruralindiaonline.org/en/library/ resource/report-of-the-western-ghats-ecology-expert-panel/
- 7. Weather and Climate Extreme Events in a Changing Climate https://www.ipcc.ch/report/ar6/wg1/downloads/ report/IPCC\_AR6\_WGI\_Chapter11.pdf

#### **Books, Magazines and Journals**

- 1. Silent Spring by Rachel Carson (1962)
- 2. Small is Beautiful by E. F. Schumacher (1973)
- 3. The One-Straw Revolution by Masanobu Fukuoka (1975)
- 4. The Song of the Dodo by David Quammen (1996)
- 5. Everybody Loves a Good Drought by Palagummi Sainath (2000)
- 6. Biodiversity Characterisation at Landscape Level in Western Ghats India using Satellite Remote Sensing and GIS by the Indian Institute of Remote Sensing (2002)
- 7. Our Iceberg Is Melting: Changing and Succeeding Under Any Conditions by Holger Rathgeber and John Kotter (2006)
- 8. Climate Change Reconsidered: 2009 Report of the Nongovernmental International Panel on Climate Change (NIPCC) by Craig D. Idso and Fred Singer (2009)
- 9. The Sixth Extinction: An Unnatural History by Elizabeth Kolbert (2014)
- 10. Half-Earth: Our Planet's Fight for Life by Edward O. Wilson (2016)
- 11. The Nature Fix: Why Nature Makes Us Happier, Healthier and More Creative by Florence Williams (2017)
- 12. Fossil Free: Reimagining Clean Energy in a Carbon-Constrained World by Sumant Sinha (2020)
- 13. The Good Ancestor by Roman Krznaric (2020)
- 14. Post Growth: Life After Capitalism by Tim Jackson (2021)
- 15. The New Climate War by Michael Mann (2021)
- 16. Down to Earth https://www.downtoearth.org.in/
- 17. National Geographic Magazine https://www.nationalgeographic.com/magazine
- 18. Climate Action https://www.springer.com/journal/44168
- 19. Nature Climate Change https://www.nature.com/nclimate/
- 20. Smithsonian Magazine https://www.smithsonianmag.com/
- 21. The Tragedy of the Commons https://www.econlib.org/library/Enc/TragedyoftheCommons.html
- 22. My Friend Dugong (Audiobook) https://open.spotify.com/show/4vC4xpj9sqZ5e8HE3HZzWm?si=krPdCe9qSmCdnFeFKMtlgw

# **Organisations**

- 1. 350.org https://350.org/
- 2. Applied Environmental Research Foundation (AERF) https://aerfindia.org/
- 3. Australian Conservation Foundation (ACF) https://www.acf.org.au/
- 4. Biomimicry Institute https://biomimicry.org/about/
- 5. Bombay Natural History Society (BNHS) https://www.bnhs.org/
- 6. C40 Cities https://www.c40.org/
- 7. Central Pollution Control Board (CPCB) https://cpcb.nic.in/
- 8. Chintan Environmental Research and Action Group https://www.chintan-india.org/
- 9. Climate Alliance https://www.climatealliance.org/home.html
- 10. Climate Reality Project https://www.climaterealityproject.org/
- 11. Environmental Protection Agency (EPA) https://www.epa.gov/
- 12. European Environment Agency (EEA) https://www.eea.europa.eu/
- 13. Friedrich-Ebert-Stiftung (FES) India Office https://india.fes.de/
- 14. Global Alliance on Health and Pollution (GAHP) https://gahp.net/
- 15. Global Green Growth Institute https://gggi.org/
- 16. Green Climate Fund https://www.greenclimate.fund/
- 17. Greenpeace https://www.greenpeace.org/international/
- 18. Indian Youth Climate Network (IYCN) https://iycn.in/
- 19. Intergovernmental Panel on Climate Change (IPCC) https://www.ipcc.ch/
- 20. International Renewable Energy Agency (IRENA) https://www.irena.org/
- 21. International Union for Conservation of Nature (IUCN) https://www.iucn.org/
- 22. Ministry of Environment, Forest and Climate Change, Government of India (MoEFCC-Gol) https://moef.gov.in/en/
- 23. Navdanya https://www.navdanya.org/
- 24. RIVERse http://riverse.in/
- 25. SELCO Foundation https://selcofoundation.org
- 26. SPROUTS https://sproutsllp.com/
- 27. Students' Educational and Cultural Movement of Ladakh (SECMOL) https://secmol.org/
- 28. Tarun Bharat Sangh https://tarunbharatsangh.in/
- 29. The Energy and Resources Institute (TERI) https://www.teriin.org/
- 30. The Nature Conservancy https://www.nature.org/en-us/
- 31. United Nations Environment Programme (UNEP) https://www.unep.org/
- 32. United Nations Framework Convention on Climate Change (UNFCCC) https://unfccc.int/
- 33. World Health Organization (WHO) https://www.who.int/
- 34. World Wide Fund for Nature (India) https://www.wwfindia.org/

# **Guidelines, Toolkits, and Manuals**

- 1. Conservation Outreach Manual by The Nature Conservancy https://reefresilience.org/wp-content/uploads/Campaign-and-Outreach-Manual.pdf
- 2. Gender and Climate Change Guidelines & Tools I UNFCCC https://unfccc.int/topics/gender/resources/ guidelines-or-other-tools-for-integrating-gender-considerations-into-climate-change-related-activities-underthe-convention
- 3. Training Manual to Support Country-Driven Gender and Climate Change https://www.adb.org/sites/default/files/publication/178959/country-driven-gender-climate-change.pdf
- 4. YouthXchange-Climate change and lifestyle guidebook I UNEP https://unesdoc.unesco.org/ark:/48223/pf0000212876/PDF/212876eng.pdf.multi

### **Videos and Films**

- 1. Dersu Uzala (1975) https://www.imdb.com/title/tt0071411/?ref\_=nv\_sr\_srsg\_0
- 2. FernGully: The Last Rainforest (1992) https://www.imdb.com/title/tt0104254/
- 3. Jurassic Park Series (1993-2022)
- 4. Ice Age (2002, 2006, 2009, 2012, 2016) https://www.imdb.com/list/ls020738784/
- 5. Darwin's Nightmare (2004) https://www.imdb.com/title/tt0424024/?ref\_=nv\_sr\_srsg\_0
- 6. An Inconvenient Truth (2006) https://www.imdb.com/title/tt0497116/
- 7. Planet Earth I & II (2006 & 2016)
- 8. Happy Feet 1 & 2 (2006 & 2011)
- 9. WALL-E (2008) https://www.imdb.com/title/tt0910970/
- 10. Avatar (2009) https://www.imdb.com/title/tt0499549/?ref\_=tt\_sims\_tt\_i\_1
- 11. HOME (2009) https://www.youtube.com/watch?v=jqxENMKaeCU
- 12. Alice in Wonderland (2010) https://www.imdb.com/title/tt1014759/?ref\_=nv\_sr\_srsg\_0
- 13. Climate Refugees (2010) https://www.imdb.com/title/tt1273201/
- 14. MAN (2012) https://www.youtube.com/watch?v=WfGMYdalClU
- 15. Midway (2013) https://www.imdb.com/title/tt2428672/
- 16. Poison on the Platter (2013) https://www.imdb.com/title/tt14143262/
- 17. #GodSaveTheOcean (2015) https://www.youtube.com/watch?v=Jq5ulfkDAVo
- 18. Before the Flood (2016) https://www.imdb.com/title/tt5929776/?ref\_=nv\_sr\_srsg\_0
- 19. Biodiversity of the Northern Western Ghats (2016) https://www.youtube.com/watch?v=5bXe2oO3VzM
- 20. Changing Climate: Moving People (UNESCO India Documentary) (2016) https://www.youtube.com/ watch?v=G24bkiT55v4
- 21. Sand mining at Vaitarna Bridge with train (2016) https://www.youtube.com/watch?v=sZNB9GtixXo
- 22. Chasing Coral (2017) https://www.imdb.com/title/tt6333054/?ref\_=fn\_al\_tt\_0
- 23. Anthropocene: The Human Epoch (2018) https://www.imdb.com/title/tt8399690/
- 24. Challenges faced by Adivasis in India (2019) https://www.youtube.com/watch?v=LtjEik7bjCY
- 25. Learn How to Cook Godok in Bamboo the Tripuri Way with Rajib (2019) https://www.youtube.com/ watch?v=nYDwj8PCakc
- 26. Save Our Sand (2019) https://www.youtube.com/watch?v=AWSAW0URbLA
- 27. SPROUTS Green Talks (2019-2021) https://www.youtube.com/watch?v=nHuo-kSinNc&list=PLez\_ KYuDDI31zj6Mo-AjtlKwyLz0m8KqF
- 28. Worth their salt (2019) https://www.youtube.com/watch?v=uAUxWC1RU64&t=259s
- 29. Challenges for sustainable urban development in Vietnam I FES Asia (2020) https://www.youtube.com/ watch?v=IJMSqLYqePk
- 30. North SIKKIM Food Tour/ Exploration in DZONGU I Culinary, Lifestyle & Cultural point of view (2020) https:// www.youtube.com/watch?v=HFy8KIjFx8s
- 31. Transforming urban water management in India I FES Asia (2020) https://www.youtube.com/ watch?v=U7MkYvJGkUQ
- 32. Wade (2020) https://www.imdb.com/title/tt12188042/
- 33. Don't Look Up. (2021) https://www.imdb.com/title/tt11286314/?ref\_=nv\_sr\_srsg\_0
- 34. Positive Energy Stories from the MENA Region (2021) https://www.youtube.com/watch?v=yjFhEcIrP6A
- 35. International Sustainability Conference 2021 https://www.youtube.com/watch?v=clby51R1pf4&list=PLez\_KYuDDI33wJbPXZBosOkJYB9ChuqjP
- 36. Positive Land Regeneration Stories from the MENA Region (2021) https://www.youtube.com/ watch?v=yG2YDn83qXE
- 37. Winning Circle I FES-India (2021) https://www.youtube.com/watch?v=SXYFQN7HGGw
- 38. Adaptation Gap Report 2022 raises alarm on climate finance (2022) https://www.youtube.com/ watch?v=PKVhzdzrF44

#### **Games and Calculators**

- 1. Carbon Calculator https://www.carbonfootprint.com/calculator.aspx
- 2. CLIMANIA: The Climate Action Board Game by Simeon Shtebunaev and Claudia Carter https://climaniathegame.com/
- 3. CO<sub>2</sub>: Second Chance by Giochix.it https://www.giochix.it/scheda.php?item=3767&lingua=0
- 4. Living Planet Board Game by Ludically https://www.ludically.com
- 5. Meltdown by GEOlino https://www.geo.de/geolino
- 6. NASA Climate Kids https://climatekids.nasa.gov/menu/play/
- 7. Plane Carbon Emissions Calculator https://www.icao.int/environmental-protection/Carbonoffset/Pages/ default.aspx
- 8. Solar Rooftop Calculator https://solarrooftop.gov.in/rooftop\_calculator
- 9. The Ants: Underground Kingdom https://play.google.com/store/apps/details?id=com.star.union.planetant (Android); https://apps.apple.com/us/app/the-ants-underground-kingdom/id1568415097 (iOS)
- 10. Train Carbon Emissions Calculator https://ecotree.green/en/calculate-train-co2
- 11. Waste Warriors A Fun and Educational Board Game on Waste Segregation and Climate Change by Upcycler's Lab https://upcyclerslab.com

# Funding Opportunities, Government Schemes, and Subscriptions

- 1. Climate Change Research Grants https://www.epa.gov/research-grants/climate-change-research-grants
- 2. Climate Reality Leadership Corps https://www.climaterealityproject.org/training
- 3. Program on Reproductive Health and the Environment https://prhe.ucsf.edu/
- 4. Schemes for wind energy by Ministry of New and Renewable Energy https://www.india.gov.in/schemeswind-energy-ministry-new-and-renewable-energy
- 5. The Habitats Trust Grants https://www.thehabitatstrust.org/grants.php
- 6. Why LEED certification I US Green Building Council https://www.usgbc.org/leed/why-leed



# **Abbreviations and Glossary**

#### Α

**Adaptation:** Adjustment in natural or human systems in response to climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities

**Afforestation:** Planting of forest on land that historically did not have a forest

ADB: Asian Development Bank

**ADHD:** Attention-Deficit/Hyperactivity Disorder

AGW: Anthropogenic Global Warming

AIIB: Asian Infrastructure Investment Bank

**AMRUT:** Atal Mission for Rejuvenation and Urban Transformation

AQI: Air Quality Index

#### В

BARC: Bhabha Atomic Research Centre
BEE: Bureau of Energy Efficiency
BGT: Bhopal Gas Tragedy
Biomass Fuels or Biofuels: Renewable fuel produced from dry organic matter or plant-based combustible oils
BMC: Brihanmumbai Municipal Corporation

**BPL:** Below Poverty Line

**Bunker Fuels:** Fuels consumed for international marine and air transport

#### С

CC: Climate Change

**C&D:** Construction and Demolition

**C40 Cities Climate Leadership Group (C40):** Group of 97 cities representing one-twelfth of the world>s population and one-quarter of the global economy

**CAG:** Comptroller and Auditor General of India

**Capacity-building:** Process of developing the technical skills and institutional capability in developing countries and economies to enable them to effectively address the impacts of climate change

**Carbon Market:** Popular (but misleading) term for a trading system wherein countries buy or sell units of greenhouse gas emissions to meet national emission limits

**Carbon Sequestration:** Process of removing carbon from the atmosphere and depositing it in a reservoir

**Cartagena Dialogue:** A collection of 40 countries working towards a legally binding agreement under the UNFCCC, and are committed to becoming or remaining low-carbon domestically

**CBD:** Convention on Biological Diversity.

CBO(s): Community-Based Organisation(s)

**CDC:** Centres for Disease Control and Prevention

**CDM:** Clean Development Mechanism

**Centre for Science and Environment (CSE):** Public interest research and advocacy organisation that aims at creating awareness about climate change and encouraging participation

#### CFC(s): Chlorofluorocarbon(s)

**CFL(s):** Compact Fluorescent Lamp(s)

**Citizen Science:** Research conducted with public participation and crowd-sourced data

**Clean Development Mechanism (CDM):** A mechanism under the Kyoto Protocol where developed countries may finance greenhouse gas emission reduction or removal projects in developing countries and receive credits

**CLT:** Cross-Laminated Timber

**CLTS:** Community-led Total Sanitation

**Coastal Regulation Zone (CRZ):** Under the Environment Protection Act, 1986 of India, to regulate activities in the coastal areas

**Conference of the Parties (COP):** A supreme body of the Convention that meets periodically to review the Convention's progress

**COSTFORD:** Centre of Science and Technology for Rural Development

**CPCB:** Central Pollution Control Board

**CRC:** United Nations' Convention on the Rights of the Child **CRED:** Centre for Research on the Epidemiology of Disasters **CRP:** Climate Reality Project

**CSR:** Corporate Social Responsibility **CZMA:** Coastal Zone Management Authority

#### D

**Deforestation:** Conversion of forest to non-forest **DIY:** Do It Yourself

**DPSP:** Directive Principles of State Policy **DSDG:** Division for Sustainable Development Goals

#### Ε

Early Warning Systems (EWS): Communication system to inform people about probable climate-related events EIA: Environmental Impact Assessment

**Emissions trading:** One of the three Kyoto mechanisms, by which an Annex I Party may transfer Kyoto Protocol units to, or acquire units from, another Annex I Party

**EPR:** Extended Producer Responsibility

ESG: Environmental, Social and Governance

**ETF:** Enhanced Transparency Framework

**European Union (EU):** As a supranational union and regional economic integration organisation, the EU is a Party to both the Convention and the Kyoto Protocol **EV(s):** Electric Vehicle(s)

#### F

**FAO:** Food and Agriculture Organization of the United Nations

FCI: Food Corporation of India

**Financial Mechanism:** To facilitate the provision of climate finance, UNFCCC provides funds to developing countries. Parties that also serve the Kyoto Protocol

FIT: Feed-in Tariff

**FMCG:** Fast-Moving Consumer Goods **FRA:** Forest Rights Act

**Friedrich-Ebert-Stiftung (FES):** Non-profit German foundation committed to the values of democracy and social justice, and promotes dialogue between stakeholders **FSM:** Fire Safety Manager

**Fugitive fuel emissions:** Unintentional or undesirable greenhouse gas emissions during storage or transport

#### G

**GAHP:** Global Alliance on Health and Pollution **GDP:** Gross Domestic Product

**GFDRR:** Global Facility for Disaster Reduction and Recovery **GIS:** Geographic Information System

**Global Warming Potential (GWP):** Index for the combined effect of the differing times greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation

**GMF(s):** Genetically Modified Food(s)

**GMO(s):** Genetically Modified Organism(s)

**GNI:** Gross National Income

Gol: Government of India

**Green Climate Fund (GCF):** At COP16, Cancun (2010), governments established a Green Climate Fund as an operating entity of the financial mechanism to support projects, programmes, policies and other activities in developing countries

**GreenHouse Gases (GHGs):** Atmospheric gases that trap the sun's heat, also cause global warming and climate change

**Group of Seven (G7):** Inter-governmental political forum of seven developed nations (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States)

#### Н

HCFC(s): Hydrochlorofluorocarbon(s)

HDI: Human Development Index

**Heat Island Effect:** Experienced largely in urbanised built areas; the infrastructure absorbs and re-emits the sun's heat **HFC(s):** Hydrofluorocarbon(s)

HTL: High Tide Line

HVAC: Heating, Ventilation, and Air-Conditioning

I

**ICE:** Internal Combustion Engines

**ICF:** International Classification of Functioning, Disability and Health

**IDMC:** Internal Displacement Monitoring Centre

**IEA:** International Energy Agency

IEC: Information, Education and Communication

ILO: International Labour Organisation

**INDC:** Intended Nationally Determined Contributions

**Intergovernmental Panel on Climate Change (IPCC):** Established by the World Meteorological Organization and the UN Environment Programme; collates secondary data on the current climate scenario

#### International Renewable Energy Agency (IRENA):

Intergovernmental organisation to promote and facilitate the use of renewable energy

IUCN: International Union for Conservation of Nature

#### J

JNR: Jabarkhet Nature Reserve

#### Κ

KCC: Khangchendzonga Conservation Committee

**Kyoto Protocol:** International agreement standing to set binding targets for the reduction of greenhouse gas emissions

#### L

Land use, land use change, and forestry (LULUCF): Greenhouse gas inventory sector that covers emissions and removals of greenhouse gases resulting from direct human-induced land use, land use change and forestry activities

LCE: Low-Carbon Economy

**LED(s):** Light-Emitting Diode(s)

**LGBTQIA+:** Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual

LocallyWeightedScatterplotSmoothing(LOWESS):Regression analysis tool to create a smoothIne through a time plot or scatter plot to get a relationshipbetween variables

LSG(s): Local Self-Government(s)

#### Μ

Mariculture: Farming of marine organisms for food and products such as pharmaceuticals, food additives, jewellery (cultured pearls), nutraceuticals, and cosmetics, in the natural environment, or the land- or sea-based enclosures MHI: Ministry of Heavy Industry MIC: Methyl Isocyanate MIB: Ministry of Information and Broadcasting **MMT:** Million Metric Tonnes **MNRE:** Ministry of New and Renewable Energy MoCI: Ministry of Commerce and Industry MoEFCC: Ministry of Environment, Forest and Climate Change MoES: Ministry of Earth Sciences MoHUA: Ministry of Urban Development MOLE: Ministry of Labour and Employment Montreal Protocol: International agreement adopted in 1987; focuses on substances that deplete the ozone layer MoP: Ministry of Power MOP&NG: Ministry of Petroleum & Natural Gas **MOWR:** Ministry of Water Resources **MSME:** Micro, Small and Medium Enterprises

MT: Metric Tonnes

#### Ν

**NAPCC:** National Action Plan on Climate Change **NBS:** Nature-Based Solutions

NDC: Nationally Determined Contribution

NDMA: National Disaster Management Authority

NGT: National Green Tribunal

**NIPCC:** Non-Governmental International Panel on Climate Change

NOC: No-Objection Certificate

Non-Governmental organisations (NGOs): Non-profit organisations are not part of a governmental structure. They include environmental groups, research institutions, business groups, and associations of urban and local governments NRM: Natural Resource Management NSSO: National Sample Survey Office

**NTFP:** Non-Timber Forest Products

#### 0

**OCD:** Obsessive-Compulsive Disorder **ODF:** Open Defecation-Free **ODS:** Ozone Depleting Substances

**Organisation for Economic Co-operation and Development (OECD):** Collaborative of governments of 37 democracies to promote sustainable economic growth

#### Ρ

People's Biodiversity Registers (PBRs): A comprehensive document of available flora and fauna including the landscape and demography in a region
PCB: Polychlorinated Biphenyl
PFtP: Plant for the Planet
PIL(s): Public Interest Litigation(s)
Planned obsolescence: Design based to force replacement over time (intentional shortening of the product's life)
PLC: Product Life Cycle
PLHIV: People Living with HIV
PMAY: Pradhan Mantri Awas Yojana
PPM: Parts Per Million
PR: Public Relations
PTSD: Post-Traumatic Stress Disorder
PV: Photovoltaic

#### Q

**Quadrilateral Security Dialogue (QSD) or Quad:** Strategic security dialogue between Australia, India, Japan, and the United States

#### R

RE: Renewable Energy

**REBOOT:** Renewable Energy Bootcamp

**Reforestation:** Replanting of forests on lands that were previously forests

**Rio Conventions:** Three conventions - the United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD), and the United Nations Convention to Combat Desertification (UNCCD); emphasis is laid on the need for actions to adapt to climate change

ROI: Return on Investments

#### S

SDG(s): Sustainable Development Goal(s)

**SECMOL:** Students> Educational and Cultural Movement of Ladakh

SHG(s): Self-Help Group(s)

**SPCB(s):** State Pollution Control Board(s) **SPM:** Suspended Particulate Matter

**Sustainable Development:** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs

#### U

UBP: Urban Biodiversity Project
UNDP: United Nations Development Programme
UNEP: United Nations Environment Programme
UNESCO: United Nations Educational, Scientific and Cultural
Organization
UN-GA: United Nations General Assembly
UNFCCC: UN Framework Convention on Climate Change
USGBC: United States Green Building Council

#### W

WLS: Wildlife Sanctuary

WMO: World Meteorological Organization

World Health Organization (WHO): Agency of the United Nations that promotes public health and gives proper information on diseases and health WtE: Waste-to-Energy



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	Page Nos.
350.org	147
Α	
Aarey	37, 93, 141
Abu Dhabi	70
Act	
- Forest (Conservation)	99
- Forest Rights (FRA)	104
- Wildlife (Protection), 1972	16, 60, 97, 98
Adivasi Lives Matter (ALM)	iv, 36, 42
Aerosol	2, 53, 56
Afforestation	27, 109, 150
Africa	23, 44, 67, 79, 136,
	156, 158
Agriculture	
- Crop Rotation	/2, /6
- Organic	XVII, 2, 9, 18, 21, 26,
	80, 97, 128, 129, 141,
	143, 150
- Shifting	72
Air Quality Index (AQI)	57, 150
Alwar District	37
Amazon (Forest/Rainforest)	3, 7, 35, 107
Amsterdam	70
Andaman and Nicobar Islands	62, 72, 97, 118
Andaman Islands	xv, 62, 97, 118
Andaman Sea	18
<i>Andolan</i> (see also in 'movements')	42, 93, 121, 141
Animal Husbandry	42, 71, 75
Antarctic/Antarctica	3
Applied Environmental	142, 147
Research Foundation (AERF)	
Arabian Sea	18
Aravalli Range	37
Arunachal Pradesh	xiv, 42, 143
Aseema Charitable Trust	iv
Asia	xvi, 26, 61, 65, 67, 69,
	148. 150. 167
Assam	42
Asthma	55, 56
Atacama Desert	161

	Page Nos.
Attention-Deficit Hyperactivity	/8
Disorder (ADHD)	-0
Australia	3, 18,135
Australian Conservation	147
Foundation (ACF)	
Awaaz Foundation	iv, 57, 117
В	
Bali	7
Bangladesh	26, 79
Barcelona	7
Basel	7, 16
Bay of Bengal	18
Belgium	49
Below Poverty Line (BPL)	104, 105
Bengaluru	126
Berlin	8
Bhopal	7, 55, 99
Bhopal Gas Tragedy	7, 55, 98, 150
Bhutan	106, 144
Biodiversity	xii, xiv, 2, 7, 11-23,
	30, 31, 37, 38, 47-50,
	57-68, 72-84, 91-98,
	139-152
Biofuels	114
Biomimicry	87, 91
Biomimicry Institute	147
Bipolar Condition	31
Birmingham	30
Board	
- Central Pollution Control	60, 147, 150
(CPCB)	
- State Pollution Control	60, 129, 152
(SPCB)	
Bogota	59
Bombay Natural History Society (BNHS)	147
Bonn	7
Borneo	72
Brazil	30
Brihanmumbai Municipal	57, 112
Corporation (BMC)	
Bristol	30
Brussels	49

	Page Nos.		Page Nos.
с		Chile	44, 141
C40 Cities	145, 147	China	8, 26, 44, 58, 75, 83,
California	7, 22, 91		87, 116, 133, 137
Cambridge	92	Chintan Environmental	iv, 83, 147
Campaigns (see also	37, 42, 47, 59, 79, 89,	Research and Action Group	
'movements')	91, 113, 121, 128, 144,	Chlorofluorocarbons (CFCs)	2, 53, 56, 63
	147	Circular Economy	4, 83, 84, 85, 132, 141
Capacity-building	xviii, 3, 8, 27, 38, 47, 52, 102, 103, 142, 150	Citizen Science	9, 15, 16, 17, 90, 92, 150
Carbon		Citizen Scientist	15, 16, 90
- Calculator	xiii, 145, 149	Clean Development	102, 150
- dioxide (CO2)	xvi, xvii, 1, 2, 8, 15, 19,	Mechanism (CDM)	
	23, 55-62, 68-82, 106,	Climate Alliance	147
	114, 115, 121, 133, 136, 149	Climate Emergency	iv, 2, 3, 39, 103
- Emissions	xviii 4 8 27 28 38	Climate Pledge	131, 132
Emissions	58, 59, 114, 119, 128,	Climate Reality Project (CRP)	113, 147, 150
- Footprint	132, 137, 149 xvi 7 20 53 59 62	Climate Resilient	xii,9,24,25,30,38,54,75 ,80,127,140,142,143
- 100(p))))	63, 64, 66, 69, 74, 86,	Coastal Regulation Zone (CRZ)	24, 97, 141, 150
	119, 121, 129, 135, 136, 139	Coastal Zone Management Authority (CZMA)	97, 150
- Low (Carbon)	9, 26-30, 48, 58, 103,	Cold Wave	6
	118, 136, 150	Colombia	59
- Market	103	Community/Communities	
- Neutral	4, 9, 103, 114, 131	- Fishing	18, 35, 37, 75
- Neutrality	9, 103, 114, 131	- Indigenous	xii, 14, 32, 36, 41, 47,
- Offset	131	5	64, 103,
- see also	2, 53, 56, 63, 150	- Pastoral	14, 33, 35, 71
'Chlorofluorocarbon'		Community-Based	32, 42, 43, 46, 150
- Sequestration	14, 29, 32, 43, 63, 85,	Organisation(s) (CBOs)	
<b>T</b> I'	132, 150	Community-Led Total	79, 150
- Irading	27,28	Sanitation (CLTS)	
- Zero	26, 136	Compact Fluorescent Lamp	58, 150
- Catastrophes	12, 17, 18	(CFLS)	
- Cattle	65, 73, 75, 81	(COP)	3, 7, 8, 41
Centre for Research on the Epidemiology of Disasters	145, 150	Construction and Demolition (C&D)	57, 120, 124, 150
(CILED) Contro for Science and	0 0/ 120 125 150	Convention(s)	
Environment (CSE)	9, 94, 120, 155, 150	- Barcelona	7
Centre of Science and	123, 150	- Basel	7
Technology for Rural		- Bonn	7
Development (COSTFORD)		- CITES	7
Centres for Disease Control	48, 150	- on Biological Diversity (CRD)	, 7 14 150 152
and Prevention (CDC)		- Ramsar	7
Chattisgarh	36, 42	- Stockholm	7
Chennai	69, 99	- UNECCC	, 7 101 102 147
Chernobyl	7, 58, 115, 116		,, 101, 102, 147

	Page Nos.
- United Nations' Convention	40
on the Rights of the Child	7
- vienna Copenhagen	7
Cornell Lab of Ornithology	90
Corporate social responsibility	30, 130, 131, 150
Corporate Social Responsibility (CSR)	30, 84, 130, 131, 150
Cross-Laminated Timber (CLT)	128, 150
Cuts International	97
Cyclone	2, 6, 7, 11, 12, 17, 18, 20, 21, 26, 29, 33, 38, 39, 44, 54, 56-58, 61, 62
- Amphan	26, 61
- Bhola	7
D	
Dam	93, 115, 116, 125
- Banqiao	116
- Dibang	93 24 37
- Upper Vaitarna	24, 37
Deccan Plateau	33
Declaration of National and	104
State Symbols	
Deepwater Horizon	116
Deforestation	2, 18, 22, 35, 44, 56, 57, 59, 72, 79, 91, 94, 96
Delhi	57, 65, 83, 87, 99, 135, 136
Democratic Republic of Congo	136
Denmark	59
Design thinking	19, 20, 139, 140
Diet	
- Medi	73, 74, 75, 76, 79 73, 74
- Vegetarian	73, 74, 75
Digital Women (DW) News	iv
Directive Principles of State	24, 150
Policy (DPSP)	
Disaster Management	11, 21, 23, 24, 25, 52, 62, 146, 151
Division for Sustainable	3. 150
Development Goals (DSDG)	2,
Do It Yourself (DIY)	xii, 150
Drought	xiv, 3, 6, 9, 12-23, 26, 29, 33, 37, 44-57, 73, 115, 130, 146

	Page Nos.
E	
Early Warning Systems (EWS)	144, 150
Earthquake	7, 22, 26, 116, 122
- Haiti	7
- Indian Ocean	7
Ecosystem(s)	xvii, 1, 2, 4, 6, 9, 11-15, 18, 19, 25, 27, 29-31, 33, 38, 41, 53-55, 57- 59, 61, 63, 64, 66, 68, 70, 75, 78, 85, 87, 90, 98, 104-106, 111, 120,
	127, 135, 140-143
Ecosystem services	9, 11-13, 29, 38, 57, 64, 127, 142
El Nino	18
Electric Vehicle(s) (EVs)	9, 10, 59, 101, 103, 114 117 135
Emissions trading	27,102, 103, 150
Energy	
- Clean	4, 9, 28, 98, 107, 113,
	117, 118, 132, 146, 152
- Geothermal	20, 108, 118
- Green	9, 28
- Non-renewable	84, 114, 118
- Nuclear	4, 52, 57, 58, 115 - 118
- Renewable	xv, 9, 20, 28, 41, 58, 59, 80-89, 100-103, 114-120, 124-132, 137, 145-151
- see also 'Coal'	8, 25, 59, 82, 89, 99, 101, 114-126, 137-152
- see also 'Fossil fuels'	xvi, 2-8, 28, 49, 54, 55, 72, 89, 101-108, 114, 119, 134
- see also 'Hydropower'	115, 118, 126
- Solar	9, 19, 20, 29, 46, 50, 59, 89, 101-121, 137, 138, 149
- Tidal	20
- Wind	9-33, 56-62, 72, 89,
Environmental Impact	90, 108-124, 140, 149
Assessment (EIA)	15, 57, 110, 150
Environmental Justice	113
Environmental Protection Agency (EPA)	147
Environmental, Social and Governance (ESG)	110, 131, 150

	Page Nos.
Erosion	22, 56, 57, 58, 62
Europe	28, 43, 49, 60, 61, 84, 130, 134, 147, 150, 155, 158, 159
European Environment Agency (EEA)	147
European Union (EU)	49, 130, 150
Extended Producer Responsibility (EPR)	30, 131, 150
F	
Fair Trade	142, 143
Fashion	
- Fast	85, 141
- Sustainable	42, 141, 143
(FMCG)	101, 151
Feed-in Tariff (FIT)	100, 150
Fifth Assessment Report (2014)	1
Flood	2, 3, 6, 12, 16, 18, 21-24, 26, 29, 32, 33, 35, 36, 38, 39, 49, 54, 56, 58, 63, 69, 78, 116, 120, 123, 140, 141, 148
Floodplains	22, 127
Food and Agriculture Organisation (FAO)	75, 150
Food security	38, 72, 79
Forest Fire	2, 6, 15, 22, 23, 33, 35, 38, 39, 54
Friedrich-Ebert-Stiftung (FES)	Cover (Front, Back, Inner), ii, xii, xviii, 99, 147, 151
Fukushima	7, 58, 115, 116
G	
Gender	3,24,32,37,39,44-48, 67,101,111,134
Genetically Modified Foods (GMFs)	72, 151
Genetically Modified Organisms (GMOs)	19, 53, 63, 151
Geneva	8
Geographic Information System (GIS)	90, 146, 151
Germany	8, 43, 51, 96
Ghar Bachao Ghar Banao Andolan (GBGBA)	121
Glasgow	7, 8, 65, 136

	Page Nos.
Global Alliance on Health and Pollution (GAHP)	147
Global Green Growth Institute	147
Global Warming	ii, xvii, 1-8, 18-23, 33,
	53-56, 75, 93, 103,
	115, 119, 150, 151
Global Warming Potential (GWP)	xvii, 115, 119, 151
Goa	62
Goregaon	112
Government of India (Gol)	24, 27, 37, 146, 147, 151
Gram Panchayat	35, 36
Great Barrier Reef	3, 16
Green Climate Fund (GCF)	147, 151
Green Hydrogen	9, 118, 137, 138
Green Infrastructure	127, 128
Greenhouse Effect	1
GreenHouse Gases (GHGs)	1, 2, 27, 53, 56, 68, 71, 73, 75, 82, 102, 103, 108, 114, 127, 151
Greenland	3.89
Greenpeace	147
Greenwashing	94, 108, 131
Gross Domestic Product (GDP)	22, 25, 26, 31, 33, 36, 60, 62, 151
Gross National Income (GNI)	39, 151
Groundwater	33, 53, 57, 77, 81, 83, 114, 123, 127, 140,
	142
Group of Seven (G7)	104, 105
Gujarat H	62
Habitat	xvi, 4, 11-17, 29,
	57-68, 79, 87, 88, 98,
	104-114, 127, 149
Haiti	7, 122
Harare	91
Heat Island Effect	2, 18, 20, 49, 56, 68, 69, 122, 127
Heat Wave	ii, 6, 7, 17, 20, 29, 49, 56, 61, 78
- California	7
- European	7, 61
Heating, Ventilation, and Air- Conditioning (HVAC)	119, 151
High Tide Line (HTL)	97, 151
Himachal Pradesh	36, 118
Himalaya/Himalayan	18, 19, 20, 35

	Page Nos.
Human Development Indices	25, 151
(HDIs)	7.24
Hurricane	7,21
- IQa	/
- Ndullid Hydorabad	120
Hydrochlorofluorocarbon(s)	56 63 102 151
(HCFCs)	50, 05, 102, 151
Hydrofluorocarbon(s) (HFCs)	1, 102, 151
I	
India	Cover (Front, Back,
	Inner), i-xviii, 1-4, 5-10,
	11-30, 31-52, 53-85,
	144 145-149 150-152
Indian Ocean	7 21
Indian Youth Climate Network	147
(IYCN)	
Indigenous	
- Crops	19, 73
- Innovations	20, 24
- Knowledge and Practices	142, 143
- Livelihoods	5
- Technology	117
- Trees	38, 68
Indonesia	30
Indradhanu Kalarang	
Communication (IEC)	113, 151
Infrared Radiation	1, 151
Infrastructure	
- Digital	141
- Green	127, 128
- Linear	63
- Rural	124
- Urban	36, 120, 133, 137
Intended Nationally	24, 151
Determined Contributions	
Intergovernmental Panel on	1 2 8 90 145 146
Climate Change (IPCC)	147, 151
Internal Combustion Engines (ICE)	10, 135, 151
Internal Displacement Monitoring Centre (IDMC)	33, 151
International Classification of Functioning, Disability and Health (ICF)	49, 151
International Energy Agency (IEA)	135, 151

	Page Nos.
International Labour	33, 151
Organisation (ILO)	00.447
International Renewable Energy Agency (IRENA)	89, 147
International Sustainability	ii, iv, xiii, xviii, 141, 145,
Conference (2nd, ISC 2021)	148
International Union for Conservation of Nature (IUCN)	xvı, 14, 145, 147, 151
Invasive Species	15, 19
Iran	26
J	
Jabarkhet Nature Reserve (JNR)	65, 151
Jaipur	37, 120
Jammu and Kashmir	118
Japan	26, 58, 91
Judia	116
	116
<b>K</b> Karpataka	62
Kamalaka Kawa Sanja	02 iv
Kedarnath	61
Kenva	43 100
Kerala	62, 123
Keystone Foundation	iv
Keystone Species	33
Khangchendzonga Conservation Committee (KCC)	66, 151
Kinnaur	36
Kolkata	61, 99
Konkan	37
Kyoto Protocol	7, 101, 102, 150, 151
L	
La Nina	18
Ladakh	19
Lakshadweep Islands	62, 97, 118
Land Use	xvi, xvii, 2, 55, 72, 75, 79, 128, 129, 133, 134
Landslide	11, 22, 35, 36, 56, 63, 127
Let India Breathe (LIB)	iv, 42
LGBTQIA+	20, 31, 37, 38, 48, 151
Local Self-Government(s) (LSGs)	36
Locally Weighted Scatterplot Smoothing (LOWESS)	xvi, 18, 151
Loktak Lake	XV
London	100
Low-Carbon Economy (LCE)	26, 27, 151

	Page Nos.
М	
Madhya Pradesh	35
Madrid	7
Maharashtra	62, 96
Malaysia	30, 78
Maldives	103
Manipur	xv, 41
Mannu Vaddars	126
Marburg	51
Mariculture	75, 151
Media	86-96
- Influencer	42, 65, 86, 141
- Mass	93
- Social	iv, xvi, 38, 41, 42, 43, 86, 90, 91, 94, 95, 96
Mega-dam	22, 32, 33
Melbourne	3, 70
Mental Health	3, 39, 41, 43, 48, 53, 56, 60, 79, 80, 112
Methane (CH4)	1, 2, 55, 56, 68, 73, 78, 81, 82, 114, 115, 118
Methyl Isocyanate (MIC)	55, 151
Metric Tonnes (MT)	59, 151
Mexico	43
Micro, Small and Medium Enterprises (MSMEs)	17, 43, 151
Microbes	6, 13
Milan	70
Ministry of Earth Sciences (MoES)	146, 151
Ministry of Environment, Forest and Climate Change (MoEFCC)	27, 37, 147, 151
Ministry of Heavy Industry (MHI)	104, 105
Ministry of Commerce and Industry (MoCI)	104, 105
Ministry of Information and Broadcasting (Min. of I&B)	104, 105
Ministry of Labour and Employment (MOLE)	104, 105
Ministry of New and Renewable Energy (MNRE)	117, 151
Ministry of Petroleum, & Natural Gas (MOP&NG)	104, 105
Ministry of Power (MoP)	123 151
Ministry of Urban Development (MoHUA)	104, 105

	Page Nos.
Ministry of Water Resources (MOWR)	104, 105
Mizoram	16
Montana	7
Montreal Protocol/ Ammendment	101, 102, 151, 161
Movements	
- Appiko	42, 141
- Chipko	42, 93, 141
- Dehing Patkai	42
- Dibang Dam	93
- Hasdeo Forest	42
- Narmada Bachao	42, 93
- Save Aarey	37, 42, 93, 141
- Save Silent Valley	42, 141
Mumbai	42, 57, 29, 70, 78, 106,
	121, 125, 133, 136
Mussoorie	65
Myanmar	72
Ν	
National Action Plan on Climate Change (NAPCC)	24, 151
National Disaster Management Authority (NDMA)	52, 151
National Green Tribunal (NGT)	16, 27, 97, 98, 99, 151
National Parks	14, 17, 37, 71, 97, 105, 106
National Sample Survey Office (NSSO)	125, 152
Nationally Determined Contribution (NDC)	xviii, 20, 103, 144, 151
Natural Resource Management (NRM)	19, 24, 38, 152
Nature-based Solutions (NBS)	142, 151
Navdanya	73, 143, 147
Netherlands	70, 122
New York	59
New Zealand	103
Niyamgiri	36
No-Objection Certificate (NOC)	36, 152
Non-Governmental International Panel on Climate Change (NIPCC)	146, 151
Non-Governmental	xii, 31,32, 35-46, 70,
Organisations (NGOs)	77, 83, 94, 111, 112,
	126, 141-152
Non-Timber Forest Products (NTFP)	22, 35, 152
North America	84, 134

	Page Nos.
Northeast India	35, 36
Norway	126
0	
Obsessive-Compulsive Disorder (OCD)	31, 152
Odisha	18, 36, 47, 50
Oil Spill	xv, 7, 20, 116
Open Defecation-Free (ODF)	79, 152
Organisation for Economic Co- operation and Development (OECD)	45, 152
Oslo	126
Ozone	1, 49, 56, 77, 93, 94,
	102, 151, 152
Ozone Depleting Substances (ODS)	102, 152
r Decific Ping of Fire	110
Pakistan	
Pakislari	20, 39
Panalina	144
Paraueep	
PdIIS	7, 20, 59, 62, 70, 101, 103
Paris Agreement	3, 7, 20, 62, 101, 103
People Living with HIV (PLHIV)	45, 152
People's Biodiversity Registers	15, 152
(PBRs)	
Peru	30
Phase Down	8, 117
Phase Out	8, 25, 102
Philippines	78, 116
Planned Obsolescence	42, 129-132
Plant for the Planet (PFtP)	43, 152
Poets for Change	iv
Pollution	
- Air	46, 54-59, 81, 98, 119,
	120
- Light	58
- Noise	xv, 54, 56, 60, 91
- Radiation	58
- Soil	57,58
- Water	xv, 56, 57, 98, 140
Polychlorinated Biphenyl (PCB)	56, 152
Post-Traumatic Stress Disorder (PTSD)	31, 39, 152
Pre-industrial	2, 3, 5, 8, 103
Product Life Cycles (PLC)	30, 152
Protected Area Network	105

	Page Nos.
Protocol	
- Kyoto	7, 101, 102
- Montreal	101, 102
Public Interest Litigations (PILs)	41, 60, 99
Public Relations (PR)	94, 152
Pune	49, 99, 142
Q	
Quadrilateral Security Dialogue (QSD) or Quad	104, 105
Queer R	48, 151
Rainwater Harvesting	20, 101, 121-127
Rajasthan	37, 46
Red Industry	119, 129
- Cement	2, 8, 9, 63, 98, 119,
	129
- Mining	33, 37, 42, 44, 105, 114, 117, 129, 136
- Transportation	xv 2 17 21-26 45-67
	108, 121, 128, 133-
Reforestation	29, 106, 152
Renewable Energy Bootcamp (REBOOT)	116, 152
Republic of Congo	136
Republic of Korea	26, 44, 59
Resilience	
- Climate	4, 18, 19, 24, 32-43, 80, 108, 127, 128, 144
- Community	33, 35
- Disaster	24
- Ecosystem	27
- Infrastructure	51, 80
- Training	23, 38
Rio Convention	7, 152
Rishi Valmiki Eco-school (RVES)	iv, 112
River	
- Arvari	37
- Bhagani	37
- Cauvery	126
- Ganga	37
- Jahajwali	37
- Kallang	140
- Mahanadi	50
- Mithi	21
- Ruparel	37

	Page Nos.
- Sarsa	37
- Seine	59
- Shabi	37
RIVERse	106
Rurban	31, 64
Rwanda	30
S	
Sanitation	xv, 3, 5, 32-44, 67-80,
	108, 112, 120, 125,
Science	141, 150
- Contar for Science	9/ 120
Environment	94, 120
- Citizen	9, 15-17, 90, 92
- Climate	15, 90
- Environmental	110
Seed	
- Bank	17, 38, 143
- Hybrid	72
SELCO Foundation	147
Self-Help Group(s) (SHGs)	43, 47
Seoul	59
Sheffield	30
Shikha Eco-Learning	
Centre (SHICOL)	50
Siberia	3
SiddhiLife	iv
Sikkim	66, 118
Singapore	69, 70, 140
Sixth IPCC Assessment Report	1, 8
(2023)	
Social Equality	5, 32
South America	136
SPROUTS	Cover (Front, Back,
	141-147
Stockholm	7, 37
Students' Educational and	19, 147, 152
Cultural Movement of Ladakh (SECMOL)	
Sundarbans	61
Surat	28
Suriname	144
Suspended Particulate Matter (SPM)	49, 53, 59, 60, 152
Sustainable Development	3, 9, 16, 76, 98, 145, 147, 152

	Page Nos.
Sustainable Development Goal(s) (SDGs)	xii, xiii, 3, 40, 48, 53, 60, 139, 145
Sustainable Housing	xv, 9
Sweden	41
Switzwerland	8
г	
Tarun Bharat Sangh (TBS)	37, 147
Telengana	14
Thailand	75
Thane	57, 90
The Energy and Resources Institute (TERI)	147
The Nature Conservancy (TNC)	147
The Sustainability Platform Asia TSPA)	iv, 69
Thiruvananthapuram	123
Filonia	46
Tipping Points	3
Tonga Volcano	2, 7
Tourism	
- Adventure	62
- see also 'Ecotourism'	xii, 14, 30, 36, 62-66, 105, 143
- Wildlife	36, 63, 64
Fransgender	45, 47, 151
Tripura	36
Tuvalu	7, 103
Typhoon	11, 21, 44, 61
U	
Udaipur	120
Ukraine	2, 58, 61
Ultraviolet Rays/Radiation	1, 54, 56
UN Framework Convention on Climate Change (UNFCCC)	7, 8, 24, 102, 147, 150, 152
Jnited Nations Development Programme (UNDP)	45, 152
Jnited Nations Educational, Scientific and Cultural Drganization (UNESCO)	147, 148, 152
United Nations Environment Program (UNEP)	146, 147, 152
United Nations General Assembly (UN-GA)	3, 152

	Page Nos.
United Nations' Convention on the Rights of the Child (CRC)	40, 150
United States Green Building Council (USGBC)	121, 149, 152
Universities	
- Christ	49
- Marburg	51
- Rajasthan	37
Urban Biodiversity Project (UBP)	16, 152
United States of America (US/USA)	12, 41, 77, 91, 92, 113, 121, 122,129, 134, 151, 152
Uttarakhand	65, 118
V	
Vehicle	
- Electric	9, 10, 59, 101, 103, 114, 117, 135
- Internal Combustion Engine (ICE)	10, 135, 151
Vienna	7
Vietnam	75, 99
Volcano	2, 7, 22, 116
W	
Washington D.C.	41
Waste	
- Food	30, 68, 81, 84
- Liquid	81
- Management	28, 38, 47, 53, 60, 82- 85, 120, 135
- Organic	81-85, 124
- Packaging	131
- Plastic	77, 81, 109, 130
- Recycle	xiv, 4, 20, 27, 47, 48, 70, 81-85, 123, 124
- Segregation	xvii, 41, 80-85, 149
- Solid	47, 57, 81, 127
Waste-to-Energy (WtE)	57, 60, 82, 83, 117, 52
Water Environs (WE)	iv, 106
West Bengal	15, 61, 62

	Page Nos.
Western Ghats	18, 35, 36, 142
Wetlands	29, 53, 56, 57, 63, 127
Wildfires	3, 7, 12, 18, 20, 26, 61, 66
Wildlife Sanctuary	
- Bhagwan Mahavir	37
- Eaglenest	143
- Jabarkhet	65
Women	5, 20, 31, 36, 38, 39, 44-48, 51, 54, 70, 79, 101, 125, 134, 135
World Bank	95, 161, 162
World Health Organisation (WHO)	49, 147, 152
World Meteorological Organization (WMO)	26, 152
World Wide Fund for Nature (WWF)	iv, 14, 59, 65, 147
х	
XCOOP	122
Y	
Yuksam	66
Z	
Zimbabwe	91



# Notes

# Notes

# Notes

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The Friedrich-Ebert-Stiftung (FES) is a non-profit German foundation, committed to the values of democracy and social justice. It was founded in 1925 and is named after Germany's first democratically elected President, Friedrich Ebert. FES India, established in the 1980s, is committed to building platforms of mutual trust for open debate and the exchange of new ideas. Using workshops, seminars, exchange programmes, and academic papers. FES India offers nuanced socio-economic analyses and fosters debates on a national, regional and global level.

SPROUTS (est. 1995) is a Mumbai-based Environmental Consulting, Eco-tourism & Research organisation, focusing on climate action via responsible tourism & wildlife conservation. SPROUTS undertakes various projects to document, conserve and protect biodiversity across South Asia.



