

ISSUE 1 | VOL. 06 | JUNE 2023

NEWSLETTER

VOICE OF ENVIRONMENT

A SCIENTIFIC AND ENVIRONMENTAL RESEARCH
ORGANIZATION

CARBON AND CLIMATE CRISIS



WWW.VOICEOFENVIRONMENT.ORG



Voice of Environment Newsletter

June 2023 * Volume 06 * Issue 01

Editors

Moharana Choudhury

Dr. Priyabrata Roy

Dr. Anu Sharma

Cover Page Editor

Dhanjit Gogoi



© All Rights Reserved by Voice of Environment 2023.


Dated-14-07-2023

I have learned that enthusiastic and committed researchers are bringing out a Voice of Environment (A Scientific and Environmental Research Organization) Newsletter with Volume **06 Issue 01, 2023** on **CARBON AND CLIMATE CRISIS**.

Carbon emissions lie at the core of the climate crisis. The excessive discharge of carbon dioxide and other greenhouse gases stemming from human activities amplifies the greenhouse effect, resulting in global warming and its catastrophic outcomes. Swift action is imperative to curtail carbon emissions and tackle the climate crisis.

This is very high time to understand the environmental concern of the current climate crisis by all of us. Let this Newsletter shall carry forward a positive, strong message regarding combating the globe on carbon and climate crisis.

Best wishes to the editorial team of the Voice of Environment Newsletter and all the contributors of this issue of the VoE Newsletter.



(Dr Rajeev Pratap Singh)

A brief account on Voice of Environment (VoE)

A group of university students began to organize activities like public awareness camps and discussions among pilgrim groups and other citizens to spread awareness regarding environmental conservation, especially for the holy river Ganga, during the Khumb Mela event at **Haridwar, Uttarakhand, in the year 2010**. Later, this group extended their work to spread such awareness more significantly and elsewhere by using social media and other means. Gradually, this mission aspires to expand its reach to global environmental conservation and protection programs. Thus the inception of Voice of Environment (VoE) an organization (**A Scientific and Environmental Research Organization**) Voice of Environment" was officially registered on 30th October 2014, under the **INDIAN SOCIETIES REGISTRATION ACT XXI OF 1860** in Guwahati, Assam. Voice of Environment is a non-governmental environmental organization dedicated to nature safeguarding, environmental research, and human welfare.

Editorial Message

Dear Readers and Nature Lovers,

The 1st issue of Volume 6 of the Voice of Environment Newsletter is now available!

First and foremost, this issue aims to address climate change and ensure a pollution-free, long-term future. The goal of this issue is for it to be a communal endeavor. However, we intend to do all possible to ensure our newsletter contains fascinating, provocative articles that appeal to a broad spectrum of researchers, environmentalists, and practitioners. Finally, we'd like to thank various individuals whose assistance and support have made our third issue possible. All of our well-wishers and supporters deserve our gratitude. We also appreciate any feedback that will assist us in formulating our future problems more entirely and scientifically.

Editorial Team,

Voice of Environment

(A Scientific and Environmental Research Organization)

Carbon and Climate Crisis

Rakesh Choudhary
Laboratory of Environment Sustainability and Energy Research
Department of Civil Engineering
National Institute of Technology Delhi, Delhi, India
Email: environmentrakesh@gmail.com

The Change in climate and the carbon crisis are the most concerning environmental challenge of this era. The two are closely linked, as fossil fuel burning is a significant wellspring of carbon dioxide emissions, the primary and essential driver of global warming and climate change. In this article, we will explore the connections between carbon and climate and discuss the steps that can be taken to address this critical issue.

Carbon dioxide (CO₂) is the most important greenhouse gas, trapping heat in the atmosphere and causing global temperatures to rise. As CO₂ levels increase, the impacts of climate change become more severe. Rising sea levels, changes to weather patterns, increased droughts and floods, and species extinction are all consequences of global warming and climate change. The consumption of petroleum products is the principal supporter of increasing CO₂ levels in the environment. As the global population continues to grow and the demand for energy increases, so does the need for more fossil fuels. This creates a cycle of consumption and emissions that is driving global temperatures higher and devastating environmental effects.

To address the carbon and climate crisis, minimising global carbon emissions levels is necessary. This can be accomplished through a series of techniques, for example, expanding the utilisation of sustainable power sources, further developing energy effectiveness, and carrying out carbon estimating and other market-based solutions.

At the same time, it is essential to invest in adaptation strategies to help individuals, communities, and countries prepare for the impacts of climate change. This includes investing in infrastructure and technologies to help mitigate the effects of extreme weather events and supporting vulnerable communities and species.

There are several ways in which individuals and organisations can help to reduce their carbon footprint and mitigate the impacts of climate change. Some actions that can be taken include:

1. Reduce energy consumption: switching to energy-efficient appliances, turning off lights and electronics when not in use, and using natural light and ventilation that can help to reduce energy consumption and associated greenhouse gas emissions.

2. Use renewable energy: investing in renewable energy sources such as solar, wind, and hydropower can help to reduce reliance on fossil fuels and low carbon emissions will occur.
3. Reduce waste: adopting practices such as recycling, composting, and reducing single-use plastic can help to reduce waste and associated greenhouse gas emissions.
4. Support sustainable transportation: choosing to walk, cycle, or use public transport instead of driving alone can help to reduce carbon emissions from transportation.
5. Plant trees: please absorb carbon dioxide from the atmosphere through photosynthesis and help mitigate the impacts of climate change. Planting trees or supporting reforestation efforts can reduce carbon emissions and promote biodiversity.

In addition, reducing carbon emissions is crucial to mitigating the impacts of climate change. While global action is needed to address this complex issue, individuals and organisations can also play a role in reducing their carbon footprint and promoting a sustainable future.

Top of form ultimately, the carbon and climate crisis is a complex and interconnected issue that requires comprehensive and collaborative action from individuals, businesses, and governments. While the challenges are daunting, there are solutions available that can assist us with reducing emissions and alleviating the effects of environmental Change.

To overcome the effects of environmental Change over ozone-depleting substance emissions is necessary. This can be accomplished through different means, for example, switching towards environmentally friendly power sources further developing energy effectiveness, and reducing deforestation. Additionally, using carbon capture and storage (CSS) technologies can help reduce carbon dioxide emissions in some industrial processes and power generation.

In conclusion, carbon and climate change are closely linked with human activities driving a significant increase in atmospheric CO₂ concentrations. The resulting global warming and associated impacts significantly threaten human societies and the natural world. Immediate actions may help reduce greenhouse gas emissions and overcome the impacts of climate change.

References:

1. Intergovernmental Panel on Climate Change (IPCC). (2018). Global Warming of 1.5°C.
2. NASA. (2021). Global Temperature.
3. International Renewable Energy Agency (IRENA). (2021). Renewable Capacity Statistics 2021.
4. U. S. Environmental Protection Agency. (2021). Reduce Greenhouse Gas Emissions.

Climate Education and Youth Activism to Combat Climate Crisis

Poulomi Chakravarty^{1*} and Sai Gattupalli²

Department of Environmental Sciences, Central University of Jharkhand, India¹

College of Education, University of Massachusetts Amherst, USA²

*Email: cpoulomi25@gmail.com

Abstract:

The climate crisis is a global issue that requires urgent action not only from the governments, and organizations but also from individuals. There must be a conscious effort on our part to understand the implications of climate change and be aware of our decisions for the sake of our future generations. The collective effort from individuals to communities will lead to better policies and implementations by our decision makers in charge. The first step towards tackling the climate crisis and reducing our ecological and carbon footprints is climate education. The stakeholders to be affected maximum are the youth and the younger generation of humans and other organisms alike. The only effective way to combat climate change is to take positive climate action and educate our youth and young learners about the science of climate, the causes and impacts of climate change and mitigative measures. The authors aim to emphasize the impact of climate education on young people's engagement in climate activism and their role in understanding and abatement of the climate crisis.

Climate Crisis and Global Impact

Climate change has transitioned from being just a debatable topic to becoming a pertinent issue that requires immediate attention through scientific and sustainable policies and solutions. As each individual is a stakeholder in this climate crisis, it is important for us to be climate conscious and environmentally aware of the implications of climate change. The world human population crossed 8 billion in 2022 and the rise from 7 billion to 8 just happened over a decade (UN ESA Report, 2022; Chakravarty et al., 2017).

Rise in climatic extreme events such as floods, intense storms, droughts, and wildfires are experienced with higher frequency across the globe, and it is attributed to anthropogenic climate change. Climate crisis is not just limited to extreme events but its axillary impacts such as famine due to crop failure, increased pestilence, potable water shortage, rise in infectious diseases are emerging rapidly causing worldwide panic (IPCC, 2022).

Climate crisis can be addressed only when the current government, policymakers and scientific community jointly work with the help of the main stakeholders that are the youth of our world.

Climate Research & Education for Climate Crisis

Climate research and education are vital components in the fight against climate change. With rising global temperatures, more frequent extreme weather events, and the loss of critical ecosystems, the need for effective and informed climate action is more urgent in the coming decades.

Climate research provides the scientific understanding of climate change, including its causes, effects, and potential solutions. On the other hand, climate education ensures that this knowledge is disseminated widely and equitably, empowering individuals and communities to act and advocate for policies that promote sustainability.

In addition, climate research has driven the development of sustainable technologies such as renewable energy sources like solar and wind power, energy storage systems, and electric vehicles (Dell and Rand, 2001). The development of these technologies has helped in reduction of carbon emissions to some extent and helped the cause of the carbon footprint reduction movement. Through climate research and education, we can work together to address the climate crisis and create a more sustainable future for all.

Climate Education and Youth for Climate Action

Climate education has a vital role in fostering global climate action from all quarters of the world. One of the most crucial ways in which climate education can promote climate action is by providing individuals with the knowledge and skills required to engage in climate diplomacy. Climate diplomacy involves working to build international cooperation on climate change, negotiate climate agreements, and build consensus around climate action (Hsu et al., 2015). It has already been proven that the youth are able to lead the climate movement by witnessing the role played by Greta Thunberg, a name which has become common in the climate action community (Sabherwal et al., 2021). From student-led protests to youth-led organizations, young people like Greta are taking action to address the climate crisis and promote sustainability. By promoting climate diplomacy, climate education can create a global community of climate activists who can work towards a more sustainable future.

Moreover, climate education can motivate youth to understand the devastating impacts of climate change and create a climate responsible behavior on an individual front. When climate education involves scientific research, socio-cultural and economic impacts of climate change, it can create an interpersonal understanding of the climate crisis and help youth relate to the impacts of climate change impacts on their personal lives.

Small steps towards climate responsible actions on individual and community level can help in maintenance of local microclimate and further lead to improved regional and global climate. Tree plantation drives, judicious use of high GHG (greenhouse gas) producing products, lesser use of individual cars and reduction in frequent flight usage can all contribute to tackling the climate crisis. Active involvement from youth is encouraged when climate education is effectively carried out and individualistic behaviors can be modified to take climate conscious actions.

Conclusion

Climate education is imperative in engaging young people in climate activism, promoting sustainable practices, shaping policies that support climate action, and fostering global action on climate change.

It is essential that we continue to prioritize climate education and conduct scientific research and study socioeconomic and cultural impact of climate change to create a sustainable and resilient future for generations to come. In conclusion, the significance of climate education in cultivating an active generation of climate advocates cannot be overstated.

Education equips young people with the necessary tools and knowledge to interpret the complexities of the climate crisis and to actively participate in finding viable solutions. This engagement with climate education is not just about understanding the scientific aspects, but also about exploring the socioeconomic and cultural consequences of climate change. This comprehensive understanding can lead to more effective, equitable and sustainable solutions. Lastly, it's important to remember that while individual actions matter, collective action will be the key to address the scale and urgency of the climate crisis. An educated and engaged youth can be the driving force behind this collective action. Their voices amplified by knowledge and understanding, can shape public discourse on climate change, influencing policymakers and industry leaders to accelerate efforts towards a more sustainable future.

References:

1. Chakravarty, P., Baudh, K., & Kumar, M. (2017). Phytoremediation: a multidimensional and ecologically viable practice for the cleanup of environmental contaminants. In *Phytoremediation potential of bioenergy plants* (1- 46). Springer, Singapore. https://doi.org/10.1007/978-981-10-3084-0_1
2. Dell, R. M., & Rand, D. A. J. (2001). Energy storage—a key technology for global energy sustainability. *Journal of power sources*, 100(1-2), 2-17.
3. Hsu, A., Moffat, A. S., Weinfurter, A. J., & Schwartz, J. D. (2015). Towards a new climate diplomacy. *Nature Climate Change*, 5(6), 501-503.
4. Intergovernmental Panel on Climate Change. (2022). Food security. In *Climate Change and Land: IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems* (pp. 437-550). Cambridge: Cambridge University Press. <https://www.ipcc.ch/srccl/chapter/chapter-5/>
5. Sabherwal, A., Ballew, M. T., van Der Linden, S., Gustafson, A., Goldberg, M. H., Maibach, E. W., ... & Leiserowitz, A. (2021). The Greta Thunberg Effect: Familiarity with Greta Thunberg predicts intentions to engage in climate activism in the United States. *Journal of applied social psychology*, 51(4), 321-333.
6. UN, ESA, (2022, November 15). As the world's population hits 8 billion people, the UN calls for solidarity in advancing sustainable development for all. *UN.org*. <https://www.un.org/en/desa/world-population-hits-8-billion-people>. Retrieved January 10, 2023.
7. WMO (2022, September 8). State of Climate in Africa highlights water stress and hazards. *WMO.org*. Press Release Number:09082022, Retrieved January 12, 2023. <https://public.wmo.int/en/media/press-release/state-of-climate-africa-highlights-water-stress-and-hazards>.

Carbon, Climate Crisis and Planting Trees

*Bijay Thakur ¹, Akash Chetry ¹, Ratul Pegu ¹ and Tarun Kamal Das ²

¹ Department of Environmental Science, Tezpur University, Napaam, Tezpur, 784028, Assam, India

² Department of Environmental Biology and Wildlife Sciences, Cotton University, Guwahati, 781001, Assam, India

*Email: bijaythakur3095@gmail.com

The term "carbon and climate crisis" refers to the increasing levels of carbon dioxide and other greenhouse gases in the atmosphere, which in turn causes an increase in the average temperature of the planet and results in a variety of adverse effects on both the environment and society. To combat the carbon and climate catastrophe, a number of different measures will need to be implemented to lower carbon emissions and increase carbon sequestration. Among these solutions are increasing carbon sequestration, creating legislation and regulations to assist climate action and other similar initiatives. In light of this, a significant question arises: "How can we increase carbon sequestration"? According to the findings of several studies, there are a number of possible solutions for increasing the amount of carbon stored in natural forests and agricultural ecosystems. These include carbon farming, carbon offsetting, and protecting and restoring natural habitats like peatlands and wetlands.

Carbon farming is one of the fundamental strategies that can be taken to address the crisis brought on by rising carbon emissions and the changing climate. Grazing management, conservation tillage, cover cropping, crop rotations, and agroforestry are all examples of agricultural practices that fall under this category. It is a method that can help reduce emissions of greenhouse gases while also improving the health and resiliency of agricultural soils. It does this by increasing the amount of carbon stored in agricultural soils.

As we know, climate change and carbon emissions are a global concern. As per the Kyoto protocol, companies can still emit a ton of carbon dioxide as long as they "offset" that ton by purchasing a carbon credit or conducting an activity somewhere else to reduce greenhouse gas emissions. So, for this, companies are implementing carbon offsetting programs based on planting trees, and this entity may buy or plant trees that will absorb carbon dioxide and thereby generate carbon offset. In light of current demand, some entities may also sell carbon credits generated by the trees over time. We also know that planting trees may be an important part of combating the worst effects of climate change. So for this planting trees on a massive scale scheme program run worldwide. But in the meantime, we don't know what's the tree what's in a tree, and how effective carbon offsetting is.

Planting plantations of monocultures or fast-growing plant species like *Eucalyptus tereticornis*, *Acacia auriculiformis*, and *Prosopis juliflora* are commonly used in forestry, carbon sink efforts, and carbon offsetting programs (Sovacool, 2011). This can lead to various issues, some of which are listed below. In most cases, these offsetting programs involve replanting native grasslands and forests with non-native species of quick-growing plants. However, there is the potential for detrimental environmental effects caused by plantations of invasive plant species. It can potentially cause the extinction of native plant and animal species, reduce biodiversity, alter nutrient dynamics, and increase the risk of wildfire. It can completely take over the plantation and even spread beyond its boundaries, which would cause significant ecological damage.

Planting trees seems like an ideal solution to address the issue of carbon emissions and maintain a healthy environment since statistics demonstrate the significant impact of tree planting initiatives in reducing carbon dioxide levels. For instance, studies indicate that each mature tree can absorb up to 22 kilograms of carbon dioxide annually (www.usda.gov). In the Indian context, governmental and non-governmental organizations have implemented policy interventions to promote tree planting and combat carbon emissions. One notable initiative is the National Afforestation Program launched by the Indian government. The fundamental goal of this program is to increase the forest cover, enhance carbon sink and sustainable forest management.

But this effort to offset carbon emissions has the primary objective of sinking as much carbon as possible rather than fostering the development of an ecosystem rich in biodiversity and good health. The non-native trees may be selected due to their capacity to adapt to harsh climates, rapid growth potential, and significant biomass yield, making them more successful at sequestering carbon than native species. Recent studies have shown that the growth rate potential of non-native plant species is faster than native plant species. Nevertheless, the same non-native plant species also disintegrate faster than native plants, accelerating the release of 150% more carbon dioxide from the soil (<https://theconversation.com/>).

Before putting exotic and monoculture plant plantations into practice to solve the carbon and climate issue, it is essential to consider the impacts these plantations will have on the environment and the surrounding communities. It should be selected based on its potential to trap carbon, compatibility with the local environment, potential invasiveness, and influence on biodiversity and ecosystem services before use.

Therefore, the suitable and sustainable approach is to plant native trees, which grow more slowly than exotic trees or trees grown in monoculture plantations, but they live longer and as a result, they store carbon for more extended periods. This can potentially resolve the issues we've been having with non-native plantations that are deteriorating quickly. However, this approach is practised much less frequently because there has been insufficient research conducted on the potential of native plants to sequester carbon and because these plants are not readily available in nurseries.

Altogether, the practice of offsetting does not promote a reduction in the emission of greenhouse gases; instead, it is a workaround that allows companies to claim they are "carbon neutral" by compensating for their emissions by planting trees, whether native or non-native (Prouty, 2009; Lohman, 2009; Bernow et al., 2001). In this approach, global carbon markets don't accomplish anything to address the potentially irreversible effects of climate change. Therefore, afforestation programs (Govt. and Non-governmental organizations) must contain a work plan with all of these factors in mind and each locality should prepare its own list of trees to be planted rather than blindly planting anything and everything. But offsetting alone, even at its peak effectiveness, cannot suffice and reduction in CO₂ emission itself should accompany these efforts to have a sustainable solution.

The importance of traditional practices also should not be undermined. In India, the conservation efforts by the Bishnoi community in Rajasthan showcase the power of grassroots movements. They have a strong tradition of environmental stewardship and protecting trees that offers an effective solution to reduce carbon emissions, maintain a healthy environment and conserve biodiversity.

References:

Bernow, S., Kartha, S., Lazarus, M., & Page, T. (2001). Cleaner generation, free-riders, and environmental integrity: clean development mechanism and the power sector. *Climate Policy*, 1(2), 229-249.

Lohmann, L., Hällström, N., Österbergh, R., & Nordberg, O. (2006). *Carbon trading: a critical conversation on climate change, z privatization and power* (p. 48). Uppsala: Dag Hammarskjöld Centre.

Sovacool, B. K. (2011). Four problems with global carbon markets: a critical review. *Energy & environment*, 22(6), 681-694.

Planting non-native trees accelerates the release of carbon back into the atmosphere (theconversation.com) accessed on 29th March, 2023

Prouty, A. E. (2009). The Clean Development Mechanism and its implications for climate justice. *Colum. J. Envtl. L.*, 34, 513.

The Power of one tree- The very air we Breathe (<https://www.usda.gov>) accessed on 16th May, 2023

Carbon Footprint Reduction

Mayuri Madhukar Jadhav
Founder of Sahyagiri Enterprises, Jath, Maharashtra, India
Email: jadhav.mm9@gmail.com

We are living in 21st century and due to industrialization, urbanization and improved standard of living we are facing so many problems, one of them is greenhouse gas emission.

We are now hearing about the terms like carbon footprint, carbon trading, carbon offset etc. But do we really know about it? It's time to understand the terms. Now let's see this term of carbon footprint in detail.

Carbon footprint is nothing but the total amount of greenhouse gases produced directly, indirectly due to human activities which is expressed in equivalent tons of CO₂. Greenhouse gases are main source of global warming and climate change. There are so many reasons due to which carbon footprint are increasing, they are listed as follows:

1. Burning of fossil fuels
2. Releasing chemicals into atmosphere
3. Reduction of the forest cover and the rapid growth in agriculture
4. Industrial activities and development
5. Rapid Urbanization

These above activities are releasing carbon dioxide into the atmosphere and directly affect on weather and are the main cause of disturbance of climate system. So carbon footprint reduction is necessary to protect our mother earth.



Small changes in lifestyle can actually make a big difference in the long run, and we can make a

change, for example when it comes to transportation, food, clothing, waste, etc. Here are some tips:

1. Food

- Try to consume locally seasonal products.
- Try to limit meat consumption, especially beef.
- Use reusable shopping bags and say no to plastic packaging.
- Buy only what you need, to avoid waste.

2. Clothing

- Take good care of your clothes.
- Buy clothes made from recycled material.
- Buy clothes with eco-label.

3. Transportation

- Use of public transport or cycle.
- Be smart about how you travel and which type of transportation you are using.
- Use of E-vehicle.

4. Energy

- Turn off the water while you clean the dishes or brush your teeth so that wastage of water would save.
- Unplug your electronic equipment when fully charged.
- Don't store unnecessary data in the cloud.
- Use of power saving equipments with 5 star rating.
- Take short showers.
- Use of renewable energy.

5. Waste

- **Try to make compost from biodegradable waste.**
- Sell not usable items to thrift shops or donate them to charity.
- Try to follow 3 R concept that is reduce, reuse and recycle.
- E-waste should be collected and given to the E-waste collection centers.



6. Everything else

- Try to use reusable filled water bottle and keep it with you all time, so you need not buy water in plastic bottles and you will save money and environment.
- For instance, what is your portion of the emissions from your local supermarket's electricity usage when you do your weekly shop there?
- Print on two sides, save single-sided pages and reuse it, and print only what you need.
- Try to proper management of E-waste. Donate used cell phones, chargers, furniture, and clothing to needy.
- Try to gift a tree and pouch of speedballs instead of any other gifts.

These are some ways from which we can reduce the carbon footprint emission personally.

Conclusion-

The goal of this article is to help people to understand and reduce the carbon footprint. By reducing your carbon footprint you can help to reduce the global warming. The process of reduction of carbon footprint can motivate you to create awareness around your surrounding and to take further climate action.

“Let's Go Green to Make Our Globe clean”

Reference:

UNEP Report: Climate Change Indicators: [https://www.epa.gov/climate-indicators/greenhouse gases](https://www.epa.gov/climate-indicators/greenhouse-gases)

Impact of Plant Phenology Response on Climate Change

Satyam Kumar Chaudhari
Central Department of Environmental Science, Tribhuvan University, Kathmandu, Nepal,
Mithila Wildlife Trust, Dhanusha, Nepal,
Environmental Conservation Forum Nepal, Jhapa, Nepal
Email: satyamchaudhari65@gmail.com

Introduction

Plant phenology refers to the timing of life cycle events in plants, such as the timing of budburst, flowering, and fruiting. These events are important indicators of the biological response to climate change and have significant ecological and economic implications. Climate change is causing shifts in plant phenology worldwide, with many plant species flowering earlier and leafing out sooner than they did in the past. These changes have been observed across different ecosystems, latitudes, and altitudes. For example, research has shown that warming temperatures have caused cherry blossom trees in Japan to bloom earlier than they did a century ago (Sakai et al., 2012). The effect of these variations on ecosystems and human society is complex and multifaceted. For example, changes in plant phenology can lead to trophic mismatches, which occur when the timing of plant growth and the emergence of insects and other animals that rely on them are out of sync. This can have cascading effects throughout ecosystems and impact food webs (Thackeray et al., 2016). To understand and address the impacts of plant phenology changes, it is essential to monitor and study these shifts in different plant species and ecosystems.

The Effects of Climate Change on Plant Phenology

Climate change is altering the timing of plant life cycle events, or phenology, with earlier flowering and leafing being some of the most noticeable effects (Menzel et al., 2006). Warming temperatures are accelerating the physiological processes that control plant development, causing a shift in phenology by a mean of 3-8 days per decade over the past 30 years in European trees (Menzel et al., 2006). This shift in phenology can have significant ecological and economic consequences, such as changes in pollination, seed production, and plant distribution, with potential impacts on biodiversity, ecosystem function, and human societies (Parmesan, 2006).

Temperature is a key driver of plant phenology changes, with warmer temperatures accelerating plant development and triggering earlier flowering and leafing (Menzel et al., 2006). Alter in precipitation patterns can also affect plant phenology, with drought conditions leading to delayed

phenology and reduced growth (Cleland et al., 2007). Day length is another important factor, particularly for plants in high latitudes where day length varies significantly throughout the year (Forrest & Miller-Rushing, 2010). Finally, plants may also adapt to changing climate conditions through genetic or phenotypic changes, such as through the evolution of earlier flowering times (Franks et al., 2014). Understanding these mechanisms is essential for predicting the responses of plant communities to future climate change.

Studies on Plant Phenology due to Climate Change

Numerous case studies have documented the effects of climate change on plant phenology in different regions and ecosystems. For example, the famous cherry blossom trees in Japan have been blooming earlier in recent years due to warmer temperatures, with peak bloom occurring an average of 6.6 days earlier per decade since the 1950s (Sakai et al., 2010). European bird species have also been affected by earlier spring phenology, with some species migrating earlier and others failing to adjust, resulting in a mismatch between peak food availability and peak chick hatching (Both et al., 2006). In alpine regions, plants are blooming earlier and moving to higher elevations as temperatures warm, with potential consequences for the entire alpine ecosystem (Grabherr et al., 2010). Arctic tundra plants are also experiencing earlier phenology, with earlier snowmelt and longer growing seasons leading to earlier flowering and leafing (Post et al., 2009). These case studies highlight the diverse and far-reaching impacts of climate change on plant phenology across different regions and ecosystems.

Climate change can have far-reaching impacts on ecosystems. One of the most significant impacts is the disruption of trophic interactions, where mismatches occur between the timing of peak food availability and the arrival of migrating animals or the hatching of young (Both et al., 2006). This can have cascading effects throughout the food chain, leading to declines in populations and changes in community structure. Plant phenology changes can also have impacts on biodiversity, with some species better able to adapt to changes than others, potentially leading to shifts in the composition and distribution of species (Grabherr et al., 2010). Furthermore, affects on agriculture and food security, as changes in the timing of pollination or fruit ripening can reduce crop yields and increase food insecurity (Parmesan, 2006). These impacts highlight the importance of understanding and managing the health and resilience of ecosystems and human communities.

Mitigating Plant Phenology on Ecosystems

Mitigating the effects of plant phenology changes on ecosystems requires proactive measures to mitigate the impact of climate change. One way to achieve this is through monitoring phenological changes to better know the timing and extent of these changes, which can inform conservation efforts (Cleland et al., 2012). Conservation and restoration of habitats can also help to mitigate the effects of plant phenology changes, as intact habitats with high levels of biodiversity are more resilient to changes (Parmesan, 2006). Promoting biodiversity can also help to buffer the impacts of plant phenology changes, as diverse ecosystems are better able to adapt to changes (Grabherr et al., 2010). Finally, sustainable land management practices, such as reducing greenhouse gas emissions and promoting carbon sequestration, can help to mitigate the underlying drivers of climate change, which is essential for the long-term health of ecosystems.

Conclusion

Warmer temperatures are causing plants to flower earlier, which can have significant ecological and economic consequences. The mechanisms underlying these changes are complex, involving temperature, precipitation patterns, day length, and genetic or phenotypic changes. Several studies reveals that climate change on plant phenology changes in the timing of cherry blossoms, bird migrations, alpine plant blooming, and Arctic tundra plant growth. These changes can have far-reaching impacts on ecosystems, including trophic mismatches, biodiversity loss, and impacts on agriculture and food security. Mitigating the effects of plant phenology changes requires proactive measures such as monitoring phenological changes, conserving and restoring habitats, promoting biodiversity, and reducing greenhouse gas emissions.

References:

- Both, C., Van Asch, M., Bijlsma, R. G., Van Den Burg, A. B., & Visser, M. E. (2006). Climate change and unequal phenological changes across four trophic levels: constraints or adaptations? *Journal of Animal Ecology*, 78(1), 73-83.
- Cleland, E. E., Chiariello, N. R., Loarie, S. R., Mooney, H. A., & Field, C. B. (2007). Diverse responses of phenology to global changes in a grassland ecosystem. *Proceedings of the National Academy of Sciences*, 104(29), 13701-13706.

Forrest, J. R., & Miller-Rushing, A. J. (2010). Toward a synthetic understanding of the role of phenology in ecology and evolution. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1555), 3101-3112.

Franks, S. J., Weber, J. J., & Aitken, S. N. (2014). Evolutionary and plastic responses to climate change in terrestrial plant populations. *Evolutionary Applications*, 7(1), 123-139.

Grabherr, G., Gottfried, M., Pauli, H., & Hedenäs, L. (Eds.). (2010). *Changes in mountain ecosystems: biodiversity, biotic interactions, and biogeochemical cycles*. Springer Science & Business Media.

Menzel, A., Sparks, T. H., Estrella, N., Koch, E., Aasa, A., Ahas, R., & Chmielewski, F. M. (2006). European phenological response to climate change matches the warming pattern. *Global Change Biology*, 12(10), 1969-1976.

Parmesan, C. (2006). Ecological and evolutionary responses to recent climate change. *Annual Review of Ecology, Evolution, and Systematics*, 37, 637-669

Post, E., Forchhammer, M. C., Bret-Harte, M. S., Callaghan, T. V., Christensen, T. R., Elberling, B., Fox, A. D., Gilg, O., Hik, D. S., Høye, T. T., Ims, R. A., Jeppesen, E., Klein, D. R., Madsen, J., McGuire, A. D., Rysgaard, S., Schindler, D. E., Stirling, I., Wilson, S. D., & Aastrup, P. (2009). Ecological dynamics across the Arctic associated with recent climate change. *Science*, 325(5946), 1355-1358.

Sakai, A., Sasaoka, Y., Sakamoto, Y., & Sato, F. (2010). The impact of climate change on cherry blossom phenology and its implications for the management of tourist destinations: a case study of Kyoto, Japan. *Journal of Sustainable Tourism*, 18(6), 841-856.

Sakai, Y., & Shimono, A. (2012). Plant phenological changes in Japan and their relation to climate change. *Ecological Research*, 27(6), 911-920.

Thackeray, S. J., Henrys, P. A., Hemming, D., Bell, J. R., Botham, M. S., Burthe, S., & Wanless, S. (2016). Phenological sensitivity to climate across taxa and trophic levels. *Nature*, 535(7611), 241-245.

Impact of Climate Crisis in India

Gourav Kumar Singh¹, Shivom Singh¹, Jyoti Bhadouria²

¹ITM University, Gwalior, Madhya Pradesh, India

²Amity University Madhya Pradesh, Gwalior, India

Email-gouravevs@outlook.com

Degradation of environment, climatic extremes, food and water insecurity, natural catastrophes, economic instability, armed conflict and terrorism are primarily driven by climate change. The Arctic is thawing, coral reefs are bleaching, and ocean acidity is rising. Everything cannot continue as usual. As climate change costs become uncontrolled, collective action is needed.

The most significant contributor to the recent alterations in climate is the greenhouse gas known as carbon dioxide. The combustion of fossil fuels, the disposal of solid waste, the cutting down of trees, the utilization of other biological resources, and some chemical processes, including the cement, oil refinery, coal mines, thermal power plant and allied industry, all add to atmospheric carbon dioxide concentrations. The carbon cycle is a natural process in which plants and animals, as well as volcanic eruptions and the interactions between the ocean and atmosphere, collect and release carbon dioxide.

Every year, the production of fossil fuels like coal, oil, and gas releases billions of tons of carbon dioxide into the atmosphere. Human-caused increases in atmospheric concentrations of heat-trapping gases are continuing unabated at historically high levels. The UNEP Emission Gap estimates for the past decade show that we are on track to keep going in the same direction.

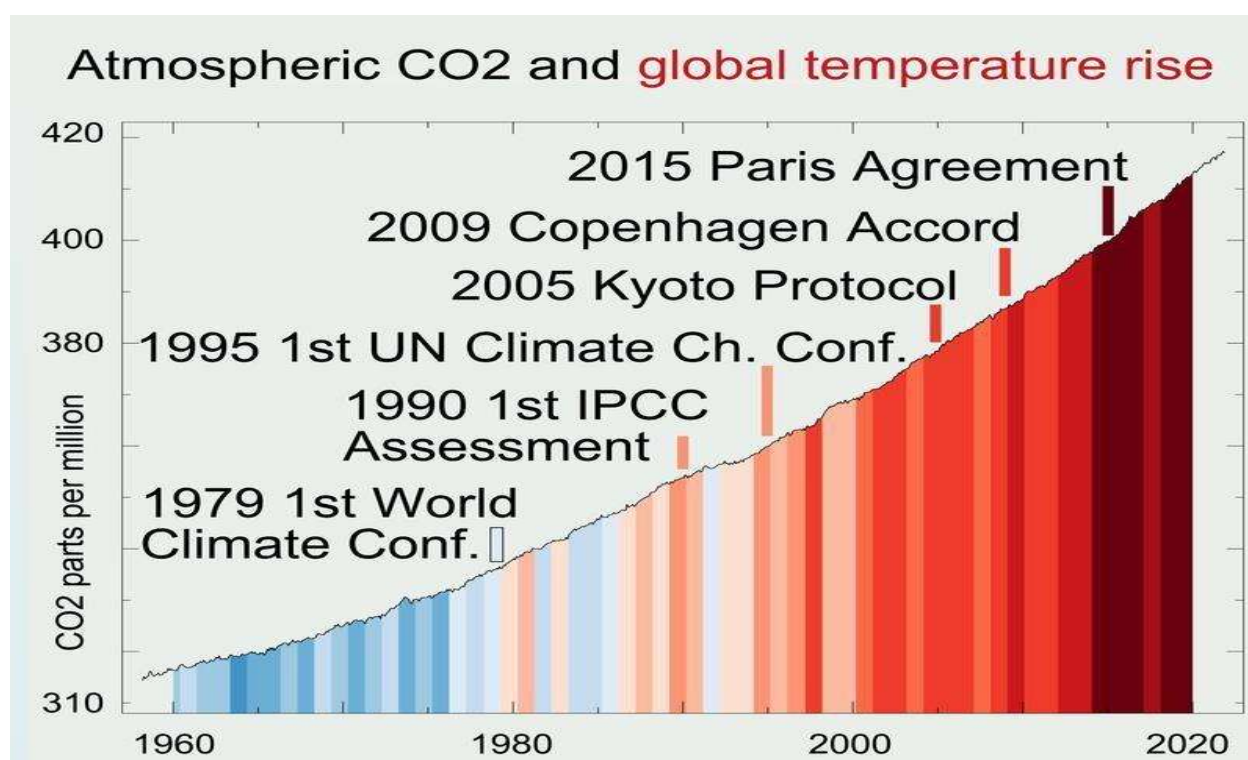


Figure 1: Global temperature trends, atmospheric CO₂ trends, and climate policies
(www.sustention.com)

Recent years have seen four of the warmest on record. One degree Celsius above preindustrial levels is considered "an unacceptable risk" by scientists, according to research published by the World Meteorological Organization (WMO) in September 2019. We must keep global warming to "well below" two degrees Celsius, with the goal of keeping it to 1.5 degrees, as stated in the Paris Climate Agreement of 2015. Temperature increases of more than 3 degrees Celsius by 2100 could cause irreversible damage to our ecosystems if we do not take global action to reduce emissions.

The melting of ice in the arctic and alpine regions is contributing to an increase in sea levels. Almost two-third of cities with a population of more than five million people are situated in areas at risk from sea level rise, and about 40% of the world's population lives within 100 kilometers of a coast. If we do nothing, major parts of several major cities including New York, Shanghai, Abu Dhabi, Osaka, and Rio de Janeiro may be flooded during our lives.

The carbon cycle ensures a consistent amount of carbon in all of Earth's storage facilities. The amount of carbon in one reservoir can affect the amount in the others. Changing land use eliminates plants that absorb carbon dioxide from the air, while using fossil fuels adds vast quantities of the gas to the atmosphere.

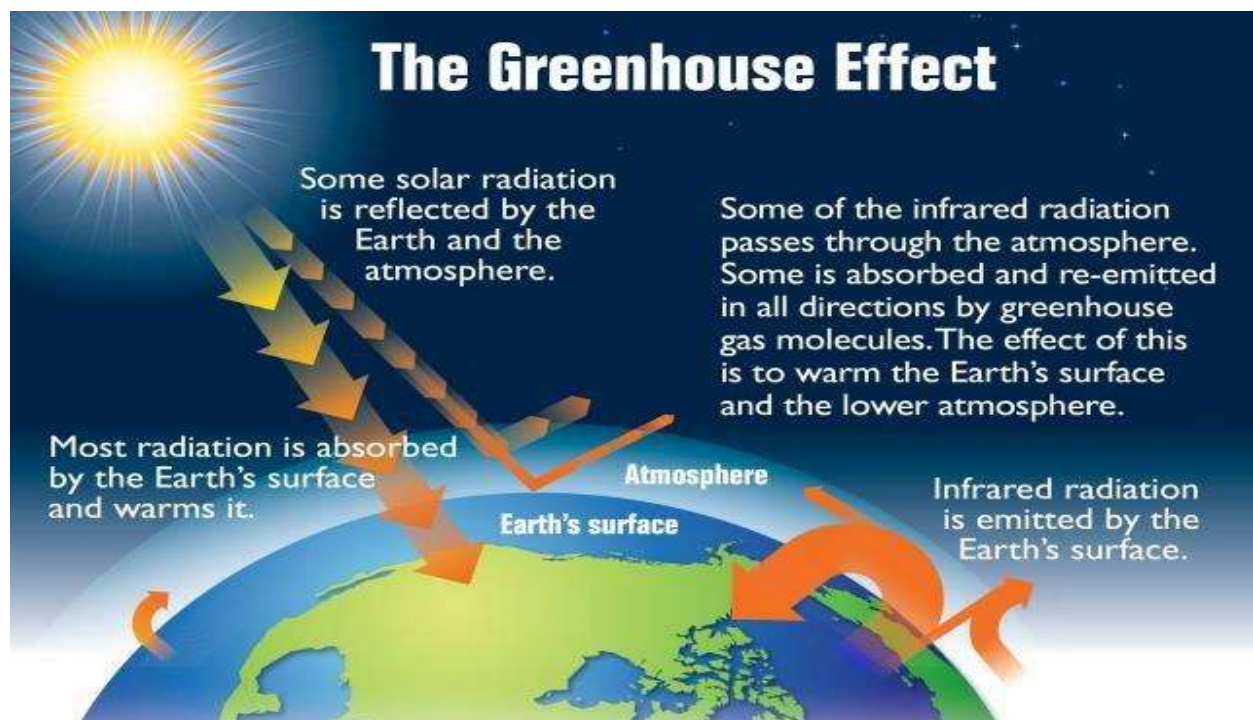


Figure 2: The Greenhouse Effects (US EPA, Royal Society)

Cloudiness, cloud height, and cloud reflectivity are all influenced by climate change. These adjustments may strengthen or weaken the initial change. The complexity of the connections between clouds and climate makes it difficult to estimate the magnitude of this feedback.

IMPACT IN INDIA

India is heating up. Temperatures climbed 1.3°F between 1901 and 2018. (0.7 degrees Celsius). Slight temperature increases can disrupt our planet's natural systems, causing heat waves, droughts, and floods.

As the climate issue threatens our everyday life and essential industries like energy, agriculture, and transportation, rising temperatures are everywhere in India and around the world. .

According to NASA's earth observatory, temperatures reached 115 degrees during a week-long heat wave. Researchers discovered a 55% increase in heat-related mortality in India between 2000-2004 and 2017-2021.

The March heat wave in India and Pakistan killed at least 90 people, burned forests, and devastated agriculture and wheat yields.

India planned to provide food aid before its farm business was harmed by the Russia-Ukraine dispute. After the heat wave, India stopped wheat exports. One study found climate change raised heat wave risk 30 times.

FLOOD, DRAUGHT AND RISING TEMPERATURE

India, like many nations, has water security and floods challenges.

India's agriculture is fuelled by the monsoon. There have been more days with exceptionally strong rains and longer dry intervals throughout the previous century. For the past seven decades, the central belt of India which extends from the western state of Maharashtra to the Bay of Bengal has experienced an increase in the frequency of intense rainfall events while simultaneously witnessing a decline in the amount of yearly precipitation. An analysis estimated in 2019, one-third of the region's glaciers will disappear by 2100. Rising temperatures have caused glacial melting, which has worsened flooding and drought in agricultural mountain towns that depend on snowmelt. Chennai and Mumbai are also flooded. Rain flooded Bengaluru, India's Silicon Valley. Increasing urbanization and poor infrastructure may have caused flooding.

Mumbai was flooded by 37 inches of rain in 24 hours in 2005, killing around 900 people. Warming in the Arabian Sea caused the moisture surge and severe rain. Extreme rain events caused \$3 billion in annual flood losses during the past decade

A SOLUTION APPROACH

Science says climate change is incontrovertible, but it's not too late to stop it. New, efficient technologies can cut net emissions and make the environment greener. Over 70% of emissions have technical remedies. Electric automobiles and renewable energy are becoming commonplace.

Solutions based on nature give us "breathing room" as we decarbonize our economy. There has been an increase in the frequency of extreme rainfall events but a drop in annual rainfall in the central belt of India (from western Maharashtra State to the Gulf of Bengal) over the past 70 years.

We can quickly transition to a cleaner, more resilient society by utilizing current, scalable technology and nature-based solutions. The future can be made greener with less human suffering, more justice, and global harmony if governments, corporations, civil society, youth, and academia all work together.

FIGHT AGAINST CLIMATE CHANGE

The country's poorest people will continue to suffer the most as a result of climate change as it destroys livelihoods and washes away towns as temperatures rise. In eastern India last year, Cyclone Yaas destroyed at least 25,000 homes and left an estimated 150,000 people homeless.

As a result of "frequent droughts and decreased rainfall," almost 70% of Indian households rely on agriculture for income, yet they "battle with smaller harvests". Extreme heat in urban areas has driven many farmers away from their farms because of the severe impact that climate change is having on their livelihoods.

These are just a few examples of how India's most vulnerable communities are being struck the hardest by the climate crisis.

There is still time to make things right, which is excellent news. But only if we take immediate action. With the help of activists like you, we at Climate Reality are able to catalyze the bold climate action that our planet sorely needs while working to bring actual solutions to communities throughout the globe.

References:

1. IPCC. (2013). *Climate change 2013: The physical science basis. Working Group I contribution to the fifth assessment report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex & P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, p. 593.
2. www.climaterealityproject.org
3. www.epa.gov/climatechange-science
4. US EPA, Royal Society
5. www.sustention.com

An Approach towards Sustainability in Relation with Climate Change

Kirti Diseja¹, *Rwitabrata Mallick²

¹Amity Business School, Amity University Madhya Pradesh

²Department of Environmental Science, Amity School of Life Science,

Amity University Madhya Pradesh

*Email: rmallick25088@gmail.com

Introduction

An effective approach towards sustainability in relation to climate change involves addressing the causes and impacts of climate change while promoting long-term environmental, social, and economic well-being. Implementing measures to reduce greenhouse gas emissions is crucial for mitigating climate change. This involves transitioning to renewable energy sources, improving energy efficiency in all sectors, promoting sustainable transportation, and adopting sustainable land management practices to reduce deforestation and promote carbon sequestration. Setting emissions reduction targets, implementing carbon pricing mechanisms, and supporting clean technologies and innovations are also important. Building resilience and adapting to the impacts of climate change is essential, considering that some degree of climate change is already unavoidable. This involves assessing vulnerability, identifying risks, and implementing adaptation strategies at local, regional, and national levels. It includes measures such as developing climate-resilient infrastructure, implementing nature-based solutions, promoting sustainable agriculture practices, and enhancing disaster preparedness and response.

Sustainable urban planning plays a vital role in mitigating climate change and promoting sustainability. It includes designing cities and communities that prioritize energy-efficient buildings, walk-ability, access to public transportation, green spaces, and mixed land-use development. Sustainable urban planning also involves incorporating climate resilience measures into infrastructure design, including flood management, water conservation, and green infrastructure. Transitioning towards a circular economy, where resources are used efficiently, waste is minimized, and materials are recycled and reused, can contribute significantly to climate change mitigation.

It involves promoting sustainable production and consumption patterns, designing products for longevity and recyclability, and adopting strategies for waste reduction, recycling, and resource recovery. Climate change is a complex and global challenge that requires collaboration and engagement from multiple stakeholders. Governments, businesses, civil society organizations, communities, and individuals all have important roles to play. Encouraging dialogue, fostering partnerships, and involving stakeholders in decision-making processes can lead to more effective and inclusive climate action. Promoting climate literacy and raising awareness about the causes, impacts, and solutions of climate change are crucial. Education at all levels can empower individuals to make sustainable choices, drive innovation, and become advocates for climate action. Communication campaigns, public outreach programs, and incorporating climate change topics into educational curricula can help foster a culture of sustainability.

It should be understood that climate change is a global challenge that requires international cooperation and collaboration. International agreements, such as the Paris Agreement, provide a framework for countries to work together towards climate goals. Sharing best practices, providing financial and technical support to developing nations, and fostering knowledge exchange are essential for global sustainability efforts. It requires a long-term perspective, policy coherence, and collective action to achieve the necessary transformation towards a sustainable and climate-resilient future. Human landscapes and living situations are influenced by climate change, which influences both social and economic growth. Increasing temperatures, increasing sea levels, and extreme weather are all effects of climate change (droughts, flooding, storms.) These consequences may have a negative impact on society and the environment by causing concerns with mental health, sickness, and land degradation.

Sustainable development is a method of ensuring that societal needs are met not only now, but also in the future. As science and technology advance, human development can have a negative impact on the natural environment. However, sustainable development seeks to reduce the environmental impact of development and promotes ways for society to adapt to the issue of climate change (*Agovino et al, 2019*).

Unsustainable industrial development, energy production, land use, and lifestyles have contributed significantly to climate change over the past 200 years. They are using the atmosphere as a free good without considering the effects on the environment, the economy, or future generations.

While this is going on, billions of people struggle to live better lives than they are entitled to, frequently by repeating the mistakes of the past (*Beg et al., 2002*). The quantities of greenhouse gases in the atmosphere today are 33% greater than they were before industrialization, and annual rates of increase have never been higher. Emissions of greenhouse gases worldwide are rising.

Both natural and human forces are thought to be responsible for the causes of climate change. While the latter is concerned with greenhouse effects on the globe brought on by CO₂ emissions and other greenhouse gases that are released into the atmosphere as a result of human activity, the former relates to solar-terrestrial interactions and feedback within the climate system (Fig. 1) (*Swart et al, 2003*).

Sustainability can be severely impacted by even a slight temperature increase, and human activities that contribute to climate change can indeed be considered unsustainable. Climate change refers to long-term shifts in temperature and weather patterns, primarily caused by human activities such as burning fossil fuels, deforestation, and industrial processes. These activities release greenhouse gases into the atmosphere, trapping heat and leading to a warming planet. However, finding long-term solutions to other issues is becoming increasingly challenging due to climate change. Our food sources, rising sea levels, the way we plan cities, and other factors are all impacted by changing biodiversity and changing climate conditions. The climate both influences and is influenced by many sustainability concerns (*MacDonald et al., 2010*). For instance, a warmer Earth makes it more challenging to grow enough food, and clearing forests to do so contributes to climate change.



Fig 1: Relationship between Climate Change & Sustainability

Sustainable development can also be accelerated by combating climate change. The only so-called environmental concern that has simultaneously caught both the public's attention and political agendas is climate change. The human and financial costs of ignoring climate change are also alarming and becoming increasingly obvious. In this way, it might serve as the impetus for the international community to take sustainable development seriously and shift from "principle" to "implementation". The costs of doing nothing would be too high. Technologies and regulations that take climate change into account can have a positive impact on the economy, the environment, and human health (*Robinson et al., 2001*).

Around 70% of greenhouse gas emissions are related to the production and use of energy. As a result, any strategy to combat climate change and promote sustainable development must centre on the energy industry. The well-known recipes include energy efficiency, renewable energy, transitioning to other fuels, deploying and transferring current technology, and developing new ones. Governments, business, and citizens all have responsibility at the national level for combating climate change and advancing sustainable development. Long-term improvement is therefore impractical in the absence of a strong international cooperation regime due to the size of the issue.

The Framework Convention and its Kyoto Protocol are just the start; there are further institutions, methods for reporting and reviewing, inventories, financial mechanisms, and other funds (Yohe *et al.*, 2006).

Sustainability is built on three pillars. They are as follows: society and culture, economics, and the environment. The use of resources at rates which do not surpass the ability of ecosystems to substitute them is referred to as sustainability. From the standpoint of sustainability, it is easy to see that the prevailing farming industry of expansion is not sustainable due to the adverse environmental consequences. Though sustainability is a broad concept, it is characterized as satisfying the demands of the present without jeopardizing future generations' ability to meet their own needs. Climate change mitigation policies and adaptation efforts are both important strategies for addressing the impacts of climate change (Fig 2) (Kane *et al.*, 2000). Mitigation efforts aim to reduce greenhouse gas emissions to slow down or stop the pace of climate change, while adaptation efforts aim to reduce the vulnerability and increase the resilience of natural and human systems to the impacts of climate change. The interaction between these two strategies is complex, and there are both potential synergies and trade-offs between them. On the one hand, successful mitigation efforts can reduce the need for adaptation by reducing the severity and frequency of climate impacts.

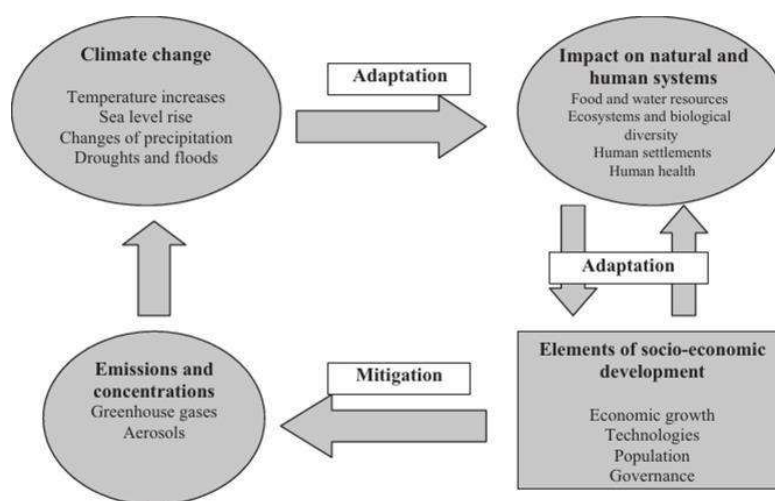


Fig 2: the interaction between the climate change mitigation policy and adaptation efforts

Measures for Implementing Sustainability

Implementing sustainability requires a comprehensive approach that involves various measures across different sectors. These measures are interconnected and require a holistic approach. It's important to customize sustainability efforts to specific contexts, considering local environmental, social, and economic factors. By implementing these measures, we can work towards a more sustainable future that balances human needs with the preservation of the environment.

- It is critical to provide people with clean and sanitary living and working conditions.
- Safeguarding against recognized and demonstrated industrial hazards. It is also critical to find cost-effective ways to salvage hazardous industrial waste.
- Promote afforestation.
- Incorporating environmental education into school and college curriculum
- All environmental issues must be socialized and humanized.

Conclusion

Climate change is the long-term modification of global weather patterns, including variations in temperature, precipitation, and other elements, brought on by the accumulation of greenhouse gases in the atmosphere, mostly as a result of human activity like burning fossil fuels. Sea level rise, more frequent and severe extreme weather events, and disturbances to ecosystems, agriculture, and human societies are just a few of the far-reaching effects of climate change.

Contrarily, sustainability is the practice of addressing current needs without sacrificing the capacity of future generations to address their own. To build a wholesome, egalitarian, and resilient society, it entails striking a balance between economic, environmental, and social aspects. Utilizing resources effectively and efficiently, reducing waste and pollution, and advancing social justice and equity are all aspects of sustainability.

Contrarily, sustainability is the practice of addressing current needs without sacrificing the capacity of future generations to address their own.

To build a wholesome, egalitarian, and resilient society, it entails striking a balance between economic, environmental, and social aspects. Utilizing resources effectively and efficiently, reducing waste and pollution, and advancing social justice and equity are all aspects of sustainability.

References:

1. Agovino, M., Casaccia, M., Ciommi, M., Ferrara, M., & Marchesano, K. (2019). Agriculture, climate change and sustainability: The case of EU-28. *Ecological Indicators*, 105, 525-543.
2. Beg, N., Morlot, J. C., Davidson, O., Afrane-Okesse, Y., Tyani, L., Denton, F., ... & Rahman, A. A. (2002). Linkages between climate change and sustainable development. *Climate policy*, 2(2-3), 129-144.
3. Kane, S., & Shogren, J. F. (2000). Linking adaptation and mitigation in climate change policy. *Climatic Change*, 45(1), 75-102.
4. MacDonald, G. M. (2010). Water, climate change, and sustainability in the southwest. *Proceedings of the National Academy of Sciences*, 107(50), 21256-21262.
5. Robinson, J. B., & Herbert, D. (2001). Integrating climate change and sustainable development. *International Journal of Global Environmental Issues*, 1(2), 130-149.
6. Swart, R., Robinson, J., & Cohen, S. (2003). Climate change and sustainable development: expanding the options. *Climate policy*, 3(sup1), S19-S40.
7. Yohe, G., Lasco, R., Ahmad, Q. K., UK, N. A., Cohen, S., Janetos, T., ... & Salih, M. (2006). Perspectives on climate change and sustainability 3. *change*, 15(39), 40.

Acknowledgement

For Cover Image, special thanks to Alanfrijns at www.pixabay.com

Announcements

- **Voice of Environment (VoE) has extended a new research division as “Biomedical Research and Allied Sciences Division” along with the existing division as “Environmental Research and Management Division’.**
- **Voice of Environment (VoE) has also launched “Project Metamorphosis” A “Hands-On Training in Scientific-Academic Writing”**

For Researchers/Scholars/Professionals

(Duration-6 to Months-12 Months)

***Interested candidates can contact with team VoE and course coordinator for the same*.**

**Best wishes
From VoE**



Everain Global Services Private Limited

(Accredited by the Quality Council of India (QCI) and NABET for MoEF&CC Category-A Forest Clearance Projects under the scheme of Forest Clearance Consultant Organization(FCCO)

Corporate Office

401, 4th Floor, Statesman House, 148, Barakhamba Road, New Delhi, Pin-110001

Project Office

Shimla, Himachal Pradesh | Ranchi, Jharkhand | Dehradun, Uttarakhand | Guwahati, Assam

Email: info@everainglobal.com | Phone: +91-9999677158/9 | Website: www.everainglobal.com

Founded in 2016, **Everain Global Services Private Limited** is a reputed New Delhi based technical consulting firm professionally managed by Retd. Senior IFS Officers who have served in the Ministry of Environment, Forests & Climate Change (MoEF&CC) and State Forest departments., recognized by **Startup India (Government of India)** specializing in consulting, advisory and project investment services. Everain has marked its presence in **23+ states** with **250+ projects** successfully accomplished.

Our major services:

- Preparation of Forest Diversion Proposals and followups for Stage-I & Stage-II Forest clearance
- Preparation of Site-Specific Wildlife Conservation Plans and followups for Wildlife Clearance
- Biodiversity/Ecological Impact Assessment
- Ecological Restoration and Plantation Services
- DGPS Mapping/Drone Surveys

Having 40+ years of experience in forest and wildlife related matters, our team is intimately aware of the methods and procedures involved in various surveys and assessments on both national and international guidelines. Not only that, but our firm also consists of qualified subject-matter experts and field surveyors having specialized degree (PhD./M.Sc.) in Forestry/Wildlife/Social Sciences from reputed institutes who are able to gather the exact information from the ground required for putting together the necessary reports that are to be submitted as part of this project.

Some of our related empanelment includes, but not limited to, as follows:

- i. Empaneled with the **O/o Principal Chief Conservator of Forests (Wildlife) & Chief Wildlife Warden, Odisha** State for Preparation of Site-Specific Conservation Plans for development and mining projects in the state
- ii. Empaneled with the **NHAI's Green Highways Division** for undertaking plantation works along the national highways across India
- iii. Empaneled with **AFC India Limited (Formerly Agriculture Finance Corporation)** for collaboration on complementary services and able to leverage each other's strengths
- iv. Empaneled with **Quality Council of India** as Training Partner for ZED Scheme
- v. Empaneled with **Global Partnership on Marine Litter (GPML)** for undertaking projects/studies on marine and microplastic pollution

To discuss more about the activities we do or discuss your requirements please call

+91-9999677158/9, Email: info@everainglobal.com

.....O.....

VARIOUS INITIATIVES BY VOICE OF ENVIRONMENT (VoE) TEAM



Plantation drive and awareness campaign at Dispur College premise on the occasion of Republic Day 2023

74th Republic Day celebrated with patriotic fervour

STAFF REPORTER

GUWAHATI, Jan 27: The 74th Republic Day was celebrated with patriotic fervour here on Thursday.

The Gauhati University celebrated Republic Day and foundation of the Gauhati University at the premises of the varsity on Thursday. Prof Pratap Jyoti Handique, Vice-Chancellor, Gauhati University unfurled the National Flag on the occasion.

The National Flag was also unfurled in the different hostels of the university by the respective wardens of the hostels.

The Gauhati University Press Sale Counter was also opened by the Vice-Chancellor on the occasion. Opening the counter, the VC said that the counter will facilitate the showcasing of the valuable publications of the university press.

The Indian Institute of Entrepreneurship (IIE), an autonomous body under the Ministry of Skill Development and Entrepreneurship, Government of India observed the 74th Republic Day of the country, with patriotic fervour at its campus in Guwahati.

Dr Lalit Sharma, director, IIE unfurled the National Flag amidst the singing of the national anthem by IIE's employees and their families.

The Tricolour was unfurled early in the morning at Royal Global University with a guard of honour and salutations to the Indian Flag. Emphasising on the binding role played by the Constitution of India in the Republic, Vice-Chancellor Prof (Dr) SP Singh, who proudly hoisted the Indian Flag, reminisced the evolving nature of celebrations of this occasion in Northeast India. Enveloping everyone in the spirit of 'one nation', Prof Singh deliberated on the 'nation' always being the first identity, first choice of every rightful citizen.

Team Voice of Environment (VoE), a youth environmental organisation, conducted a plantation drive and environmental awareness programme at the Dispur College premises here on Thursday.

The plantation drive began in the morning after the hosting of the National Flag on the college premises. The VoE team was joined by the Dispur College principal, lecturers, students, and other volunteer members. The team has planted saplings of some ornamental and medicinal plants.

The Institute of Advanced Study in Science and Technology (IASST), Guwahati, Assam, celebrated the 74th Republic Day of India in the institute where the faculty members, staff, officers and research scholars participated in the celebrations. The

function began with the unfurling of the National Flag followed by a review of the parade by Prof Ashis K Mukherjee, director, IASST.

The Northeast Frontier Railway celebrated the 74th Republic Day in a befitting manner. The central programme was held at the NFRSA complex at Maligaon, where Anshul Gupta, General Manager of NF Railway unfurled the National Flag in presence of a gathering of railway officials and their family members. He also inspected march-past by contingents of RPF, Territorial Army, Civil Defence, and Bharat Scouts and Guides. The Republic Day was also celebrated in all the five Divisions of NF Railway viz., Tinsukia, Lumding, Rangiya, Alipurduar and Katihar, where the Divisional Railway Managers unfurled the National Flag in presence of Divisional railway officials.

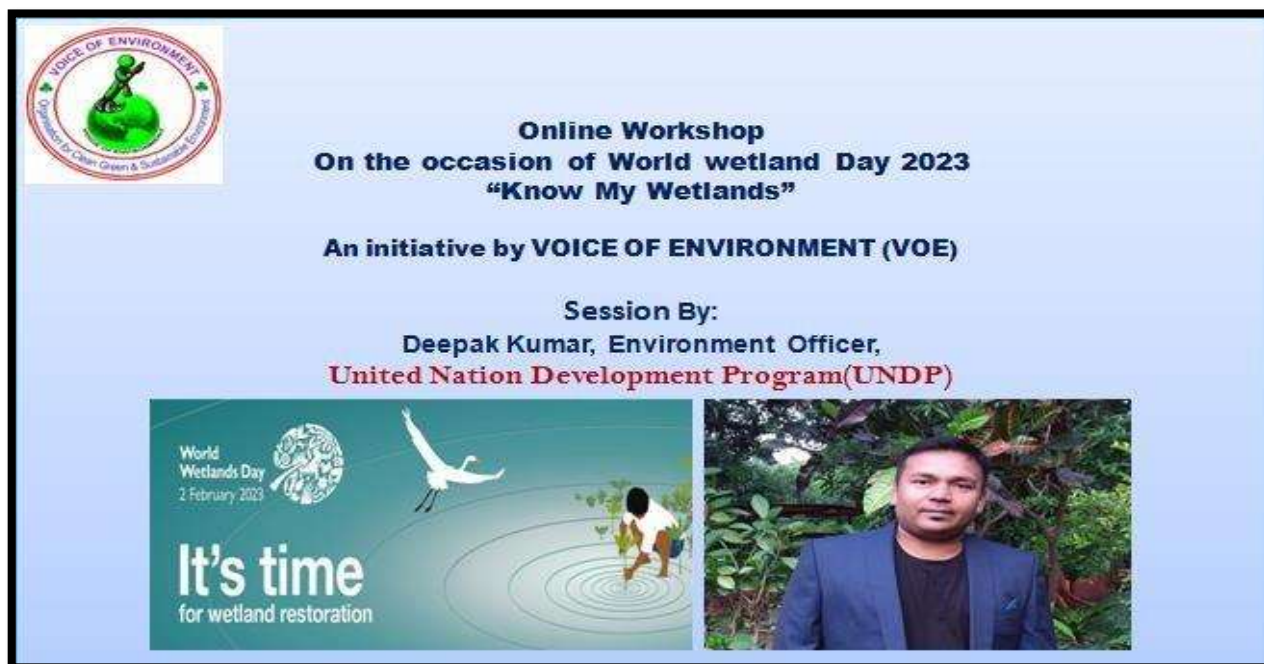
Republic Day was also celebrated in Guwahati Central Jail on Thursday. An online chess training programme among the prisoners was inaugurated in the presence of G Ramesh of Indian Oil Corporation Limited and Inspector General of Prisons of Assam Barnali Shama.

The Day was also celebrated by Mahapurusha Srimanta Sankaradeva Viswavidyalaya, Guwahati unit here.

Reported by The Assam Tribune (A English Daily) 28th January 2023

Media Report Links-

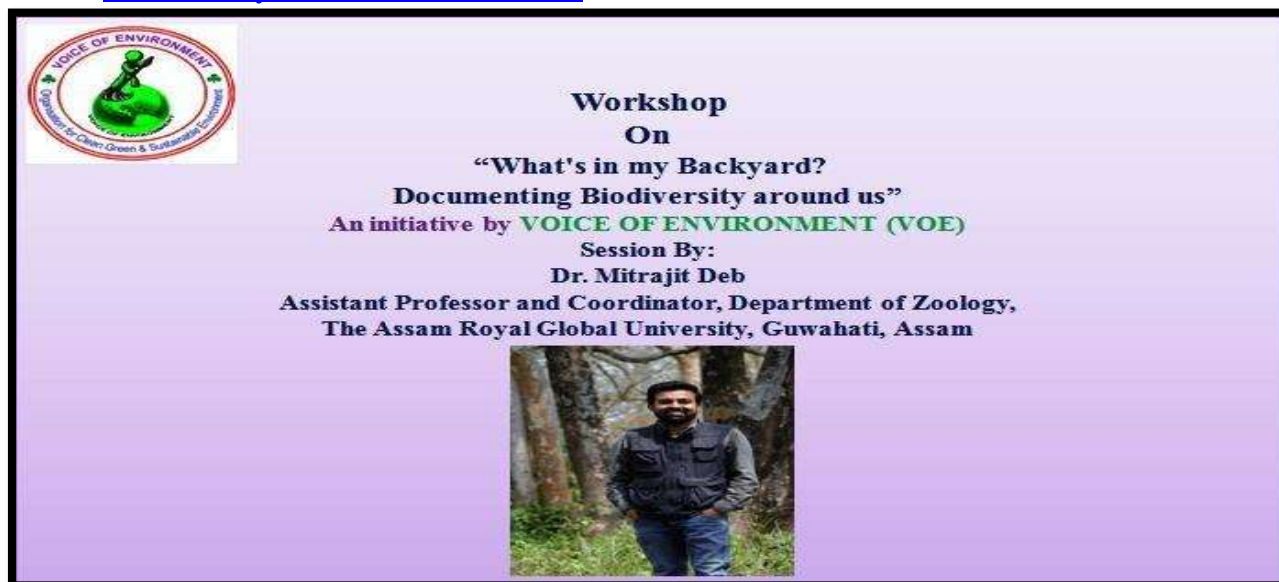
- https://guwahatitimes.com/plantation-drive-on-the-occasion-of-74th-republic-day-at-dispur-college/?fbclid=IwAR1OJ_GRyD6GniiHnX6L3vgeSwNyS9SwXVS-atqHlWbM-4mE6jR4EnqtHhE
- <https://www.google.com/amp/s/www.sentinelassam.com/amp/guwahati-city/plantation-drive-on-the-occasion-of-74th-republic-day-at-dispur-college-634835>
- <https://indigenoussherald.com/TripuraNews/voe-celebrates-r-day-through-plantation-drive-20272.html?fbclid=IwAR0ny2APvDOJUrMOKI-I77Sb5SRLN6g30IynWU-7ID6ktfUBCA5faASCfRk>



A workshop on the occasion of World Wetlands Day 2023

Media Report Links-

- <https://assamtribune.com/guwahati/why-chandubi-lake-should-be-declared-as-ramsar-site-1460519>
- <https://neindiabroadcast.com/2023/02/03/international-wetlands-day-2023-was-observed-by-voice-of-environment/>



Media Report Link-

- <https://neindiabroadcast.com/2023/02/20/voe-organize-a-workshop-on-whats-in-my-backyard-documenting-biodiversity-around-us/>



Online Workshop On “Know Your Carbon Footprint Associated with Climate Change”

An initiative by **VOICE OF ENVIRONMENT (VOE)**

Session By:

Mr Suresh Kumar

Environment Expert MLFP- WB, ADB, AIIB, KfW, India



Workshop on Climate Change

STAFF REPORTER

GUWAHATI, Feb 12: A workshop on “Know Your Carbon Footprint Associated with Climate Change” was held by Voice of Environment (VoE), a youth environmental organisation based in Guwahati, Assam. The workshop emphasised the urgent need to prioritize reducing CO₂, as an increase would make the Paris agreement's (adopted by 196 parties at COP 21 in Paris in 2015) goals unattainable. Awareness and conservation are taught in primary, secondary, and higher education to raise awareness about climate change due to the excess heat of greenhouse gases, especially the abundance of carbon dioxide (CO₂) in our atmosphere. Team VoE is aligned with international initiatives like the UN-

FCCC Framework Convention on Climate Change (1992), the Kyoto Protocol (1997), and the Paris Agreement (2015). The discussion session has kicked off in the presence of Mr. Suresh Kumar, who has 15 years of experience in the environment, water, sanitation, and climate change with various UN agencies such as UNICEF, UNDP, the World Bank, the Asian Development Bank (ADB), the African Development Bank (KfW), and the Asian Infrastructure Investment Bank (AIIB) in India as well as in Africa and South East Asia over the globe, as a speaker, and Dr. Anu Sharma, Lecturer, Higher Education Department, Jammu and Kashmir, as moderator, Moharana Choudhury, an environmentalist and researcher from Guwahati, Assam, and other Voice of Environment members.

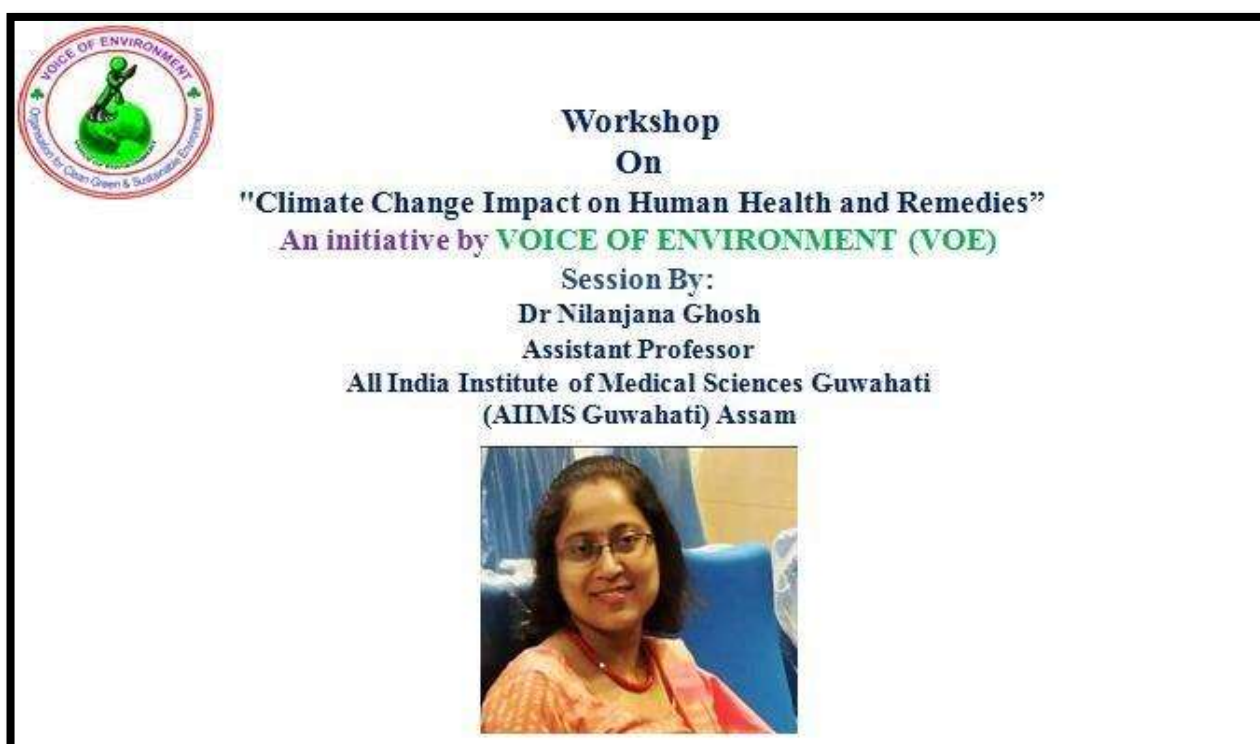
The workshop session started at around 6 p.m. with opening remarks by Dr. Anu Sharma introducing the panel members, speakers, participants, and other VoE members. She also explained the concept of the carbon footprint emitted by an individual, a group of people, or an institution in a broader way. Then the session was continued and taken over by Suresh Kumar, who explained the cause of carbon dioxide emissions at the individual and household level, the reason and source of carbon footprint emissions, and their mitigation. He also talked about the anthropogenic factors that cause CO₂ emissions; on the other hand, it encourages people to control their carbon footprints by reducing, reusing, and recycling the process. Kumar also displayed data on the carbon footprint emitted by travel vehicles that use various types of fuels (such as diesel, gasoline, and compressed natural gas), household appliances (such as electricity, refrigerators, washing machines, cooking stoves and ovens, TVs, and fans), food consumption, wet waste, dry waste, and so on. He also discussed the trend of global averages: the average carbon footprint is closer to 4 metric tonnes per year, and the carbon footprint of the USA is 16 metric tonnes per person per year (one of the highest rates in the world). The best chance of avoiding a 2-degree Celsius rise in global temperature is for the average global carbon footprint per year to drop to under 2 metric tonnes by 2050. To combat climate change, the session concluded that we should all reconsider and review our carbon footprints by reducing our uses and consumption, as travelling 10 kilometres in a single diesel or petrol car emits more than 2 kg of CO₂, stated a press release.

S. Sruthi, a student of biotechnology at the SRM Institute of Science and Technology, Chennai, finds the workshop informative and appreciates the workshop. She also understood the need for awareness of the carbon footprint. Anamika Das, a biotechnology student at the SRM Institute of Science and Technology in Chennai, attended the VoE workshop and found it beneficial, learning a lot about carbon footprint science. Sneha Reshmi, from the department of Environmental Science at A N College, Patna, viewed the workshop as informative for her as she came to know about the current scenario of carbon footprint, which is associated with climate change. Rakesh Chaudhary, a research scholar from the Civil Engineering Department at the National Institute of Technology in Delhi, found the session very informative and thought-provoking, which gave him an in-depth understanding of how our individual and collective actions can influence global warming and cooling of the environment. He also appreciates the speaker, Suresh Kumar, for engaging him with his knowledge and contagious enthusiasm for the topic. “He feels more empowered now to make changes to reduce his carbon footprint and help protect the planet.”

Reported by The Sentinel (A English Daily) 12th Feb 2023

Media Report Links-

- <https://assamtribune.com/assam/workshop-on-know-your-carbon-footprint-associated-with-climate-change-held-in-guwahati-1462243>
- <https://www.sentinelassam.com/guwahati-city/workshop-on-climate-change-held-by-voice-of-environment-in-guwahati-637267>
- <https://neindiabroadcast.com/2023/02/12/a-workshop-on-know-your-carbon-footprint-associated-with-climate-change/#:~:text=An%20environmental%20organization%20in%20Guwahati,the%20targets%20outlined%20in%20the>



Media Report Links-

- <https://neindiabroadcast.com/2023/03/06/workshop-on-climate-change-and-its-impact-on-human-health-and-remedies/>
- <https://guwahatitimes.com/workshop-on-climate-change-and-its-impact-on-human-health-and-remedies/?fbclid=IwAR1Oym4A5IOCI2VkoRu7L0L7i6eIKdyJ9xdJIvbCYRBUKoCjwolPWaikuO8>



Workshop On

"Valuing Water: Groundwater Perspectives- Issues and Challenges"

An initiative by **VOICE OF ENVIRONMENT (VoE)**

Session By:

Dr Ritusmita Goswami

Assistant Professor

Centre for Ecology Environment and Sustainable Development,
Tata Institute of Social Sciences (TISS), Guwahati-781013



The Assam Tribune

Date 10 Mar 2023

Workshop on groundwater challenges

STAFF REPORTER

GUWAHATI, March 9: Voice of Environment (VoE), an environmental NGO conducted a workshop titled 'Valuing Water: Groundwater Perspectives – Issues and Challenges' recently.

The workshop is part of its ongoing initiative on environmental education and awareness mission among the students, youths and community.

The event was attended by Dr Ritusmita Goswami, assistant professor, Centre for Ecology, Environment, and Sustainable Development, Tata Institute of Social Sci-

ences (TISS), Guwahati, as guest speaker, and Dr Anu Sharma, lecturer, Higher Education Department, Jammu University and McDonald Choudhury as moderator.

Dr Anu Sharma began the workshop session by introducing the speakers, panel members, participants, and other VoE members.

Dr Goswami presented the groundwater scenario, especially the arsenic-related issues. She highlighted the major groundwater issues in India and the challenges in the northeastern part of the country. The discussions revealed that the groundwater arsenic scenario was alarm-

ing in Northeast India, particularly in Assam. She also expressed the need for mass awareness among the people and government interventions to save the lives of millions from this menace. After the session, people from different States and branches interacted with the panellists.

Arsenic groundwater contamination in different parts of the world results from natural and anthropogenic sources, adversely affecting human health and the ecosystem. Millions of people from other countries heavily depend on groundwater containing an elevated level of arsenic for drinking purposes.

Reported by The Assam Tribune (A English Daily) 10th March 2023

Media Report Link-

- <https://neindiabroadcast.com/2023/02/27/workshop-on-valuing-water-groundwater-perspectives-issue-and-challenges/>



World Environment Day celebration on 5th of June 2023 at Regional Science Centre, Jawaharnagar Khanapara, Guwahati, Assam

Media Report Links-

- <https://www.sentinelassam.com/north-east-india-news/assam-news/world-environment-day-2023-celebrated-at-guwahatis-regional-science-centre-652383>
- [https://neindiabroadcast.com/2023/06/05/initiatives-on-world-environment-day-celebrated-at-regional-science-centre/#:~:text=Voice%20of%20Environment%20\(VoE\)%2C.of%20Regional%20Science%20Centre%2C%20Guwahati.](https://neindiabroadcast.com/2023/06/05/initiatives-on-world-environment-day-celebrated-at-regional-science-centre/#:~:text=Voice%20of%20Environment%20(VoE)%2C.of%20Regional%20Science%20Centre%2C%20Guwahati.)

NGO Voice of Environment (VoE) celebrated World Environment Day today on the theme 'Solutions to plastic pollution' on the premises of the Regional Science Centre, Guwahati.

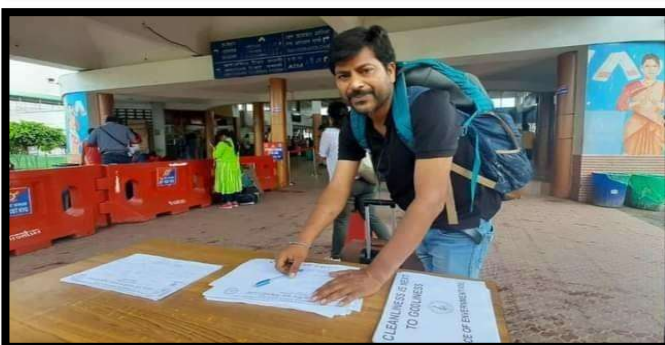
The programme was a part of VoE's ongoing initiative on environmental education and awareness mission among the students, youths and community.

The programme was conducted in collaboration with the Regional Science Centre, Guwahati, a unit of the National Council of Science Museums, Ministry of Culture, government of India.

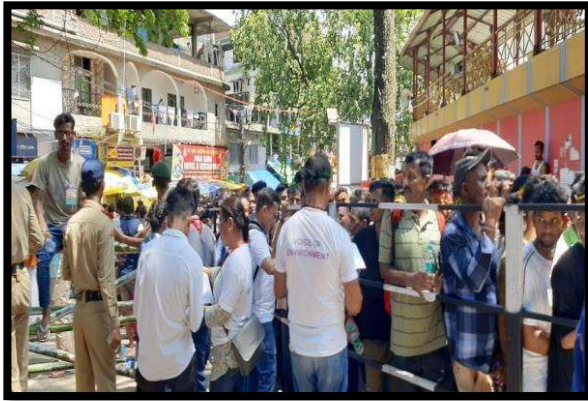
The programme started around 9.40 am with a plantation drive conducted on the institution premises in the presence of Sujay Majumder, Curator and Project Coordinator, Regional Science Centre, environmentalist Moharana Choudhury of VoE, Dr Hari Prasad Agarwal, Principal, Department of Architecture, The Assam Royal Global University, among others.

A presentation was delivered by Dr. Hari Prasad Agarwal, as a guest speaker from VoE on 'Waste Management Integration with Urban Farming.'

Reported by The Assam Tribune (A English Daily) 6th June 2023



**Clean and eco-friendly Ambubachi Mela 2023 campaign at Kamakhya Railway Junction
Guwahati, Assam**



Clean and eco-friendly Ambubachi Mela 2023 campaign at Kamakhya Temple, Nilachal Hill Guwahati, Assam

NGO bid to celebrate clean, eco-friendly Ambubachi Mela

STAFF REPORTER

GUWAHATI, June 24: As part of its Mission Clean Green Assam initiative, NGO Voice of Environment (VoE) has launched a clean and single-use plastic-free premise campaign from Kamakhya Temple where the Ambubachi Mela is currently under way.

To that end, VoE had signed an MOU with Kamakhya (Devalaya) Temple authority on December 22, 2016. In continuation with the previous mission, a joint drive was conducted by VoE in association with Kamakhya Temple authority to create awareness among devotees, visitors, sadhus, etc., to celebrate a clean, eco-friendly Ambubachi Mela-2023. The drive was conducted at the temple premises.

Environmentalist Moharana Choudhury kicked off the awareness drive with a speech on the significance of ecological aspects and the



Devotees gather for Ambubachi Mela at Kamakhya Temple, in Guwahati on Saturday. – UB Photos

environmental importance of the Nilachal Hills during the mega event. A signature campaign and one-to-one interaction with the devotees and visitors was also done. An interview and exchange of thoughts on sanitation, cleanliness, health-hygiene and eco-friendly premises were also conducted.

Team VoE had earlier worked on an awareness drive and signature campaign to create mass sensitization among devotees, visitors and sadhus at the Kamakhya Rail-

way Station on the occasion of Ambubachi to keep the temple premises clean and eco-friendly.

NGO AAYA, in collaboration with alumni association of Guwahati NCC, initiated a programme of beverages distribution among nearly 1,000 devotees of the Kamakhya Temple during the ongoing Ambubachi Mela. The distribution of packaged fruit juice, packaged water, etc., was done on Saturday, a press release stated.

More programmes are on the anvil for the devotees.

Reported by The Assam Tribune (A English Daily) 25th June 2023

Media Report Links-

- <https://www.sentinelassam.com/north-east-india-news/assam-news/guwahati-voes-clean-eco-friendly-plastic-free-ambubachi-mela-2023-initiative-654438>
- <https://www.sentinelassam.com/guwahati-city/an-awareness-campaign-launched-by-voice-of-environment-at-kamakhya-temple-premises-on-the-occasion-of-ambubachi-mela-2023-655345>
- <https://neindiabroadcast.com/2023/06/26/an-awareness-campaign-initiated-by-voice-of-environment-at-kamakhya-temple-premises-on-the-occasion-of-ambubachi-mela-2023/>

Research and Studies

The screenshot shows the ScienceDirect website interface. At the top, there's a navigation bar with 'ScienceDirect' logo, 'Journals & Books', a search bar, and 'Register'/'Sign in' buttons. Below this is a secondary bar with 'Access through your institution' and 'Purchase PDF' options. The main content area features a sidebar on the left with links like 'Article preview', 'Abstract', 'Introduction', etc. The central part displays the article title 'Landfill: An eclectic review on structure, reactions and remediation approach' from the journal 'Waste Management', Volume 164, June 2023. The authors listed are Tridib Mondal, Moharana Choudhury, Debajyoti Kundu, Deblina Dutta, and Palas Samanta. Their affiliations with various departments in India are provided. A 'Get citation' button is in the bottom left, and a 'FEEDBACK' button is in the bottom right.

A collaborative paper published via prestigious journal (Impact Factor-8.1+)

Link <https://www.sciencedirect.com/science/article/abs/pii/S0956053X23002593?via%3Dihub>

The screenshot shows the ScienceDirect website interface for the journal 'Total Environment Research Themes'. The article title is 'Trend analysis of long-term meteorological data of a growing metropolitan city in the era of global climate change' by Sayantan Halder, Moharana Choudhury, Santanu Choudhury, and Palas Samanta. The authors' affiliations are listed. The page includes an 'ARTICLE INFO' section with keywords like 'Mann-Kendall test', 'Sen's slope', 'ARIMA', 'Guwahati', and 'Climate change'. The 'ABSTRACT' section begins with 'It is crucial to look at the spatiotemporal meteorological dynamics from the perspective of climatic variability...'. A 'Check for updates' icon is visible on the right.

Link- <https://www.sciencedirect.com/science/article/pii/S2772809923000333?via%3Dihub>

Guwahati has turned warmer by 1.5°C in 50 years, says study

Kangkan.Kalita1@timesgroup.com

Guwahati: Research by scientists from India Meteorological Department (IMD) and leading universities in collaboration with research organisations have shown that Guwahati city has recorded an average temperature rise of above 1.5 degrees Celsius in the past 50 years, which is the threshold limit, as described in the COP21 Paris meeting of the United Nations Framework Convention on Climate Change (UNFCCC).

The findings for maximum and minimum temperature in Guwahati are consistent with increasing temperature trends in Iran and Serbia, respectively, researchers said. According to climatologists, an increase beyond this threshold may lead to drastic change in climate in



Annual trend shows an average increase of 2.05 degrees Celsius in maximum temperature in 50 years

Choudhury of Climate Research & Services, India Meteorological Department, Pune, independent researcher Sayantan Halder from Kolkata, environmentalist Moharana Choudhury of environmental research and management division, Voice of Environment (VoE), Guwahati, and Palas Samanta from department of environmental science, Sukanta Mahavidyalaya, University of North Bengal, Dhupguri.

"A significant rise in maximum temperature is observed. Pre-monsoon, monsoon and winter months witnessed a major rise in temperature. The magnitude of the change is greater in minimum temperature," read the paper focused on the largest city of the region and gateway to the northeast.

The annual trend shows an average increase of 2.05 degrees C in maximum temperature in 50 years, while the minimum temperature rose by 1.09 degrees C.

"Expanding urbanisation, worldwide warming, and shifts in atmosphere's circulation are just a few of the reasons that have contributed to rising patterns in ambient temperature. Increased baseline evapotranspiration and arid environments are expected in Guwahati due to substantial upward patterns in both maximum and minimum temperature," read the paper.

The paper, which highlighted meteorological, time series data (1970-2019) of Guwahati found average annual maximum temperature (50-year mean) to be 29.22 degrees C, with the monsoon season (32.14 degrees C) witnessing the highest temperature.

In the post-monsoon and winter months, the average maximum temperature increased by 2.35 degrees C and 1.9 degrees C, respectively.

The rainfall trends showed a decline in precipitation in winter and monsoon months and an upward trend in pre-monsoon and post-monsoon months. There has been a significant drop in monsoon precipitation (4.95 mm per year) and a slight drop of 0.62 mm in winter months, while both pre-monsoon and post-monsoon months witnessed slight growth in rainfall over the years (1.59 mm and 0.1 mm per year, respectively). The study also examines the monthly precipitation trends, with July showing the steepest decline, and March, April, May, September, October experienced increased rainfall.

Reported by The Times of India (A English National Daily) 16th June 2023

Media Report Links-

- <https://timesofindia.indiatimes.com/city/guwahati/guwahati-has-turned-warmer-by-1-5-degrees-celsius-in-50-years-says-study/articleshow/101040436.cms#:~:text=GUWAHATI%3A%20Research%20by%20scientists%20from,as%20described%20in%20the%20CO>
- <https://neindiabroadcast.com/2023/06/18/how-guwahatis-temperature-and-rainfall-patterns-have-changed-over-the-past-50-years-a-research-study-says/>
- https://epaper.sentinelassam.com/EditionPage/EPpage.php?edn=Saturday%20Fare&isid=THESENTI_SATF_20230701#Page/1
- <https://neindiabroadcast.com/2023/07/15/climate-change-is-a-concern-from-global-to-regional-level/>

Annual trend shows significant decrease in rainfall

Study indicates decline in precipitation in Guwahati

SIVASISH THAKUR

GUWAHATI, June 19: A research study on long-term meteorological data focussing mainly on rainfall and temperature pattern of Guwahati, the biggest metropolis of the North-east, has indicated a decline in precipitation during both monsoon and winter months.

At the same time, pre-monsoon and post-monsoon months have exhibited upward trends in rainfall. The annual trend also shows a significant decrease in rainfall over the study period, with a decline of 4.95 mm per year, amounting to a total drop of 245.5 mm over 50 years.

The research paper titled 'Trend Analysis of Long-Term Meteorological Data of a Growing Metropolitan City in the Era of Global Climate Change' highlights 50 years' meteorological and time series data (1970-2019) of Guwahati city and used statistical tests and models to analyse the trends and make predictions for the next ten years.

The article was published in the international journal *Total Environment Research Themes* (Elsevier).

"These results are consistent with a previous study conducted in Ranchi, India, which also found a decline in monsoon rainfall. The study further examines the monthly precipitation trends, with July showing the steepest decline, and March, April, May, September, and October experiencing increased rainfall. The kurtosis and skewness values' analysis suggests that the rainfall data during monsoon and post-monsoon months have lower variability than in other seasons," environ-

mentalist Moharana Choudhury of NGO Voice of Environment (VoE) – one of the co-authors – told *The Assam Tribune*.

The study reveals increased maximum and minimum temperatures throughout the year and across seasons. The highest temperatures are observed during the monsoon season, followed by the post-monsoon and pre-monsoon periods. The winter season exhibits the lowest temperatures.

The findings are consistent with a previous study conducted in Dibrugarh in upper Assam, which also reported an increasing trend in maximum and minimum temperatures. Overall, the study highlights the changing patterns of rainfall and temperature in Guwahati over the past 50 years and provides insights into the climate trends in the region.

The study has been authored by Sayantan Halder from Kolkata, Moharana Choudhury, Santanu Choudhury of Climate Research & Services, India Meteorological Department, Pune, and Dr Palas Samanta from the Department of Environmental Science, Sukanta Mahavidyalaya, University of North Bengal, Dhupguri.

According to the authors of the research study, these findings are essential for policymakers and researchers to understand and mitigate the potential impacts of climate change on water availability and climate scenario at regional and global levels.

"This research study will shed light on global and regional climatological aspects and we are looking forward for more such research collaboration for extensive study on climate change," Choudhury said.

Reported by The Assam Tribune (A English Daily) 20th June 2023