

CELEBRATING WORLD ENVIRONMENT DAY WITH CIPLA ALONG WITH SRINILUKA COLLEGE OF PULMONOLOGY

THE environment bestowed upon us by Mother Nature presents itself as a collection of ecosystems.

An ecosystem is a community of organisms (plants, animals & microorganisms) living in conjunction with its nonliving environment. Ecosystems are the basic units of ecology. An ecosystem consists of two main components: biotic and abiotic. The biotic way to conserve the more sensitive biotic component is to protect the ecosystem. A stable ecosystem has a natural rate of change in harmony with nature having its own checks and balances contributing to natural, internal cycles of dynamic equilibrium. Unless there is a disaster like a landslide, forest fire, an earthquake or a volcanic eruption, it will remain stable for 1000s of years. The present time is human interference and this stability is affected the entire ecosystem could collapse. This is applicable not only to forest but to all natural ecosystems and it is evident that nature is largely responsible for the destruction of nature by exploitation of natural resources.

This presentation will examine the consequences of such exploitation, the current awareness of their impacts and the proposed steps to be taken to avoid a catastrophic disaster to the very existence of man on Earth.

The following photos illustrate a few ecosystems of Sri Lanka. In the first, the aesthetic value of natural ecosystems, there are several services provided by them. For example, trees supply O₂. An average, healthy human being consumes an equivalent of three O₂ cylinders per day. Considering the cost of a cylinder to be Rs.1500/-, the cost of O₂ consumed per day is Rs.1500/- (i.e. Rs.1,512 Mn per year). If he lives for 65 years the total cost of O₂ he had used will come up to Rs.206,730 Mn. This is produced by photosynthesis of green plants mainly from forest communities. There are several other ecosystem services that are enjoyed by man and the total value of such services has been estimated as \$ 3.3 trillion which is nearly twice that of all products and services produced by man.

The rapid rate of development achieved by man especially after the industrial revolution,

THE ROLE OF MAN IN THE ENVIRONMENT



Littoral and Coastal ecosystem

has been achieved by the misuse and misuse of natural resources together with the addition of enormous quantities of industrial waste causing severe environmental pollution. The 'Great Acceleration Curve' by Steffen et al (2009) shows that 1950 had been a watershed year after which industrial and other development activities have taken place at an unprecedented rapid rate.

It is stated that if everyone wants to enjoy the standard of living of an average American, it will require four more planets. The great philosopher (Aristotle) said 'It had once existed' there is no need for man's need but not his greed.

If humans continue their activities without restraint, there is no doubt that we are heading towards the self destruction of this planet. Some scientists now therefore named the present period as the geological epoch Anthropocene highlighting the negative impacts caused by anthropogenic activities.

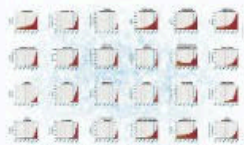
Awareness of all these happenings and their potential disastrous consequences has brought together concerned scientists, policy makers, politicians and corporate administrations to evaluate the current global status and examine the possible measures to overcome an onerous and this timely realization is something to rejoice. It started with the UN Conference on Development and Environment (The Earth Summit) held in Rio de Janeiro, Brazil in 1992. After considerable deliberations consensus on



Dry mixed forest ecosystem

by alternative renewable sources of energy, the gradual reduction in the use and manufacture of internal combustion engines etc. pose severe challenges to the current living styles of man particularly in the industrialized countries. Reviewing the progress after 20 years of the Earth Summit at the Rio + 20 summit in 2012, a three dimensional program was adopted for: (1) poverty alleviation, (2) sustainable patterns of consumption and (3) resource utilization that facilitate ecosystem conservation, regeneration and resilience in the face of new challenges. However, many countries are yet to take meaningful steps in this direction. For instance, for the ranking of Human Development Index (HDI) health, education and income are the major factors considered. Although it has been suggested to change this to Human Sustainable Development Index (HSI) that considers negative points for negative impacts of development, it is yet to be implemented. If the new HDI ranking is adopted Australia, United States of America and Canada will drop from their current positions of 24, 4 & 6 to HSI ranks of 26, 28 and 34 respectively.

Let us look at the scenario in Sri Lanka. Having ratified the International Convention on Biological Diversity in 1994, a Biodiversity Conservation Action Plan (BCAP) was developed and adopted in 1996/99, with the establishment of a biodiversity secretariat (BS) in the Ministry of Environment. The BS subsequently prepared an amendment to the BCAP, the Red List of



The great acceleration curve (after Steffen et al 2009)

several issues had been reached, foremost among them was the acceptance that man himself is largely responsible for the negative effects on the environment resulting in global changes of increases in temperature, rise in sea level, climate change, destruction of the protective ozone layer etc. Agreement was reached on a number of remedial measures to protect the environment and conserve biodiversity. Foremost among them was the International Convention on the Conservation of Biodiversity (CDB). All the participating countries accepted this convention some under conditions and a few after several years. Following the Earth Summit International Conferences, Symposia, Workshops and Discussions were held to ensure that human activities have minimum negative impacts on the environment. Nonetheless, decisions for the phased out elimination on the use of coal, the replacement of fossil fuel use

threatened fauna & flora highlighting the need for the protection of specific groups, an expanded Red List of concerned conservation, the Biodiversity Conservation Action Plan and the National Biodiversity Strategic Action Plan (2016-2022).

Highly attention needs to be focused upon pollution of our freshwater bodies that include ponds, lakes, reservoirs and irrigation tanks. Based upon observations made on the aigal populations of these water resources, a clear pattern of change that has happened during the past century is evident. The population density of algae has increased but its diversity has decreased. This is an indication of increased pollution. Planktonic organisms become less diverse with increased pollution because only those species that can withstand pollution will survive. The more resistant species will become dominant and increase in density. What is more alarming is, the dominant species in most of the water bodies are a potential toxin producing cyanobacteria (blue-green algae). There is an imminent danger that the accumulation of cyanobacterial toxins which cannot be destroyed by boiling the water, could become a widespread environmental health hazard in the near future.

In conclusion, it is accepted that development is necessary, but should adjust sustainable utilization of natural resources and harmonize with environmental protection and conservation of ecosystems and biodiversity.

The human species should earn its leadership among all living beings by playing a more protective and benevolent role towards all forms of life on Earth.

In conclusion, it is development should adopt sustainable utilization of natural resources and harmonize with environmental protection and conservation of ecosystems. The human species should earn its leadership among all living beings by playing a more benevolent role towards all forms of life on Earth.

Vidya Nidhi S. A. Kulasekara
Emeritus Professor, University of Peradeniya
and Research Professor, National Institute of Fundamental Studies

AIR POLLUTION AND RESPIRATORY TRACT INFECTIONS

One health is a trio that brings humans, animals and the environment they share as one unit. The atmosphere is not only a habitat but it is considered the medium for the dispersion of microorganisms. Any living organism needs to breathe to produce energy, and the first phase of the breathing process is inhalation or taking in oxygen from the air. Inhalation of air includes various gases, hydrocarbons, aerosols, and particulate matter (PM). Bacteria, fungi, viruses, pollen, and byproducts of microorganisms such as endotoxins and mycotoxins are significant components of bioaerosols. The airborne microbes are transported via attaching to dust particles. Air pollution introduces various contaminants to the atmosphere. It poses a global threat to humans, living organisms, and the environment. Poor air quality significantly affects children as their lungs are underdeveloped, their immune systems are weak, and exposure to air pollutants will alter their lung functions and retard growth.

The causative agents for respiratory infections include viruses, bacteria, mycoplasma and fungi. Respiratory tract infections could be categorized as upper & lower. Most upper respiratory tract infections are viral origin. Bacteria infections include tuberculosis, caused by *Mycobacterium tuberculosis* type b and bacterial shuntings by *Streptococcus pneumoniae*. Causative agents for the lower respiratory tract could be viral (*Influenza* & *Brucella*) or bacterial (community-acquired pneumonia). Understanding the sources of microorganisms can contribute to effective airborne infection control strategies to efficiently reduce microbial air pollutants. Although studies on airborne organisms have been undertaken in many developed countries, developing countries such as Sri Lanka have not paid much attention to the issue of airborne microorganisms.

Several studies were conducted to determine the variations in airborne bacterial communities within indoor and the heavily traffic congested city environment of Kandy, Sri Lanka, using culturable methods and molecular techniques.

According to the paediatric health study results, 58% of urban and 31% of rural preschoolers are freed from at least one respiratory viruses, wheeze, etc. High total respiratory counts (colony forming units (CFU) per m³) were seen in urban preschools (indoor: 4.6x10⁵ vs 2.4x10⁵, outdoor: 4.2x10⁴ vs 2.8x10⁴). Inhalation dose rates were high in urban preschools, both indoor and outdoor (2.0x10⁴ and 1.0x10⁴ CFU/kg/day). Regardless of the site, indoor microbial counts were high and most were opportunistic pathogens. The study conducted on the Kandy hospital recorded higher counts of airborne microorganisms in the hospital environment, including susceptible people. The analysis of the air quality research revealed that the traffic congested Kandy City harbours a dynamic and diverse range of atmospheric bacteria. Among the identified 28 bacterial types, 22 species were recognized as opportunistic pathogens. A high number of culturable bacteria and total bacteria enhances the health risk to immunocompromised people. Due to the mountains surrounding Kandy City, air circulation within the city reduces the mixing of fresh air. Results obtained indicate that traffic congestion and emissions contribute to the total bacterial load in large quantities. In another study we examined the airborne bacterial community during the 2019 November haze event that occurred in Sri Lanka. Results to prove that haze events have an impact on the airborne bacterial load which increases with the intensity of the haze condition with the bacterial load observed during the haze event was 420% higher when compared to non-hazy days.

These studies emphasize the need to implement policies to monitor the air quality and to develop guidelines on how to prevent associated diseases.

Author: Dhammika Magana Arachchi
(Professor - National Institute of Fundamental Studies)

Restoring clean air-Tackling the challenges of the invisible killer

Air pollution is a major public health issue around the globe, especially affecting resource poor countries. Air pollution occurs when excessive quantities of substances like gases, particulate matter and biological molecules enter the earth's atmosphere. Air pollution brings about disease, allergies and even death upon humans. It also inflicts harm on other living organisms such as animals and food crops, and may damage the natural and built environments. Human activities and natural processes can both cause air pollution.

According to WHO statistics, ambient air pollution accounts to an estimated 8 million deaths each year due to stroke, heart disease, lung cancer and chronic respiratory diseases. Around 92% of the world's population live in places where air quality levels exceed WHO limits. Major outdoor pollution sources include vehicle exhaust, power generation from fossil fuels, construction industry, waste incineration and industrial exhaust.

More than 3 billion people worldwide cook with solid fuels on open fires inside their homes, and in many cases without ventilation, exposing people to smoke, dust and toxic gases generated by combustion.

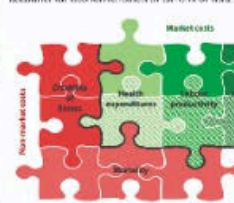
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ECONOMIC CONSEQUENCES OF AIR POLLUTION

Economic consequences of air pollution are largely underestimated and under evaluated in developing countries. Air pollution has emerged as the fourth leading risk factor for premature deaths worldwide. Lost outputs from premature deaths and morbidity attributable to air pollution accounts for economic losses of US\$ 1.6 trillion.



How to combat air pollution

- We should achieve economic targets while,
 - Protecting the natural environment
 - Improving air quality
 - Preventing greenhouse gas emissions
 - Ensuring affordable and cleaner energy supply

It is about a green growth strategy, boosting productivity by improving air quality, using resources efficiently and making the shift to a low carbon economy.

STRATEGIES TO IMPROVE AIR QUALITY

1. Control of vehicle emissions

- The country needs an eco-friendly transport system.
 - Effective public transport system
 - Move to lower emission road vehicles - Buses/ trains
 - Improving road infrastructure
 - Driving Restrictions
 - Import Regulations on Second-hand Vehicles
 - Electrification
 - Low Emission Zones
 - Encourage active travel - Walking/ cycling

2. Control of Emissions at home

More than 3 billion people worldwide cook with solid fuels on open fires inside their homes, and in many cases without ventilation, exposing people to smoke, dust and toxic gases generated by combustion.

- Public awareness
- To move away from biomass fuel
- Modification of the design of cooking stoves
- Improvement in ventilation
- Use of new appliances
- Coordination and global initiative

3. Action to reduce emissions from industry/ power plants

4. Prevention of Pollution related to construction

Given the nature of work undertaken on various construction sites, dust is one of the main causes of air pollution. Dust is categorized as particulate matter that is smaller than 10 microns in diameter.

ULTIMATE SOLUTIONS

The most basic solution to combat air pollution is to move away from fossil fuels and replacing them with renewable energy sources include: Solar energy, wind energy, hydropower, wave power, bio gas and geothermal energy.

The environmental and health effects of air pollution are alarming. Use of fossil fuels and biomass for energy generation, industrial emissions and construction industries are the most common causes of air pollution in developing countries. Walking and cycling will bring economic and environmental benefits. Biogas technology is a viable source of energy when developing a control strategy it is essential to determine the sources and priority pollutants in individual countries. Continuous monitoring of air quality is important. Replacing fossil fuels with renewable energy will be the ultimate solutions to combat air pollution. We must reduce our consumption of energy by adopting responsible habits and using more efficient devices. Political commitment, public awareness and a national action plan will enable an effective control programme to tackle the invisible killer.

Author: Dr. Chandana N. Kulathunga
(Consultant - Respiratory Physician, District Hospital - Mirigama)

Author: Dr. Dushantha Madgedera
(Consultant - Respiratory Physician, National Hospital - Kandy)

THE PANDEMIC AND THE ENVIRONMENT

Air quality during the pandemic

Coronavirus disease (COVID-19) pandemic caused much disruption to the economic, social and health status globally during the years 2019-2021. However, it also provides an opportunity for the environment to reduce the ambient air pollution due to the temporary closure of industries and jobs and the restrictions within cities and countries as a result of imposed lockdowns. In many industrial and densely populated cities the Air Quality Index (AQI), PM2.5, PM10 and NO₂ were reduced significantly in 2020 which however reversed in 2021 with the reduction in restrictions.

Most countries in the world were affected by the COVID-19 infection however, some regions of the world were more affected in terms of infection and mortality. Although exact reasons for such variations are not clear yet, a significant correlation has been found between air pollution and COVID-19 infection / mortality in some regions of the world. Air air pollution may also influence COVID-19 transmission, may increase vulnerability and have harmful effects on the prognosis of COVID-19 patients. Fine Particulate matter (PM2.5, PM10) and NO₂ have been associated with increased prevalence of many respiratory diseases and fatality.

Environmental effects of extensive use of face masks

Face masks

Face masks are the most commonly used to curb the spread of the virus in the COVID-19 pandemic. The usage and production of face masks increased exponentially with the global spread of the pandemic. Of the many types of face masks the surgical masks and the N95 masks were the most popular. Their manufacture entails the use of plastics and/or other derivatives of plastics. The pandemic demanded the production of billions of face masks globally per year requiring a very high energy consumption and the release of CO₂ as green house gas to the environment. The extensive use of face masks also result in increased land fill and medical waste. Most of the components in the waste of the face masks result in the addition of plastic and micro plastic pollution to the environment causing increased environmental pollution and negative impact to human and animal health. Many countries have already begun to explore possibilities of reusing, repurposing and classification of recommended disposable masks and also the feasibility of producing biodegradable masks and home made or non-certified masks.

Author: Dr Kirithi Gunasekera
(Consultant - Respiratory Physician)



Indoor air pollution

Exposure to indoor air pollution kills 3.8 million people each year. Over 3 billion people use polluting fuels and devices such as wood, coal and dung in simple stoves for daily cooking. The resulting household air pollution is the world's single greatest environmental health risk.

Scientific evidence shows that air pollution is closely linked with respiratory tract infections. The pandemic of coronavirus 2 (SARS-CoV-2), has resulted in over 5 million deaths globally. The exposure to solid waste gases and fumes resulted in an increase in the number of COVID patients, in the severity of the disease and its mortality rates. As COVID-19 swept across the globe, countries started to restrict people's movement to stop the spread of the disease. With the lockdown measures came major reductions in air pollution from vehicles, air planes and factories. Photos of clear blue skies over Delhi in India - a city usually covered by smog and pollution - circulated media outlets around the globe.

EFFECTS OF AIR POLLUTION: NOT LOCALISED

EPA (United States environmental protection agency) determined, in 2009, that emissions of carbon dioxide and other long-lived greenhouse