



Newsletter

Voice of Environment

(Organization for Clean, Green & Sustainable Environment)

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Beat **Air** Pollution





Save our Souls... message received from Mother Earth!

Voice of Environment Newsletter

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FORWARD

I take this opportunity of forwarding a message on air pollution, cause, and related problem- for **Voice of Environment**. Entire world today is expressing a great concern for survival of humanity because impact of climate change has become a serious problem. The impact of this phenomenon is visible in current year in the form of rains, floods, landslides and may other natural disasters due unusual pattern of rains.

Pollution is understood by introduction of undesirable substances in natural environment. If these substances are introduced in air that cause Air pollution-a type of environmental pollution that affects the air and is usually caused by smoke or other harmful gases, mainly oxides of carbon, sulphur and nitrogen and so on. Air pollution has been identified as a danger to human health and Earth's many ecosystems for a long time. Air pollution can also cause headaches, dizziness, and nausea etc. Long-term health effects from air pollution include heart disease, lung cancer, and respiratory diseases such as emphysema. Air pollution can also cause long-term damage to people's nerves, brain, kidneys, liver, and other organs. In short, air pollution is a big challenge to humanity. However, the remedial measures to prevent air pollution are very simple. Every citizen can participate in bring down pollution within permissible limit. Few measures among many are to increase forest cover, stop uncontrolled deforestation, increase green belt around institutions and public place, controlled use of automobiles/personal vehicles, regular maintenance of vehicles, inculcate habit of use pooled vehicles or public transport, and minimal use of coal and firewood and soon.

I wish **Voice of Environment** group will take these suggestions to make the public aware and to educate about the simple actions. I am confident that such measure will facilitate to create a healthy and livable environment.

28th August, 2019

(Prof.G.S.Solanki)

From the Desk of the Editor:

Hi Folks!

Hope you are keeping well as we are back with a new issue!

The current issue focuses on the central theme Air Pollution in consonance with this year's World Environment Day theme. We are releasing this issue with a heavy heart as we painfully witness the great forest fires of Amazon rainforests that is causing humongous loss to the entire globe. Forests are the sources and sink of carbon that we emit due to anthropogenic processes. Amazon rainforests are the lungs of our planet. They are the sources of more than 20% oxygen in global oxygen budget. The great rainforests along the Amazon basin are one of the most pristine biodiversity hotspots of the globe. The Amazon region hosts more than half of the world's remaining tropical forests, and some parts have among the greatest concentrations of biodiversity found anywhere on Earth. Overall, the region is estimated to host about a quarter of all global biodiversity. The ongoing degradation of Amazonia is a result of cumulative greed of large corporations and capitalist governments who lacks knowledge of sustainable development. Our poor species are paying the prices of our limitless stupidity and exploitation of natural resources locked in the tropical forests of the world. The air pollution caused by the forest fires need no explanation as big cities such as Sao Paolo, Brazil is under thick smoke and haze for the most part of the day during the ongoing fires as the smoke travels more than 2000Kms aided by dry air and wind. Conversely, the stabilization of Amazonian deforestation and degradation would be an opportunity for local adaptation to climate change, as well as a potential global contributor towards mitigation of climate change. We need to stand together in this global crisis and fight back for our forest and environmental rights. Our upcoming generations must enjoy a world with fresh air, water and exquisite natural beauty. It is possible only if we come together and take collective action raising our voices but not the sea levels. Like always, experts, academicians, students and people from different backgrounds have contributed wholeheartedly to make this issue worthy of academic experience.

We wish our readers a happy reading and expect constructive suggestions and criticisms through email in voeditor@gmail.com. Also, don't forget to write us mentioning new themes and new avenues that would make Voice of Environment Newsletter a more engaging one!

INVITED ARTICLE

Air Pollution: Mother Earth taking a slow & steady step towards becoming a Gas Chamber:

A Narrative from Indian Perspective

Monali Sen, IFS

Joint Secretary

Environment Department

Government of Rajasthan, India

Introduction:

The word Pollution is nothing new – not at least in a unique issue sort of way – pollution has been the greatest challenge imposed on Mother Earth since the dawn of 21st Century. With the tide of industrial boom, sweeping destruction of the Carbon Sink named Forest to give way to Humanity, more & more dependency on artificial weather control & general luxury of life; the impending inevitability of choking off our own existence by all-engulfing pollution is emerging as the most prominent Global Scale problem today. Air pollution is ranking at the top amongst others. The black emissions of vehicle, industry & biomass burning, the suspended particulate matters arising out of Construction & Demolition Waste, even the burning of household fuel gives rise to Air Pollution.

Present Scenario in India:



Our Nation has reflected its pledge towards protection & conservation of nature by mandating it in the Constitution; for this purpose, the Air (Prevention and Control of Pollution) Act, 1981 was enacted under Art. 253 of the Constitution. even then there are challenges strong to overcome only with a meticulously planned approach & wisdom. As the issue of Air Pollution is multi-sectoral, involving power, transport, industry, residential, construction, and agriculture. In order to address the issue, therefore the Government has undertaken significant steps like notification of National Ambient Air Quality Standards and sector-specific emission and effluent standards for industries, setting up monitoring stations for assessment of ambient air quality, introducing cleaner fuels like CNG, LPG etc., launching of National Air Quality Index (AQI), banning of burning of biomass, issuance of directions under

Air (Prevention and Control of Pollution) Act, 1981 & so on.

The most prominent approach taken by GoI is the National Clean Air Programme (NCAP) for reduction of Air Pollution in both regional and urban levels. The NCAP is a joint programme of Central Ministry of Environment, Forest & Climate Change being monitored & implemented through CPCB (Central Pollution Control Board).

CPCB has 166 Air Quality Index (AQI) Stations installed all over the

BY 2024, POLLUTION CUT BY 30%







NATIONAL CLEAN AIR PROGRAMME (NCAP)	
Cities to be covered: 102	
GOAL: To meet annual average ambient air quality standards	
MID-TERM (5 YEARS) TARGET: Reducing air pollution by 20-30% by 2024, taking 2017 as base year	
HOW: Through city-specific air pollution abatement action plan	
INTERNATIONAL SUPPORT AGENCIES: World Bank, German development agency (GIZ), AFD (French funding agency), Swiss Development Corporation, Bloomberg Philanthropies	

BUILD CAPACITY BY SETTING UP:

- 1 National emission inventory
- 2 Air Information Centre for data analysis
- 3 Source apportionment studies
- 4 Guidelines for indoor air pollution
- 5 Rural monitoring stations

country, producing daily AQI value for monitoring purpose. Similarly, the State Pollution Control Boards (SPCB) has Ambient Air Quality Monitoring Station (AAQMS) installed in respective states as well for the same monitoring at State level. Under NCAP, CPCB is also carrying out the National Air Quality Monitoring Programme (NAMP) to determine status and trends of ambient air quality, the violation of standards & developing mitigative measures for the same. The programme involved a total of 731 operating stations in the country. Ambient Air Quality Data for the year 2017(Under NAMP) has recorded the level (inµg/m3) of Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Particulate Matter PM₁₀ (particulate matter having aerodynamic diameter ≤10 micrometre) & Particulate Matter PM_{2.5} (particulate matter having aerodynamic diameter ≤2.5 micrometre) all over the Country for a wide variety of time period; finally calculating the Annual Average value.

The National Air Quality Index prepared based on the data has been colour coded with 7 colours;

AQI	Remark	Color Code	Possible Health Impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lungs, asthma and heart diseases
201-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

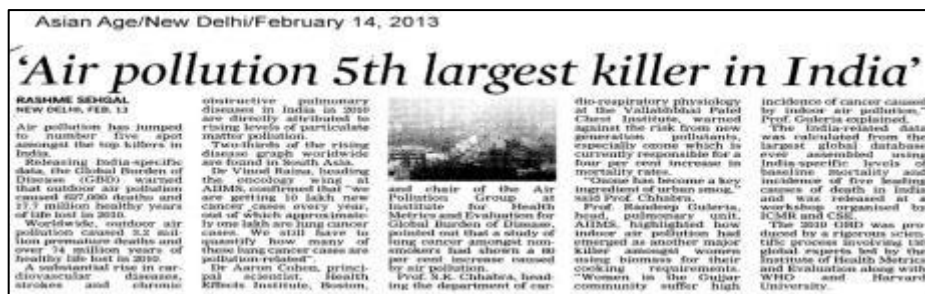
Red being the Severe (affecting healthy people and seriously impacting those with existing diseases), while Green being the Good colour with minimal impact. Based on this National Air Quality Index, 102 cities have been identified as Non-Attainment Cities in the country, where the Ambient Air Quality is over the safety level for all the four parameters recorded.

Future Goal:



The immediate goal of our country is to meet the prescribed annual average Ambient Air Quality Standards at all locations in the country in a stipulated timeframe, i.e. a 5-year plan starting with 2019 & the target is 20%–30% reduction of PM2.5 and PM10 concentration by 2024. The approach to attain this is collaborative, multi-scale and cross-sectoral coordination between Central Ministries, State Government and local bodies. The first step taken to achieve this goal is in the form of making an Action Plan for the 102 Non-attainment cities.

The Action Plan of Non-Attainment Cities have been prepared in a phased target pattern, i.e. starting with identification of emission sources & assessing the extent of contribution of these sources in pollution, thereby prioritizing the sources that need to be managed immediately, with simultaneous evaluation of various options for controlling the sources with regard to feasibility and economic viability, ultimately culminating in mitigation of safety standards. At present all the states are in the process of finalizing the Action Plan, with few already completed the task & started implementing the same.



Hon'ble National Green Tribunal (NGT) has also taken up the matter of Air Pollution as one of the biggest threat to Human life & thereby issuing directions to all states for timely

compliance of the Action Plan & achieving the goal of cleaning our environment with fresh & pure air for all.

Conclusion:

Culminating towards the end, the only conclusion that can be drawn is that Air is for all; from a busy industry unit to the village on the bank of a pristine flowing river. The pollutant contributors may have the major responsibility of control but even then the general public shares the duty of preventing pollution. The duty can be prohibitory, regulatory or informative, based on the level of functioning, but it's a duty – a Fundamental Duty of a Human being towards Mother Earth. The initiatives taken by the government only become successful by peoples' participation and disciplined coordination. Air being the lifeline, maybe the moral obligation are of a more binding nature in this case. Never the less with a determination of the whole country, it can be achieved to make the future less polluted & habitable.

References:

1. <http://cpcb.nic.in>
2. <http://vikaspedia.in>
3. <http://pib.nic.in>
4. <http://moef.gov.in>
5. www.google.com

PR Speaks...

The Amazon rainforest is the world's largest rain forest which is responsible for almost 20% of the earth's fresh oxygen supply is at the risk of getting burned out completely, It has been burning for over 20 days resulting in a major biodiversity and ecosystem loss. The devastating impact can already be seen in different regions in South America including the Atlantic coast and Sao Paulo, Brazil's largest city. Though forest fires are common in the Amazon during this period, as it is a dry season in the southern Amazon, the year 2019 has seen an unprecedented rise in the number and intensity of forest fires. The worrisome fact is that the burning has increased at a time when there is a huge decrease in the rates of deforestation in the Brazilian Amazon.

The most bio-diverse place on earth, the Amazon rainforest teems with life. This forest is currently home to an uncountable number of species of fauna and flora. Thousands of tree species, 50,000 species of other plants, and hundreds of thousands of insects can be found throughout the forest habitats of the region. It is very difficult to summarize the complexity of the Amazonian ecosystem because of the sheer magnitude and complexity of life. While the immediate impact of the fire would be changes in the heating of the regional atmosphere, in the long term it is expected to lead to an increase in the global carbon dioxide concentration.

The Amazon rainforests also provides crucial ecosystem goods and services to humanity, including many that have considerable economic and societal value. The term "**ecosystem goods and services**" has become widely used in recent years, and typically refers to the supply of valuable

products and materials (including agricultural, forest, mineral, and pharmaceutical commodities), the support and regulation of environmental conditions (through processes like pollination, flood control, and water purification), and the provision of cultural and aesthetic benefits (including ecotourism, heritage, and sense of place) by ecosystems. Rain forests in the Amazon sequester carbon from the global atmosphere, regulate the water balance and flow of the entire Amazon River system, influence the patterns of climate and air chemistry over much of the continent, and may even ameliorate the spread of vector-borne and water-borne diseases across the region. But the long-term sustainability of the Amazonian rain forests, and the multiple goods and services they provide, may now be under threat from human actions. The region has been experiencing high rates of deforestation for many years, and this may now be affecting the ecological integrity of the forests.

But as forests burn and global warming worsens, the impact of Amazon deforestation continues to gradually undo the fragile ecological processes that have been refined over millions of years. Ironically, as rainforest continues to disappear, scientific work from the last two decades has shed light on the critical ties that link the health of rainforests to the rest of the world.

At the end, we can take the following steps to help save the Amazon as well as the world's other rainforests:

- Say no to deforestation and boycott the consumption of products, the production of which promote deforestation (such as palm oil)
- Reduce oil consumptions
- Invest in rainforest communities and support rainforest action network to save and protect them
- Create habitat for migrating animals
- Support indigenous communities
- Reduce your carbon footprint as much as possible
- Let your voice be heard...

References:

1. Connell, J.H. (1978). Diversity in Tropical Rain Forests and Coral Reefs. *Science*, 1302-1310.
2. Gentry, A. H., & Dodson, C. (1987). Contribution of nontrees to species richness of a tropical rain forest. *Biotropica*, 149-156.
3. Queenborough, S.A., Metz, M.R., Wiegand, T. & Valencia, R. (2012). Palms, peccaries and perturbations:

This is a new section of Voice of Environment Newsletter to be written by none other than our very own PR aka Priyabrata Roy, He is a SRF with Indian Council of Medical Research (ICMR) New Delhi, Government of India. He is attached with Department of Molecular Biology, University of Kalyani. He is actively attached with Basudha Laboratory Centre for Interdisciplinary Studies, Kolkata as Junior Scientist and engaged in cross-cutting research activities. In this corner, he will regularly write on burning environmental issues that stare at us as an imminent danger.

THE RISING TREND OF NEAR SURFACE AIR TEMPERATURE IN THE MANGROVE DOMINATED INDIAN SUNDARBANS REGION

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Marine pelagic systems are susceptible to climate change through extreme events and the contraction or expansion of oceanic zones. For example, sea temperature changes driven by variations in the North Atlantic Oscillation (NAO) have been linked to fluctuations in cod (*Gadusmorhua*) recruitment and habitat shifts off Labrador and Newfoundland (Rose et al., 2000). On the west coast of Canada and Alaska, the Gulf of Alaska is exhibiting increased temperature and decreased salinity levels. The result is seen in shallower mixed layers, which lead to reduced nutrient supply (Whitney and Freeland, 1999), impacting primary production levels and altering food webs (Bjornstad and Grenfell, 2001; Zabel et. al., 2003; Richardson and Schoeman, 2004). The rising trend of near surface air temperature in the mangrove dominated Indian Sundarbans region (as revealed from the data bank generated from Sagar Island, Fig. 1) has the possibility of altering the biotic community in this designated World Heritage Site of Indian sub-continent. Hence a proper management action plan is of great importance to minimize and control the emission from brick kilns, industries, fishing vessels and trawlers, which are the main point sources of GHG (Greenhouse Gas) in this deltaic complex, Fig. (2). Also there is a need to develop nursery of blue carbon on large scale basis, which can act as GHG and temperature regulators.

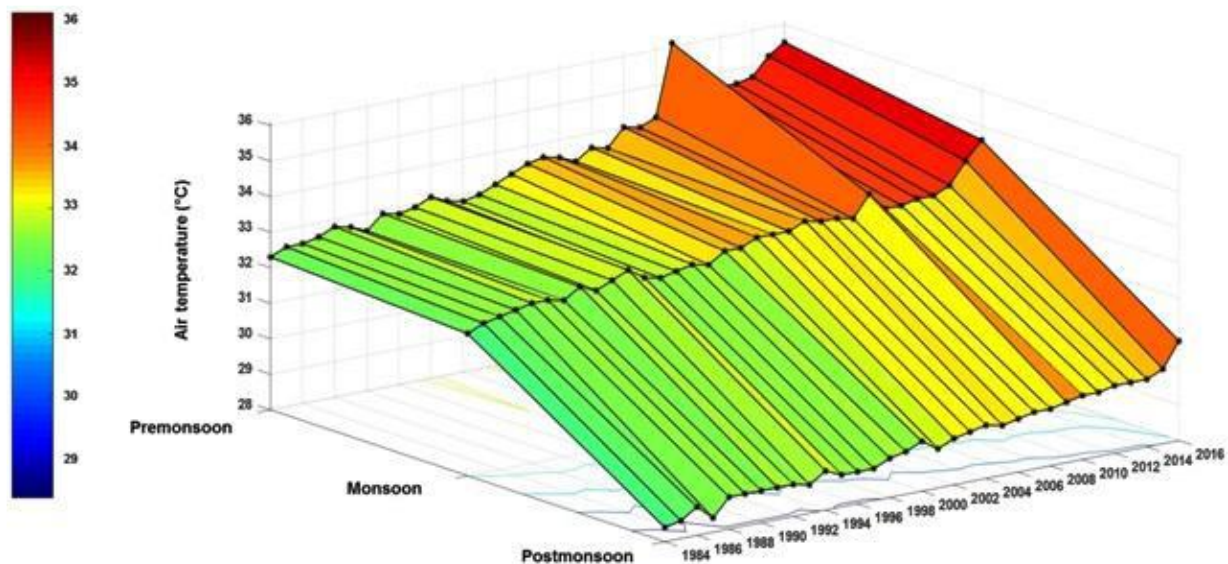


Figure 1. Temporal variation of near surface air temperature in Sagar Island

Source: Agarwal et.al, 2018



Figure 2. Point sources of GHGs in and around Indian Sundarbans

Source: CC BY 4.0. Creative Commons (CC)

BIOINDICATORS OF ENVIRONMENTAL POLLUTION: AN IN-DEPTH INSIGHT

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A Preliminary Background

Bioindicators incorporate natural processes, species, or networks; utilized to evaluate the nature of the earth and how it changes over time. Changes in the earth are regularly ascribed to anthropogenic unsettling influences (e.g., contamination, land-use changes) or normal stressors (e.g., drought, late spring freeze). The boundless advancement and use of bioindicators have happened fundamentally since the 1960s. Throughout the years, we have extended our collection of bioindicators to help us in contemplating a wide range of conditions (i.e., aquatic and terrestrial), utilizing all major scientific categorizations.

Be that as it may, not every single natural process, species, or networks can fill in as effective bioindicators. Physical, synthetic, and natural components (e.g., substrate, light, temperature, competition) fluctuate among conditions. After some time, populaces advance methodologies to augment development and proliferation (i.e., fitness) inside a particular scope of ecological elements. Outside a person's ecological optima, or resistance extends, its physiology, as well as conduct, might be contrarily influenced, decreasing its general wellness. Decreased wellness can in this way disturb populace elements and change the network overall. Bioindicator species successfully show the state of the earth due to their moderate resistance to natural changeability. Interestingly, uncommon species (or species assemblages) with restricted resistances are frequently

excessively delicate to natural change, or excessively rarely experienced, to mirror the general biotic reaction. In like manner, omnipresent species (or species arrays) with wide resistances are less touchy to ecological changes which generally exasperate the remainder of the network. The utilization of bioindicators, in any case, is not simply confined to a solitary animal type with a constrained natural resilience. Whole people group, enveloping an expansive scope of natural resilience, can fill in as bioindicators and speak to different wellsprings of information to survey ecological condition in a "biotic list" or "multimetric" approach.

Besides, organic procedures inside an individual can go about as bioindicators. For instance, merciless trout possess coldwater surges of the western United States. Most people have an upper warm resistance of 20°– 25°C; hence, their temperature affectability can be utilized as a bioindicator of water temperature. Animals touching, consuming, and logging is instances of human-related aggravations that can build water temperature in these streams and be recognized by merciless trout at different organic scales. A prompt reaction of merciless to warm contamination happens at the cell level. In particular, heat stun protein (hsp) amalgamation increments to shield imperative cell capacities from warm pressure. We can evaluate hsp levels to gauge warm worry in relentless trout and survey how the earth has been modified. On the off chance that warm pressure endures, such physiological changes are commonly tractable at the individual dimension through conduct changes and resulting decreases in development and advancement. In the extraordinary cases, notwithstanding, substantial and tenacious warm modifications can decrease populace numbers and even lead to neighbourhood annihilations, making compositional moves warm water fisheries.

Bioindicators vs. Biomonitoring: A Scientific Dilemma

In normal usage, the expressions "biomonitoring" and "bioindication" are exchangeable, yet in mainstream research, these terms have progressively explicit implications. Bioindicators subjectively surveys biotic reactions to ecological pressure (e.g., nearness of the lichen, *Lecanoraconizaeoides*, demonstrates poor air quality), while biomonitors quantitatively decide a reaction (e.g., decreases in lichen chlorophyll substance or assorted variety shows the nearness and seriousness of air contamination). From this point forward, the expression "bioindicator" is utilized as an aggregate term to allude to all terms identifying with the identification of biotic reactions to ecological pressure. Inside this structure, there are three principalelements of bioindicators (1) to screen the earth (i.e., physical or potentially concoction changes), (2) to screen environmental procedures, and (3) to screen biodiversity.

Instances of natural, biological, and biodiversity markers can be found in a wide range of life forms possessing various conditions. Lichens (an advantageous interaction among organisms, green growth, and additionally cyanobacteria) and bryophytes (mosses and liverworts) are frequently used to evaluate air contamination. Lichens and bryophytes fill in as viable bioindicators of air quality since they have no roots, no fingernail skin, and gain every one of their supplements from direct introduction to the air. Their high surface territory to volume proportion further empowers the capture attempt and amassing of contaminants from the air.

Like lichens and bryophytes, aquatic macroinvertebrates have a significant number of the trademark qualities of good bioindicators. The most widely recognized use of macroinvertebrates as bioindicators, due to their speciose nature, is at the network scale. A healthy stream or waterway regularly contains in excess of 40 recognizable taxa, speaking to a scope of territory inclinations and life history techniques. This ordered and practical assorted variety can catch the heap reactions to various stressors and unsettling influences, including the nearness of fine residue, metals, supplements, and hydrologic modifications. Appropriately, macroinvertebrate networks have been regularly utilized as natural, biological, and biodiversity pointers. As of now, each of the 50 conditions of the United States utilizes oceanic macroinvertebrates to survey the organic strength of streams and waterways.

Bioindicators vs. Traditional Methods: A Conceptual Thought

Researchers have customarily led concoction examines and legitimately estimated physical parameters of the earth (e.g., ambient temperature, salinity, nutrients, pollutants, available light and gas levels), while the utilization of bioindicators utilizes the biota to survey the total effects of both substance toxins and environment changes after some time. Thus, the utilization of bioindicators is on a very basic level not quite the same as exemplary proportions of natural quality and offers various points of interest. To begin with, bioindicators add a fleeting segment compared to the life expectancy or living arrangement time of a life form in a specific framework, permitting the incorporation of current, past, or future natural conditions. Conversely, numerous synthetic and physical estimations just portray conditions at the season of inspecting, expanding the likelihood of missing sporadic beats of toxins. Furthermore, contaminants can happen in exceedingly low fixations. Dreary examinations with very touchy advancements, at a restrictive expense, are required to recognize such low fixations. When distinguished, researchers must connections any potential natural peril with these follow measures of contaminants, when such connections are largely obscure. On the other hand, the resilience scope of bioindicators gives an image of naturally important dimensions of poisons, regardless of how little.

Another advantage of the utilization of bioindicators is their capacity to show aberrant biotic impacts of contaminations when numerous physical or concoction estimations cannot. Plainly, a pipe dumping phosphorus-rich sewage into a lake will antagonistically influence the biological system. Phosphorous normally confines essential creation in freshwater biological systems; in this way, we may foresee that raised phosphorus focuses will build the development and generation of certain species. Synthetic estimations, in any case, may not precisely mirror a decrease in animal types assorted variety or how the development and propagation of different species may decay because of aggressive prohibition. Roundabout contaminant impacts are particularly hard to gather from concoction or physical estimations because of bioaccumulation. Metals, among different contaminants, amass in natural life forms, making metal focuses enhance through sustenance networks. In this manner, contaminant levels at higher trophic dimensions might be underrepresented by physical or substance estimations.

Conspicuous Qualities

Considering the 1.7 million species that right now archived on Earth, how would we pick only one as a bioindicator? The appropriate response is basic: No single species can sufficiently show each kind of aggravation or worry in all conditions. Contingent on the particular condition, the species present, and neighbourhood unsettling influences, proper bioindicator species, or gatherings of species should be chosen. Scientists have set up an expansive arrangement of criteria that species must show to be viewed as great bioindicators.

Pros and Cons

The various advantages of bioindicators have prodded administrative commands for their utilization in nations around the globe and their consideration in a few worldwide accords. However, bioindicators are not without their issues. Like the canaries in the coal-mineshaft, we depend upon the affectability of some bioindicators to work as early-cautioning signals. In certain occurrences, we cannot segregate common fluctuation from changes because of human effects, subsequently constraining the pertinence of bioindicators in heterogeneous conditions. In like manner, populaces of pointer species might be affected by components other than the aggravation or stress (e.g., disease, parasitism, competition, predation), confusing our image of the causal instruments of progress. A second analysis of the utilization of bioindicators is that their pointer capacity is scale-subordinate. For instance, an expansive vertebrate marker (e.g., a fish) may neglect to demonstrate the biodiversity of the neighbourhood's creepycrawly network. Third, bioindicator species constantly have contrasting territory prerequisites than different species in their biological system. Dealing with a biological system as per the natural surroundings necessities of a specific bioindicator may neglect to secure uncommon species with various prerequisites. At last, the general goal of bioindicators is to utilize solitary animal groups, or a little gathering of animal groups, to survey the nature of a domain and how it changes after some time, yet this can speak to a distortion of an overwhelming framework.

Like all administration devices, we should be aware of its defects. In any case, the restrictions of bioindicators are obviously eclipsed by their advantages. Bioindicators can be utilized at a scope of scales, from the cell to the environment level, to assess the soundness of a specific biological system. They unite data from the organic, physical, and concoction segments of our reality that show themselves as changes in individual wellness, populace thickness, network structure, and biological system forms. From an administration viewpoint, bioindicators illuminate our activities with respect to what is and isn't organically reasonable. Without the greenery in the tundra, the vicious in the mountain stream, and the canary in the coal-mineshaft, we may not perceive the effect of our aggravations before it is past the point where it is possible to effectively counteract them.

A Final Thought

Finally, given a large number of substances and elements to screen, researchers currently comprehend that the biota itself is the best indicator of how biological systems react to unsettling influence or the nearness of a stressor. While the utilization of entire networks (and every one of animal types' reactions inside them) can be instructive, issues can emerge in particularly speciose living spaces. A normal tropical rainforest may contain roughly 300 tree species for every hectare and identifying the reaction of every individual species to an unsettling influence is obviously implausible. Besides, an unnecessary number of unique species' reactions can cloud an unmistakable bioindication sign (e.g., a few species may increase while others deplete). In these cases, to coordinate all the immediate and aberrant impacts of an aggravation researchers centre just on a subset of the biota or single species to recount to the story. This limited methodology makes checking even more naturally important and knowledgeable. Besides, a typical issue with compound and physical estimations is that they improve a convoluted reaction innate in these species-rich natural surroundings. Bioindicators depend upon the muddled complexities of biological systems and utilize an agent or amassed reaction to pass on a dynamic image of the state of the earth.

INSIGHTS INTO CERTAIN INNOVATIONS WHICH COULD SUSTAIN IN ERA OF ATMOSPHERIC POLLUTION AND GLOBAL WARMING

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The industrial revolution was one of the first incidences which directed human attention to the by-products of the industries which would be causing harm to the environment. Chopping down of forests for timber utilization in various industries coupled with no insight into development of strict laws for sustainable management of industries along with steady human population growth started presenting health hazards in humans. Use of coal and other non-renewable resources for various human purposes was counted upon as reasons for the London Smog 1952 which resulted in the Clean Air Act, 1956. The '70s saw the hullabaloo regarding ozone layer depletion by chlorofluorocarbons and the subsequent Montreal protocol which brought many countries on one platform for a common concern regarding the planet.

The production of pollutants started and global warming was triggered a long time back. Now, in 2019, the Mauna Loa Observatory in Hawaii calculated the concentration of CO₂ in the atmosphere as over 415 parts per million (ppm). Despite so many years of the global effort to reduce global warming and heal the ozone layer, the carbon dioxide in the atmosphere is at present, at the highest level. Scientists have concluded that the last time planet Earth had experienced such a high carbon dioxide level was when humans had not even evolved.

In the wake of this grave concern regarding air pollution, scientists and innovators are working towards bringing in new technology to trap atmospheric pollutants and recycle it. The policymakers are working towards the reduction of atmospheric pollutants and still meet product demands. In the last few years, certain interesting innovations have come up which trapped the atmospheric pollutant, reduced health hazard for humans, brought awareness and helped in mitigating the effects of an impending climate catastrophe. Here are few such examples:

1. Like we filter our water why can't we filter atmospheric pollutant by clothes we wear? All of us wear clothes and we are mobile. Hence all our human population can filter atmospheric pollutants too. Catalytic Clothing is a fashion initiative started by former fashion designer Helen Storey and University of Sheffield Professor, Anthony Ryan. The cloths can be coated with nano-titania catalyst which can be developed as a detergent and can attach with cloths when one washes them. Nano-titania is a powerful catalytic agent which can speed up the conversion of (for example) harmful NO_x air pollutants to harmless byproducts that can be washed away with the rain.
2. **Prometheus** founder and CEO, Rob McGinnis has patented the concept of making a big machine which can trap atmospheric carbon and transform it into usable fuel, **gasoline**. The concept aims at developing carbon neutral form of transportation.
3. **Graviky lab** co-founder and inventor of **Air-Ink**, Anirudh Sharma developed a device which would arrest soot discharged from vehicle exhaust pipes. The collected soot undergoes a purification process to remove heavy metals. Along with purification, the soot is finally mixed with

a solvent to develop an ink which can be used for various painting purposes. The usefulness of the invention is calculated by the amount of carbon dioxide it is converting and hence the makers presented that “more than 203 gallons (770 litres) of Air-Ink have been harvested to date, which is equivalent to the CO₂ emissions from driving a diesel vehicle for 2.3 years without a break”.

4. **Novomer** has developed sustainable polymer which can be used commercially in coating, sealant and elastomers. The polymer is developed by using carbon dioxide, carbon monoxide from the atmosphere in combustion with propylene oxide or ethylene oxide.

5. **10XBeta** CEO Marcel Botha developed a “Shoe without a footprint” whose sole is made out of converted carbon dioxide. The carbon dioxide from heavy industries and power plant was captured and was the basis of developing the foam which is being used for the making of sole of the shoe.

6. **Liquid Light** co-founder Kyle Teamey aims at trapping and converting atmospheric carbon dioxide and developing raw materials like ethylene glycol for polyester fibre, plastic bottles and antifreeze. The invention is a set of catalysts which can produce 60 carbon-based chemicals from carbon dioxide and electricity.

The scientist across the globe are working towards various methods of trapping carbon dioxide, reducing global warming, reducing vehicular pollutants and recycling the same. Yet a major onus is on the policymakers in mitigating effects of climate change. The land-use policies should be clear-cut defined with a major focus on green space and green cover. The land-use land cover policy should be strictly followed and no agricultural land, forest or green space land should be diverted for concrete construction.

The effects of climate degradation are very much evident. North India faces severe smog during winter months and short-term remedies like stopping the usage of vehicles, odd-even number rules, not allowing farmers to burn crop would not be effective. A landscape-level approach to understanding land-use and land cover would bring larger impact on climate change understanding.

ARE WE REALLY SAFE AT HOME?

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When we return home after a tiring day at work or college, we need closure from the rest of the world and crave our own personal space. We close the windows and doors, switch on the AC and play the soul-satisfying music. We are eventually lost in the comfort of our living space without realizing how unfavourable it becomes.

Indoor culprits might not seem so obvious since we mainly associate air pollution with the smoke generated from vehicles, powerplants and factories. However, it might come as a shock to most of us that **indoor air might be two to five times more polluted than the outdoor air.**

A study conducted by NASA revealed that the household upholsteries, cleaning materials, synthetic fibres, rug cleaners, etc., release formaldehyde, benzene and trichloroethylene which are

responsible for causing chronic obstructive respiratory diseases, lung cancer, pneumonia and asthma. Household appliances are also sometimes known to release toxic gases like chlorofluorocarbons and carbon monoxide. Machines and household chemicals aren't the only risk factors. Friends who smoke indoors might seem cool, but that's really not the case. They are spewing a mouthful of carcinogens at your face and degrading the quality of indoor air.

What can be done to improve indoor air quality? When faced with dire situations, we humans turn to mother nature's way of maintaining balance and harmony in the ecosystem and implement ways for our own survival.

Outdoor plants can be brought inside and placed in a sunlit place. Not only do they add to the aesthetic beauty of the indoor space but they also have a soothing effect on our minds. It is common knowledge that plants absorb carbon dioxide and use it for photosynthesis. Plants also absorb harmful gases such as volatile organic compounds and hence can be used to improve the air quality of indoor spaces.

The **Gerbera daisy** absorbs benzene and trichloroethylene and releases ample quantities of oxygen into the atmosphere. **Peace lilies** are easy to care for and help reduce the volatile toxins such as benzene, acetone, xylene, ethyl acetate and trichloroethylene. The **spider plant** can be placed near the fireplace or the kitchen where there is significant carbon monoxide, xylene and formaldehyde build up. The **bamboo palm** is another good natural air purifier as well as an insect repellent. It also removes benzene, formaldehyde carbon monoxide, xylene and chloroform from the air. **Golden Pothos** are broad-leaved houseplants and can grow up to 40 meters in length and removes or reduces formaldehyde, toluene, benzene, carbon monoxide and xylene.

Apart from these, there are many other plants that work as natural air purifiers. Most people nowadays run to buy fancy and expensive air purifiers many of which require significant amounts of energy to function. We should realize that there have always been better natural options. Plants already do such a wonderful job of soil purification by phytoremediation; so, why can't we count on them to make our favourite place a healthier and safer place to live?

THE GROWING ECLIPSE OF AIR POLLUTION

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Air Pollution is the presence of contaminants and harmful substances in the atmosphere. Some of the common example of air pollutants are soot, smoke, pollen, aerosols, methane and carbon-di-oxide, particulate matter. Air Pollution is one of the major global issues of present times. Recognizing the extent of the problem, the United Nations Environment Program declared that the theme of this year's (2019) universal plan is - Air Pollution.

The range and effects of air pollution are not distributed evenly in the world. In India, the National Air Quality Index (AQI) is used as a measure for outdoor Air Pollution which rates air quality in various cities throughout the country based on the presence of eight pollutants viz. Particulate Matter PM_{2.5} and PM₁₀, Nitrogen Dioxide (NO₂), Sulphur Dioxide (SO₂), Carbon Monoxide (CO), Ozone (O₃), Ammonia (NH₃) and Lead (Pb). It was launched in October 2014 by the then Environment Minister Mr. PrakashJavdekar as an initiative under "Swachh Bharat". The index transforms complex air quality data of these pollutants into a single number and a colour which is further categorized based on ambient concentration values of air pollutants and their likely health impacts into six categories i.e. Good, Satisfactory, Moderately Polluted, Poor, Very Poor and Severe. The AQI is indicating degradation in air quality in major cities especially around winter season.

The decline in air quality affects quality of life and is a severe environmental risk to health. As per WHO (2018) report, increased levels of air pollution can result in diseases such as heart diseases, lung cancer, and both chronic and acute respiratory diseases, including asthma. A 2013 assessment by WHO's International Agency for Research on Cancer (IARC) showed that (outdoor) air pollution is carcinogenic to humans, with pollutants such as particulate matter most closely associated with increased cancer incidence, especially lung cancer. It also highlighted there might be an association also between outdoor air pollution and increase in cancer of the urinary tract/bladder. WHO (2018) also estimated that in 2016, 58% of outdoor air pollution-related premature deaths were due to ischemic heart disease and strokes while 18% of deaths were due to chronic obstructive pulmonary disease and acute lower respiratory infections respectively. 6% of deaths were also due to lung cancer.

While most of these effects emerge due to long-term exposure, air pollution can also cause short-term complications including sneezing and coughing, eye irritation, headaches, and dizziness. The pollutants not only cause direct health issues but also responsible for indirect

negative externalities due to global warming caused by the greenhouse effect. Some of these challenges such as heat-waves, extreme weather and food supply disruptions are related to increased greenhouse gases.

As of 2016, around 91% of the world population was living in places where the air quality was not up to the WHO air quality guidelines. Most of these inhabitants were from low- and middle-income group countries. India as a thriving developing country cannot ignore the importance of air quality while planning for economic growth and social development. To attain sustainable development where citizens of the country are healthy to reap the benefits of development and contribute to nation's growth, it is vital that practical regulations are placed and under an effective monitoring system for sectors causing most of the pollutant emission like transportation and industries.

Countries like China, for example, is tackling the smog-choked skies caused from years of rapid industrial expansion, partly by closing or cancelling coal-fired power plants and the U.S., California is setting an example through its emissions standards aimed at improving air quality, especially in places which are in acute need like Los Angeles. On a larger scale, countries are collectively making commitments to limit emissions of carbon dioxide and other greenhouse gases on international platforms such as the Paris Agreement as ratified on November 4, 2016, and the Kigali Amendment which seeks to advance from the Montreal Protocol, banning heat-trapping Hydrofluorocarbons (HFCs) and Chlorofluorocarbons (CFCs). In addition, innovative and minimalistic measures including electric-based solution, renewable energy, earth hour, pollution pods, smog-free towers, air pollution based ink etc. are the need-of-the-hour.

In a step towards ratifying the issue India's "*Hawaane de*" was launched this year on the World Environment Day (5th June). It is aimed to raise awareness in the general public regarding the increasing air pollution levels. More of such initiatives and solutions are required on the part of the government as well as the people/individuals to curb this soaring environmental issue. It is important to understand that although the problem is there on a global level, the developing and under-developed countries will bear the burden by a disproportionately greater margin.

FUGITIVE DUST CONTROL IN CEMENT INDUSTRIES

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Introduction

Cement is a mineral, non-metallic material with hydraulic binding properties, and is used as a bonding agent in building materials. It is a fine powder, typically grey in colour, that involves a mixture of the hydraulic cement minerals to which one or more forms of calcium sulphate have been added. The cement manufacturing process can be divided into the following primary process components:

- Raw materials acquisition and handling,
- Kiln feed preparation,
- Pyro processing or Clinkerization,
- Finished cement grinding.

The necessity for control of Fugitive Dust

The dust generated from cement plant may be classified as inert dust or nuisance dust and can be defined as dust which contains less than 1% quartz. Due to the low content of silicates, nuisance dust has a little adverse effect on the lungs. Any reaction that occurs from such dust is potentially reversible. If irritative dust is present in extreme concentrations in the workplace, it can reduce visibility, cause unpleasant deposits in eyes, ears, and nasal passages, and can cause injury to the skin by chemical or mechanical action. Dust is classified based on an occupational-health point of view into three primary categories: **respirable**, **inhalable** and **total dust**.

Respirable dust refers to those dust particles that are sufficiently small to penetrate the nose, the upper respiratory system and reach deep into the lungs. If particles penetrate the deep respiratory system which is generally beyond the body's natural clearance mechanisms of cilia and mucus, then they are generally retained. **Inhalable dust** is the fraction of dust which enters the body but is trapped in the nose, throat, and upper respiratory tract. The median aerodynamic diameter of inhalable dust is about 10 microns. **Total dust** includes all airborne particles, regardless of their size or composition. Due to the adverse effects of fugitive dust, its control is necessary. If it is reused or recycled, we may reduce its effects and quantity for disposal.

Control Techniques for Fugitive Dust

For the purpose of controlling fugitive emissions from different sections, various cement industries have adopted different combinations of control measures with varying degrees of effectiveness. The sources and control measures for fugitive dust emissions are given in table 1.

Table 1. Source and Control measures for Fugitive Dust emission

Area	Control Measures
Unloading Section (Limestone, Coal & other relevant materials)	<ul style="list-style-type: none">• Some enclosure should be provided for all unloading operations, except wet materials like gypsum.• Water should be sprayed on the material prior to and during unloading.• High-Efficiency Intensive Pulse jet bag filter should be installed as APC.• Regular water sprinkling should be carried out to control the dust generation.• Regular health check-up should be carried out for workers.• Dust masks should be provided to workers.• CEMS is recommended for online monitoring of air pollution.
Fuel Handling	<ul style="list-style-type: none">• Fuel should be transported up to the storage bunkers through conveyor belts. The closed belt conveyor system and provision of de-dusting bag filters.• Airborne dust at all transfer operations/points would be controlled either by spraying water or by extracting to bag filter.• Generated used oil should be collected and utilized as an alternative fuel in a kiln.• Pucca Floor should be provided at the stockyard.• Regular water sprinkling should be done to avoid dust generation from transportation.
Fly Ash of Limestone/gypsum Handling	<ul style="list-style-type: none">• Transportation vehicles should be covered with a tarpaulin sheet while transporting materials.• Dust collected from air pollution control equipment should be 100% recycled in the system.• Generated used oil from plant machinery should be utilized as an alternative fuel to burn in the existing cement plant.• Provide dust extraction arrangement for packing machines.• Provide adequate ventilation for the packing hall.
Cement Packing Section	<ul style="list-style-type: none">• Spillage of cement on the floor should be minimized and cleaned daily to prevent fugitive emissions.• Prevent emissions from the recycling screen by installing appropriate dust extraction system.
Clinker Handling	<ul style="list-style-type: none">• Regular water sprinkling should be done to avoid dust generation from transportation.• Transportation vehicles should be covered with a tarpaulin sheet

Fugitive dust due to
Transportation

while transporting materials.

- High-efficiency intensive pulse jet bag filters should be considered to arrest the airborne dust at all the locations where transfer of material takes place.
 - The automatic bagging machine with bag filters should be installed for the packaging plants.
 - Unloading of coal trucks should be carried out with proper care avoiding dropping off the materials from height. It is advisable to moist the material by sprinkling water while unloading.
 - The sprinkling of water should be done along the internal roads in the plant in order to control the dust arising due to the movement of vehicular traffic.
 - Thick greenbelt should be developed around the plant to arrest the fugitive emissions.
 - Vacuum sweeping system should be implemented for the whole plant with no dust left behind.
 - All the workers inside the plant should be provided with disposable dust masks and other PPEs as per the requirement.
 - Only valid PUC vehicle should be used for the transportation of materials and equipment.
 - The construction site should be barricaded with sheets to avoid dust emission due to wind from the project site.
 - Fuel should be transported up to the storage bunkers through close conveyor belts system.
 - We should follow the environmental guidelines for the prevention and control of fugitive emissions from cement plants.
 - The spilled-overcement from the packing machine should be collected properly and should be sent for recycling.
 - Proper engineering controls to prevent the fugitive emissions may include arrangements like providing guiding plate, scrapper brush (for the removal of adhered dust on cement bag), etc.
 - A suitably qualified person should be designated to operate as Dust Control Officer. He should be provided necessary training be aware of operational and maintenance aspects. Dust Control Officer (Environmental Officer) should be responsible for the proper control of fugitive emissions.
 - The entire fuel storage area should be covered with permanent weather shed roofing and side walls i.e., in closed shed.
-

Silo Section

- The proper drainage system should be provided in all fuel storage areas.
 - The silo vent should be provided with a bag filter type system to vent out the airborne fine dust particles.
-

Conclusion

Cement belongs to the most often used building materials and its production is increasing over the world because of rapid urbanization. The cement industry is extremely energy-intensive and produces many emissions, odours and noises. It is a major source of emissions such as CO₂, NO_x, SO_x, particulate matter etc. These can significantly affect human health as well as the environment. A current trend in the field of cement production is the focus on low-energy types of cement, utilization of waste in cement production and the associated reduction of CO₂ emissions. Therefore, reuse and recycling are an important part of modern cement production. The main source of pollution from the cement industry is fugitive dust. So, fugitive dust control from the cement industry is a very important aspect.

ACTIVITIES OF GREEN HABITAT TO REDUCE AIR POLLUTION IN CHAVAKKAD, KERALA

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World Environment Day (WED) falls on June 5th every year and is the United Nation's annual celebration to raise global awareness of the environment and the need to take positive actions to protect it. Green Habitat is an NGO, from Chavakkad, Kerala, who are involved in the conservation of turtles, mangroves, house sparrow and honey bees. Air is a vital component of the earth's environment and even a slight change in its composition can affect the development of organisms. Hence, on the world environment day, Green Habitat did its bit to initiate and contribute towards the cause.

Vehicles are responsible for the deterioration of air quality but the impact is much less in Kerala. However, the numbers of vehicles are increasing over the years and that's a matter of concern. Industrial emission is limited to areas around the industries and thankfully Kerala does not have many such industries.

Kerala is a state where air pollution is less compared to other states in India and is blessed with lush greenery. The main air pollution in Kerala is caused by the burning of domestic waste as the state does not have any concrete waste management system. Hence Green Habitat has initiated an awareness program in this direction. People were advised to segregate the waste into three categories. Food waste was converted to compost. Plastic, glass and other non bio-degradable materials were made into one category and the other category was bio-degradable materials such as paper etc. Burning of waste was discouraged. Apart from this, the smoke emitted from *Chullas* is a cause of air pollution. Though this has reduced considerably due to LPG, still most households burn firewood for boiling water and cooking rice. In this regard Green Habitat has advised all the households in the locality to use smoke-free *Chullas*.

Apart from this Green Habitat takes awareness programs regarding air pollution especially in schools, as they are the future. Classes motivating and teaching students to keep the environment and surroundings clean were held. Students were taught the importance of recycling. School children and the general public were encouraged to use bicycles as a mode of transport. Green Habitat carried out planting of mangroves along the entire stretch of Canoli canal in Chavakkad. Saplings were planted on beaches, which was a major program in the region involving panchayat members and local people (Figure 1).

All the activities of Green habitat were extensively covered by print and visual media, thus creating mass awareness. In a nutshell, Green Habitat propagated the idea of "Reduce, Reuse and Recycle" leading to reduction in air pollution.



Figure 1: Afforestation Programme by Team Green Habitat

A COMPARATIVE STUDY OF AIR POLLUTION INDEX ON THE CHLOROPHYLL LEVELS OF THE PLANT SPECIES- *PONGAMIA PINNATA* (L.) MERR.

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Introduction:

Pongamia (Millettiapinnata), also known as Pongamiapinnata, is a tree species with a wide distribution throughout India. Pongamia is a medium-sized, fast-growing tree or shrub (15–25 m tall). It has been described as briefly deciduous or evergreen with a drooping or spreading branching habit and broad crown (Orwa et al. 2009). The preferred habitats include coastal and riverine habitats, primarily in humid tropical and subtropical areas. The **Pongamia** species tolerates a wide range of soils, including saline soils. It also produces large numbers of water-dispersed seeds. The Pongamia species is a commonly roadside grown tree species in Bengaluru. The Pongamia species is sensitive to pollution and shows a remarkable change in terms of photosynthesis. The emissions from the vehicles comprise of a huge content of environmental pollution in Indian cities, especially in Bengaluru. The problem is much more aggravated due to narrow and congested roads, and old poorly maintained vehicles. (Priyanka et al. 2013) Petrol and diesel engine driven motor vehicles release a wide variety of pollutants particularly benzene, carbon monoxide, organic compounds, oxides of nitrogen, sulphur dioxide and suspended particulate matters like ultra-fine primary particles, smoke, metals (Cd, Co, Cu, Pb, etc.) and inert dust. The ultra fine particles, when released, quickly coagulate into larger particles through reaction with other pollutants like sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds (Street et al. 1996). Studies show that under polluted conditions, plants develop different morphological, physiological and anatomical changes (Inamdar and Chaudhari 1984, Iqbal 1985, Gupta and Ghose 1988, Gravano et al. 2003, Novak et al. 2003, Dineva 2004).

In view of all the above this study will seek to explore some of these issues. The present study primarily analyses the comparative status of Chlorophyll index of the Pongamia species from different locations of Bengaluru. This will also review the SO_x, NO_x Suspended Particulate Matter (SPM) of the selected areas along with suitable suggestions to improve the productivity of the Pongamia species.

Study Area:

The study was conducted at various locations of Bengaluru city i.e., Graphite India – Whitefield Road (Industrial Area), Amco Batteries – Mysore Road (Residential/Rural/Other Area), Victoria Hospital – (Sensitive Area), K.H.B Industrial Area – Yelahanka (Industrial Area),

Yeshwanthapura Police Station - (Residential/Rural/Other Area) , Peenya Industrial Area – (Industrial Area)

Materials and methods:

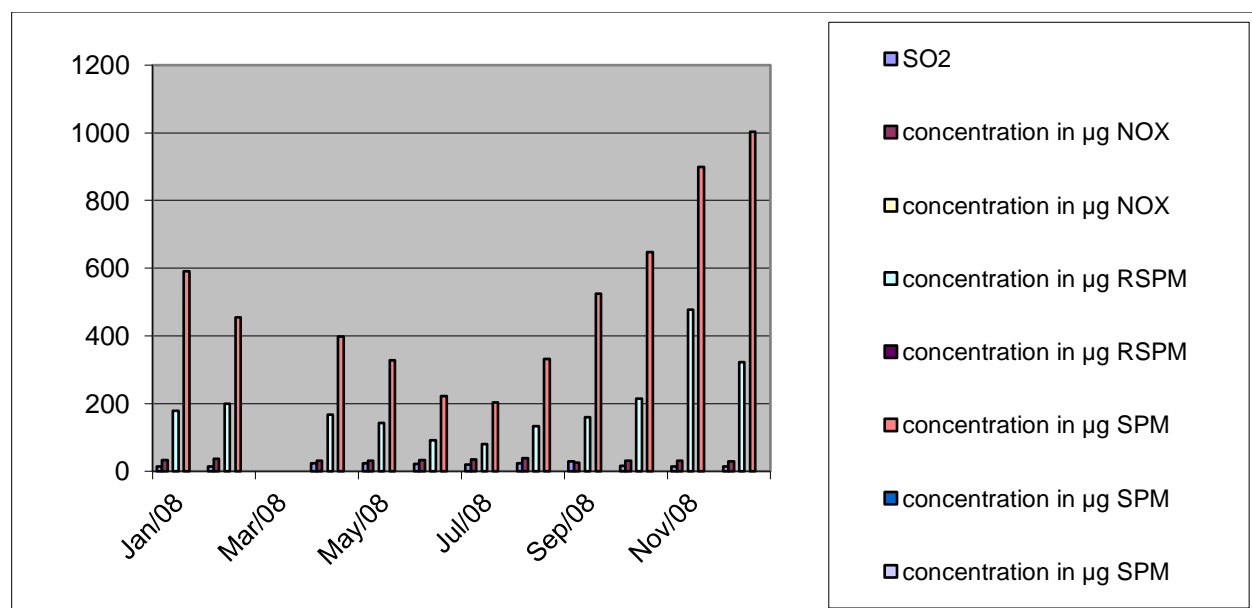
Data Collection: The leaves of the Pongamia species has been collected from seven different locations of the city manually and conducted the laboratory tests i.e, on total chlorophyll content by optical density method , stomatal index by quickfix method and correlate the values of ambient air quality of NO_x, So_x content with the chlorophyll content and with stomatal index.

Results:

Annual Comparative analysis of the SO₂, NO₂, and SPM: Suitable comparisons for various parameters were conducted and the data for one year on SO_x,NO_x and SPM collected in order to conduct the research study.

Gases and Particulate Matter	06-Apr	06-May	06-Jun	06-Jul	06-Aug	06-Sep	06-Oct	06-Nov	06-Dec	06-Jan	07-Feb
SO ₂	23.4	22.9	22.4	19.7	23.8	28.9	15.7	13.8	13.8	14	14.2
NO _x	31.4	31.8	32.2	34	39.1	24.8	31.6	31.5	30.1	32.9	37.3
RSPM	167	142	91	81	133	159	214	477	323	179	199
SPM	398	328	222	204	332	525	647	900	1004	590	455

Graphical representation of the Pollution levels on monthly basis:



Stomatal and Chlorophyll index: The stomata and chlorophyll index of Pongamia species showed a gradual decrease in terms of chlorophyll levels in the highly polluted areas. Even the flowering pattern and the pod size varied from the less polluted areas to the highly polluted areas. For few areas flowering pattern also shifted and reduced the number of flowers in the sampled areas.

Discussions and Conclusion:

Planting trees to combat climate change is one of the basic concerns to conserve our natural resources. The current study shows high levels of pollutants will cause a change in the lifecycle of the Pongamia plants, especially in the epidermal tissues. From the study, it is clearly evident that in the Pongamia plants of the sampled areas showed that in summer the number of stomata decreased. The Stomatal opening leads to sub stomatal chamber, when the pollution is high in the atmosphere and less in sub-chamber, simple diffusion takes place (the pollutant will move from the region of its higher concentration that is the environmental environment into the region of its lower concentration i.e. the stomatal chamber). Therefore when the pollution is higher the plant tends to reduce the number of stomata so that the pollutant does not enter the plants. If it's too windy to Stomatal index reduces in order to check transpiration. Thus, Proper selection of species is needed for planting trees along the streets and avenues is very important. Trees reduce gaseous air pollution by way of absorption. Plants produce oxygen in the process of photosynthesis, thereby pumping large quantities of oxygen into the atmosphere. It would be interesting to know that 1 hectare of woodlot absorbs 3.7 metric tons of carbon dioxide and release 2.5 metric tons of oxygen. Dust in cities settles on the leaves and branches of the trees. Thus the dust is prevented from flying into the buildings and atmosphere. The flying dust collected on trees is washed down to the soil during the rains. So the trees serve as dustbins or filters. One hectare of tree-growth collects about 30 metric tons of dust. A greenbelt of trees with 50-100m. width decreases atmospheric dust level up to 52%. With increasing automobiles its very much important to combat the pollution levels and the Pongamia species is the biological indicator works as a sign to understand how much the area is polluted.

References:

1. Rai. P and R.M. Mishra; ' Effect of urban air pollution on epidermal traits of road side tree species, Pongamiapinnata (L.) Merr. 1, 2 School of Environmental Biology, A.P.S. University, Rewa (M.P.), 486003 India <http://www.iosrjournals.org/iosr-jestft/papers/vol2-issue6/B0260407.pdf>
2. Iqbal, M.Z. 1985. Cuticular and anatomical studies of white clover leaves from clean and air-polluted areas. *Pollution Research* 4: 59-61.
3. Kulshreshtha, K., Srivastava, K. and Ahmad, K.J. 1994b. Effect of automobile exhaust pollution on leaf surface structure of *Calotropisprocera* L. and *Neriumindicum* L. *FeddesRepertorium* 105: 185-189
4. https://www.daf.qld.gov.au/_data/assets/pdf_file/0003/67575/IPA-Pongamia-Risk-Assessment.pdf
5. https://en.wikipedia.org/wiki/Millettia_pinnata

CONSERVATION BEGINS AT HOME: “BECOME SMART RESIDENTS OF A SMART CITY”

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The development of smart cities is the need of the society as well as the necessity of the government. The efforts are constantly oriented towards making the life of all citizens comfortable. Sadly, the effects of the changing land-use on different faunal groups residing in the urban landscape have been identified but remain ignored among several social challenges. Additionally, increased pollution levels contribute to shifting of local fauna to similar peri-urban habitats which leads to the movement and gradual loss of native species. The concept of urban forests is rapidly becoming popular abroad. In India, it still remains overlooked. It is interesting to know that ancient Indian literature has given prime importance to plantations. Several plant species having societal importance have been mentioned in Atharvaveda, Ayurveda, Vastusashtra and other holy scriptures. The knowledge remains bound within the libraries because there is a missing link between the modern architecture and ancient science of conservation of species and amicable living. However, a balance is needed between the aesthetic value and ecological sustainability of the planning and design of cities.

Air pollution is a big challenge which has impacted big cities and reached to the adjoining areas. The impact is not localized. Therefore, the only way to escape the negative impacts is to enhance the green cover by developing urban greens or urban forests. In addition, cities are facing an urban heat island effect whereby the temperature of the residential areas is much higher than the other land use areas. In case the issues are not focused on urgent basis, smart cities may fail to reach their main objective i.e. sustainability.

Now-a-days conservation and protection of the environment is considered as a job of the government or NGO's and remains a reluctant topic within our household. It is thought to be a tedious and burden job in our busy lives. Leave aside changing the land-use for our sustainability, we citizens are polluting the habitat for other living beings and there is a big impact on the local flora and fauna in cities. The big question is what can the residents do?

The answer is simple. “*Just leave some space for nature within your dwelling and in your heart*”.

The residents within their own societies can emphasize on sustainable solutions which are within their reach and do not require much time or investment. These practices have been a part of our culture.

Environment conservation not only increases the aesthetic value of the area, it also brings together the dwellers and builds harmony. Several researches have reflected towards the multiple benefits of greenery on mental health and physical wellbeing.



A paradigm of the impact of societal contribution towards conservation – Sparkling Meadows, Panjari, Nagpur

[Photo Courtesy: Mr. S V Deshpande]

A small step towards conservation of the local biodiversity we started in 2014 at “Sparkling Meadows residential plan”, Panjari, Nagpur by planting mixed vegetation including grasses, shrubs and tree species. After a span of five years (2019), the area harbours more than 50 different plant species which have attracted about 75 species of birds including few local migrants, 25 species of butterflies and some species of reptiles and mammals. Besides providing life-giving oxygen and relief from heat and air pollution, it also offers seasonal organic fruits and vegetables for the residents.

Some effective and easy steps to maintain local biodiversity:

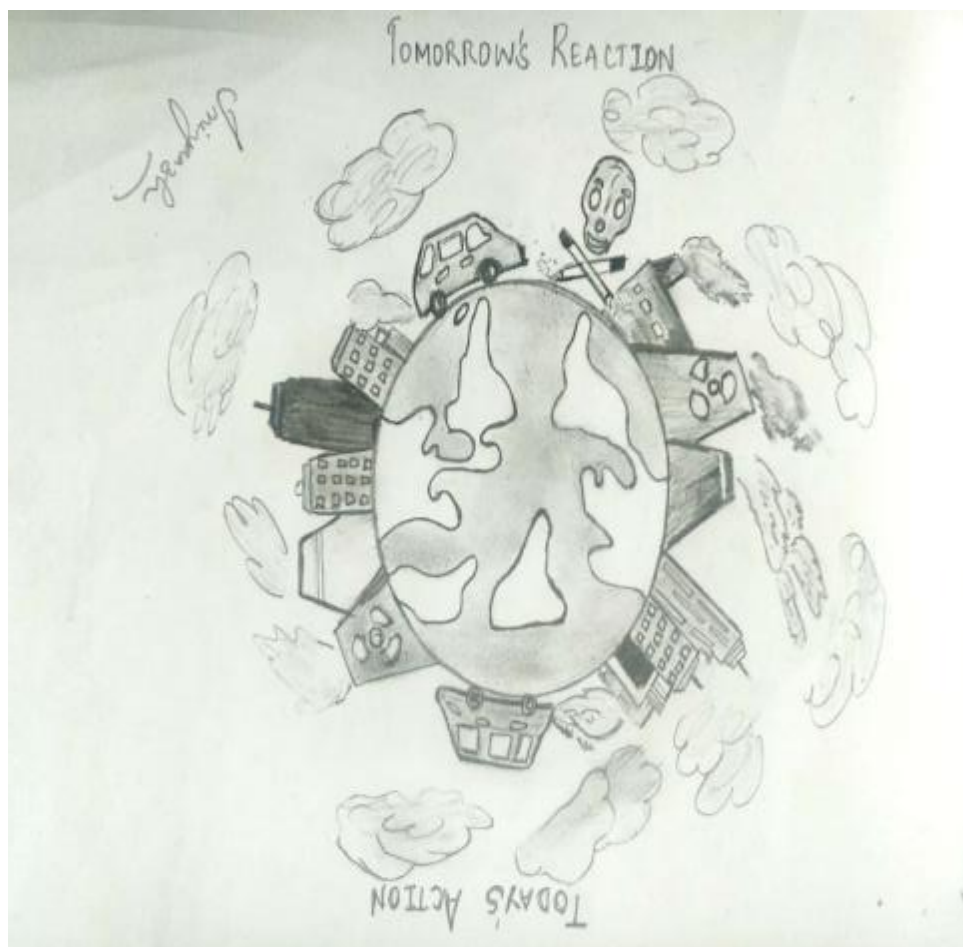
- Keep some space for greenery within your house and around.
 - Buy planting species which can attract different faunal groups, get the information of the importance of that species and make others aware about it.
 - Allow pollinators like birds and bees in your society by adding nectar-producing plants.
 - Appreciate leaf litter: it is not less than any gold. It can be converted to organic manure for your kitchen garden to procure organic food.
 - Spend some time moving around your colony identifying the flora around. It can eventually lead to the preparation of an inventory for the species at your place.
 - Do not remove grasses, trim them if you want.
 - Emphasize on rainwater harvesting for every household.
 - Allow mud roads, they soak water and recharge the groundwater level.
 - Develop a small kitchen garden and compost your kitchen waste.
 - Encourage children to play outdoors and make them familiar with the flora and fauna.
- Education about the environment is important for the future.

About the Authors:

Mr. Sameer V Deshpande is a freelance consultant for ecology and biodiversity. He has submitted his thesis for PhD in Botany to RTMNU, Nagpur, on the role of vegetation in reduction of air pollution near thermal power plants. As a nature enthusiast, his interests include photography and habitat restoration. He has an experience of more than 14 years in Environmental Impact Assessment working with reputed organizations like NEERI, IUCN etc. Presently, he works for Biodiversity Assessments, Aquatic Ecology and certified through MoEFCC for green belt designing for different Industries / polluting sources.

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Cartoon Courtesy: Iniyaazh Sundar



BE THE SOLUTION TO BEAT AIR POLLUTION

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Air pollution has become part and parcel of our lives. Every day and night we are inhaling poisonous air and damaging our internal systems slowly and steadily. It is not visibly effective but the tiny dust particles are continuously causing harm to our lungs, heart, brain and other vital organs. The main aim of World Environment Day 2019 is to spread a strong message to the human world to combat the need of the hour i.e. to beat air pollution.

The People Republic of China is the host of this year's World Environment Day. The message is to control air pollution, minimize global warming, reduce emissions and work together for a sustainable future. The situation is alarming and becoming worst day by day which will be much more effective for our future generation. If we do not act together now, there will be no future for the next generation.

According to research and various databases, it is observed that nine out of ten people are critically exposed to high levels of air pollutants worldwide. It has been found that around 7 million people throughout the world die prematurely per year from various types of air pollution. Out of these, nearly 4 million deaths are reported from the Asia-Pacific region. Air pollution causes several other chronic diseases especially alarming for infants, kids, and older people.

Air pollution can be prevented by proper systematic sustainable coordination between local people, local authorities, NGOs, voluntary organisations, pollution control boards, testing laboratories, private sector organisations, energy sector, fuel sector, mining sector, policymakers, industries, corporate stakeholders, lawyers, banking and financial sector, local administration and government.

There are a number of activities that can be done to help the situation. Examples of such activities include:

- cycling and walking short distances instead of availing fossil fuel-powered transportation
- reuse, recycling and reduction of plastics, solid wastes, etc.
- increasing greenery in homes and domestic places
- installation of solar lights and solar items in higher quantity
- reduction of solid waste materials incineration
- switching off lights and other electronic gadgets when not in use
- checking and optimizing the efficiency of home heating systems
- installation of smart devices and sensor-enabled equipment to prevent electricity wastage
- prevention of trash burning, tires burning, rubber and plastic burning
- the banning of duplicate fuel used in tempos and autos

- opting for more ENERGY STAR label while purchasing any electronic gadgets
- carpooling and using public transportation whenever possible
- purchasing portable gasoline containers labeled “spill-proof,” where available
- always keeping car, boat, and other engines properly tuned

Awareness campaigns, more and more involvement of youths, door to door survey, rallies for environmental conservation etc. are required with much more efficiencies and in a structured way. We have to be the solution to pollution and that is the only way to prevent air pollution and minimize the rate of contamination.

LEGAL FRAMEWORK FOR CONTROLLING AIR POLLUTION; GAPS AND POTENTIAL

Aarohi Srivastava

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This is the era of modernization, urbanization, and industrialization. As time progresses, we humans are becoming more and more dependent on technology to fulfil our needs.

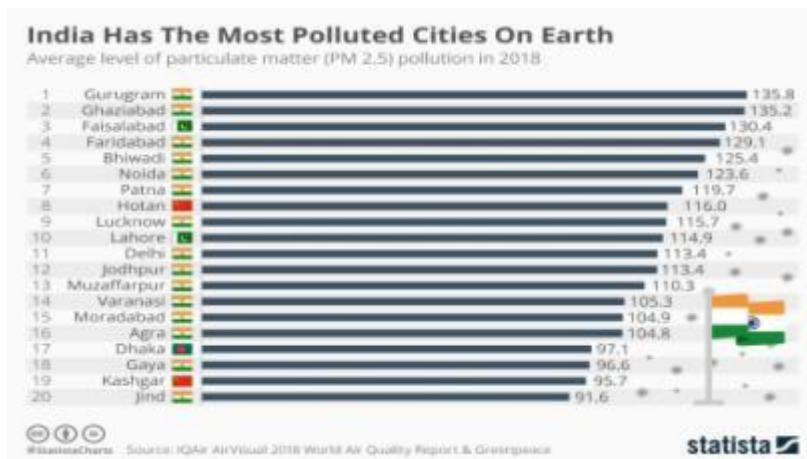
Rampant industrialization, overexploitation of natural resources, vehicular emissions, traffic congestion, population explosion, etc., are major contributors to air pollution in India. This thereby has a significant negative impact not only on humans, flora, and fauna but our environment as well. Keeping in purview the detrimental consequences of Air Pollution, the Government of India under Article 253 of the Constitution of India enacted the Air (Prevention and Control of Pollution) Act, 1981, for the prevention, abatement, and control of air pollution. The Act confers the regulatory power to the CPCB and SPCB for the same.

The Air Act prescribes for penalties as well as imprisonment of the offenders; Section 22, 31-A, 37, 38, 39 describe the same. From time to time several amendments have been made so as to improve the effectiveness of the Act.

Now the major question is whether these laws are enough to combat and tackle the burgeoning

issue of air pollution? Also, how efficient have these laws been to do so?

The above question sparks a scope of debate but the facts below would help us arrive at a better picture.



According to Air Visual 2018, World Air Quality Report of Greenpeace and Air Visual analysis; twenty-two of the world's 30 worst cities for air pollution are in India; Gurugram being the most polluted city in the world. The report is based on the average level of particulate matter (PM 2.5) pollution in 2018.

The Executive Director of Greenpeace Southeast Asia says "Air pollution steals our livelihoods and our futures, but we can change that, we want this report to make people think about the air we breathe because when we understand the impacts of air quality on our lives, we will act to protect what's most important".

The WHO estimates that 7 million people a year die prematurely from exposure to air pollution globally, with the World Bank calculating the cost to the World economy in lost labour as \$225 billion.

Despite stringent laws and measures India's air quality is worsening at an alarming rate. There is a desperate need for introspection and critical thinking to identify the gaps in our legal framework and understand what we are lacking. Lack of infrastructure, insufficient manpower for effectively implementing the Act, callous attitude of industries, the rift between the Act and present-day air problems, etc., are some of the challenges we face today.

One main reason which many environmentalists have been vocal about is the lesser quantum of punishment for the offences mentioned in the act. Many industries chose to pay the penalties rather than complying with the provisions of the act as during violations the amount of profit incurred is several times the amount they pay as penalties.

Many times defaulters are aware of the fact that although there are laws for such violations, they can easily evade them with minimal losses.

In rural areas, the lack of awareness and poverty are the main reasons behind accelerating air pollution. To conclude, the action plan for bridging the present gaps requires:

- amendments in the statutory regime with special emphasis on critically polluted areas and ecologically sensitive areas,
- improvement in assessment methods,
- focus upon propagating knowledge and awareness about the harmful effects of pollution as well as the mitigative and preventing measures for combating the same,
- intervention in the EIA process,
- identification of future problem areas and tightening the punishments for offences made under the Act.

AIR POLLUTION AND URBAN AGRICULTURE: CHALLENGES FOR CROP PRODUCTION

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Air pollution is a complex mixture of gases and particles at an unusual concentration in the air, which is dangerous to humans and plants. The air pollution mainly includes oxides of nitrogen (NO_x) and sulfur (SO_x), volatile organic carbons (VOCs), as well as several essential and toxic metals along with particulate matter (organic carbon, elemental carbon, Zn, Fe, Cu, As, Cd, Mo, Ni, Pb, and Hg). As per the WHO report “State of Global Air 2018”, air pollution produces an enhanced level of pollutants in most parts of the globe (Kumar et al., 2019). In recent years, the levels of air pollutants have increased rapidly in urban and peri-urban areas in several megacities (UNEP, 1999). In India, air pollution has increased rapidly with increasing urban populations, motor vehicles, petroleum fuels, poorly maintained roads and ineffective environmental regulations.

Half the world’s population is residing in metro cities and towns. As a result of this, poor inhabitants often face problems in gaining access to sufficient supplies of nutritionally balanced food in their diet. For urban populations, urban and peri-urban agriculture (UPA) is an important source of food and vegetables. The production and processing of crops, mainly vegetable crops, is a common part of the urban and peri-urban livelihood strategies (Lee-Smith and Prain, 2006). Urban agriculture (UA) is an activity established within or on the fringe of a city or a metropolis, which grows, processes and distributes a variety of food and non-food products primarily to the urban area. Human and material resources, products and services found in and around that urban area are primarily utilized. (Mougeot, 2001).

Due to air pollutants, agricultural land adjacent to urban areas is exposed frequently to air pollutants of the urban surroundings. A significant threat to crop production is gaseous air pollutants, particularly sulphur dioxide, nitrogen dioxide and ozone (TeLintelo et al., 2002). In Indian metro-cities, the concentrations of phytotoxic air pollutants often exceed the thresholds of toxicity to plants (Pandey et al., 1992). Air pollution has the potential to decrease both yield and the nutritional quality of crop plants (Ashmore and Marshall, 1999). The severe environmental problem in developing countries is air pollution, which is the leading crisis in several megacities. The reason for concern is the significant threat posed by air pollution to crop and vegetable production in the vicinity of the city (urban and peri-urban areas), where the livelihoods of urban residents are reliant on access to cheap and safe food of high nutritional quality (Sen, 2010).

In Asia, China is shifting towards the highest levels of urban and peri-urban vegetable supply. Almost 76% of the total vegetables supplying in Shanghai is produced within 10 km radius from the point of sale, and in Beijing, it is touched at 85%, with 79% of fruits coming from peri-urban areas (Lee-Smith and Prain, 2006). Several studies were carried out to assess the loss of crop production in urban and peri-urban areas around the megacities. The yield of paddy crop reduced by 1.42 qts/ha in the distance zone of 0–2 km. In the distance zones of 2–4, 4–6, and 6–8 km the yield of paddy crop reduced by 47, 28 and 20 kg/ha respectively. The wheat yield declined as 108, 36, 22, and 15 kg/ha in 0-2, 2-4, 4-6, and 6-8 km distance zones respectively. The yield of other crops like maize, pigeon pea and potato have also shown a similar trend. This study indicates that air pollution has detrimental effects on the crop yield and economy in the vicinity of the city (fig. 1& 2) (Sen, 2010).

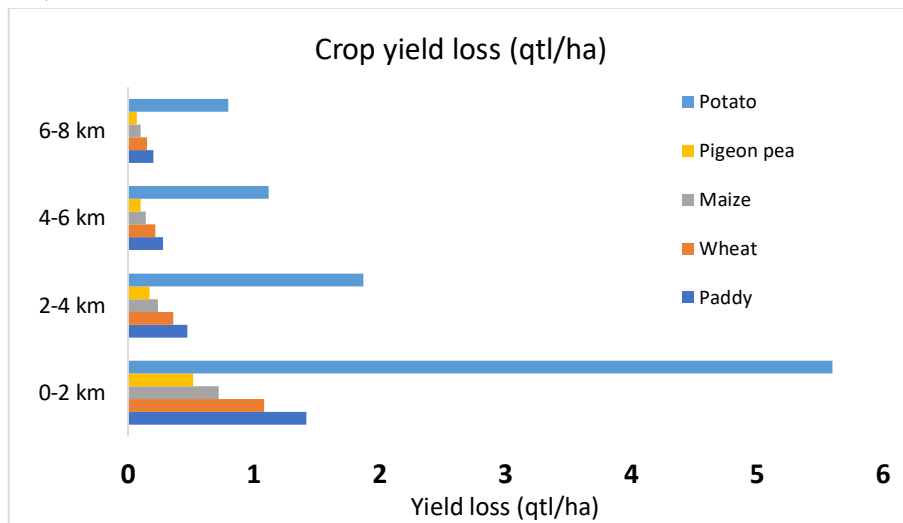


Fig.1 Distance-wise reduction in crop yield due to air pollution

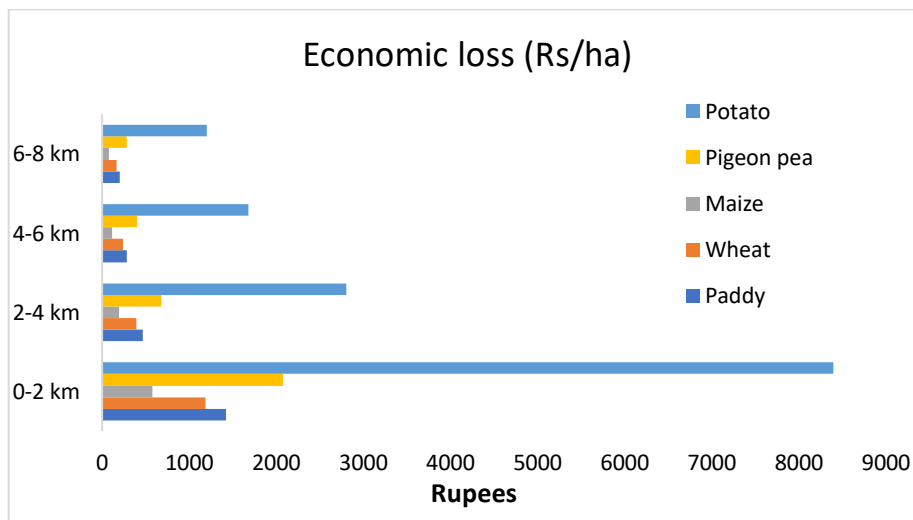


Fig.2 Distance wise reduction in crop yield due to air pollution

References

- Ashmore, M.R., Marshall, F.M. 1999. Ozone impacts on agriculture: an issue of global concern. *Advances in Botanical Research* 29: 32-49.
- Kumar, S., Prasad, S. and Yadav, K.K. 2019. Utilization of Air Pollutants by Plants: Need for Present and Future Scrutiny. *J. Agric. Food Chem.*67(10): 2741-2742.
- Lee-Smith, D. and Prain, G. 2006. Understanding the links between agriculture and health for food, agriculture, and the environment *Urban Agriculture and Health. Focus 13. IFPRI (International Food Policy Research Institute).*
- Mougeot, L.J.A. 2001. Urban agriculture: Definitions, presence, potentials and risks. In *Growing cities, growing food. Urban agriculture on the policy agenda: A reader on urban agriculture.* Edited by Barker et al. Feldafing, Germany: German Foundation for International Development (DSE); 2001.
- Pandey, J., Agrawal, M., Khanam, N., Deo Narayan Rao, D.N. 1992. Air pollutant concentrations in Varanasi, India. *Atmospheric Environment* 26B: 91-98.
- Sen, C. 2010. Effect of air pollution on peri-urban agriculture in Varanasi, India. *Journal of Interdisciplinary Economics* 22(3): 219-227.
- TeLintelo, D.T.H., Marshall, F.M., Bhupal, D.S. 2002. Urban food: the role of urban and peri urban agriculture in India: A case study from Delhi. *Food, Nutrition and Agriculture* 29 (FAO), 4-13.
- UNEP. 1999. *Global Environment Outlook.* Earthscan, London

IMPACT OF AIR POLLUTION IN AGRICULTURE

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Introduction:

Agricultural crops may be injured when exposed to high concentrations of various air pollutants. The nature of the injury can range from visible markings on the foliage, to reduced growth and yield, and even to the premature death of the plant. Air has physical and chemical properties that are vital for life. Temperature, water vapour, movement, oxygen, and carbon dioxide in the atmosphere have a direct effect on food and fibre production. Air quality is changed by introduction of contaminants into it, and agricultural activities using such air may be affected adversely. Damage to plants by air pollutants is related to meteorological conditions, particularly temperature inversions in the atmosphere. The development and severity of the injury depend not only on the concentration of the particular pollutant but also on a number of other factors. These include the length of exposure to the pollutant, the plant species and the developmental stage it is in, as well as the environmental factors conducive to a build-up of the pollutant and to the preconditioning of the plant, which makes it either susceptible or resistant to injury.

Factors of Air Pollution:

For more than a century air pollution has had a notable effect on agriculture. Burning coal and petroleum produces sulfur oxides. Fluorides result from smelting, glass and ceramic manufacture. Rising levels of ammonia, chlorine, ethylene, mercaptans, carbon monoxide and nitrogen oxides are found in the air. Motor vehicles and growing population produce photochemical air pollution affecting not only the urban concentrations but also the contiguous rural areas. The mixture of pollutants from all sources, including agriculture, has released a host of contaminants such as aldehydes, hydrocarbons, organic acids, ozone, peroxyacetyl nitrates, pesticides, and radionuclides into the air. The effect of these pollutants on food, fibre, forage, and forest crops is variable, depending on concentration, geography, and weather conditions. Damage to crops by air pollution, of course, brings economic loss as well.

Measures of air pollution through agriculture approach

Agriculture is the most susceptible tool for an impact study of air pollution. Impact of air pollution can be assessed through study of enzymology, molecular biology, biochemistry and physiological processes. Air pollution is considered as a stress factor for plants which can be effectively utilized as a diagnostic tool which includes study of abnormalities in enzyme activities, alteration in the physical and chemical configurations of biological macromolecules, growth retardation studies as well as tissue or cellular injury. Such studies are based upon the response of air pollutants through the following factors

- Acid gases
- Products of combustion
- Products of reactions in the air
- Miscellaneous effluents

Recommendations:

- Focus on developing air pollutant monitoring networks into agricultural and forested areas.
- Studies on yield response relationships under different environmental conditions to project future yield losses at increasing specific pollutant load
- Develop bio-indicator protocols for impact evaluation.
- Studies on synergistic effects of increased concentrations of CO₂ and O₃ on plants along with temperature/drought.
- Development of policies towards framing air quality guidelines for protecting vegetation including crops.

AIR POLLUTION: SERIAL KILLER

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Introduction

Air pollution is growing fast on a global level on account increasing population and consequently to meet the demand and lifestyle through extensive industrialization, urbanization and transportation. All these activities contribute significant air pollution indoors and outdoors causing serious diseases to human beings including deaths. In other words, such increased air pollution is emerging as a serial killer. Air pollution is a major environmental health problem affecting everyone in low, middle, and high-income countries. Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer and both chronic and acute respiratory diseases, including asthma. Ambient air pollution accounts for an estimated 4.2 million deaths per year due to stroke, heart disease, lung cancer and chronic respiratory diseases. Around 91% of the world's population lives in places where air quality levels exceed WHO limits. Pollution causes various cancers, heart diseases and lung diseases, to name just a few. Comparatively, death by pollution is larger than any other major cause.

Air Pollution-Turning Silent Killer into Serial Killer

The World Health Organization (WHO) reveal the fact that air pollution levels are alarmingly high in many parts of the world in as much as that 9 out of 10 people breathe air containing high levels of pollutants. Besides, it has also been reported by WHO that an alarming death toll of 7 million people every year caused by ambient (outdoor) and household (indoor) air pollution. Moreover, over 3 billion people out of which most women and children are still

breathing poisonous smoke every day from using polluting stoves and fuels in their homes. The WHO also reveal the fact that fine particles in polluted air penetrate deep into the lungs and cardiovascular system, causing diseases including stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases and respiratory infections, including pneumonia. It has been reported that 21% death caused due to pneumonia, 20% from stroke, 34 percent from ischemic heart diseases, 19% from chronic obstructive pulmonary disease (COPD) and 7% from lung cancer. The WHO has reported that the ambient air pollution alone caused around 4.2 million deaths while household indoor air pollution caused about 3.8 million deaths worldwide.

Moreover, around 3 billion people which amounts to more than 40% of the world's population do not have access to clean cooking fuels and technologies in their homes resulting in household air pollution.

Case Study of Air Pollution: Hazira Industrial Estate, Surat, Gujarat, India.

In India, the ambient atmospheric conditions have progressively deteriorated due to urbanization, industrial development, lack of awareness, poor maintenance of motor vehicles and poor road conditions. Transport vehicles and industrial emissions are the major sources of pollutants in the Hazira industrial estate atmosphere. This case study is an analysis of the ambient air in Hazira industrial estate employing ambient air quality. The 24-hourly average concentrations of four major criteria pollutants, viz. Particulate matter PM_{10} , $PM_{2.5}$, Sulphur Dioxide (SO_2), and Nitrogen Dioxide (NO_2) at different locations in Hazira industrial estate were selected. Sampling and analysis were carried out as per CPCB, IS 5182 & EPA and instrument operation manual for the parameters $PM_{2.5}$, PM_{10} , SO_2 , NO_x .



Fig. 1. Air Sample Collection from Hazira Industrial Zone

PM₁₀ was observed in the range of 61.8 – 86.4 µg/m³. PM_{2.5} was observed in the range of 31.6 - 47.6 µg/m³. SO₂ concentration was observed in the range of 9.0 -15.9 µg/m³. NO_x concentration was observed in the range of 13.1- 22.8 µg/m³.

Air Quality Index (AQI)

Air Quality Index (AQI) is one such tool for effective dissemination of air quality information to people. The AQI for 4 parameters has been calculated for running 24-hr averages. It can be seen that for pollutants air quality is satisfactory.

Table 1. Result of AQI analysis

S.No.	Locations	SUB Index				AQI
		PM ₁₀	PM _{2.5}	SO ₂	NO _x	
1.	Hazira Industrial Estate	110	71	16	24	110
2.	Suvali	91	70	16	23	91
3.	Mora	88	68	15	22	74
4.	Damka	82	69	16	23	77
5.	Rajgari	76	70	15	23	76
6.	Kavas	74	67	15	23	74
7.	Dumas	70	65	15	22	70

Conclusion

Air Quality Index represents that the air quality of Hazira Industrial estate is not good to breathe. Maximum AQI and responsible parameter for pollution are recorded in Hazira industrial estate are PM₁₀. The increase in the pattern of PM₁₀ and PM_{2.5} concentration in ambient air, it is suggested that proper air pollution control measures must be adopted by the individual industry by their own levels like ESP, high-efficiency pulse jet bag filters, regular water sprinkling, and other measures to control the fugitive dust.

Green Air: Clean Air

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Air pollution a major worldwide problem due to anthropogenic activity. In a simple word, we can say that air pollution is contamination of air by harmful substances, which can cause harm to humans, animals. Because air quality is closely linked to earth's climate and ecosystems globally. Air pollution is hard to escape, no matter how well developed an area you live in. It is all around us. microscopic pollutants in the air can slip past our body's defences, penetrating deep into our respiratory and circulatory system, damaging our lungs, heart and brain. Every year, 543000 children younger than 5 years die from respiratory disease linked to air pollution. Worldwide, bad air caused an estimated 4.2 million premature deaths in 2016, about 90 % of them in low and middle-income countries, according to WHO. Due to increasing urbanization, its main disadvantages are air pollution. Poor air quality kills people. Everyone has learned proper value of clean air/environment. Now a day's people have to move towards sustainable, green technologies. Green technology is an environmentally friendly technology is developed and used in a way that protects the environment and conserves natural resources. Technology whose use is intended to mitigate or reverse the effects of human activity on the environment. Going green or using technologies that are friendly to the environment are among the many ways that countries are looking into in order to spur economic growth and improve the lives of its citizens. Green technology uses renewable natural resources that never depletes and new and innovative energy generation techniques. Among the possible areas where these creations and growth are expected to come from include; green energy, organic agriculture, eco-friendly textiles, green building constructions, and manufacturing of related products and materials to support green business. Besides, other forms of green technologies in field of generation of energy are applicable using by solar power and fossil fuel. So, future generation can also be benefitted from them without harming the planet. Green technology covers a broad area of production and consumption technologies. The adoption and use of green technologies involve the use of environmental technologies for monitoring and assessment, pollution prevention and control, and remediation and restoration. Monitoring and assessment technologies are used to measure and track the condition of the environment, including the release of natural or anthropogenic materials of a harmful nature. Prevention technologies avoid the production of environmentally hazardous substances or alter human activities in ways that minimize damage to the environment. Green technology refers to products, equipment or systems which satisfy the following criteria:

- a) It minimizes the degradation of the environment;
- b) It has zero or low greenhouse gas (GHG) emission is safe for use and promotes healthy and improved environment for all forms of life;
- c) It conserves the use of energy and natural resources;
- d) It promotes the use of renewable resources;
- e) Green technologies might help in the production of alternative fuels, thus, reducing our dependency on the conventional fossil fuels.
- f) Green technologies are able to protect and preserve the environment.
- g) These are sustainable in the long term.
- h) These also have the potential of creating new jobs.

There is so many techniques are available worldwide to prevent air pollution. Different types of technologies which are used to reduce air pollution in a greenway are listed below:

- **Renewable Fuel and Clean Energy Production:** The most basic solution for air pollution is to move away from fossil fuels, replacing them with alternative energies like solar, wind and geothermal.
- **Energy Conservation:** Producing clean energy is crucial. But equally important is to reduce our consumption of energy by adopting responsible habits and using more efficient devices. Solar energy has been an alternative source of electricity for decades, though it is not widely used. Sunlight that reaches the earth's surface provides, 10000 times more energy than we consume, and solar power aims to harness this force. Solar technologies use sunlight captured through solar cells to provide electricity for heating, cooling, and even running small electronics like a calculator. Researchers have determined that if we covered only 0.1 % of the earth's surface with efficient solar cells, we could replace all other forms of energy.
- **Eco-friendly Transportation**
 - **Rail transport:** Rail transport is naturally a green mode of transport. However, it can be made further greener by introduction of other renewable energy / less energy-consuming practices. Indian railways have taken the initiative of the introduction of optimal light control system which controls the lighting load of all kinds. Retro-fitment of LED lights in coaches has also been initiated, which may save up to 40% of light.
 - **Electric vehicle:** The National Electric Mobility Mission Plan (NEMMP) 2020 is one of the most important and ambitious initiatives undertaken by the Government of India that has the potential to bring about a transformational paradigm shift in the automotive and transportation industry in the country. This is a culmination of comprehensive collaborative planning for promotion of hybrid and electric mobility in India through a combination of policies aimed at gradually ensuring a vehicle population of about 6 – 7 million electric/hybrid vehicles in India by the year 2020 along with a certain level of indigenisation of technology. India's first electric car is Mahindra e2o, formerly known as the Reva NXR.
- **Green Building:** Green technology helps in reducing emissions, conserves water, reduces waste, and consumes less energy than conventional technologies. Green buildings also use materials in a more efficient way. Over 20 years, a single solar water heater can keep over 50 tons of carbon dioxide emissions out of the atmosphere. Geothermal pumps reduce emissions by up to 70 % and use up to 50 % less electricity.
- **Green Belt Development:** In addition to our regular duties of reducing, reusing and recycling, have you thought about planting trees?

- Trees are able to clean the air and absorb harmful airborne particles and gaseous pollutants. Toxins such as nitrogen oxides, ammonia and sulphur dioxide through their leaves, bark and roots. This improves the air quality in the microclimate around the trees and contributes to a healthier and cleaner environment overall. Trees also soak up the harmful carbon dioxide in our atmosphere. In one year, an acre of mature trees absorbs the same volume of carbon dioxide as produced from a 26,000-mile car journey! Aside from cleaning the air for us, trees supply us with fresh oxygen to breathe. Trees planted in an urban environment can not only counteract the warming effects concrete and buildings have on the environment, but they have also been shown to clean the air of pollutants and particulates created by traffic that are harmful to us. Through the process of photosynthesis, trees are able to absorb carbon dioxide from our atmosphere and reduce the greenhouse effect, creating a less polluted, more sustainable world for our future generations.

- **Green chemistry:** The invention, design, and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances come under the purview of green chemistry.



(Source. Anastas, P. T., Warner, J. C. (1998), *Green Chemistry: Theory and Practice*, Oxford University Press: New York, p 30)

- **Green Nanotechnology:** Green nanotechnology is the study of the ways in which nanotechnology can benefit the environment, such as by using less energy during the manufacturing process, the ability to recycle products after use, and using eco-friendly materials. It assists to provide clean water to billions of people via novel filtration techniques and the ability to decontaminate dirty water; solving efficiency issues so as to increase the use of renewable energy, and for waste management and environmental remediation etc.

- **Technologies for Industrial Air Pollution Reduction:** We can reduce air pollution from industries or factories by using public transport to travel, increasing the efficiency of equipment to consume less energy and opting for natural gas. When purchasing vehicles for your company consider buying most efficient, lowest polluting or if possible zero emission electric vehicle, encourage employees to use bicycle for daily commute, ensure drivers in your company obeying traffic laws, speed limits, maintaining vehicles properly and keeping optimum air pressure in tyres, replace lights in your factory to energy efficient bulbs, go

green by limiting the use of paper as it may save some trees, choose materials which are made from recycled materials, improve machineries or manufacturing processes to reduce emissions from factories, boosting performance of boilers can sharply reduce air pollution from industry, earlier companies used electric motors with efficiencies 60-90 % now electric motors with 95% of efficiency are also available, proper maintenance of boiler e.g. blowing dust from surface, reducing excess air can reduce air pollution from industries, reducing the need of steam, the use of boiler, by identifying leaks can boost system by 10-50%, switching from coal, oil to natural gas reduced operating costs and extend plant's life by eliminating corrosion from fuels and to identify irregularities in pollutants level in air and keep your pollutants level within limits.

Picture Courtesy: Shivani Sahay



AIR POLLUTION WITH A SOLUTION

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“You have spread air pollution then who will search for the right solution.”

Solution efforts on pollution are always a big problem. This is why prevention interventions are always a better way of controlling air pollution. These prevention methods can either come from government (laws) or by individual actions. Air pollution is a major concern of new civilized world, which has a serious toxicological impact on human health and the environment. In support of this observation, the World Health Organization estimates that every year, 2.4 million people die because of the effects of air pollution on health. In many big cities, monitoring equipment has been installed at many points in the city. Authorities read them regularly to check the quality of air. Air pollution can be prevented only if individuals and businesses take a step to reduce air pollution today.

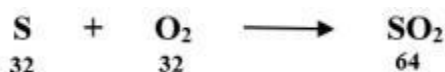
Air pollution has a number of different emission sources, but motor vehicles and industrial processes contribute to the major part of air pollution. According to the World Health Organization, six major air pollutants include particle pollution, ground-level ozone, carbon monoxide, sulphur oxides, nitrogen oxides, and lead. Long- and short-term exposure to air-suspended toxicants has a different toxicological impact on human including respiratory and cardiovascular diseases, neuropsychiatric complications, the eyes irritation, skin diseases, and long-term chronic diseases such as bronchitis, cancer and heart attacks.

In the present time, air pollution has not been reached to that level which can't be controlled by some preventive solutions. If people stick to regulatory measures or preventive measures for controlling air pollution, it could help to increase the quality of air and we go ahead one step to protect the environment.

Some solutions for controlling air pollution adopted by humans in daily life which are strictly enforced include a ban on open burning of household waste, maintain automobile well-tuned and maintain limit driving by carpooling, using public transportation and walking etc.

Let's understand by example, select “use of public transportation” as a solution for air pollution reduction and identify how we can contribute to protecting the environment.

Consider one person travelling daily from Valsad to Surat and Surat to Valsad by train for work. If he started travelling by road in a diesel car, it causes air pollution by emitting SO₂ in the atmosphere. Generally, in diesel, sulphur content is 500 ppm by weight and density of diesel is 845 kg/m³. So, 1 kg of diesel has volume = (1/845) = 0.00118 m³ = 1.18 lit.



If, 32 gm of sulphur producing 64 gm SO₂ then, 500 mg sulphur produces 1 gm SO₂.

Let's assume that the car is giving an average of 15 KMPL. The total distance between Valsad to Surat is 93 km. So, total km travelled by person in a day is (92 x 2) 186 km and assume that he travels 300 days in a year between Valsad and Surat. So, total requirement of diesel per day

is 12.4 lit and diesel required per year is (12.4 x 300) 3720 lit. Now, SO₂ generated from 3720 lit of diesel is,

$$\begin{aligned} &= \frac{3720 \text{ lit} \times 1 \text{ gm}}{1.18 \text{ lit}} \\ &= 3152.54 \text{ gm} \\ &= 3.152 \text{ kg/year} \end{aligned}$$

If we assume that the person works at Surat for 20 years, it means his contribution to SO₂ emission is (3.152 x 20) 63.04 kg by using diesel car.

This calculation is based on just one person. Think of every person who travel by train or public transportation start travelling by their personal vehicles, how much amount of sulphur would be emitted per day in the atmosphere?

If we started adopting such solution in our daily life like not burning of household waste in open area, keep our automobile well-tuned and maintain limit driving by carpooling, using public transportation and walking etc. it can help us to reduce air pollution emission. We cannot eliminate or remove air pollution from the environment but we can try our best side to reduce air pollution.



INDOOR AIR QUALITY

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Indoor air quality refers to the physical, chemical, and biological characteristics of air in the indoor environment within a home, building, or an institution or commercial facility. Indoor air pollution is a concern in the developed countries, where energy efficiency improvements sometimes make houses relatively airtight, reducing ventilation and raising pollutant levels. In urban areas, exposure to indoor air pollution has increased due to a variety of reasons, including the construction of more tightly sealed buildings, reduced ventilation, the use of synthetic materials for building and furnishing and the use of chemical products, pesticides, and household care products. Indoor air can be up to 10-times more polluted than outdoor air. Many types of pollutants can affect indoor air quality. While some of these pollutants such as dust and hair are visible to the naked eye, most others go undetected. These invisible air pollutants can cause severe health issues including respiratory ailments. Home, office and commercial air purifier products with multi-stage filtration process can be used to effectively remove pollutants from the air. To clean indoor air pollutants from a room with the use of HEPA filter and Ozone air. The best method to improve your indoor air quality is to have some of these houseplants around, try to eliminate the source of the pollutants and have an air purifier working to cleanse the air at all times. One of the few houseplants that will bloom indoors, the peace lily with its seashell-shaped spathes really will bring a touch of summer into a dreary winter. It also prefers low-light conditions and has a high transpiration rate that will humidify your air perfect for the office. Always fertilize only when soil is moist. NASA's analysis of indoor houseplants revealed that the Peace Lily was the most efficient at removing airborne Volatile Organic Compounds (VOCs), including formaldehyde, trichloroethylene and benzene. Simply put it in a dark corner, give it water once a week and this little plant will help purify the air around that general area. The major downside of Peace Lily (*Spathiphyllum sp.*), however, is that it is mildly toxic to both humans and pets. If a human ingests any part of this plant, they may start to feel nauseous, experience difficulty when swallowing, or feel a burning sensation in their mouth or skin. If they start to feel any of these symptoms as a result of ingesting *Spathiphyllum* then it would be wise to seek medical help immediately. The Peace Lily blooms in the spring and the white bracts last anywhere from a few weeks to two months. Some household plants that are improve indoor air quality at all time Peace Lily (*Spathiphyllum*), Areca Palm (*Dypsislutescens*), Lady Palm (*Rhapisexcelsa*), Red-Edged Dracaena (*Dracaena reflexa*), Barberton Daisy (*Gerbera jamesonii*), Florist's Chrysanthemum (*Chrysanthemum morifolium*), Devil's Ivy (*Epipremnummaureum*), Snake Plant (*Sansevieriatrifasciata*), Flamingo Lily (*Anthuriumandraeanum*), English Ivy (*Hedera helix*), Weeping Fig (*Ficusbenjamina*).

Case Study: BiohmConsultare Private Limited (Biohm-बायोम™) established in 2018 having its registered office at 705, Luxuria Business Hub, Near VR Mall, Dumas Road Surat. Biohm is dealing with Environmental Consultancy and Engineering Solutions which satisfies the statutory, regulatory, stakeholders' and others' requirement. BCPL has a commitment to quality services through systematic techniques confirming constant development through intermittent reviews of performance.

Air Quality Index: The AQI is an index for reporting daily air quality. It tells you how clean or unhealthy your air is, and what associated health effects might be a concern. The AQI focuses on health effects you may experience within a few hours or days after breathing unhealthy air. The AQI is calculated for four major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution, carbon monoxide, and sulphur dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health.

Air Quality Index Values	Levels of Health concern	Colours
0 to 50	Good	Green
50 to 100	Moderate	Yellow
101 to 150	Unhealthy for sensitive group	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Ambient air quality condition of Surat:

Air quality index in Surat - Dumas Road, near Magdalla, Surat, Gujarat 395007, India. It may cause minor breathing discomfort to sensitive people. Resident in Surat city runs the risk of serious health problems from the high levels of particulate matter in the atmosphere to industrial emissions and noxious fumes of vehicles. Healthy people may enjoy outdoor activities. Main pollutant is PM₁₀ in this area concentration is 72.78 µg/m³ which is satisfactory. The concentration of NO₂ is 5.36 µg/m³ which is in the range. The concentration of O₃ is 58.17 µg/m³ which is satisfactory. The concentration of PM_{2.5} is 28.26 µg/m³ which is good. SO₂ concentration was observed in the range that is 16.35 µg/m³, which is well within the standard limit. All results were found well within the limit and desired range.

Fig. 1:Indoor quality of BiohmConsultare Pvt. Ltd.:



The air quality index of BCPL is 25.



Fig. 2: Peace Lily (on the left) and Snake Plant (on the right)

AIR POLLUTION AS A DEVELOPMENT INDICATOR

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Among the major concerns surrounding climate change and the Anthropocene, air pollution is a prominent one. The rapid and unsustainable form of development that the world has undertaken in the past decades has taken a toll on our environment and air pollution has reached dangerous levels in several countries around the world. We are living out a dystopian novel, where people have to wear masks to protect themselves from deadly smog and clean air is sold in bags and bottles. Gross Domestic Product (GDP) has been considered the most significant indicator of a country's development, economic growth and standard of living in the past few decades. However, it wasn't created with this purpose in mind and rightly so. GDP is simply a measure of the number of goods and services produced in a country annually and while it may have correlations with development or standards of living it is not even close to being an accurate measure of the social or environmental wellbeing of a country. Of course, many have come up with alternatives such as the Gini coefficient that measures inequality, the Human Development Index and the Happiness Index. In honour of this year's World Environment Day theme, why not think a little more outside the box and consider air pollution as the new GDP?

The most common justifications for using GDP as an economic, development or welfare indicator include its ease of measurement and comparability across nations. Air pollution levels of countries are already being quantified and measured worldwide. Several countries have developed an Air Quality Index that measures the content of six pollutants in the air and categorizes air pollution on a numerical scale that can be easily compared across nations.

Not only would an air pollution indicator fulfil these requirements of easy measurement and comparability, but it can also convey additional relevant information on actual living standards and welfare of a country's population. Air pollution kills more than 3 million people a year and causes several health issues like respiratory illnesses, lung cancer, heart diseases and so on, making air pollution a reasonable indicator of living standards and health conditions of a country. Furthermore, combustion of fossil fuels has been identified as the main cause of climate change and is also the largest contributor to air pollution. This means that air pollution levels can act as an indicator for the level of carbon-emitting activities contributing to climate change. Thus, a rich country, with high levels of carbon-emitting activities would not be considered as advanced as it is with GDP as the indicator, providing information and incentives for climate change abatement technology and policies.

Thus, considering the technical aspects of measurement as well as the additional valuable information it conveys, an air pollution indicator or index presents itself as a reasonable replacement for GDP as a development or welfare indicator.

WHERE THE BREATHING GOES!!!

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Abstract This paper discusses the level of air pollution near a water body in Tiruchirappalli in Tamil Nadu when the state government has started work on a two-year-long INR 17.56-crore project under the Smart City Mission 2018-19 from May of 2019 (1).

The National Air Quality Index (AQI) was launched in 2014 under the Swachh Bharat

Abhiyan. AQI considers eight pollutants to rate air condition on concentrations of Sulfur dioxide (SO₂), nitrogen dioxide (NO₂), suspended particulates smaller than 10 µm in aerodynamic diameter (PM₁₀), suspended particulates smaller than 2.5 µm in aerodynamic diameter (PM_{2.5}) carbon monoxide (CO), ammonia (NH₃) lead (Pb) and ozone (O₃) measured at the 342 monitoring stations across India to cover 240 cities. (2)

(3) BreezoMeter is an AQ app. (2014) designed by an Israeli firm. Using this we can know what we breathe. It gets real-time ambient AQI, at a specific location, in real-time at the highest resolution. By using proprietary dispersion algorithms it calculates air quality every hour. It utilizes big data infrastructure to gather air quality & weather measurements.

Keywords: Air Pollution, Air over a water body, Air Quality Index, BreezoMeterUyyakondan, Trichirappalli Mission 2018-2019

Reducing Air Pollution



Human activities produce waste of one kind or another and this waste has to be disposed off. Much of the waste is dumped in landfills, burnt or released into water or air. There is a limit on the amount of pollution a piece of land, water body or air can disperse. Beyond their level of absorption and ingestion the remains stay as a pollutant.

Fortunately, the air over a coordinate does not remain stationary for very long periods. There are, however, situations where an air mass can be trapped either physically or dynamically for several weeks; in one location where such trapping causes severe air pollution problems. The pollutants circulate over such places.

Air pollution is the collection of visible and invisible particles from smoke, pollen, methane, cigarette smoke, volatile organic compounds, formaldehyde, asbestos, carbon dioxide and other substances is an accumulation trapped in stagnant water, air or landfills. People who cook and heat their homes by burning biomass, kerosene, and coal generate ambient particulate matter. Then comes traffic, industry, natural sources including soil dust and unspecified sources of pollution. Other greenhouse gases include methane —which comes from such sources as landfills, the natural gas industry, and gas emitted by livestock. Living things emit carbon dioxide when they breathe this includes rivers lakes and water bodies and all animals and plants. Carbon dioxide is the most common gas. Human lives, vegetation, agriculture, domesticated animals and all man-made industrial development lean on water bodies, which may be ocean, lake or river and they all pump carbon dioxide into the air above. This process of synergy of water body and living in the discovery of civilization in order to breathe.

Breathing River



The town of Trichirappalli has mushroomed around the river Cauvery and its tributary and distributaries. Uyyarkondan River is one tributary of river Cauvery over 2500 years old. It was named 1000 years ago during the Chola dynasty reign when a temple and a channel for this river was built by the King Raja RajaCholan. This tributary canal originates from the Cauvery near Pettavaithalai and traverses about 70 km

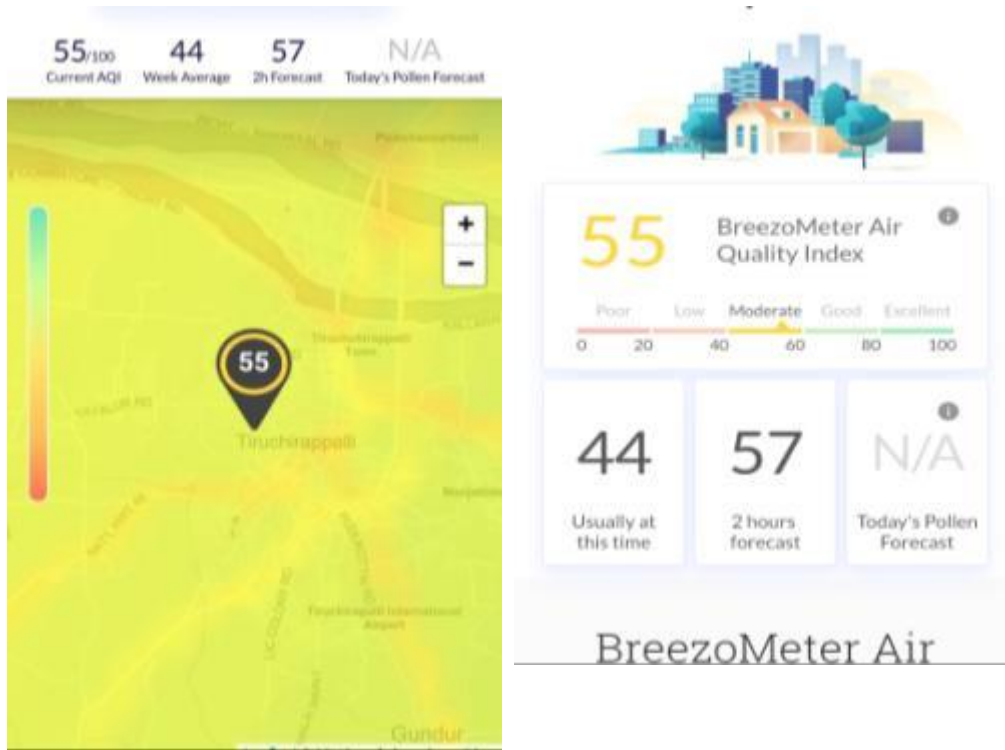
upto Vazhavanthankottai tank, irrigating 32,000 acres fertile land. (4)

With the growing urbanization, a 7-km city stretch has become an eyesore with several open drains and sewage from houses being let out directly into it. This river must be now a closed system, with very little dispersion across the boundaries. Now imagine how much more this river would have pumped pollutant gases into the atmosphere in order for it to cleanse itself while breathing. The gases released trap heat in the atmosphere and contribute to climate change.

In a study in 2015 conducted in Tamil Nadu all the stations' AQI fall under good and satisfactory category except Trichy where the majority of the days the AQI fall under the moderate category. From the AQI of all the stations, it is observed that responsible pollutant is PM10. The other parameter (i.e.,) SO2 and NO2 fall under good category for all stations for all days.



The higher value of PM10 is mainly due to vehicular pollution. (5) If you see all the study has been around the city and not around a water body. As enclosed government data given in (Annexure -1).



Even now in the year 2019, the AQI of Trichy is still in moderate category.

Let us understand where this breathing goes!

A shallow river is heated more rapidly than a deep river. There is evidence from cloud photos taken from satellites that a thermal circulation is developed around most rivers with an average diameter of more than 2 km. The shallower the boundary layers stronger wind shear influences the pressure aloft. (7) This river is very shallow. It is only of the depth of two humans standing one over the head of the other.

Incidentally, the Mission area chosen does not have heavy traffic. Also we find that it is not PM10 that is annoying but it is PM2.5, which is higher here. The size, depth, and shape of the water body and landfill should be considered in order to understand where the breathing goes.

A key finding in one of the study is how the concentration of NO_x affects the formation of PM2.5, found in smog, by changing the chemistry of the hydrocarbon vapours that transform into the particles less than 2.5 microns across, or about 3 percent the width of a human hair. (6)

Based on the available information, globally 25% of urban ambient air pollution from PM2.5 is contributed by traffic, 15% by industrial activities, 20% by domestic fuel burning, 22% from unspecified sources of human origin, and 18% from natural dust and salt (8)

PM2.5 has always been dominant around this water body 38.31µg/m³. The main source being combustion processes (solid waste burning, dead bodies burning), construction rubbles disposal,



biological wastes particles with bacteria and virus.

One Month Average data of both day and night readings

PM _{2.5}	38.31µg/m ³
PM ₁₀	50.75 31µg/m ³
CO	193.44ppb
NO ₂	1.01ppb
O ₃	61ppb
SO ₂	1.24ppb

The burning ghats will continue for other societal reasons. But in order to prevent people from littering the river, bio-fencing would be established for 2,600 meters. Three public parks would

be established along the left bank of this river. A total of 430 granite stone benches would be placed at different locations. The entire 2.6 km stretch would have gardening with landscape arrangements.

The project would enable the provision of various amenities for the 2.6 km out of the 8.7 km length of the canal in the city limits. Improving road, formation of pathway, construction of retaining wall, the establishment of parks and provision of road site streetlights.

As part of the rehabilitation, Public Works Department (PWD) would take up bed lining and construction of retaining wall for a stretch of 1,250 metres in the Palakkarai area, where the canal is subject to the heaviest pollution.

1. Fencing to prevent dumping of solid wastes to be undertaken.
2. The PWD would clear the silt on the polluted stretch.
3. Strict vigilance and no-tolerance to visibly polluting vehicles, industries, open burning, construction activities etc.;
4. Identifying sources contributing significantly to rising air quality levels and actions for reducing emissions from such sources are to be taken

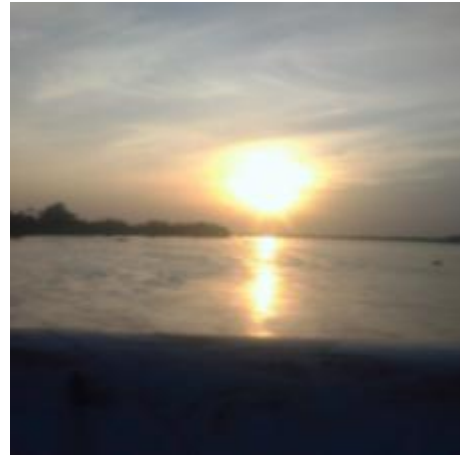
Suggestions:

Azadirachta Indica (neem), *Ricinus Communis* (castor bean), *Prosopis Juliflora* (kabulikikar/vilayati babul), *Dalbergiasisoo* (sheesham) and *Delonix regia* (gulmohar) These flora species which have good Air Pollution Tolerance Index (APTI) value may be used for green belt planning (9).

Trichy city corporation may use latest technology drones flying or stationary over the water body so that live data on pollution is relayed to commissioner's office and also it becomes a scientific but decorative attraction which would instil fear in those who make this a dump.



*Open to Sky
Under the Sun and even the moon
Inhaling and Exhaling
That reason for Earth to mother all lives – Air
It is the water body that needs to breathe for any life form to exist
That is where the breathing goes !!!!*



References

1. <https://economictimes.indiatimes.com/news/politics-and-nation/1000-year-old-chola-period-uyyakondan-canal-to-be-renovated-soon/articleshow/47417139.cms>
2. https://en.wikipedia.org/wiki/Air_quality_index
3. <https://www.breezometer.com>
4. <https://www.thehindu.com/news/cities/Tiruchirapalli/uyyakondan-riverfront-development-work-begins/article25989981.ece>
5. <https://www.sciencedirect.com/science/article/abs/pii/S1309104218304835>
6. <https://www.omicsonline.org/open-access/assessment-of-air-quality-index-for-cities-and-major-towns-in-tamil-nadu-india-2165-784X-1000304-99889.html>
7. <https://www.sciencedaily.com/releases/2019/03/190326160515.htm>
8. <https://www.futurity.org/rivers-streams-earths-surface-climate-change-1799312/>
9. <https://www.sciencedirect.com/science/article/pii/S1352231015303320>
10. <https://www.dailypioneer.com/2017/page1/these-20-plants-can-guzzle-pollutants-finds-du-study.html>
11. <https://www.sciencedirect.com/science/article/abs/pii/S1309104218305075>
12. https://books.google.co.in/books?id=94VRCQAAQBAJ&pg=PA163&lpg=PA163&dq=SPM+RSPM+trichy&source=bl&ots=Q8TGVtVjWf&sig=ACfU3U2KACb8_bDcONIn8dsQLOcTYF9f0A&hl=en&sa=X&ved=2ahUKEwjX0cfJtaniAhVbfhOKHf7sBYgO6AEwEXoECAkQAO#v=onepage&q=SPM%20RSPM%20trichy&f=false

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AIR POLLUTION IN INDIA – ARE WE FIGHTING A LOST BATTLE?

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Pollution refers to the contamination of the Earth's environment with materials that hamper human health, quality of life or the natural functioning of the ecosystems. The major forms of pollution include air pollution, water pollution, noise pollution and soil contamination. Air pollution refers to the release of pollutants into the air that is injurious to human health and the planet as a whole. Air pollution affects the young and the old, the rich and the poor, and people in all areas of the globe. Research over the past several decades has discovered large number of ways in which poor air quality affects our health and quality of life.

Air pollution consistently ranks among the top risk factors for death and disability worldwide. Breathing polluted air has been recognized as increasing a person's chances of developing heart disease, chronic respiratory diseases, lung infections, and cancer. In 2017, air pollution was the fifth-highest mortality risk factor globally and was linked with about 4.9 million deaths and 147 million years of healthy life lost.

India has some of the highest air pollution levels in the world. According to the World Health Organization (WHO), India has 13 of the world's 20 most polluted cities in terms of particulate matter smaller than 2.5 micrometres (PM_{2.5}). According to CPCB's National Ambient Air Quality Report 2008, the annual average concentration of total suspended particulate matter in Delhi was 278 $\mu\text{g}/\text{m}^3$ in other words, Delhi's air was critically polluted round the year. But Yamunanagar, Surat, Patna, Jharia, Faridabad, Kanpur, Agra and Ludhiana had still higher levels of particulate pollution than Delhi round the year ranging from 200 $\mu\text{g}/\text{m}^3$ to 375 $\mu\text{g}/\text{m}^3$.

In short, the picture of air pollution is nothing short of terrible. Moreover, this pollution is widespread and growing. This is the picture when the quality of pollution monitoring is extremely meagre. Even after looking at these figures neither the Central government nor any of the state governments have as of now cared for formulating an impactful plan to control this pollution and bring it to acceptable levels. Anything is happening at environment conservation front is piecemeal.

The biggest sources of pollution are power plants, industries and vehicles. The rate with which vehicular pollution is growing is absolutely astounding. The Centre for Science and Environment has found that between 1975 and 1995 the country's economy (GDP) grew by about 2.5 times the vehicular pollution load grew by eight times. Since India is in the nascent stages of industrialization, power generation, motorization and urbanization, we can be assured that pollution will grow enormously unless major efforts are made to control it.

The question, therefore, is: Will we be able to achieve it? It is always hard to envisage the future but if we consider the past trends the simple answer is: Not for a very long time. If we look at the

history of pollution in different countries, pollution grew very rapidly in Western countries soon after the economic boom that followed the Second World War. It was a period during which the West created enormous economic wealth. By the late 1950s, the air and water were extremely polluted. The Thames and the Rhine had become sewers, the same condition in which we currently see Yamuna and Gomati. Japan was suffering from an unknown but appalling neurological disorder called Minamata Disease. It was impossible to breathe in Tokyo, London or Los Angeles. This led to an awakening and powerful environmental movement in the 1960s and which gained strength during the 1970s.

With the environment also becoming an electoral issue, governments and political parties began to retort to the issue. During the 1970s and 1980s, Western governments did two things mainly. Firstly, they made strong laws and enforced them with great discipline and, secondly ensured a substantial amount of industrial investment in pollution control. As a result of all these efforts, by the mid-1980s the Thames was once again beginning to breathe and so were the waters of other rivers. Urban air was also becoming reasonably clean. Thus it took nearly 20 years or one generation from the mid-1960s to the mid-1980s to bring about the noticeable change. The battle is still far from won. Western industries still produce huge toxic wastes, carbon dioxide and sulphur dioxide emitted by their power plants, industries and vehicles are threatening to destabilize the world's climate.

In India, we are in the same situation that the West was facing in the 1960s. The question today is: Will we be able to replicate what the West did in one generation? Will India's rivers and cities begin to breathe by the 2030s? The answer is: Very Unlikely. For three key reasons which manifestly differentiate us from the West. First, pollution control has yet to become an electoral issue in India.

India's politicians have not shown any stern interest in addressing pollution as an important issue. Even for Lok Sabha elections 2019, environment was not in the key issues that the political parties were focusing. The government PSUs and power stations are heavy polluters. Politicians do not want to take steps against small polluters either the small-scale units or the small taxi-drivers/three-wheeler drivers because they constitute important vote banks. Therefore, India's electoral democracy is proving to be very weak to deal with the scourge of pollution. As a result, India's pollution control laws are not very effective in making the industries and people accountable for the environment. And it seems that this situation is unlikely to change in the near future.

Second, pollution control requires enormous discipline and effective regulation. Given the state of political and bureaucratic corruption in India, it seems extremely dubious that pollution control laws will be enforced with any level of effectiveness.

Third, pollution control requires huge investment and given the fact that India's per capita income even today is far less than what the Western countries had achieved in the 1950s, therefore it is hard to see this investment being made. To achieve it, the government needs to search for cost-effective measures. The government can take the comparatively cheaper

precautionary measures than the extremely expensive curative measures. Also, it can insist that the companies big or small have to meet certain minimum standards for environmental conservation or face severe penalties. But for achieving this we need strong will power and determination from our lawmakers and government officials. But, the pollution control department is today one of the most pathetically incompetent government department in the country. Also, the government is not showing proper interest in tackling the situation. As a result, the polluter-politician-government official nexus is becoming extremely strong. What does this mean then? It simply means that looking at current situations, it seems that India would not be able to clean pollution in one generation. If it takes at least 2 generations, we will begin to see leaner air only by the 2050s. In other words, the current generation is going to leave behind a totally unlivable habitat for at least two of its generations. The future is, therefore, nothing less than scary. Thus we need to take steps to preserve our environment and consider reducing pollution as an utmost important task. Only then we will be able to provide the coming generations a better place to live and grow.

THAT POISON IN THE AIR

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The contamination of air, caused by harmful gases, dust, smoke etc., which changes the properties of ambient Air, is causing Air Pollution and making the Air Toxic; the sources are Natural as well as Man Made. The Air Pollutants are not just deteriorating Human health but are also deteriorating our Planet's Health.

22 cities in India are in the list of Worlds top 30 polluted cities in the World (IQAIR Air visual). A survey showed that Air pollution caused 1.2 million deaths in India last year (Quartz). Poor air quality is causing Respiratory disorders, Heart diseases, Strokes, Diabetes etc. According to an independent study released by the International Institute for Applied Systems Analysis (IIASA) and the Council on Energy, Environment, and Water (CEEW), by the year 2030, over 674 million people in our country are likely to breathe air with high concentrations of PM_{2.5}.

Household fuels are the biggest source of outdoor air pollution in India, Reducing the use of cheap fuels such as Wood, Kerosene, Coal, and Dung can alone lower the Air pollution levels without any changes to the emissions from the other sources (Kirk R. Smith, UC Berkley).

UjjwalaYojna was launched to shift households from conventional fuels (Fire Wood, Coal Kerosene) to LPG aiming to reduce pollution from household fuels but 20% UjjwalaYojana consumer did not even go for a second refill as reported by oil marketing companies. Non-

availability of LPG at some places in UP, Maharashtra and Rajasthan could not make it help achieve its goal of reducing pollution from Household fuels.

Toxic air is the biggest enemy of this era which is chaos in everyday life leading to poor health, reduced visibility (SMOG), difficulty in breathing, affecting plant health, diminishing crop yield and causing Climate Change. Some of the Air Pollutants like Carbon Dioxide; Methane etc are the Green House gases which are causing Global Warming leading to Climate change. The average global temperature on Earth has increased by about 0.8° Celsius (1.4° Fahrenheit) since 1880. This Climate change is amplifying the effects of Air Pollution making it Worse (CDC).

Different techniques can be used to control Air Pollution some of them are switching to electric vehicles which are not yet popular in India due to its cost and limitations. CNG powered Public transport which didn't work as expected due to high costs. The usage of natural gas in India has gone down at 6.2 per cent in 2018 compared to 10.2 per cent in 2010, due to insufficient supply. India is way below the global standards to support CNG Vehicles as of present we can cater just 30 Lakh vehicles.

Aerial spraying of water for settling down suspended pollutants is not viable for clearing up a City's pollution as we are already facing Water Scarcity.

National Clean Air program is launched in January 2019 focusing on 109 cities aiming to reduce their pollution levels by 30% in the next 5 Years but this program will need to stay at par with the growing economic needs.

Switching to Electric Vehicles by 2025 is in Pipeline which includes the sale of only Electric 2 and 3 wheelers from 2023. This switch will also boost the value of Rooftop solar electric systems. We still need better solutions for managing emissions from solid waste, industries, Agriculture, Transport, Power and Household sector. The solutions should also stay at par with the Economic growth leading to Sustainable development.

TOP TWELVE CAUSES OF AIR POLLUTION

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Air pollution is a type of environmental pollution that is caused by the presence of a substance which has harmful or poisonous effects. These substances may be gases, particles or biological molecules. Going into the depth of air pollution the major factors contributing to the causes of air pollution are listed below :

1. Particulate Matter

Air pollution is characterised by the presence of particulate matter in the air of the Earth's atmosphere. These particles of soot and metals give smog its murky colour. Fine particles pose the most serious threat to human health, as they can penetrate deep into the lungs.

2. Poisonous Gas

Air pollution is also caused by the presence of poisonous gases in the air we breathe. Poisonous gases like Carbon dioxide (CO₂), Carbon mono-oxide (CO), Sulfur oxides, Nitrogen oxides etc are responsible for air pollution.

3. Vehicle Emissions

The vehicle exhaust fumes in cities which contain different gases and form the largest source of air pollution. Carbon monoxide is the principal bearer of air pollution that is emitted from the exhaust of the vehicles. Vehicle emissions are another source of fossil fuel emissions. Private transportation accounts for about 10 percent of our carbon footprint, or the amount of carbon dioxide our lifestyle and activities contribute to the atmosphere, reports Carbon Footprint Ltd.

4. Burning of Fossil Fuels

The U.S. Department of Energy estimates that fossil-fuel-burning power plants supply almost two-thirds of the nation's electricity needs. Fossil fuels include oil, natural gas and coal. When these fossil fuels are burned, they release carbon dioxide, methane, nitrogen and particulate matter into the atmosphere. The burning of fossil fuels to produce energy releases a significant amount of these greenhouse gases into the environment and hence cause the greenhouse effect. Thus, fossil fuels cause air pollution.

5. Pollution From Air Conditioners

When the filters in air conditioners are not changed regularly, it combines with air along with its dirt and pollutants leading to the pollution inside house. This makes us breathe disease-causing air inside our houses too.

6. Dust & Dirt.

Air Pollution from dust and dirt is also a popular air pollutant. Everyday labour in agricultural and construction industry lifts up dirt and dust that goes into the atmosphere leading to air pollution. Dust lifted from tractors in fields and also land clearing and general demolition in the construction field.

7. Household Pollution

Household chemicals that are being used without proper ventilation is also a major source of indoor air pollution. This type of indoor air pollution is very harmful for babies and infants.

8. Natural Processes

Natural processes can also contribute to the effects of air pollution. Natural events such as volcanoes and tornadoes can stir up debris which causes widespread air pollution. Natural erosion of rock and soils releases toxins such as radon into the air. Radon is the second leading cause of lung cancer in the United States, according to the National Cancer Institute.

9. Deforestation

Forests act as sinks for carbon dioxide through a process called carbon sequestration. Trees store carbon dioxide in their plant tissue as they take in this gas to undergo food-making. When these forests are burned and destroyed, this storage area for carbon dioxide is removed, increasing the concentrations of atmospheric carbon dioxide. The abundance of these gases causes global warming.

10. Industry

Industry or factory is a major contributor to air pollution. Industrial processes release pollutants such as nitrous oxide, sulfur oxides and hydrofluorocarbons into the air. Agricultural practices such as livestock rearing and landfills also contribute to atmospheric methane concentrations. The overall effect is an increase in the global warming potential.

11. Wood Fires

Wood fires also cause air pollution by releasing particulate matter into the air. These particles can become lodged in our respiratory system, causing irritation to tissues. The particles can also aggravate existing health conditions such as asthma, warns the U.S. Environmental Protection Agency.

12. Smoking

We are still at risk of the dangers of smoking even if we are a nonsmoker. The University of Minnesota estimates that up to 90 percent of the American population is routinely exposed to secondhand smoke. Tobacco smoke contains 40 carcinogens, making it an especially lethal form of air pollution.

Title - Mask: The loss of identity
Medium -Acrylic colours on 130 GSM A4 size paper
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SURVEY OF VEHICULAR AIR POLLUTION IN GARDEN REACH AREA

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Objectives: Our objectives was to make a study about vehicular air pollution and its effect on local air quality and student's health.

Objectives wise methodology and work plan:

At two places in Garden Reach, the survey was done with the help of local traffic police for two different times in a day for consecutive 10 days at a stretch.

- ❖ The rate of flow of different types of vehicles in this area
- ❖ Amount of monthly fuel consumption of different vehicles
- ❖ Types of fuel used by different vehicles
- ❖ Age of vehicles.
- ❖ Mileage of different types of vehicles.

- ❖ A survey of student's health due to mainly vehicular pollution is done for different age group student.

Experiments carried out: For 30 seconds exhaust deposition of different vehicles was taken on filter paper attached in a steel saucepan and its mass is measured with a high resolution weighing machine (upto 4 decimal). S.P.M (suspended particulate matter) in the air is also measured by a simple device consisting of filter paper, a CPU fan attached with 12V DC supply.

Observations:

1. The mileage of the vehicles is inversely proportional to the total use of fuel consumed.
2. S. P.M. in the air of the Garden Reach area is high compared to the standard value.
3. Effect of air pollution on lower age group students is much than upper age group students

Results:

1. The maintenance of vehicles is the most important to reduce vehicular pollution.
2. The types of fuel and age of vehicles are less important to understand pollution.

To solve the problem, we arranged an awareness programme on how to check vehicular air pollution is organized in local areas and the idea of a simple water-based improvised device to reduce vehicular exhaust deposition was discussed.

AIR POLLUTION AND HUMAN HEALTH: AN ANALYSIS OF WEST BORAGAON DUMPING GROUND IN GUWAHATI CITY, ASSAM-INDIA

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Air pollution is the activity of harmful or excessive quantities of substances including gases, particles, and biological molecules are introduced into Earth's atmosphere. It may cause different diseases, allergies and even death to humans and it may harm the other living organisms such as animals and food crops and may damage the natural or built environment. Air pollution is the resultant of the admixture of various harmful gases in the atmosphere or finely dispersed liquid aerosols at rates that exceed the natural capacity of the environment to dissipate and dilute or absorb them. These substances may reach concentrations in the air that cause undesirable health, economic, or aesthetic effects.

It is a mixture of natural and man-made substances in the air we breathe. It is typically separated into two categories: outdoor air pollution and indoor air pollution.

Many aspects of human beings are influenced by the environment, and many diseases can be caused, sustained, or exacerbated by environmental factors. Environmental health is defined more by the problems faced than by the approaches used.

The problems include the treatment and disposal of different wastes, purification of dirty water supplies, the impact of overpopulation. Though the boundaries of environmental health are not rigidly defined, the challenges and priorities of environmental health vary between communities and the responsibilities that can be shared in many ways. While some people spend more time than others working on these problems, we all affect environmental health through our individual and collective decisions.

Some of the more commonly reported environmental health issues due to solid waste disposal in Guwahati city relate to the uncollected wastes that are strewn on roadsides and drains, retaining water and clogging drains, thus leading to stagnant waters which encourage mosquito vector in abundance. Uncollected wastes provide food and breeding sites for insects, birds and rodents and the disease vectors connected with them.

World Health Organization mentioned that air pollution is an invisible killer that lurks all around us, preying on the young and old. Learn how it slips unnoticed past our body's defences causing deaths from a heart attack, stroke, lung disease and cancer. 24% of all stroke deaths are attributable to air pollution. Air pollution causes 1.4 million deaths from stroke every year. 25% of all heart disease deaths are attributable to air pollution. Air pollution causes 2.4 million deaths due to heart disease every year and 43% of all lung disease and lung cancer deaths are attributable to air pollution. Air pollution causes 1.8 million deaths due to lung disease and cancer every year. Most air pollution-related deaths are from noncommunicable diseases (NCDs). In terms of global disease burden, air pollution is the cause of over one-third of deaths from stroke, lung cancer, and chronic respiratory disease, and one-quarter of deaths from ischaemic heart disease. From smog hanging over cities to smoke inside the home, air pollution poses a major threat to health and climate. The combined effects of ambient (outdoor) and household air pollution cause about 7 million premature deaths every year, largely as a result of increased mortality from stroke, heart disease, chronic obstructive pulmonary disease, lung cancer and acute respiratory infections.

More than 80% of people living in urban areas that monitor air pollution are exposed to air quality levels that exceed WHO guideline limits, with low- and middle-income countries suffering from the highest exposures, both indoors and outdoors.

Growing air pollution has emerged as a serious concern. The vehicular emission and dust contributing a major share of the deteriorating air quality in the city. The Pollution Control Board Assam (PCBA) which has been monitoring the city's ambient air quality under the National Air Quality Monitoring Programme (NAMP) has recorded high levels of air pollution in all its monitoring stations in the city. Data with the air quality monitoring station at Bamunimaidam reveals presence of respirable suspended particulate matter (RSPM) and suspended particulate matter (SPM) well above the prescribed limit since 2008.

Air Pollution in Guwahati has increased in recent years due to the different causes such as growth of traffic and other urban activities. The uneven topography, the geographical conditions

and the climatic factors, and elements like circulation of air, temperature, radiation level and alternating change of the local low and high-pressure gradient have a role in the growing concentration and unequal dispersion of the air pollutants within the city. The concentration of pollutants is also affected by the micro-level changes in the atmosphere. As the city is blocked on three sides by the hills and the hillocks, free movement of air is hampered for which the pollution level is comparatively higher in a few pockets. Vehicular emission is also increasing in the city. The number of vehicles in Guwahati have doubled in the last five years which has led to more fuel consumption and more emission in the city. The vehicles during traffic congestion throw high collective air pollutants into the environment. The highly air polluted sector of the city is the central part Use of Municipality dust bins are mandatory for the people to dispose their waste. But it has been seen in the field that people do not dispose the wastes in a proper manner. Instead, they dispose it different ways which are not hygienic or safe for the people. The west Boragaon dumping ground is one of the most air-polluted areas of the city. The odour of dumping ground and waste burning smog pollutes the air and indirectly affects human health. During the field study it is found that the people living nearby dumping ground is suffering lots of diseases related to air pollution. It is found that 95 percent people of Sipini Nagar, Brindaban Nagar, Surabhi Nagar area strongly complain that flies make their life miserable. The students of Pragjyotish School are unable to take their tiffin in the school during tiffin time. The open burning of the wastes causes severe air pollution besides making the products of combustion fly in the ambient air of the nearby area. People complain of odours coming towards their area from the burning sites when wind blows. The study reveals that there is a positive relationship between air pollution and health. People awareness and goodwill of government can solve the problems of air pollution of West Boragaon area of Assam- the doorway of North-East India.

CARBON SEQUESTRATION BY MANGROVES – RESULTING IN CLEAN AIR

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Mangroves are termed as 'Tropical tidal wetlands' and they are salt-tolerant forest ecosystems in the tropical and subtropical intertidal regions of the world. Mangrove forests are among the most threatened habitats in the world (Mathew *et al.*, 2001). 50% of the world's mangrove forests have been lost as a result of clearing and alteration of coastlines (Duke, 1992). The tangled mass of roots provides safe havens and refuge for spawn, fry, fingerlings and juveniles of many species of finfish, shellfish and crustaceans. Apart from sustaining life mangroves act as a carbon sink also termed carbon sequestration. Carbon sequestration is the process involved in carbon capture and the long-term storage of atmospheric carbon dioxide or other forms of carbon by plants and mangroves save the maximum carbon. One of the key ecosystem services of mangroves, salt marshes and salt flats is the retention of carbon and nutrients within sediments. In mangrove ecosystem approximately half the nutrient and carbon stocks can be in sediments (Catherine Lovelock *et al.*, 2007).

Carbon sequestration is now perceived as a means for conservation and restoration. Despite the small geographical extent of mangroves (0.1% of the earth's continental surface), they are considered as potential carbon sinks and proposed as a low-cost effective option for mitigating greenhouse gas (GHG) emissions and climate change, due to their much greater carbon storage potential per unit area (Donato *et al.*, 2011).

Mangrove forests are among the most carbon-rich habitats on the planet. Studies indicate that mangroves can sequester four times more carbon than rainforests can. Mangrove forests can play an important role in carbon removals because they are among the most carbon-dense ecosystems in the world, and if kept undisturbed, mangrove forest soils act as long-term carbon sinks and in the process keep the atmosphere clean. If mangrove carbon stocks are disturbed, resultant gas emissions may be very high. Tons of this carbon is released due to mangrove forest loss. There are many significant studies on carbon sequestration in India such as by Ray and Jana (2017), where they studied the impact of Sunderbans as a carbon sink for gases emitted by thermal plants around Sunderbans and by the cosmopolitan city of Kolkata and by Chaudhari and Pejaver (2010), where they studied the impact of mangroves in carbon sequestration in Thane creek, the most polluted creek in Mumbai.

Mangroves are carbon sinks but are being increasingly cleared by human beings by coastal reclamation and pollution. Only mangroves can provide natural control of eroding shoreline and increasing tidal amplitude due to global warming apart from carbon sequestration. If mangrove carbon stocks are disturbed, resultant gas emissions may be very high. Clearing of mangroves can rapidly result in significantly reduced carbon stores. The estimated carbon stored in these ecosystems is so large that it makes mangrove important for climate change mitigation (Murdiyarsot *et al.*, 2009). According to Chaudhari and Pejaver (2010), conservation of mangroves

will increase fixation of atmospheric carbon and carbon accumulation in the form of organic matter that enters sediment through litterfall and residing macrobenthos density and destruction of mangroves results in the oxidation and release to the atmosphere of the organic carbon stored in the sediments. Hence mangrove planting efforts need to be undertaken on a large scale along the coastal belt of India to have cleaner air.

References:

- Chaudhari, S. and M. Pejaver. 2010. Conservation of mangroves with respect to their potentiality of organic carbon accumulation in sediments of Thane creek, Maharashtra, India. *Wetlands, Biodiversity and Climate Change*, 22nd-24th December 2010, Lake: p.1-12.
- Donato, D. C., J. B. Kauffman, D. Murdiyarto, S. Kurnianto, M. Stidham and M. Kanninen. 2011. *Nature Geosci.*, **4**, 293–297.
- Duke, N. C. 1992. Mangrove floristic and biogeography. *In*: Robertson, A. I. and D. M. Alongi (Eds.), Tropical mangrove ecosystems, *American Geophysical Union*, Washington DC: 63-100.
- Lovelock, C. and J. Ellison. 2007. Vulnerability of mangroves and tidal wetlands of the Great Barrier Reef to climate change. *Climate Change and the Great Barrier Reef: A Vulnerability Assessment*.
- Mathew, G., R. Jayabaskaran and D. Prema. 2001. Mangrove ecosystems in India and their conservation. *In coastal fishery resources of India-conservation and sustainable utilization*. P 186-196.
- Murdiyarto, D., D. Donato, J. B. Kauffman, S. Kurnianto, M. Stidham, M. Kanninen. 2009. Carbon storage in mangrove and peatland ecosystems - A preliminary account from plots in Indonesia. Working paper 48. pp. 35. www.cifor.cgiar.org.
- Ray, R. and T. K. Jana. 2017. Carbon sequestration by mangrove forest: One approach for managing carbon dioxide emission from coal-based power plant. *Atmospheric Environment*, 171 p. 149–154.

IMPACT OF AIR POLLUTION ON AQUATIC ECOSYSTEMS

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Air pollution is a big issue worldwide which gives rise to events such as global climate change. CO, soot, C₄H₄O₂, C₄H₄O, Hg, etc., are largely produced by open cast burning of the waste material. Air pollution in India is mostly caused by fuel wood and biomass burning, large scale burning of crop residue in agricultural fields, use of adulterated fuel, emission from vehicles and traffic congestion. In terms of greenhouse gas emissions, India holds the third position followed by China and America.

Air pollution and its impact on Aquatic Ecosystem

Ecosystems are impacted by air pollution. It affects their ability to function and grow. Emitted NO_x and SO_x pollutants reacts with water droplets and precipitate as acid rain. Due to this precipitation SO_x and NO_x affects water quality by decreasing its pH. Precipitation also increases the acidity of the soil, which badly impacts the flora and fauna. Ultimately, acidification affects the ability of ecosystems to provide “ecosystem services”, such as nutrient cycling, on which the planet and human life is dependent.

Eutrophication is the process of accumulation of nutrients, including nitrogen and phosphorous, in water bodies. Nutrient overloads in aquatic ecosystems may be caused by emissions of nitrogen oxides which through physio-chemical processes find its way into the aquatic body. This results in the formation of algal blooms and depletion of oxygen levels in the aquatic system which hampers the survival of aquatic biodiversity.

Facts about impact of air pollution on aquatic ecosystems

- Open Ocean sites show current levels of acidity have increased by 26% since the start of the Industrial Revolution.
- Coastal waters are deteriorating due to pollution and eutrophication. Without concerted efforts, coastal eutrophication is expected to increase by 20 percent by 2050.

Remedial Measures

Effect and geographical extent of the acidification of surface water caused by air pollution is monitored by the international cooperative programs. The principle objective of the international cooperative program is to monitor and develop ways to mitigate the current status of the ecosystem as well as the manipulations which occur in the ecosystem which causes the phenomena of the climate change.

CLEAN ECO-FRIENDLY AND PLASTIC FREE BASISTHA TEMPLE

(A Historic and Age Old Heritage Site of India) Initiative by Voice of Environment.



In keeping with the **MoU** signed between the **Basistha Devalaya (Temple) Authority, Guwahati, Assam** and **Voice of Environment** on **May 27, 2018** team **VoE** has started as mission as **‘Clean, Eco -Friendly Plastic Free Basistha Temple Premise Creation’** which was started on the occasion of **World Environment Day 5th June 2018**. The team **VoE** afterward have been conducting such mass awareness campaigns at temple premise time to time to create a mass sensitization among the devotees, visitors, local shopkeepers, vendors, residents and temple priests to keep the temple premise and **Basistha Ganga river** as clean and plastic free which is having not only ecological importance but also having a great mythological faith thus, on the auspicious occasion of **Sravana Month** in which millions of devotees across the state and the country comes for visit the temple for the **Bol Bam Mela** festival at Basistha temple every year.

The team VoE has been conducting “**Cleanliness Drive**” at Basistha Temple premises and for the Basistha Ganga River which is an important part of Basistha Temple. Team Voice of Environment led by **Bhaskar Hazarika, Rupam Mitra and Environmentalist Moharana Choudhury**, started the activity at temple during the sundays by collecting the plastic bottles and other trash from Basistha Ganga River and also interacted with devotees by requesting not to throw the plastic wastes and others waste materials into the river and also not to bath in the river with detergent soap which is also written in display boards by temple authority. This campaign the Bol Bam devotees’ team also joined to help the team VoE for collecting of such plastics items which were there in the **Basistha River** and then they have disposed these wastes in marked dust bins by temple authority. It is said that **Cleanliness is next to Godliness**. Cleanliness and ecological aspects are directly related to eco-tourism, livelihood generation of the area well as mythological importance of such iconic tourist place of Assam. Team VoE request all to join this noble initiative to change the scenario together.

#Clean Basistha Temple

#Beat Plastic Pollution

#Save Basistha River



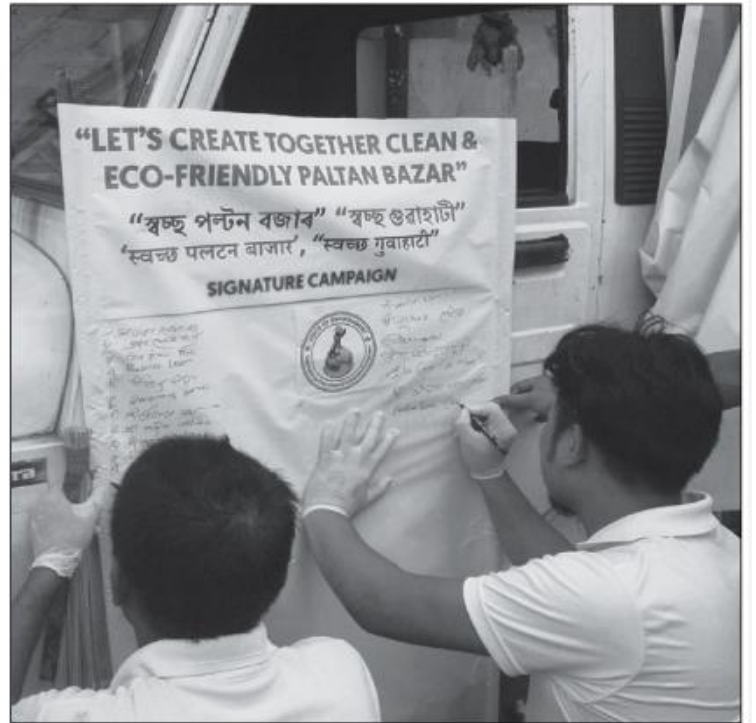
Team VoE at Basistha Temple premise with devotes during the Environmental Campaign and drive.



In continuation of all these team VoE is conducted a drive “**Cleanliness Drive**” and **Mass Environmental Programs** at Basistha Temple premises to save the **Basistha Ganga River** which is an important part of Basistha Temple for the consecutive **7thth** week from **Bol Bom Mela** this year. Team **Voice of Environment** led by **Bhaskar Hazarika, Biju Ray, Mridul Das, Dipjati Dhakuria**, VoE senior member as **Girish Kotoki** started the activity on this Sunday started collecting the plastic bottles and other trash from Basistha Ganga River and also interacted with devotees by requesting not to throw the plastic wastes and others waste materials into the river and also not to bath in the river with detergent soap which is also written in display boards by temple authority.

Local youth association as **Assam Seva Samiti** team led by **Raju Sharma, Ranjan Kavita and Dhiren Sharma** also joined the initiative today for and cleanliness drive and collecting plastics items other waste items which were there in the **Basistha River** team have disposed these wastes in marked dust bins by temple authority.

It is said that **Cleanliness is Next to Godliness**. Cleanliness and ecological aspects are directly related to eco-tourism, livelihood generation of the area well as mythological importance of such iconic tourist place of Assam and the country. This place is very important as because of it is also directly related to eco-tourism, livelihood and sustainable development of the area. Thus team believes if we all the stakeholders join hands together the for sure a major changes can bring on ground level by sending a strong sustainable message in the state and the country said by one of the active VoE member as **Environmentalist, Moharana Choudhury** as youths can play an important role to change the scenario together.



বিশ্ব পৰিবেশ দিৱস উপলক্ষে 'ভইচ অৱ এনভাইৰনমেণ্ট'ৰ স্বাক্ষৰ অভিযান

লুইতপৰীয়া প্ৰগতি
সংঘৰ ব'হাগী উৎসৱ

মহানগৰ বাৰ্তা, ৫ জুন : লুইতপৰীয়া প্ৰগতি সংঘৰ সৌজন্যত আৰু মহিলাসকলৰ সহযোগত ব'হাগী উৎসৱ-২০১৯ বৰ্ণাঢ়া কাৰ্যসূচীৰে ৭



MONDAY, APRIL 29, 2019

CITY

THE ASSAM TRIBUNE, GUWAHATI 7



Children taking part in a march against trafficking organised by Abhinandan Foundation India, Abheek Foundation, Matri and World Vision in Gauhati on Sunday. - UB Photos

'Protect Umananda Island' drive organised

CITY CORRESPONDENT

GUWAHATI, April 28: Voice of Environment (VoE), an organisation of environment activists, organised a campaign 'Protect Umananda Island and its Ecology' in collaboration with the Department of Environmental Science, Royal Global University (RGU), here on Sunday.

As part of the campaign, a team from VoE gathered at the Umananda Ferry Ghat in the morning and interacted with devotees and visitors from across the country regarding plastic pollution with reference to biodiversity conservation at the world-famous Umananda



Island, which is also a heritage site of Assam. The team reached the island and started a cleanliness drive there. They collected plastic waste from around the island and disposed it at place marked by the temple authorities. The team later conducted a plantation drive by planting several fruit plants, keeping in

Tobacco awareness prog held in city slum

CITY CORRESPONDENT

GUWAHATI, April 28: In an effort to make children aware of the harmful effects of tobacco, the Consumers' Legal Protection Forum (CLPF) and Consumer Voice, New Delhi, organised an awareness programme at a GMC slum in Bhangagarh on Sunday.

The awareness programme on the harmful effects on tobacco and tobacco products was organised in association with Chakshu, an organisation working among slum children where around 70 children and their parents took part.

Addressing the gathering, Advocate and CLPF secretary Ajoy Hazarika said, "An inter-

national tobacco companies sell tobacco products around schools, and vendors display tobacco products in ways that are appealing to children and youth," Chakshu founder Jitendra Kakati said that the tobacco consumption rate in this dense slum was higher than in other areas of Guwahati.

Sheehansu Singh from Consumer Voice said that the density of tobacco vendors in Guwahati was too high, both in commercial and residential areas, and there was no record available with government agencies about tobacco vendors.

An interaction session also took place where parents of children who consume tobacco





বায়ু দূষণ
সুপূর্ণা লাহিড়ী

Doloi (The Head Priest of Kamakhya Temple)

চারিপাশের সব কিছু নিয়ে গড়া পরিবেশ,
দূষণের কারণে ধীরে ধীরে হচ্ছে সব শেষ।
বায়ু হচ্ছে দূষিত, কারণ তার নানা,
মিশছে যখন হরেক রকম বিষাক্ত পদার্থের কনা।
প্রধান কারণ হচ্ছে ধোঁয়া, উৎস কারখানা-যানবাহন,
চলছে দেদার গাছ কাটা আর হচ্ছে নগরায়ন।
কিছু করে মানুষজন, কিছুতে নেই মনুষ্য- নিয়ন্ত্রণ,
যেমন হয় মরুভূমিতে খুলোঝাড় বা অরণ্যে আগুন।
CO, CO2 এর উৎস হল কাঠ কয়লা তেলের দহন,
ওজেন স্তর হচ্ছে পাতলা, করছে ক্লোরো ফ্লুরো কার্বন।
ক্ষতিকারক অতিবেগুনি রশ্মি টুকছে বুকে ধরার,
তপ্ত হচ্ছে মেদিনী, বাড়ছে থার্মোমিটারের পারা।
করছে দূষণ সাসপেনডেড পার্টিকুলার ম্যাটার,
ফল ভুগছে মানুষ - উদ্ভিদ - জন্তু - জানোয়ার।
তাপ বিদ্যুৎ কেন্দ্রে হচ্ছে SO2 এর সৃষ্টি,
ফলে হচ্ছে ধোঁয়াশা আর অ্যাসিড বৃষ্টি।
মানব দেহে বঁধছে রোগ এসব তারি প্রতিফল,
হচ্ছে ক্ষতি ফুসফুস, ত্বকের, বাড়ছে রোগ জটিল।
জল মাটি বায়ু- সবতেই হচ্ছে দূষণ,
করতে হবে রোধ, হতে হবে সচেতন।
বিশ্ব পরিবেশ দিবস পালিত হয় পাঁচ ই জুন,
বাঁচাতে পরিবেশ করতে হবে বনসৃজন।
তবেই হবে পৃথিবী সবুজ শ্যামল নির্মল,
বাঁচবো মোরা হাসি খুশি, থাকবে ভালো সকল।।

Kamakhya Temple, Guwahati Assam has selected its place as the second runner-up in the Swachh Iconic Place in Phase -I under the Swachh Bharat Mission Initiative (Clean India).

The Award for the same will be presented at Vigyan Bhawan in New Delhi on Friday, September 6, 2019.

Team VoE congratulate Maa Kamakhya মাকামাখ্যা Temple Authority, Local Government Administration, All the local Residents, Devotees, Shopkeepers, Vendors,volunteers and All for their support and works towards this mission.

VoE is thankful to each and every VoE members who worked tirelessly for this cause, VoE Advisory Board Members, All the Mentors and Senior Members of VoE for their spontaneous guidance, motivation and support so far. At last but, not the least the All the Media Houses and Media Personals for their support for this cause so far.

Join hands-

**"Together we can make the difference for sure"
Clean Eco Friendly Plastic Free Kamakhya Temple Premise
Beat Plastic Pollution.**

Team VoE Achievement



Mr. Moharana Choudhury, Team VoE member was felicitated by Assistant High Commissioner of Bangladesh to India on behalf of “The Centre of Ethics and Sustainable Development” 5th June 2019 at Guwahati, Assam, India.



Team VoE at Umananda Island, and Paltan Bazar, Guwahati Assam during the drive and Environmental campign.



Team VoE at **Paltan Bazar** Railway station



Oath taking for Cleanliness at **Paltan Bazar**

Indigenousherald
Face of Northeast India
Estd. 2006 Friday, June 07, 2019

-MENU-

Clean Guwahati City Initiative by "Voice of Environment"

PR



Guwahati, June 6, 2019: Voice of Environment (VoE), an environmental NGO unanimously selected Paltan Bazar as one of model settlements to develop a smart ecosystem where residents, vendors, Hotels, Market Malls, Police Administration come to collaborate together for a joint initiative as "Clean & Eco-friendly Guwahati City Mission", Guwahati is considered as gateway of North Eastern States of India and also one



During the **Signature Campaign**

