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Effects of global warming & climate change- Opinions, thoughts and remedial strategies

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Abstract- Squandering of precious natural resources, burning of fossil fuels & release of CO_2 in the atmosphere acting as glass panel not allowing the heat reradiation in the outer space, suicidal pollution of rivers, lakes & oceans, unplanned construction activities, and Dam construction have caused immense destruction to biosphere resulting into global warming & climate change. The impact of climate change on the loss of biodiversity (the latter is critical in bringing resilience impacting fertility) is so great that time is not far when world would face an ecological collapse & if the worst came to the worst, the extinction of life. It is true that fossil fuel (coal), power the world economy yet if the consumption of coal, oil, gas continues unabated the environmental problem won't stop. The increasing population needs, forced humans to indulge in deforestation, killing wild animals, exploit resources, growth of industries, excessive use of pesticides, insecticide, fertilizes, use of coal for energy all have destroyed environment immensely. That an increase of temperature of 1.5 Celsius over pre - industrial level would substantially threaten life as the world would see heat wave, heavy rainfall, extreme weather conditions, shortage of water, reduced farm output, bleaching of corals, rise of sea level & many more events. The author have incorporated thoughts and opinions of different authors at one platform, discussed the consequences and have suggested certain remedial measures.

Key words: Global warming & climate change, consequences, thoughts & opinions remedial measures.

INTRODUCTION

The earth's biosphere is a complex system in which events and crisis occur which is indicated by non-linear unpredictable changes. The increasing CO_2 levels leads to melting of ice caps and increase in sea levels. This in turn would disrupt life of people from Islands of Maldives, Marshall Islands, Nauru and Tuvalu and other coastal low lying areas, their histories, traditions and cultures will be lost forever.

Climate change impacts insects and pests. The decline of a parasitoid, wasps and flies playing an important role in biological pest control has been observed at various places like Nepal (decline of natural enemies of pests) United States (decline of nearly 40% grassland bird index during 1968 and 2014). In addition to these extreme weather events cause disruption to species distribution and yields. Cold and windy days in spring disrupts pollination, rising temperature can shift the range of fishes impacting fisheries. Briefly understanding all these changes, the present authors have concentrated on what are the present scenario of global warming, its consequences and possible remedial measures. The present article includes thoughts and opinions of different authors who wrote on global warming.

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MATERIALS & METHODS

Different research papers and informations have been consulted and incorporated.

Present scenario

Pollution at glance

Oxygen in the atmosphere is an absolute necessity to live comfortably but nature has been exploited for acquiring comforts thus air has become polluted. In Delhi itself "the number of four wheelers have exceeded one crore. These vehicles emit CO_2, CO, SO_2, nitrogen hydrocarbons, etc in the air of urban areas, is now polluted.[1]

Industrialization has played a great role in polluting the air, smoke coming out of chimneys contain lead, mercury, copper, cadmium, arsenic & asbestos etc. Beside these, it also emits CO_2, CO, SO_2, H_2S hydrogen fluoride. Petroleum refinery too releases SO_2 & nitrogen oxide.

In many places, burning of solid biomass in poorly ventilated spaces add to environmental pollution. Nearly 1.3 million premature deaths in India have been reported by WHO – 2018. It also leads to approximately 30% of ambient air pollution in India. "One of the major constituents of house hold air pollution is PM 2.5 which affects local & regional climate change".[2]

The present authors opine that in order to reduce such pollution it would be worth to provide liquefied petroleum gas cylinders to each & every house hold. Ujjwala Yojana of the Govt. of India is an effort towards this venture.

Climate change resulting from growing green house gas (GHG) emissions from human (anthropogenic) activities is the prime cause of global warming and if the CHG emission is not controlled, the temperature of the earth is bound to increase. The affect of temperature increase can have potentially harmful effect on our ecosystems, biodiversity health, behaviour & livelihood, also many other events can happen.

Green house gas CO_2 is released in the atmosphere due to burning of fossil fuels (coal, oil, natural gas) etc or via domestic cooking. Apart from emissions from transport, industrial activity, changes in land use, agriculture (including live stock) & waste management are also responsible. Other short lived climate pollutants include black carbon, methane and ground level ozone, which along with other pollutants, particulate matters from the same sectors combine to aggravate air quality & cause climate change.[3]

Rajendran (2019)[4] observed that India's emission of CO_2 are low at 1.8 tonnes per capita, compared to the world average of 4.2 tonnes possibly due to reduction in the consumption of petroleum products and the decline in Cement production.

CONSEQUENCES

Health Hazards:-

In areas covered by snow such as Arctic & Himalayan region, the deposition of Black carbon onto ice & snow darkens the surface, increasing the absorption of solar radiation.[5] Higher temperature raises the level of ozone and other pollutants in the air which causes cardiovascular diseases.

In all probability it raises the level of nitrogen oxide (NOX), ozone (O_3), black carbon (BC), particulate matters, dust & floating pollen. These are pollutants to which people are exposed.

Dr. Nayar, HOD Respiratory Medicare Allergy and Sleep disorders at BLK Super - specialty Hospital opines that particles less than 2.5 can directly enter our respiratory system and can lead to breathlessness, cough, fever and even choking. Our nervous system gets affected & can experience headache, nausea or vomiting. It also affects heart.

Ozone

Ozone is a ubiquitous urban pollutant (Dobson unit is used for measuring the density of ozone; one Dobson unit = a layer 0.01 mm thin layer at 0-1 ATM (Atmospheric Pressure). It has been found that CO_2 is the main culprit of thinning of ozone layer. In human, inhalation of ozone in amounts low as 0.1 to 0.2 ppm is sufficient to cause toxicity characterized by edema, airways hyper – responsiveness, alveolar epithelium damage & impaired host defense.[6]

Acute inhalation of ozone is associated with an inflammatory response characterized by the accumulation of macrophages at the site of injury. Thus cells along with resident alveolar epithelial cells get activated & release cytotoxic & pro – inflammatory mediators.

Ozone & Agriculture

Surface ozone is generated by chemical reactions between primary pollutants such as oxides of nitrogen and volatile organic compounds in the presence of sunlight.

O_3 toxicity in plants has been studied by Elstner *et al*. (1991)[7]; Batini *et al*. (1995)[8]; Pitcher *et al.* (1996)[9]; Polle *et al*. (1995)[10]; Melhorn *et al.* (1994)[11]; Menser (1964)[12]; Castillo *et al.* (1987)[13]; Chameides (1989)[14]; Heritt *et al*. (1990)[15]; Kangasjarvi *et al.* (1994)[16]; Anttonen *et al.* (1996)[17]; Schraudner *et al.* (1996)[18]; Sandermann (1996)[19].

Like any other gas, O_3 enters the plant leaves through stomata as part of normal atmospheric gas exchange, goes in apoplast, it reacts quickly with biomolecules, water located there. Some of it, may be converted into secondary ROS (Reactive Oxygen Species) such as superoxide anion radicals ($\ddot{o}_2$), hydroxy radicals ($\dot{o}H$), H_2O_2 and singlet oxygen – Hoigne *et al*. (1975)[20]; Koppenol (1982)[21]; Grimes *et al*. (1983)[22]; Byvoel *et al*. (1975)[23]; Kanofsky *et al*. (1995)[24]; Extremely higher dose of O_3 permeate to the underlying plasma membrane. O_3 reacts with apoplastic bimolecules & generate toxic species (lipid peroxidation products) that initiates damage to plasma membrane lipids & proteins resulting into decreased photosynthesis, electrolyte leakage and accelerated senescence.

Heat wave / heat stress - labour hours lost

In India 40 million heat wave exposure cases have been reported compared to 2012 there by the country lost nearly 75,000 million hours of labour in 2017 (equivalent to a year's work for 7% of working population) compared to about 43,000 million hours in 2000, an increase of more than 30 million labour hours lost in less than two decades.

Forest Fires

Dry and deciduous forests in the borderlands of Chattishgarh, Maharashtra & Telangana are affected by fires every year. Parts of western Himalayas such as Uttarakhand & Himachal Pradesh experienced severe forest fires. "Forest fires season" is time after winters when there are natural changes of forests catching fire due to rise in temperature.

Forest fires were also witnessed in Uttarakhand (Pauri, Garhwal, Rudra prayag, Nainital, Chamoli, Udham Singh Nagar, Bageshwar, Champawat & Pittoragarh. All this was reported by Roy (2018)[1]. According to the state forest department there have been 989 fire incidents between Oct. 1, 2020 & April 4, 2021 in Uttarakhand, destroying around 1,297.43 hectares of rich biodiverse forests. Since 2000 forest fires have affected over 48,000 hectares in the said state- report state forest. The causative factors are anthropogenic, carelessness & due to rise in temperature less of 'rain in winter etc.

REMEDIAL MEASURE

In order to combat increase in temperature strong international co-operation is needed to stop / minimize the causative factors to a level which does not destroy the environment. Following are advisable

1. Shift to low or zero emission
2. Electrifying transport
3. Development of green infra - structure
4. Increasing the energy efficiency.

Chandra Bhusan Deputy Director General of Centre for Science and Environment (CES) opines that "through it will be very difficult in the current global economic system to limit warming to 1.5°C, it is not impossible. This will require acting on all fronts to rapidly reduce emission by 2030 without an active participation of the United States, this will be impossible".

The present authors suggest that "plants with more CO2 absorbance capacity can be developed by 'gene editing technology' (CRISPR technology - i.e. clustered regularly interspersed short palindromic repeats".

The idea may appears to be fantastic yet an effort in the direction needs consideration.

There are trees available which imbibe air pollution which can be planted as for needs. Plants have to be selected on the basis of the types of pollutants, their intercity, location and easy availability & suitability of the climate conditions. Hydrogen is considered a source of clean energy. As a fuel it can run electric motos, or burned in internal combustion engine & has a number of industrial uses. It can be compressed or converted to liquid, easily stored.

Normally, hydrogen is produced through stream methane reforming and coal gasification. This raised the fuel's carbon foot print, despite it burns cleanly. The traditional catalysts through produce hydrogen from water yet it relies on expensive platinum group elements raising the cost and therefore large scale splitting becomes rather impractical.

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