

Climate crisis—"an emergency

DR DEBAPRIYA
MUKHERJEE

A majority of the public has recognized the climate crisis as an "emergency" and it is viewed as the most important issue facing the world, ahead of migration, terrorism and the global economy. In India, the campaign 2019 by the two main political parties the Bharatiya Janata Party (BJP) and the Congress, including regional parties in India followed by 100 days performance of Central Government mainly focused on waiving-off farm loans, assuring minimum income to poor people, review of GST structure, 200 days work provision, probing of demonetization, surgical strike, abrogation of Article 370 for development of J & K, zero budget natural farming and many more. Sadly, governments both at center and states has failed to tackle this climate crisis, backing the interests of corporate in the name of development over the well being of ordinary people. The common people are practically facing the extreme heat waves, storm and floods, draught, landslides, sea level rise, wildfires leaving a trail of a) human and animal life losses, b) destruction of infrastructures, communication networks, and agricultural/livestock buildings, c) loss of crops and soils, d) transport of sediment loads and pollutant during incessant rainfall. Despite repeated warnings to the occurrence of devastating calamities, no sound scientific mechanism is in place to identify the areas that are currently susceptible

to the occurrence of these calamities and to take preventive measures to save human life and properties.

Recent past, the severity of flood in Kerala killed at least 370 people, displaced 780,000 and caused 30000-50000 crore worth of damage. Also the Kedarnath landslide in Uttarakhand in June 2013 caused by flash floods that resulted in over 5,000 deaths, was identified as the most tragic such disaster. Regarding heat waves, India witnessed 13 warmest years out of the 15 years and the annual mean temperature rising by 1.2 degrees Celsius. Burning of more than 375,000 hectare in Uttarakhand in 1995, 80,000 hectares in the Ganga-Yamuna watershed area in 1999, 19,000 hectares in Himachal Pradesh in 2010 and 10,000 hectares in Maharashtra in 2008 and 2010 is the clear evident of emitting greenhouse gases and jeopardizing vulnerable ecosystem. The vulnerable North East is also facing same problems. In six years till 2017, forest fires increased by 160 per cent in our country.

According to the report published by Paris-based International Energy Agency, global carbon dioxide emissions rose 1.7% in 2018, the highest rate of growth since 2013, and 70% higher than the average increase since 2010 and in India, emissions rose by 4.8%, although the nation's per capita release remained low at only 40% of the global average. India recorded a 4% rise in energy demand, led by coal (power generation) and oil (transport), the two biggest contributors to greenhouse gas emission. Since

the last century, the average global surface temperature has risen by 0.74 °C (95% confidence interval: 0.56-0.92 °C). At the end of 2015, 195 nations adopted the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC), which focused on limiting the increase in the global temperature to less than 2 °C above pre-industrial temperatures and on framing efficient and sustainable policies to prevent the increase of temperature and carbon emissions. The Greenhouse gas emissions (GHG), especially carbon dioxide (CO₂), emissions, are considered to be the main drivers of global warming as advocated by many scientists. If drastic measures are not taken, this crisis as warned by scientists, would have a huge impact on racism, division and conflict in future years.

In India, deforestation and use of coal in cement, power and other industrial production are all pumping out CO₂ into the atmosphere. Besides fossil fuels pumping out the harmful gases, natural weather fluctuations will exacerbate the problem as they hamper the ability of carbon sinks to store it. Cities are also responsible for three quarters of energy consumption and GHG emissions because more than half of the population is living in the cities. Despite huge GHG emission, coal consumption is being increased for supply of electricity. Crop burning that cause severe pollution during winter has not been stopped. Introduction of cleaner production concept and

alternative sources of energy are still a distant dream. Additionally, a considerable amount of atmospheric GHG is produced through soil processes though these processes help to consume CO₂ but human activities alters the exchange of carbon (C) and nitrogen (N) between soil and atmosphere. Thereby CO₂ is by far the biggest contributor to climate change.

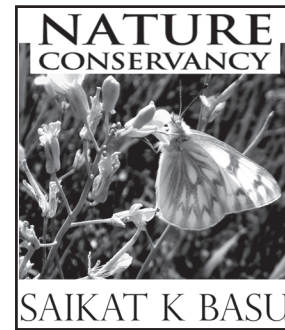
Now there is a growing consensus that climate is changing, but beliefs about the causal factors vary widely among the general public. Such causal beliefs are strongly influenced by cultural, political, and identity-driven views. As a result, the polarization of this climate debate has gone too far. Most interestingly, at least three-quarters of the public think the world is facing a "climate emergency", with climate breakdown at risk of becoming "extremely dangerous". The overwhelming majority in many countries including India were already seeing the influence of the climate crisis in extreme weather events, such as heat waves and floods. They describe it as a direct threat to ordinary people. Considering the climate crisis, the UN secretary general, António Guterres, has called for heads of government to bring plans—not words—to address the climate emergency ahead of a 2020 deadline for countries to raise their national targets under the Paris agreement. The treaty signed in 2015 obliged governments to keep temperatures well below 2C and to strive for 1.5C. India is a long way from even reaching reasonable levels of compliance

of Paris Agreement goals.

The major obstacle in mitigating the climate change is that citizens are relatively skeptical about increasing of earth temperature due to human activity and that will cause severe adverse impacts on the environment. However it is a massive challenge but there are real opportunities to make an impact individually and globally. It requires hard thinking and real commitment to change over to renewable energy and taking stern action against illegal deforestation, logging and mining gangs. Now governments must be tougher not only on big polluters to force them for restrictions on gas emission and wastewater discharge from the plants and municipalities but also on the top management of forest department to ensure sustainable afforestation and prevention of forest loss because the time is running out to save the planet. Most importantly, our politicians must understand the scale of the problem and take swift action on climate change so that environmental pressures do not become a source of hostility, anger and competition in our societies. If government do not take strong and decisive actions that this emergency requires, millions of people in India needs to demonstrate to the streets for solving this climate crisis as already observed in many countries.

(The writer is the former Senior Scientist Central Pollution Control Board and can be reached at : dpncpcb@yahoo.com)

Multi-Crop Based Pollinator Sanctuary: A New Canadian Model for Comprehensive Bee Conservation



Insect pollinators like bees are showing a trend of gradual decline across Canada, including the province of Alberta. A number of natural and anthropogenic factors are responsible for this but the bee populations, in particular, are the worst impacted. Environmental pollution, over application of agro-chemicals, changes in the land use patterns, industrial agriculture, parasitic diseases, lack of sufficient foraging plants, poor bee nutrition are some of the factors impacting bee populations significantly. Over 750 species of native bees are reported in Canada with Western Canada housing around 400 species alone. Southern Alberta particularly according to leading bee research experts is one of the major native bee diversity hotspots of the nation; and deserves special care and attention to secure their long term future. A wide diversity of native bees does not produce hives and actually live under the soil. Hence a habitat creation greatly benefits them in their annual life cycle of birth, regeneration and death by providing them with affordable, sustainable artificial, high quality, environment-friendly and farmer-friendly Pollinator Sanctuaries. Decline of pollinator insects will significantly impact crop production and hence directly and indirectly affect crop security. It is therefore important to develop a long term, comprehensive, cost effective and sustainable conservation model to protect natural insect pollinators like bees.

Recently, Farming Smarter, an applied research organization from Southern Alberta, Canada funded by the Alberta provincial grant entitled Canadian Agricultural Partnership (CAP) has started a new experiment in the conservation of insect pollinators with special emphasis to honey bees and native bees. By using a combination of local grown annual and perennial crops and wildflowers with varying flowering periods they have been experimenting to establish small plot Pollinator Sanctuaries to attract insect pollinators in large numbers. The experiment has been demonstrating excellent results in terms of the rich biodiversity of local insect pollinators captured in Farming Smarter rainfed plots have zero pesticide or herbicide application. The results from this Pollinator Sanctuary experiment has demonstrated that mixture of annual and

perennial crops with varying flowering periods could extend the bee foraging cycles beyond the conventional season and help insect pollinators including native bees and honey bees to forage for an extended period with an adequate supply of nectar and pollen through a significant part of the year. The project attempts to comprehensively identify top performing local crop species with respect to establishment, regeneration and in attracting natural insect pollinators like bees with particular emphasis to native bees. The judicious selection of appropriate crop species in the Farming Smarter experimental plots with different flowering period is showing great promise in protecting and conserving pollinators and can serve as a model for successful establishment or restoration of natural ecosystems.

Currently available commercial Pollinator Mixes consisting of native wildflowers is not a viable option due to their poor adaptability to local agronomic conditions, high yield fluctuations (based on locality and annual production variation), as well as high management and production cost (irrigation, pest management, high cost of native plant seeds). There is a huge emphasis currently in Canada and the US regarding extensive use of wildflowers for conservation of native pollinators like wild bees. However, it is important to note that there is no easily available and well documented research document or protocol or agronomic manual available for cultivating wildflowers in North America. No doubts these native plants attract pollinators in their natural ecosystems like the Rockies or foothills or the vast Prairies; and there are some highly specific insect pollinators that are exclusively dependent on specific plant species for collecting nectar and pollen that has developed over millions of years of evolution.

However, we need to remember that there is an inherent danger of native wildflower species transforming into weeds under the field and could prove to be detrimental to our ecosystem and economy equally. Furthermore, the cost of wildflower mix are so high that they will not attract any crop producers as they do not have much end values in commercial production system like grazing, or as pasture or as cover crops or in managing soil health or even as alternative food or forage or as industrial crops. The important question is why are then our farmers not interested to grow them at the commercial scale? The answer is neither is there specific and credible agronomic production information and research available on these wildflowers or the native plant seeds are easily available and accessible. Why should the farmers other than few homeowners be interested in planting

wildflowers seed that the conservation agencies promote so aggressively? Without involving farmers, minor patches of wildflower conservation efforts cannot save insect pollinators.

Suitable Pollinator Mixes as demonstrated by the Framing Smarter experiments could be used to create Pollinator Sanctuaries along farm perimeters, hard to access and unused areas of a farm, forest fringes, adjoining highways, boulevards and wetlands, city and municipal parks and gardens, golf courses, unused or agronomically unsuitable areas, remediation sites, and unused available sites in both rural and urban areas. Development of suitable eco-friendly Pollinator Mixes for different agro-climatic regions could therefore have both positive ecological and economic implications in terms of ecological services and environmental cost-benefit ratio. This project has wide implication in pollinator conservation as well as creation and establishment of low cost of ecological niche to protect pollinators, local biodiversity and in building a better local environment. Pollinator Sanctuaries, integrated with wetland development, can develop into suitable aquatic habitats for aquatic birds, especially if the accompanying water body is well stocked with fishes. Since forage species are included in the proposed Pollinator Mixes they could be used by ranchers as pastures for late fall grazing of animals. This new multi-stakeholder integrative approach can serve or cater to a large number of groups and communities at various levels in disseminating and educating public on the conservation of insect pollinators like bees. Locally adapted Pollinator Mix with their unique combination of diverse crop species suited and adapted for individual agro-climatic and ecosystem regions has the potential to yield optimal results towards successful bee conservation.

It is important however to note that plant yield and adaptation varies according to different ecosystems and agro-climatic conditions. It is also important to note that plants exhibit a strong Genotype X Environment interaction. As a consequence, it is not advisable to use same Pollinator Mix at different locations and habitats for integrated habitat development. Locally adapted biodiverse Pollinator Mix selected through multi-location trials under varied geographical, geological, ecological and climatic variations across different latitudes needs to be seriously evaluated for getting optimal results. An important approach for the project could be to develop a handy manual or protocol for farmers and crop producers to use pollinator-friendly practices and strategies that will help in pollinator conservation by making some minor adjustments to their conventional agricultural practices and/or strategies.

We might lose them before we get to know them

Protecting plant diversity in the Kangchenjunga Landscape

NAKUL CHETTRI

Ensnared in our concrete homes and glass offices, we may easily forget how the trees and plants outside our windows are not just part of the landscaping architecture, they are among creatures that made life on earth, as we know it, possible. We see plants as resources, which exist to produce our oxygen, start our food chains and regulate our planet's water cycles. We value the aesthetic, ecological and economic gains plants provide, and acknowledge the sheer number of forms in which they appear.

In any given area, plant diversity increases when different species of plants are able to flourish and multiply. Collectively, this diversity helps balance the environment we live in, protects sloping land from giving way, enriches our water resources and lends us comfort, joy, and good health—providing shade and shelter, blooming into full colour in spring, and supplying material for vital plant-derived medicines. Importantly, ecosystems with diverse plant species are also rich animal habitats and provide raw materials for many industries. In spite of their importance and despite realizing that many

varieties are disappearing from our ecosystems, we are not yet doing enough to ensure the future of our plant resources.

The Eastern Himalaya, located at the juncture of the Indo-Malayan, Palearctic, and Sino-Japanese realms, is one of the Earth's biologically richest areas. Variations in altitude, climate, and forest types lend the region its unique diversity. Many scholars, who have researched this region, recognize it as a 'cradle of flowering plants', and its rich plant diversity—high species numbers and high endemism—has been well recorded. Nestled in the Eastern Himalaya is the Kangchenjunga Landscape, which traverses the borders of Bhutan, India and Nepal. With 22 Important Bird and Biodiversity Areas, 11 Important Plant Areas, 19 protected areas, one Ramsar Site and one UNESCO World Heritage Site (the Khangchendzonga National Park in Sikkim), the Kangchenjunga Landscape is a priority area for biodiversity conservation.

To better understand the region's biodiversity and review the major conservation challenges it faces, a review of existing literature on plant species of the Kangchenjunga

Landscape was recently completed. There are 5,198 species of plants belonging to 1,548 genera and 216 families—along with at least 44 species that are threatened at the global or national level—in the landscape. Among these, 182 species are endemic to the Eastern Himalaya.

Plant research in the Kangchenjunga began in 1854 with an expedition headed by the noted British naturalist Joseph Dalton Hooker. However, the bulk of the research information on the region (85%) was collected between 1990 and 2016, which points towards increasing interest and investment in studying its biodiversity. There have also been increasing reports from the research community of the discovery of new plant species. Despite such interest, research in the landscape has been sporadic. Most of the data and information we have is from the Indian Himalaya. Comparatively less research has been conducted in Eastern Nepal and Bhutan. We do not yet have a complete picture of just how many varieties of plants are found in the region, and we do not know how many of them we're losing, and at what pace.

In spite of the gaps and despite the impacts of key

drivers such as climate change, forest degradation, and overexploitation, we know that within 25,000 km², the Kangchenjunga Landscape hosts over 5,000 recorded plant species. This is truly exceptional. The landscape is home to half of the estimated plant species in the Eastern Himalaya, a number that is easily comparable with the total number of plant species reported in Nepal (6,653) and Arunachal Pradesh, India (4,117), which are spread over 147,181 km² and 83,743 km² respectively.

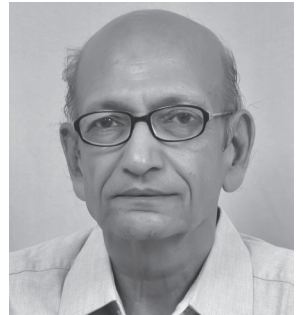
Globally, there are 300,000-400,000 known species of plants. Human civilizations—in different parts of the world and over different time periods—have historically depended on at least 3,000 varieties for food. Today, only about 150 plant species are cultivated, and just 10 meet over 90% of the world's food requirements. Biodiversity in agriculture is the lowest it has ever been, and it goes without saying that many other food resources and valuable plant species remain unexplored. As a result of human-induced pressures, a third of all species reported so far are at risk of disappearing forever. The rate at which this extinction is projected to occur will be 1,000-10,000 times greater

than what has so far been recorded. It is more important for us now than it has ever been to work together to protect our biodiversity.

In the Eastern Himalaya, the transboundary Kangchenjunga Landscape provides space for collective documentation of plant resources to understand global changes and challenges, and develop human resources to focus on good science and long-term collaborative research. Transboundary collaborative studies in the region (fostering cross-border research in Bhutan, India and Nepal) could provide opportunities for joint conservation interventions that carefully consider the impacts of climate change on the Himalaya and point towards how we can ensure the survival of our natural heritage into the future.

(Chettri is a Senior Biodiversity Specialist at the International Centre for Integrated Mountain Development (ICIMOD) and Programme Coordinator of its Kangchenjunga Landscape Conservation and Development Initiative. He is a co-author of the recently published Plant diversity of the Kangchenjunga Landscape, Eastern Himalayas.)

Give Education Vouchers to compete with the Computer



DR. BHARAT
JHUNJHUNWALA

Founder of Ali Baba, Jack Ma, in his address at the World Economic Forum said that only by changing education can children compete with machines. This means that reform of our education system should be the top economic priority. Our educational system, in rural areas in particular, is dominated by the government schools. However, not one of the 21 students in the merit list of Class X of UP Education Board came from government schools. There was none among the 14 students in the merit list of Class XII either. The pass percentage of government schools are much behind private schools across

the country. This is despite the salary of the government teachers today being about 35,000 rupees while salary of private teachers being about Rs 8,000 per month. We are spending our scarce economic resources only to ensure that we do not give good education.

The UP Government was spending Rs 25,000 per student per year on primary and secondary education in 2016-17. This would be about Rs 30,000 per student in 2020. This expenditure includes fake enrollments. The government schools make these to access benefits such as mid-day meals and free uniforms. A survey of nine districts in Bihar found 4.3 lakh fake enrollments. A survey of Jharkhand found 7.6 lakh fake enrollments. The actual per student expenditure would be about Rs 40,000 rupees per student per year if we exclude the fake enrollments. Therefore, if we reduce the assured salaries of government teachers by one-half, and distribute that amount to all the students, it would provide Rs

20,000 per student per year and enable the students to pay the fees of a school of their choice.

The National Sample Survey indicates private elementary-schools' median fee was Rs 417 per month in 2014. The corresponding figures for 2020 would be Rs 600 for elementary schools or, say, Rs 1,000 for the primary and secondary education together. It will be possible for the students presently enrolled in government schools to migrate to above-median private schools and pay their fee of up to Rs 2,000 per month. The private schools will also get additional moneys to upgrade the quality. This will lead to competition between schools. It will become necessary for the government schools to improve their teaching so that they get the vouchers and use the money to compensate for the one-half reduction in their salaries. Famed economist Milton Friedman held that education is like any other service like say that of a barber or a taxi. The quality of schools and the

educational status of our youth will improve by bringing in market-based competition. The Government will not have to bear any additional expenditure either.

International evidence is available for the positive impact of competition among schools. A study by the National Bureau of Economic Research of United States found that "Evidence on both small scale and large scale programs suggests that competition induced by vouchers leads public schools to improve." A study of the voucher system in Colombia by the World Bank said that those benefitting from the vouchers "scored 0.2 standard deviations higher on standardized tests, controlling for age, gender, parents' schooling, and residence." The same study found that in New Zealand "schools started to compete for students... because they received more operating funds as enrollment increased, salary scales and prestige for principals were linked to school size, and schools gaining

students were widely perceived to be successful, which motivated school boards to expand enrollments." The voucher system was introduced in Andhra Pradesh on experimental basis. A study by the Center for Civil Society found that voucher students performed better than their counterparts in government schools in English and in Maths



in Telugu medium private schools. The same study says that there was a positive and statistically significant impact on English, with voucher students scoring 2.2 points higher although there were no differences in performance in Hindi or Maths. The program was also particularly effective in improving girls' performance,

the study says. The conclusion is that the voucher system leads to increase in competition and improvement in educational achievement.

The main negative impact of the voucher system discussed in academic literature is the impact on social inequality. A number of studies show that voucher system leads to the upper class students migrating to the better schools in Sweden, New Zealand, United States and other developed countries. This problem has to be understood in the context of the developed countries. The United States has a rule whereby all students—rich and poor—living in a designated area have to necessarily go to the same school. There is no choice. The introduction of voucher-led choice immediately leads to the migration of upper class students to the better schools. The situation in India is entirely different. There is no compulsion of attending a particular school. As a result, the upper class students already go to a better and more expensive school. The voucher system will

only enable the poorer students to migrate to the better school in this circumstance. Perhaps for this reason a paper published in the Journal of Economic Literature said that vouchers delivered modest test-score gains in Andhra Pradesh "with no adverse distributional effects."

An argument extended for the poor performance of the government schools is that the poorer students are enrolled there. This is correct. However, the solution does not lie in investing more in the government schools because anecdotal evidence suggests this does not lead to better education. The solution is to provide vouchers to the poorer students and help them migrate to the better schools.

Another argument against the voucher system is that the private schools often provide freedom of cheating in exams. This argument applies where the schools are autonomous and make their own final assessments. In our country the exams of Class X and XII are conducted by CBSE or State Boards where the private- and government school

students have the same access to cheating.

We must immediately reduce the salaries of government teachers by 50 percent and distribute the saved amount of Rs 20,000 per student per year to all students so that they can take admission in a private- or government school of their choice. The government teachers will then have to garner only one-half of their salaries from the vouchers. They would also have the access to the school buildings already constructed from government funds. A caveat is that the value of the voucher can be increased for remote areas, say, to Rs 4,000 per month, so that both government and private the schools there can be run with smaller number of students. We need to move fast and provide high quality education to our youth by introducing the voucher system as highlighted by Mr Jack Ma.

(Formerly Professor of Economics at IIM Bengaluru Author's phone: 85278-29777)