



CLIMATE CHANGE RESEARCH INSTITUTE

**AWARNESS AND CAPACITY  
BUILDING WORKSHOP**

# **CITIES AND PLASTICS POLLUTION**

## **Challenges & Solutions**



# **PROCEEDINGS**

# **World Environment Day**

# **5th June 2023**

ORGANIZED BY

**CLIMATE CHANGE RESEARCH INSTITUTE**



Climate Change  
Research Institute



INDIA INTERNATIONAL CENTRE



## Preface



A workshop on Awareness and Capacity Building on “**Cities and Plastics Pollution: Challenges & Solutions**” has been organized by the Climate Change Research Institute in association with the India International Center, on June 5, 2023. Current workshop topic was in line with the UNEP theme this year i.e., ‘**Solutions to Plastic Pollution**’ and India’s theme as **LiFE Mission**.

Our Institute has been actively taking a lead to in having science campaigns on World Environment Day and implementation of Sustainable Development Goals relating to plastic pollution. In 2018, when India was the host country for World Environment Day, a half-day Awareness workshop on ‘Implementing Sustainable Development Goals in India: Beating Plastic Pollution’ was held on 8th June, 2018 in collaboration with Indian International Centre, New Delhi. A Joint Workshop on Marine Ecology: Implementing Sustainable Development Goal 14 was held at Kochi with the Centre for Marine Living Resources & Ecology (CMLRE), Kochi on 21st September 2019 to address marine pollution. Steps were taken through information dissemination for human resource development. Our **Climate SAR Bulletin** - Plastic Pollution and Climate Change, Vol. V - No. 2 , July - December, 2018 and Vol. VII, no.1 Climate Change and Marine Ecology - January 2020 were highly appreciated.

In the current workshop, the topics for discussion included;

- Plastic production & waste management for circularity actions
- Urban plastic waste management and challenges
- Scientific solutions to curb plastic pollution
- Tackling plastic pollution in Seas

We feel honored and profusely thank Prof G. D. Sharma, Former Secretary, UGC for chairing the Panel Discussion and Ms. Beate Langset, Counsellor, Climate & Environment, the Norwegian Embassy, New Delhi for delivering the Keynote Address. We sincerely thank Sh A.K. Jain, Sh Gautam Sen, Er Sourabh Manuja, Dr Shyamala Mani, Dr R Venkatesan, Dr S Ahmad and Ms Shweta Frederick for sharing their vast experience and perspectives. I thank Ms Priya Vyas, Editor Springer and Dr Neha Tripathi for making the event a success. Lastly, I convey thanks to Principal Dr Anuradha Amos for a lively performance of girls from St Thomas School and would be pleased to offer them membership to our Institute.

**Dr. (Mrs.) Malti Goel**  
Chief Executive and President  
Climate Change Research Institute

## CONTENTS

<u>Sr. No.</u>	<u>Title</u>	<u>Page No.</u>
1.	Preface	3
2.	Executive Summary	5
3.	Nukkad Natak by Girls from St Thomas Higher Secondary School	6
4.	<u>Theme Address</u> by Dr. (Mrs.) Malti Goel, President & Chief Executive, CCRI and Former Adviser, DST	7
5.	<u>Keynote Address</u> by Ms. Beate Langset, Counsellor, Climate & Environment, the Norwegian Embassy, New Delhi	10
6.	<u>Panel Discussion</u>	
6.1	Opening Remarks by Chairman Prof. G.D. Sharma, Former Secretary, UGC and Ex-Director, CEC	13
6.2	Er. Sourabh Manuja, Waste Management Advisor, CCP-ME, GiZ	14
6.3	Dr. Shyamala Mani, Professor (Retd.), NIUA, Delhi, India	16
6.4	Dr. R. Venkatesan, Technical Consultant, NCCR, Chennai (online)	17
6.5	Dr. S. Ahmad, Former VC, Jamia Hamdard	18
6.6	Ms. Shweta Frederick, teacher, St. Thomas' Girls Sr. Sec. School	19
6.7.	<u>Moderator's Remarks</u> by Shri Gautam Sen, Ex-ED, ONGC and Ex-Sr. VP, Reliance	22
7.	<u>Book Release</u>	24
8.	<u>Vote of Thanks</u> by Dr. Neha G. Tripathi, Secretary, CCRI	26
9.	Pre-Workshop Abstracts	27
	List of Participants	29

## **Executive Summary**

### **Science Campaign by Climate Change Research Institute in Association with IIC, New Delhi**

#### **Workshop on Awareness and Capacity Building on ‘Cities and Plastics Pollution: Challenges & Solutions’, on June 5, 2023 at Lecture Hall 2, India International Centre Annexe, New Delhi**

On the eventful day of June 5, 2023, the India International Centre Annexe was buzzing with World Environment Day 2023 Science Campaign organized by the Climate Change Research Institute (CCRI) on “Cities and Plastics Pollution: Challenges and Solutions”. Students from St Thomas Girls Sr. Secondary School gathered and performed *Nukkad Natak* to connect with the theme.

The event provided a unique opportunity for creating awareness and the stage was set by Dr. (Mrs) Malti Goel, President and Chief Executive CCRI. The CCRI has been taking many initiatives for capacity building on emerging topics of environment and climate change and the President thanked IIC for collaborating in this cause. The Keynote address was delivered by Ms Beate Langset, Counsellor, Climate & Environment, Norwegian Embassy, sharing her insights from Norway. This was followed by a Panel Discussion Chaired by Prof G. D. Sharma, Former Secretary UGC. Shri Gautan Sen moderated the session. Er. Saurabh Manuja, Waste Management Advisor, CCP-ME, GiZ; Dr S. Ahmad, Ex-VC Jamia Hamdard; Dr. R. Venkatesan, Technical Consultant, NCCR, Chennai (online); Dr. Shyamala Mani, Ex-Professor, NIUA; Shri Gautam Sen, Ex-VP Reliance and Ex-ED, ONGC; Ms Shweta Fredrick, ST. Thomas School inspired the audience by sharing their experiences in the area of managing & controlling plastics pollution in the cities and gave valuable suggestions. Dr. Neha G. Tripathi, member Secretary, CCRI thanked the eminent speakers and the distinguished participants. This highly anticipated event provided an extraordinary opportunity to gain insights into the complexities and challenges involved in controlling plastics pollution and the possible solutions.

The event also offered a new Book Release on “Climate Resilient, Green and Low Carbon Built Environment”. The book is authored by Shri A.K. Jain, Former Commissioner (Planning), DDA and published by Springer Nature in a publication collaboration with the Climate Change Research Institute. Ms Priya Vyas, Editor, Springer Nature spoke on this occasion.



**G-20 Compact bags ‘Introduction to Urban Farming’ distributed to all the participants.**



**Climate Change Research Institute**

**Awareness and Capacity Building Workshop**

**Cities and Plastics Pollution: Challenges &  
Solutions**

**PROCEEDINGS**

**World Environment Day 2023**

held on

**5<sup>th</sup> June 2023, at Lecture Hall 2, IIC Annexe, New Delhi**

*In association with*

**India International Center**

## Nukkad Natak on Controlling Plastic Pollution - by Girl Students



### Glimpses of Performance by Students from St. Thomas Girls Sr. Sec. School, Mandir Marg, New Delhi

#### **STUDENT PARTICIPANTS**

1. Ms Bhavya Berry, Class- XA
2. Ms Awesome Nanda, Class- VII
3. Ms Saima Yadav, Class- IX
4. Ms Anaya Batra, Class- IX
5. Ms Sanskriti, Class- X-D
6. Ms Jiya, Class- X-D
7. Ms Samaira Rohil, Class- IX
8. Ms Yashyma, Class- X
9. Ms Vaishnavi Choudhary, Class- X
10. Ms Tishadar Kaur, Class- X



# Awareness and Capacity Building Workshop on “Cities and Plastics Pollution: Challenges & Solutions”

World Environment Day 2023

5<sup>th</sup> June 2023 at India International Center, New Delhi

## Theme Address



**Dr. (Mrs.) Malti Goel, President & Chief Executive, CCRI and Former Adviser, DST**

*Plastics, in many ways, contribute positively to society. There is, however, a dark side: the way we produce, use and dispose of plastics is polluting ecosystems, creating risks for human and animal health and destabilizing the climate.*

- Inger Andersen, Executive Director, UNEP

Dr (Mrs) Malti Goel extended hearty welcome to the distinguished guests and dignitaries present and looked forward for a fruitful Panel Discussion for finding solutions to mega problem of Plastics Pollution. The Climate Change Research Institute is a not-for-profit organization working with a mission to promote understanding of climate change, mentoring and developing human resources. Our workshops initiatives for youth in schools, colleges, researchers and for society at large on emerging topics of environment and sustainability are motivating and well-liked. India International Center has been our partner for more than a decade and we are extremely thankful for it.

As we know the World Environment Day is being celebrated every year to raise awareness about the significance of a healthy environment & life styles and to implement actions to



protect the nature. India was the Host Country for the year 2018 and the theme was *Beat Plastic Pollution*. The CCRI Awareness and Capacity Building Workshop held on June 8th 2018 led to a **Policy Paper** on 'Strategy for Controlling Plastics Pollution in India'. It was sent to all concerned Ministries and organizations by the Chairman of our Governing Council Prof D. P. Agrawal. The Policy Paper came out with **five recommendations (5Is)**

- Implementation of Plastics Regulations, both at government and state levels
- Integrated management of plastic waste through recycling, refuse and reuse
- International Agreements for controlling plastics pollution in oceans
- Incineration techniques for conversion of plastics into fuel and hydrogen
- Innovation in Technology to produce Bio Plastics or Green Plastics

The UNEP theme this year is '*Solutions to Plastic Pollution*'. We had a good beginning with "Nukkad Natak" performed by the girls from St. Thomas Higher Secondary School on creating awareness about Plastics pollution.

Coming to the today's theme '*Cities and Plastics Pollution: Challenges & Solutions*', she said plastic, first chemically synthesized in 1862, became commercial only in 1960s almost 100 years later. There has been exponential growth in the use of plastics since then. The production and consumption of plastics has increased globally 20 times between 1990s and now. Use of plastics was encouraged in all walks of life, as CO<sub>2</sub> footprints became smaller when plastics replaced conventional materials. At present plastics are integral part of our life and it is becoming clear that solutions to control plastic pollution cannot be assessed in isolation and must be considered in terms of whole plastic value chain.

In this context, I refer to recent UNEP Report, which concluded that Plastic pollution could reduce by 80 per cent by 2040, if countries and companies make deep policy and market shifts using existing technologies. Three critical steps for finding solutions are suggested as;

- ✓ Scenario building for giving projections of future plastic use
- ✓ Highlighting the adverse Impacts and challenges
- ✓ Finding Solutions and taking actions

Our Institute has been contributing to create campaigns to address the issue through its publications 'Climate SAR', delivering lectures, publishing articles in journals and holding workshops about marine debris/ health effects etc. Various initiatives taken to control single use plastics by coffee shops, hotels in India and abroad and use of plastics in road construction in cities in India –Pune, Surat, Indore, Chennai and others were reported in Climate SAR. 'University News' published our article on 'Beat Plastic Pollution – Towards Swachh Bharat Abhiyan' with Dr Sandeep Chatterjee as co-author. At the invitation from Dr.

M. Sudhakar then Director, Center for Marine Living Resources, Kochi under MoES, we conducted the workshop on 'SDG 14 – Life Below Water' at Kochi in September 2019.

India's theme for the World Environment Day 2023 is LiFE (LiFEstyle for Environment) Mission. Through this mission India will put forward and propagate a healthy and sustainable way of living based on its traditions and the values of Conservation and Moderation, throughout the world. Circularity actions for waste management involve addressing challenges of Employment, Sustainability, Growth, Skills, Education and Awareness. Waste minimization and Energy recovery would be at the core of this.

*"Changing behaviour to moderate consumption is not tokenism, but can reduce global emissions to a large extent"*

- Bhupender Yadav, Union Environment Minister, India.

With this background we proposed following topics for today's Panel discussion,

- Plastic production & waste management for circularity actions
- Urban plastic waste management and challenges
- Scientific solutions to curb plastic pollution
- Tackling plastic pollution in Seas

We look forward to insightful deliberations.

Thank you for your attention!

## **Keynote Address**



**Ms. Beate Langset, Counsellor, Climate & Environment, the Norwegian Embassy, New Delhi**

Ms. Beate Langset, Counsellor, Climate & Environment, the Norwegian Embassy, New Delhi delivered Keynote address. She has been Director of Information in a Municipal Waste Company and has vast experience in circular economy. Ms. Langset, thanked Dr. Malti Goel and wished everyone happy World Environment Day. She said it is an honor to be here among all these doctors and professors. Plastic pollution no doubt is a big challenge all over the world and millions of metric tons of plastics are produced every day. While half of this plastic waste is recycled, incinerated or discarded into landfills, a significant portion of what remains ends up in our oceans. There is Plastic waste thrice the size of France in the Pacific Ocean between California and Hawaii.

She referred to an article in the magazine Visual Capitalist that India is one of the largest contributors of plastic waste. Most of the plastic waste found in the deep blue waters comes from poor waste management in different parks, beaches or along the storm drains lining our streets. Bits of plastic waste are carried into our drains, streams and rivers by wind and rainwater runoff, they turn into plastic superhighways, transporting the plastic to the oceans to create a vortex of plastics. According to a study, countries with a smaller geographical area, longer coastlines, high rainfall and poor waste management systems are more likely to wash plastics into the sea. For example, China generates ten times more plastic waste than Malaysia, whereas 9% of Malaysia's total plastic waste is estimated to reach the ocean in comparison to China's 0.6%. Many high-income countries, like Norway generate high amounts of plastic waste. But they are either better at processing it or exporting it to other countries. Meanwhile, many of the middle income and low income countries that both demand plastics and receive bulk exports have yet to develop the infrastructure needed to process it.

As a counsellor of Climate and Environment at the Norwegian Embassy, she has had the opportunity to travel in south east, west and north parts of India. The cities have the key role in fighting the challenges and develop solutions regarding plastic pollution in India. It was interesting to see how different cities tackle waste management. The cleanest city Indore had holistic thinking and is a genuine Circular Economy. The waste management sector employs 75,000 people and involves all levels, from the street sweepers to the recyclers, managers and politicians. It was not only the technical and digital solutions that were impressive, but also how the citizens had changed their behavior and how proud they were to live in Indore.

There are two factors that must be in place to succeed, (i) Systems and (ii) Commitment. Relating to her experience in Norway, where she worked with waste management and circular economy for more than a decade, she said Norway is a small country with 5.5 million people. It has pretty well developed infrastructure for waste segregation at homes in paper, plastic, metal, food waste, hazardous waste, etc. This system works, but it is dependent on individual dedication. In addition to that, more and more cities invest in innovative technology, sorting solutions. Norwegian solutions may not suit Indian cities, but knowledge sharing is important. Several Norwegian companies are now investing in waste management in India. TOMRA is a great example on how Norwegian technology can be used all over the world. TOMRA recycling has pioneered the use of sensor based technology for automating the recovery and recycling of different types of waste. To date, more than 9,000 systems have been installed in 100 countries worldwide, including India. TOMRA has invented the reverse vending machines. Every supermarket in Norway has these machines where you can put your bottles or your cans into this vending machine and get money back. With approximately 82,000 installations in over 60 markets, TOMRA captures more than 45 billion empty cans and bottles every year.

She cited an example from Norway-India cooperation, which is there from 1953 onwards. In 2019 the joint Task force on Blue Economy has been launched following a decision by the Prime Ministers of Norway and India in 2018. Both prime ministers agreed that Blue Economy can deliver economic growth, new jobs, improved nutrition and increased food security, if managed sustainably. The blue economy cooperation is therefore among one of the main pillars of our Norwegian-Indian bilateral relationship. It has catalyzed increased cooperation on marine pollution and green & environmentally friendly solutions. Combating plastic pollution and marine litter is a key priority of both Norway and India. And since 2019, a number of projects have been started under the Indian - Norway marine pollution initiative. Improvements of waste management through co-processing of non-recyclable plastic waste are initiated in cities like Gurugram and Agra and in coastal areas. Testing and monitoring chemical and plastic waste in rivers and recycling on construction

and demolition waste was done with pilots in Delhi and Goa. In Mumbai, Norway is supporting work on cleaning up beaches and is helping local communities to adapt sustainable practices.

Norway and India have an extensive dialogue on enhancing the circular economy and reducing pollution of rivers and oceans. Norway considers that digitalization and digital business models are key enablers of the transition to circular economy. An involvement from private sector is an important part of the Norwegian strategy. By developing new knowledge, technology and business models, waste can become a valuable resource and even the source of new industries and local employment. We should look at waste not as a huge problem but as a resource with possibilities for innovation, for higher income, for sustainability, for a better environment, for more jobs and for more secondary raw materials.

She expressed happiness that this workshop that has its focus not only on challenges but also the solutions. Awareness and capacity building are main factors for less plastic pollution. She conveyed best wishes for a fruitful workshop.

**Ms. Langset responded to several questions from the audience.**

## Panel Discussion

### Opening Remarks



**Prof. G.D. Sharma, Former  
Secretary, UGC and Ex-Director,  
CEC**

Prof. G.D. Sharma chaired the Panel Discussion on 'Cities and Plastic Pollution'. In his opening remarks he recalled when there was no plastic, we used to carry our cloth bag to collect the products. Milk distribution in a city was through glass bottles not the plastic bags. With the advent of plastics both solid and liquid products were started being carried in them and plastic uses are expanding every day. He recalled a visit to Yemen made a few years back. All along the way while travelling from Sanaa to Taiz in Yemen, fields were littered with the plastics. Obviously, plastic pollution is not only a problem of cities, but of every area. In the flood structures of Taiz, plastics would block so all flowing water was affected. There was need to educate people to not to throw the plastics in the flood structures. Therefore he suggested to them to announce it from mosques and temples as one of the important environmental requirement. It was needed to create awareness campaigns for controlling plastic pollution. In advanced countries like Paris, consistent effort to reduce plastic pollution has been made and we find there is very less littering of the plastic on the road.

He suggested that it is desirable that we find solutions to plastic pollution control by innovative ways. We need to think differently; for ex. collection of plastics from the homes, like it is being done for newspapers. When there were no plastics the food was served on the banana leaf that was biodegradable. An example of innovation is ice creams plastic cones that are now replaced by edible cones. Policy initiatives need to be introduced; for

manufacturers of plastic, suppliers of plastic to the distributors, and for the individual effort. Use of plastics in hot foods is another major health hazard.

He said the education is first foremost step at home and in the social community. Kind of a movement; '*No smoking, No plastic*' has to be started. Other initiatives are needed to be taken for developing a new material which is good, irrespective of liquid or non-liquid use. Biodegradable plastic is also an option.

Finally, we have great panellists in this group and I am sure some of these questions will be answered. He invited Er Sourabh Manuja to make his remarks.

### **Distinguished Panelist**



**Er. Sourabh Manuja, Technical Advisor,  
Deutsche Gesellschaft für Internationale  
Zusammenarbeit (GIZ) GmbH**

Er. Sourabh Manuja talked about the role of digitization as a solution in achieving sustainable waste management. Waste includes plastics that lead to marine litter. He said while discussing about awareness and capacity building related to plastics, it is not a question about city or a country being small or large, but it's about how close they are to the coastal lines. A good question could be; is plastic an issue? Answer would be; maybe, or maybe not. He said from GiZ as technical waste management advisor he is working under a project to develop a network website with Ministry of Housing and Urban Affairs and would like to share the findings here. A platform where cities, states, material recovery facilities can basically collect data on waste, provide information to recyclers, and industries and cement plants has been developed.

Two main global challenges due to waste management are; Marine litter and Global warming. Globally, we are putting roughly 11 million tons of plastics every year into ocean.



About 150 million tons is already existing and floating in oceans. Two of the 10 world's most plastic carrying rivers are Ganga and Brahmaputra from India. In waste management scenario, the sustainable waste management hierarchy very clearly indicates that we should target to reduce, reuse and then only go for recycle. Mapping across three cities viz., Kochi, Kanpur and Port Blair has been done to find where littering is taking place and how is litter entering into marine environment. Then we started strategizing how this waste can be managed more appropriately. We identified hotspots in these cities and developed a digital monitoring platform for tracking the waste and monitoring its flow. In India regulatory compliance under solid waste management rules said that it is a duty and responsibility of local authorities and villages as well as grand panchayats to set up material recovery facilities.

India consumes 13.6 kilograms per capita per year of plastics, which is less than global average of 30 kgs per capita per year. A baseline study was conducted in 2021. More than 85 consultations took place to identify what is it that recyclers want? How many types of waste materials? If we say plastics, how many type of plastics? In which color, condition, packaging do they need it? If you say paper, how many types of paper, newspaper, duplex, two ply cardboard, or five ply cardboard, in what color, condition, packaging they need it? A portal called *SanSadhan* has been developed with 52 parameters identified. The portal is basically a connect between material recovery facilities at city, state or national level.

Currently the portal is on pilot stage with eight cities. The portal tracks what is available for recycling, what is sent for disposal, what is available in stock, how much was sent for energy recovery and how much was sent for road constructions. It could track 14 types of plastic sub-categories to see what was sent out for recycling, what was available in stock, what is there sent out for energy recovery. A rigorous monitoring has been made possible through mobile phones. Such information data bank facilitates different user groups at national level, state level, ULBs, MRFs as well as companies for managing their waste including plastic waste. It assists in reducing marine pollution especially in coastal cities and cities on the river banks.

His detailed presentation can be viewed at the link;

<https://drive.google.com/file/d/1VGoZjS1oWARXljg01oNWdf1P69M6tNlj/view?usp=sharing>

## **Distinguished Panelist**



**Dr. Shyamala K. Mani, Professor (Retd.)  
NIUA, Sr. Advisor, Public Health  
Foundation of India (PHFI)**

Dr. Shyamala K. Mani thanked the Chairperson and the Moderator. She congratulated students who performed on Plastic Waste and complimented Dr. Malti Goel for inviting her for this workshop, which is very lively. She pointed out that global plastic production amounts to 390.7 million tons. India is having a share of only 6.4%. About 42% of overall plastics all over the world is getting consumed by packaging. Use of biodegradable plastic is in the range of about 1%. The major issue of plastic pollution is that 79% of the total plastic produced in the world is entering into our environment. Barely 9% of the total is being recycled. In a door-to-door project survey in Bangalore it was found that, two thirds of the plastic from MRFs is landing without recycling.

Plastic comes from petroleum and it is known as virgin plastic. With her vast experience on healthcare waste management and life cycle studies on plastic waste; she explained harmful effects of plastics, particularly incineration releases gases that increase carbon footprints and cause climate change. Air quality monitoring was done to know what kind of recycling was happening, what kind of products are being made. From the field studies supported by CPCB, plastic waste management recycling rules 1998 were announced, especially banning the use of recycled plastic for beverages and also for food packaging. In 2011 & 2016 Amendments came out and in these the government permitted use of plastic bags of thicknesses from 20 microns to 50 microns and 75 microns to 120 microns, respectively.

Despite many regulations it is noted that plastics production has almost doubled between 2000 and 2020. Plastic pollution life cycle, from extraction to dumping, is becoming almost circular into the ocean and into the environment. She pointed out many adverse health

impacts of plastics and suggested that alternatives to plastics in the vital sectors and banning of single use plastics; are the way forward.

Her detail abstract can be seen at page no. 27 and her presentation can be viewed at the link;

<https://drive.google.com/file/d/1QTEcAzxtPFoRI4oIpKxUOXHCE1gpOJrR/view?usp=sharing>

### **Distinguished Panelist**



**Dr. R. Venkatesan, National Centre for Coastal Research, MoES, Chennai India  
Formerly Scientist G – NIOT Chennai**

Dr. R. Venkatesan was connected on zoom from Chennai. At the outset he said he would cover all the issues related to marine environment. The vital issue has been how plastic reaches the ocean. His early research on how the plastic has reached Nicobar coast was published in 2003. A recent UNESCO report talks about the 1600 rivers bringing plastic to the ocean. They are all located close to the major cities. That is why today's discussion is important on how cities are contributing to marine pollution. There are also aquatic phenomena where this plastic gets circulated and finally it could be reaching the seabed. Floating plastic gets disintegrated in the micro plastic and nano plastics and like tiny fibres they are at the mid-water column, so they may not be reaching to the seabed or they may not be floating to the surface.

Currently, it is assessed that there are about 50-75 trillion pieces of plastic and micro plastics in the ocean. He showed pictures of what has gone into the deep ocean even the deepest part of the earth. When the diving vessel has gone down they found the plastic over there. In Arctic, India has installed India's Arctic Observatory and micro plastics were seen there. He described Ministry of Earth Sciences project in North Indian Ocean for collecting these plastic debris in the ocean. Studies have been carried out on the oceanographic parameters how does the plastic get circulated. Few years ago a container

load of the plastic toys were dropped into ocean and the former President of the US spoke how these were brought in the Pacific. The surface current that were accumulating these, could be pictured from the satellite.

He said modelling study of plastic waste movement were carried out when plastic was dropped in Chennai coast and reached the Pondicherry after few days. He explained the technique being developed and used for sampling in the water column, using scanning microscope. Finally images on the microscope are analysed on how plastics get in this integrated water in different sizes. When a long fish was caught and cut open, we found a bottle cap inside the animal fish body. Studies in Arabian Sea close to the Lakshadweep Islands, which are pristine having lots of coral reef, had plastic which could have entered mainly because of the ship traffic. Many other studies were described.

He concluded by saying that at present Government is taking a lot of measures. Stringent activities have begun to stop plastics and debris getting into oceans. Individuals have to change so that this plastic waste is controlled. Even though it may be out of your house, but if there is a way by rain or in the sewer, it could reach the ocean one day or another. Once it gets into the ocean it will remain forever. He said, we need greater awareness to have various activities at individual level to reduce plastic use to stop polluting the oceans.

Dr Venkateshan' detail abstract can be seen at page no. 28 and his presentation can be viewed at the link;

<https://drive.google.com/file/d/1LUWIFVrAFwuaSxzPyHw1IPWIfHS9X65-/view?usp=sharing>

### **Distinguished Panelist**



**Prof. S. Ahmad, Former VC, Jamia Hamdard and Director CEERI, Pilani**

**Prof. S. Ahmad**, at the outset said that he is an electronic engineer and appreciated that the participants from different disciplines are here. However, his ideas are different from what others have expressed. He said that contribution of the panellists should be more to address the problem. He suggested a friendly approach towards plastics, to make it usable instead of trying to destroy it. The plastics are made of strong covalent bonding and they are difficult to manage and difficult to manipulate.

He said some bacteria can break strong covalent bonds in plastics. Plastic eating mushrooms have been developed. People have made magnetic coils to put it into sea and manage plastics. There is enzymatic recycling also; plastics can be recycled by making it react with enzyme. These enzymes work as catalyst to make bio plastics. One needs to look towards nature and find out how these things are being done in nature for millions or trillions of years. A company has started working on recycling of plastics and making useful material out of that. Plastic is a very, very peculiar material. In Materials Sciences, basics of bonding of hydrogen, carbon, nitrogen and other compounds like heavy metals which when get detached cause pollution, needed to be understood. One needs to look in multidisciplinary way, in a very systematic manner to modify the material for making it useful where it is needed and not to use it where it is not needed, because of cost.

Thank you

### **Distinguished Panelist**



**Ms. Shweta Frederick, Teacher, St. Thomas' Girls Sr. Sec. School**

Ms. Shweta Frederick represented Dr. Anuradha Amos, Principal, St. Thomas' Girls Sr. Sec. School. She apologised on behalf of the Principal who really wanted to be here and speak, and said she wishes each one of you a very happy environment day. She thanked the



chairperson, distinguished panellists, Dr Malti Goel and all delegates for this opportunity and honour. She said for a 'common cause' we all are so committed for a better environment.

She talked about Eco-Club initiatives from the school. Delhi government had started setting up eco clubs around 2001 and made it almost compulsory for every school to have an eco-club. St. Thomas School has started earlier and has an eco-club for almost 25 years now. The school is creating awareness among children and they are taught and are inspired to take care of the environment. In the last 15 years or so, there has been a lot of emphasis on plastic pollution control. It is ingrained in each mind that plastic is a huge big monster & we all had to get rid of. She gave examples of how school came together in an initiative to phase out single use plastic. It is being done by making a huge poster put up on the wall, for everyone to see and write their thoughts on it. Workshops are held for students to make them aware of segregation; how to do segregation at homes? What kind of waste should be segregated and put in what kind of bins? Variety of plastic waste was collected and ways for its disposal responsibly were discussed. Students, who committed in the waste segregation team, were in class 6 and they are now in class 11. They are our **waste management team** and are heading it. They supervise every class and check whether the plastic has been segregated. The school also started segregating paper and its recycling to make items which can do away with single use plastic.



At this juncture Ms Shweta said that it has been pointed out to them on certain occasions that one cloth bag or one paper bag will have more embodied energy than a plastic bag. It is better to use a sturdy plastic bag which will last for years than to use a paper bag or a cloth bag which might just get torn. She requested esteemed panel here to enlighten her on this issue.

In conclusion, Ms Shweta Frederick informed that school is taking many other initiatives by associating with different organizations and sharing knowledge with students, related to science, social science, and other subjects, including maths the need for lifestyle for environment. She quoted from Jane Goodhall, *'what you do makes a difference. You have to decide what kind of difference you want to make'*. The choice is yours.

Thank you so much.

This was followed by a discussion

**Dr Malti Goel** in response to her query about a cloth bag vs plastic bag made following observations. She said, we should not forget that every new technology faces challenges in terms of cost and social acceptance, and dilemmas it may face in future use. Advent of plastics; a disruptive technology in 1960s, was seen as an alternative to conserve precious earth resources and metals. Use of plastics for replacing conventional materials was encouraged in all walks of life, as CO<sub>2</sub> footprints became smaller when plastics being lightweight, cost effective and durable were preferred. They not only conserved metals, but also energy and forests, so solutions to climate change. The crisis emerged when we learnt more about it and collection of plastic waste on land and sea have led to reversing that. It is true that embodied energy of a cotton or paper bag is higher than a plastic bag. However, single use of any bag is a worst choice. We now need to find new technology to get the solution for plastic litter. It is like "Technology introduces problems and Technology is the solution."

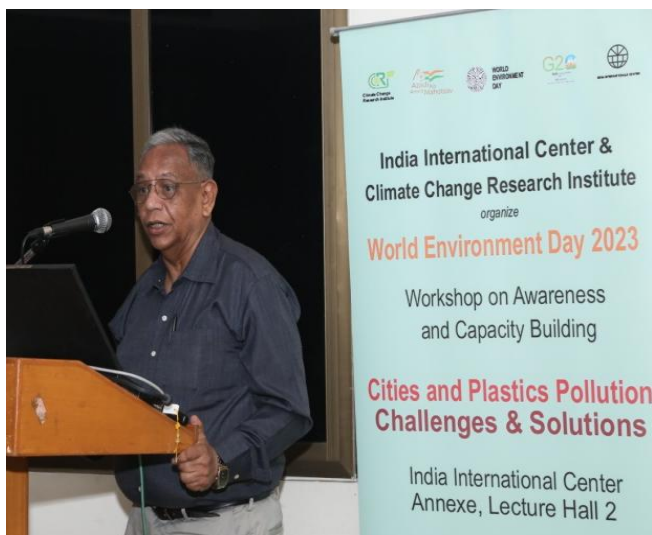
**Prof G. D Sharma** observed that some countries have developed the technology for managing plastic waste and you don't find littering anywhere. But in some scattered plastic waste has large impact in terms of clogging of the rains, eating of the plastic by the animal has become another issue. When you go to cancer department in the Delhi in the AIIMS the first and foremost thing people come and teach that don't use the plastic bottles. There will be always an opinion on certain subject. One is a scientifically based opinion; the other is from experience from the loss which takes place in the society. He observed that one needs to examine whether to ban the production of plastics or to develop a technology which would reduce the harmful effect of the plastic. More discussions followed.

Ms Shweta's presentation can be viewed by the link;

<https://drive.google.com/file/d/1JnAYyH4apx2QSfwxCiqkWeg21sEj4XUA/view?usp=sharing>



## Moderator's Remarks



**Shri Gautam Sen, Ex-ED, ONGC and Ex-Sr. VP Reliance and Moderator for the Session**

Shri Gautam Sen made his remarks on cities and plastics pollution. He thanked the Chairman, all Panellists and said good presentations have been made by Dr. Sourabh Manju, Ms Shweta, Dr. Venkatesan, and Dr. Shyamala Mani to address the issues. They spoke very well on what they are actually working on. To avoid much repetition, his focus will be mainly on two things; (i) scientific solutions to curb plastic pollution, (ii) and to curb marine pollution. He observed plastic pollution, which we have created is a part of our 'natural stupidity'. As we know plastics are made of hydrocarbons; chemically, they are mainly two types, thermoplastics and thermo-settings. They have different properties and different uses; thermoplastics have two-dimensional bonding while thermo-settings have three-dimensional bonding. On heating thermoplastics melt, it can be reused and re-moulded; while thermo-setting plastics don't, they're brittle. Plastics also contribute around 3.5% of the global greenhouse gas.

Many advanced countries have the capability of recycling, reusing, and they are able to solve or manage plastics better. But unfortunately, they are exporting it to those countries; that do not have that capability and the technology, which is why plastic pollution is increasing in the world. China has been a major importer of Plastic waste. However in 2019, China has banned import of plastic waste. Today South East Asia is a major importer. India also imports. Ocean-based plastic pollution originates primarily from the fishing industry, nautical activities and aquaculture. It gets it from urban and storm water run-offs, sewer and through rivers. There are five major gyres (water current movement due to earth's rotation), North pacific, South pacific, North Atlantic, South Atlantic and Indian ocean. Plastic terminates in these gyres.

With the weathering and under the influence of solar UV radiation, wind, currents and other natural factors, plastic breaks down into small particles called micro plastics (particles smaller than 5 mm) or nano plastics (particles smaller than 100 nm). These microplastics, are eaten by sea animals, fish and other ocean animals. Plastics or microplastics, enter into our body when we eat them.

He said microbes are being used to eat up oil spillage, similarly microbes have been discovered who eat away some of these microplastics, though the process is slow. There are about 30,000 known enzymes and their combinations have been found, which can degrade plastics. He described how using technology like AI, ML (machine learning) and simulation, one can work out the kind of combination of an enzyme to break down a particular plastic.

Other scientific solutions are being looked into. A darkly pigmented species of fungus, known as *Aspergillus Tubingensis* in Mushrooms has been found to contain agents that can degrade polyurethane. Nano magnetic coils can break plastics causing around 25% reduction in eight hours by oxidizing plastics. Examples were cited, an Australian company Licella Holdings has developed a new patented technology, known as Catalytic-Hydrothermal Reactor that can convert unrecyclable plastic into oil, includes all kinds of plastics. An Indonesian start-up company has been researching ways of converting seaweed into a bioplastic. Plastic waste can also be converted in useful products, like construction material, breaks, furniture, etc.

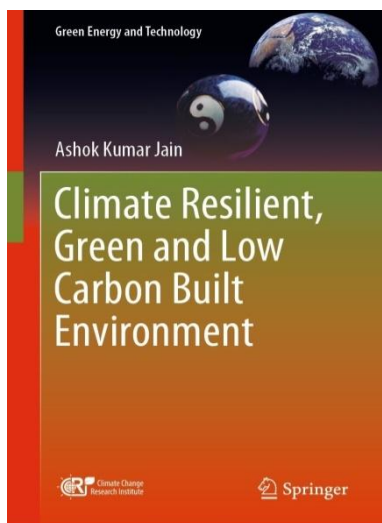
He pointed out that there are global agreements; a Plastic Waste Partnership (PWP) was established under the Basel Convention in 2017 to promote the environmentally sound management (ESM) of plastic waste at the global, regional and national levels and to prevent and minimize its generation. He said benefits will be trillions of dollars, if we are able to reduce our plastic pollution.

**He then invited discussions from the floor and the Panelists responded to the questions and observations from the delegates.**

Mr Sen's presentation can be viewed at the link;

[https://drive.google.com/file/d/1rI1Ya\\_-Ef7u\\_L00kbQURgSZ4lCxfBYb\\_/view?usp=sharing](https://drive.google.com/file/d/1rI1Ya_-Ef7u_L00kbQURgSZ4lCxfBYb_/view?usp=sharing)

## Release of CCRI Book



### **Release of Book on Climate Resilient, Green and Low Carbon Built Environment, 2023**

**Dr (Mrs) Malti Goel** introduced the session and said that after a very enlightening discussions on how we can go about finding solutions for plastic pollution from cities and how we can make lifestyle changes; we are pleased to announce that our institute in collaboration with Springer Nature has published a book on a subject related climate resilient cities. The book titles as “Climate Resilient, Green and Low Carbon Built Environment” is authored by Sh. A. K. Jain, Former Commissioner (Planning), DDA and GC member CCRI. We are extremely thankful to Ms Priya Vyas, Editor, Springer Nature for joining the event and for her dynamic support. She then invited the Shri A. K. Jain to introduce the book and to share his experience.



**Shri A.K. Jain, Former Commissioner (Planning), DDA**

**Shri A. K. Jain** at the outset thanked Dr. Malti Goel for initiating to write a book on this topic on behalf of the Climate Change Research Institute. He said he is grateful to Ms Priya Vyas, Editor from the Springer for all the efforts she has made to produce this beautiful

book and to bring five copies in advance, for today's event. This publication is done by Springer and CCRI together and is a part of the technical series in Green Energy and Technology. This book contains basically 11 chapters in about 150 pages. The motivation was that about 70% of the energy is consumed by the cities and the buildings contributing to 75% of carbon emissions. The book describes how to make urban forms carbon resilient and how such actions can lead to achievement of Sustainable Development Goals. He said the book has a Foreword by a very reputed American architect Christopher Banninger, who is settled in India. He has observed that anyone can open any page, any chapter, need not to read the whole book to get good ideas. Dr. Malti Goel in her foreword message has said that this is a rare book where the practice and pedagogy have been merged together. He requested Ms Vyas to say a few words.



**Ms Priya Vyas, Editor-Applied Sciences & Engineering, Springer Nature, Springer Nature India Pvt Ltd.**

**Ms Priya Vyas** from Springer said that indeed a lot of extra effort has been made to get the book ready today. She had to miss her other engagements to attend the World Environment Day event. She thanked Shri A. K. Jain, Prof G. D. Sharma, Shri Gautam Sen and Dr Malti Goel and said that this comprehensive book has been published under the collaboration of Climate Change Research Institute and Springer Nature. She said many other impressive and ground-breaking researches, which are directly affecting the environment and finding solutions to fight those challenges have been published under this collaboration. Springer Nature is also working actively towards all the Sustainable Development Goals. This book series called 'Green Energy and Technology' is bringing books across the world on emerging topics and is Scopus Indexed. So for all the researchers and scientists getting published in this book series also gets Scopus Indexing, which is a benefit for a researcher or a scientist. I am really thankful to CCRI for putting forth the research of the scientists across.

## Vote of Thanks



**Dr. Neha G. Tripathi, Secretary, Executive Committee CCRI and Ex-Ass Prof. SPA**

Dr Neha Tripathi conveyed vote of thanks and said that on behalf of Climate Change Research Institute (CCRI) I thank everyone and I will be brief as the time is running out. She said the programme began with imposing performance of Nukkad Natak by the girls from St Thomas Higher Secondary School. About solutions to plastic pollution, we all are greatly enlightened from the discussions today. She thanked all distinguished panellists and the Chairperson. Perspectives and views from policy makers, scientists, engineers, NGOs were shared. She thanked IIC for facilitating this event and giving us this opportunity to share information and bring awareness to everyone. She wished happy environment day to all and said that we should take a pledge not just for today to be plastic free, but *'less plastic day can be every day'*. She then invited everybody to join for tea upstairs on the ground floor before leaving. Thank you



## Pre-Workshop Abstracts

### Cities and Plastic Pollution – Challenges and Solutions

Dr. Shyamala K. Mani

The global plastic production is estimated to be 390.7 million tonnes per year and that of India is 25 million tonnes a year, 6.4% of global share as per data published in Feb 2023. Globally, 42% of overall plastics produced are consumed by packaging sector and 17% by the construction sector, whereas in India 35% is consumed by the packaging sector and 23% by construction sector. Bioplastic production is 1% out of 300 million tonnes of conventional plastics produced annually.

A global material balance study on plastics points out that **79 per cent** of the total plastics produced in the world enters our environment as waste. Only **9 per cent** of the total plastic waste in the world is recycled. A Central Pollution Control Board (CPCB) report (2018-19) puts the total annual plastic waste generation in India at a humungous **3.3 million metric tonnes per year**. Even this data, frightening as it is, might be an underestimation. While India's plastic waste problem is not as huge as that of the rich world, it is, growing. Richer states like Goa and Delhi produce as much as **60 grams and 37 grams per capita per day** respectively – against a national average of **8 grams per capita per day**.

The challenge in Indian cities and now in rural areas too is that citizens resort to using plastics for single use like carry bags and as packaging or for multiple use like water bottles for the sake of convenience with very little thought for the environment or public health. Their argument often is that if plastics are bad for the environment and health, then the government should ban it and close the industries manufacturing them. The government, on the other hand, feels that instead of banning an industry, it may be prudent to regulate it. Therefore from 1999, Indian government has made rules under EPA 1986 to regulate usage of recycled material for food and beverage packaging. Plastic Waste Management Rules, 2011, 2016, increase the thickness of the plastic carry bags from 20 microns to 50, 75 and now 120 without placing a ban on the use of any category of plastics.

Life cycle study of plastic waste conducted in India since 1996 shows that certain categories of thermoplastics like Styrofoam or Polystyrene, PVC or Poly Vinyl Chloride, PUR or Polyurethane and different categories of thermoset plastics like melamine and plastics in e-waste having flame retardants are extremely hazardous to the environment and produce bi-products during their manufacture and recycling, which cause irreparable damage to the human body. Furthermore, additives and chemicals used in the manufacture and remanufacture of plastics are easily liberated during dismantling, thermal and chemical processes. Incineration releases chemicals that enter the body, becoming a part of the food chain causing bioaccumulation, carcinogenesis, and mutagenesis. Indiscriminate use and disposal of plastics increases carbon footprint and causes microplastic generation and accumulation in the land and marine environments.

Therefore, governments all over the world need to recognize that the plastic problem is not an issue of mere regulation and voluntary action since it is affecting the health and environment at such a rapid rate that it is threatening the viability of the human species. Alternatives to use of plastics in the vital sectors can be useful although it is a question of behavioural change to go back to reusables and sustainable materials friendly to Nature.



## **Inland to the Ocean: Transport, Mixing, and Fate of Plastic Pollution in the Ocean**

Dr. R. Venkatesan

Marine Plastics is the most common and exponentially increasing human pollutant in the world's ocean. The plastic trash enters the sea and degrades physically and chemically in the water, breaking down to minute bits of plastic debris known as microplastics. Plastics on the beach degrade due to weathering, resulting in surface embrittlement and microcracking, producing microparticles transported into the sea by wind or wave action. In the open ocean there are no boundaries for these plastics to drift and settle down on the sea bed. UNESCO reports that 1600 rivers in urban cities all over the world bring marine debris to the ocean. The Indian Ocean rim countries have the highest population densities globally. Unique atmospheric, oceanographic, and topographic features of the Indian Ocean that has an effect on the plastic distribution, such as reversing wind directions due to the monsoon, fronts, and upwelling regions and to be addressed as a global menace rather than local issue. The microplastics transfer in a vertical column is from surface water and through lateral transport by underwater circulation. Microfiber is the most common type of plastic found in the Ocean. A systematic study was undertaken by the Ministry of earth sciences to assess marine/micro plastics in open ocean on board research vessels for 2 years. Systematic sampling was done on the surface, midwater and sea bed in 100 locations far away from shore in deep sea covering seasons monsoon, pre monsoon and post-monsoon in seven expeditions during 2018 and 2019. Sampling was done in the international shipping route (IS) and in selected river discharge areas (Coastal locations). Our study showed that microplastics are observed in almost all the locations in the Open Ocean in different seasons.

In this regard the management practices in India, such as LiFE- Lifestyle for Environment, which encourages individuals to adopt sustainable practices, such as eco-labelling of beaches, trash booms in urban rivers, implementing the polluter pays principle, ensuring healthy oceans, and promoting a sustainable blue economy are progressing well. The Government of India's effort to control plastic waste management with Extended Producer Responsibility is an approach where the producer is mandated via policy for treatment and/or disposal of plastic packaging waste. This EPR framework for used tyres, batteries, and revised rules for e-waste and plastics kindled interest among the G20 countries. The amount of solid waste generated in coastal city Chennai is around 5200 tonnes per day and the majority of it can reach the Bay of Bengal. Fishing activity leaves broken or abandoned fishing gears left on the seabed leading to Ghost fishing gears. The Department of Environment of Government of Tamilnadu joined with the Department of Fisheries to initiate a programme to encourage fishermen to bring back used or damaged fishing gears with incentives. Finally, we as individuals have to change our lifestyle. No matter how many acts of legislation come Together, we can do better is the best solution. We can bring about a simpler life without endless waste — a life where people and the planet flourish. Let us work to leave this earth best to live for future generations. Technology can help us to save this planet. But more than anything, we must learn to value nature

Keywords — Microplastics, Microfibers, water column, Indian Ocean



## Climate Change Research Institute

World Environment Day, 5<sup>th</sup> June 2023, at Lecture Hall 2, IIC Annexe, New Delhi

### List of Participants

<b>S. No.</b>	<b>Name of Participants</b>	<b>Designation/ Organization</b>
1.	Ms. Beate Langset	Counsellor, Climate & Environment, the Norwegian Embassy, New Delhi
2.	Er. Sourabh Manuja	Waste Management Advisor, CCP-ME, GiZ
3.	Dr. Shyamala Mani	Professor (Retd.), NIUA, Delhi, India
4.	Prof. S. Ahmad	Former VC, Jamia Hamdard
5.	Dr. (Mrs) Malti Goel	President & Chief Executive, CCRI
6.	Shri Gautam Sen	Ex-Executive Director, ONGC and Ex-Sr. VP, Reliance
7.	Shri A.K. Jain	Former Commissioner (Planning), Delhi Development Authority
8.	Shri Suresh Goel	Suresh Goel & Associates
9.	Dr. Neha G. Tripathi	Ex-Ass Prof, School of Planning & Architecture
10.	Sh. R.C. Nakul	Aston Energy Pvt. Ltd.
11.	Sh. V.S. Verma	Former Member, CERC
12.	Prof. G.D. Sharma	Ex-Director, CEC and Former Secretary UGC
13.	Sh. L.K. Bansal	Retd. Bank Manager, PNB
14.	Sh. Neeraj Gupta	Ex-AGM, NPCC
15.	Dr Anil Kumar Vashishtha	Delhi State Science Teachers' Forum
16.	Mr Abhinav Roy	Motilal Nehru College
17.	Mr Pranav Raj Sharma	Motilal Nehru College
18.	Ms Shweta Frederick	St Thomas Girls Sr Sec School, Mandir Marg
19.	Dr Anjana Sen	Independent
20.	Dr Priyanka Chaudhary	Brilliant Convent School, Pitam Pura, Delhi

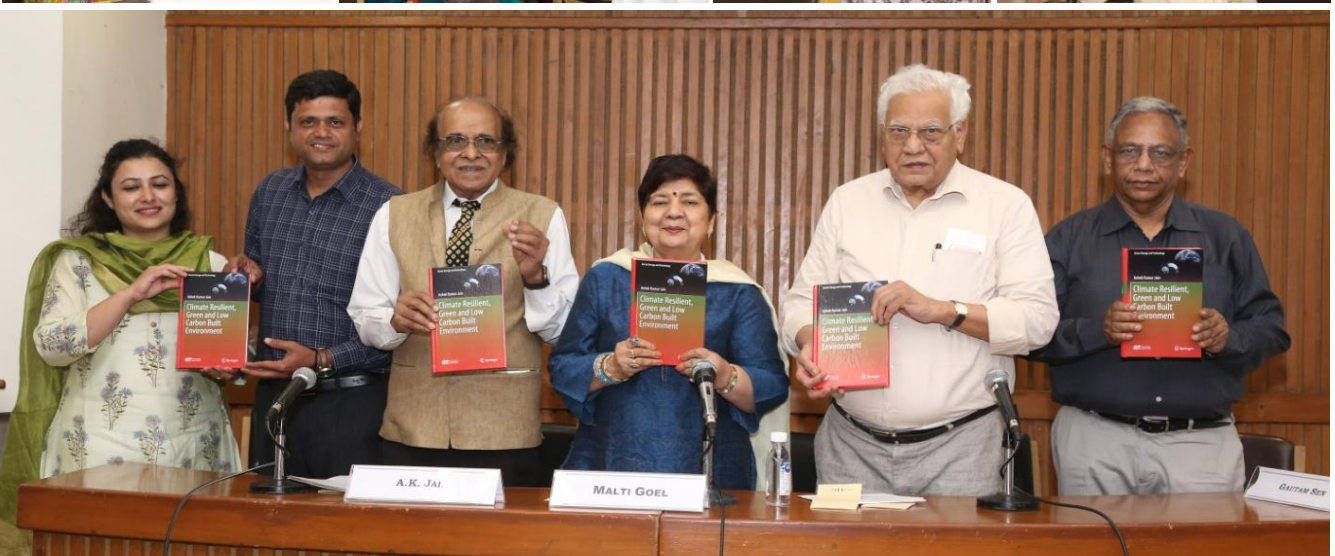
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32.	Mr Yogi Raj	Freelance
33.	Dr Anu Jindal	Purple Streak centre for Arts
34.	Ms Purnima Gupta	Former Economic Adviser, Govt. of India
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37.	Mr A. K. Goyal	UNESCO
38.	Mr Rajan Anand	Healing Touch
39.	Mr Vishal	Scorpio Post
40.	Mr Ishwar Singh	CPCB/ MoEF & CC (Formally Add. Director)
41.	Ms Chandani Mehra	Lawyer
42.	Mr Ashok Kumar Verma	Lawyer
43.	Er K. K. Roy Chowdhury	Independent Consultant
44.	Mr M. C. Garg	Self employed
45.	Mr. Prabhu Razdan	Center for Social Development & Research Foundation
46.	Mr Divyanshu	VR AR MR

47.	Mohammad Abrar	Climate Change Research Institute
48.	Pankaj Kumar	Suresh Goel & Associates
49.	Amit Kumar	Sandeep & Suresh Goel Associates
50.	Ms. Aarti Rajput	Climate Change Research Institute

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