

General Introduction about the Garden & Role of Plants in Mitigating Air Pollution and Global Warming



Introduction about the Botanic Garden

A Botanic Garden is an open museum of living collection of myriad of plants, where trees, shrubs, herbs, climbers, lianas etc. are scientifically arranged, properly labelled based on an internationally accepted classification, and more closely allied groups/plants are specially grown together for better understanding of species. Unlike parks, in Botanic Gardens trees conserved in Arboretum, Gymnosperms and Pine trees are grown in Pinetum, Pandanus (screw pine) in Pandanetum, orchids in Orchidarium, bamboos in Bambusetum, palms in Palmetum, cactus in Cactarium etc.

Primarily, the earlier Botanic Gardens were set up with a role to introduce, grow and multiply important economic plants from around the globe and to carry out acclimatization study in different trial plots so as to release for cultivation in newer areas. Further emphasis was given to develop improved varieties of economically important plants of the region for commercial exploitation by conducting various horticultural researches such as hybridization, selection, cross pollination, trial etc. It also acts as a data base of plants and a living repository of native and exotic species. Comparative study of living and preserved herbarium specimen also being made through Botanic Garden for clear understanding of particular species and further taxonomic advancement.

At present there are about 2000 Botanic Gardens in the world and India having about 120 (including university, municipal and regional gardens) among that the Indian Botanic Garden (IBG), Howrah formerly known as 'Company Bagan', the Royal Botanic Garden, Kolkata, at present AJC Bose Indian Botanic Garden (AJCBIBG), Howrah, is one of the best landscaped gardens in the world. The original history of IBG is almost similar to the Kew Garden in England which is situated on the bank of the river Thames, a few miles away from London. The Kew garden is about 50 years younger to IBG, Howrah which owes its interests in the Botany of Royalty but the latter has been established with economic and scientific aims. The Kew garden started initially with a meagre area of 15 acres of land in 1841 and during the course of time it grew further under the hands of a well-known botanist Sir William Hooker, the first director of Royal Botanic Garden, Kew and now it possesses 288 acres. The Royal Botanic Garden, Kolkata, on the contrary, situated on the bank of river Hooghly a few kilometres away from Kolkata, established by Col. Robert Kyd in 1787, in a vast area of about 300 acres of land and it was regarded as the largest and one of the oldest botanic gardens in the world till the middle of 19th century and now occupies an area of 273 acres.



The Great Banyan Tree of AJCBIBG, Howrah



The Kyd's Monument at AJCBIBG, Howrah

Currently, the garden with an area of 273 acres and being a living repository of 1377 species of plants possesses 25 divisions and 24 interconnected lakes, and the lakes are connected to the Ganges through sluices for the regular inlet and outlet of water. The garden is a unique place of learning & rich array of curiosity and occupies matchless

attractions like the 'Great Banyan Tree', a living wonder in the plant kingdom; the Large Palm House containing rich collection of palms including *Lodoicea maldivica* (the Double Coconut palm); Branching palm (*Hyphane thebaica*) introduced from Egypt; The century Palm (*Corypha macropoda*) ; The Giant Water Lily (*Victoria amazonica*) brought from Amazon river; The queen of flowering trees (*Amherstia nobilis*) a native of Burma; The mountain rose or Venezuelan rose (*Brownea* sp.); The Baobab tree or Kalpavriksh (*Adansonia digitata*) native of Africa; The Rosogolla tree (*Chrysohyllum cainito*); The Cannon ball tree (*Couroupita guianensis*); The African Sausage tree (*Kigelia pinnata*) and the mad tree (*Pterigota alata* var. *irregularis*); The 'Candle Stick Tree' (*Permentiera cereifera*) etc., are a few to mention.

Right now, Acharya Jagadish Chandra Bose Indian Botanic Garden is taken as a centre of conservation of plant resources from their extinction. This garden serves as a living repository of plants of a country and also of selected exotic species, and a 'safe abode' for the rare and endemic plants. As a result, it houses the germ plasm collection of selected economic, ornamental and medicinal plants and their wild progenitors. The garden also acts to promote educational programmes in order to generate awareness about the value of trees and other curious, beautiful, interesting plants with delightful landscaping and display. This garden also organises flower, foliage and plant shows etc.; exchange of viable seeds, seedlings and other propagules as well. As a whole, this garden acts as a data bank of information and documentation on holdings in the botanic garden.

During the time of establishment of this Garden in 1787, Bengal was reeling through the aftermath of 'Great Bengal Famine' and subsequent failure of crops. So the garden played a greater role for introduction of many crops and economic plants like Tea, Coffee, Mahogany, Teak, Cardamom, Cinchona, Cinnamon, Cotton, Indigo, Nutmeg, Pepper, Clove, Sugarcane, Potato, Sago, Cocoa etc., and other species used as food, vegetable, fodder, oil, fruit, fibre, timber and ornamental plants were first introduced into this historic Garden. Multiplication of most of the introduced species carried out in the Garden itself and distributed to different parts of the country for commercial cultivation. Such a way this garden has helped for the economic development of the country.

Role of Plants in Mitigating Air Pollution and Global Warming

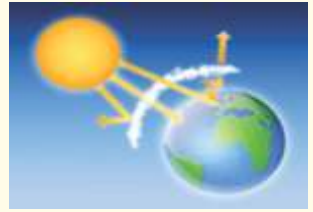
Global Warming :

Global warming is an overall increase in earth's temperature including the oceans. This occurs when the greenhouse gases trap heat and light from the sun in the earth's atmosphere which increases the temperature. A greenhouse gas is a component of the atmosphere that absorbs radiation emanating from the earth's surface i.e. they collect heat and light from the sun. Many of the gases emitted into the atmosphere by modern industrial processes are greenhouse gases. These include carbon dioxide, Chlorofluorocarbons, methane, and nitrous oxide. Global warming is also referred to as the greenhouse effect.

The greenhouse effect causes heat to build up instead of escaping into space. With too many greenhouse gasses in the air, the earth's atmosphere will trap too much heat and the earth will get too hot. This is like when heat is trapped in a car. On a very hot day, the car gets hotter when it is out in the parking lot. This is because the heat and light from the sun can get into a car by going through the windows but it



can't get back out. This is what the greenhouse effect does to the earth. The heat and light can get through the atmosphere but it can't get out, as a result the temperature rises. Just as the car would be over heated, so would the earth's atmosphere. Global warming has adverse effects on our environment. Plants however, help in mitigating the effects of global warming.



Many believe that human activities are a major cause of global warming, which may have catastrophic consequences for the climate and the environment. Some of the causes of global warming include :

- *Carbon dioxide emissions from burning fossil fuel in power plants* : Our ever increasing addiction to electricity from coal burning power plants releases enormous amounts of carbon dioxide into the atmosphere. 40% of U.S. Carbon dioxide emissions come from electricity production, and burning coal accounts for 93% of emissions from the electric utility industry. Every day, more electric gadgets flood the market, and without widespread alternative energy sources, we are highly dependent on burning coal for our personal and commercial electrical supply. Man has released tons of pollutants into the atmosphere accelerating the greenhouse effect.



- *Carbon dioxide emissions from burning gasoline for transportation* : Our modern car culture is responsible for about 33% of emissions of carbon dioxide. With our population growing at an alarming rate, the demand for more cars means that we are increasing the use of fossil fuels for transportation and manufacturing. Our use of vehicles is outpacing our discoveries of ways to mitigate the effects, with no end in sight to our massive car culture.



- *Methane emissions from animals* : Methane is another extremely potent greenhouse gas, ranking right behind Carbon dioxide. When organic matter is broken down by bacteria under oxygen-starved conditions (anaerobic decomposition), methane is produced. The process also takes place in the intestines of herbivorous animals, and with the increase in the amount of concentrated livestock production, the levels of methane released into the atmosphere is increasing.



- *Deforestation, especially tropical forests for wood, pulp, and farmland* : The use of forests for fuel (both wood and for charcoal) is one cause of deforestation, but in the first world, our appetite for wood and paper products, our consumption of livestock grazed on former forest land, and the use of tropical forest lands for commodities like palm oil plantations contributes to the mass deforestation of our world. Forests remove and store carbon dioxide from the atmosphere, and this deforestation releases large amounts of carbon, as well as reducing the amount of carbon capture on the planet. Deforestation has many negative sides to it. Loss of trees results in a reduction in the earth's capacity to absorb carbon dioxide, and this is said to be a cause of global warming. Certain species of plants, the potential source of lifesaving medicines, will disappear. Nevertheless, forest destruction continues unabated. In fact, the rate of destruction has increased in recent years.



- In the last half of the 20th century, the use of chemical fertilizers (as opposed to the historical use of animal manure) has increased. These fertilizers are a source of nitrous oxide released to the atmosphere.

Effects of Global Warming :

Global warming has adverse effects on our planet earth and also on us as individuals. The major effect of global warming is the depletion of the stratospheric ozone layer which is supposed to prevent the direct penetration of dangerous sun rays. This ozone layer depletion has adverse effects on man and the environment. These include :

- Scientists predict an increase in sea levels worldwide due to the melting of two massive ice sheets in Antarctica and Greenland, especially on the East coast of the U.S. However, many nations around the world will experience the effects of rising sea levels, which could displace millions of people. Even in our country Nigeria, the rising sea level in areas like Lekki, Lagos State continues to be a threat.



- Deforestation and bush burning exposes the soil to direct sunlight which leads to loss of soil nutrients and one of the effects of this is crop failures. Shortages in future are likely to threaten food production, reduce sanitation, and hinder economic development and damage ecosystems.

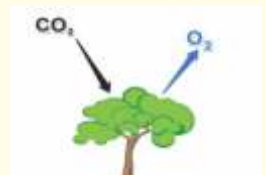


- As warming occurs, more evaporation occurs, causing more regional droughts. Flooding is another effect of global warming. Rising temperatures may also foster the spread of disease by enabling mosquitoes, ticks, and other disease-carrying organisms, including fungi, to spread farther afield. "The dangers posed by climate change are nearly as dire as those posed by nuclear weapons," says the Bulletin of the Atomic Scientists. "The effects may be less dramatic in the short term but the next three to four decades climate change could cause irreparable harm to the habitats which human societies depend for survival." Adding an even more ominous note, some scientists believe that changes attributed to global warming are occurring faster than they had expected. Clearly, the threat of global warming must be taken seriously which human societies depend for survival."



The Role Plants Play in Mitigating the Effect of Global Warming :

Plants play a major role in mitigating the effect of global warming. One of the major causes of global warming is carbon dioxide (CO₂). Plants help in reducing the quantity of global warming found in the atmosphere. Through the pores called stomata in their leaves, plants take in carbon dioxide from the atmosphere that they use for photosynthesis. They then give off water through the stomata in a process called Evapotranspiration which cools the plant just as perspiration cools human beings. Evapotranspiration also cools the surrounding air – a tree can transpire up to ten gallons of water on a hot day. But when carbon dioxide levels increase, plants' stomata shrink, releasing less water into the air and reducing the cooling effect.



Plants also help in replenishing the oxygen in the atmosphere which is what we humans breathe in. Plants also prevent direct sun penetration to the soil thereby preventing the excessive loss of soil nutrients which leads to massive crop failures. Plants also serve as wind breakers against flood and storms. Plants can be referred to as the earth's natural air

conditioner as trees provide shade and also help in cooling the environment. The standing rain forests provide services to the world. These services include absorbing and storing carbon dioxide, preventing soil loss and flooding, recycling nutrients, regulating rainfall, and providing a home for endangered animals and a shelter for wild crop plants. Forests also provide fascinating scenery and a place for recreation. All such environmental services, say the researchers, have economic value. An example of a plant that plays a major role in mitigating the effects of global warming is the bamboo. This plant is perhaps the fastest growing plant on earth and has an important role to play in restoring balance to the planet's climate system and greatly reducing the adverse effect of global warming.

Currently, the 30 billion tons of carbon dioxide produced by humankind are wreaking havoc on the global environment. Bamboo offers one of the fastest methods of reducing the effect global warming has on the environment. Bamboo homes are a carbon capture and storage system. Building green homes with bamboo will sequester carbon dioxide for a hundred years. Each acre of bamboo plants takes carbon dioxide from the atmosphere and turns it into sugars, through the process of photosynthesis, then transforms these sugars into the compounds that make up bamboo fibre. The carbon dioxide from the atmosphere is thus locked up inside the bamboo fibre itself. Every green home built by bamboo has over 15 tons of carbon dioxide locked up or sequestered within its fibres. Each and every green home we build contributed to our mission to reverse the effects of global warming. (*Union of concerned scientists, National Headquarters, 2 Brattle square Cambridge, 2012*)

Remedies to Global Warming :

There are many things that we as individuals can do to help mitigate the effects of global warming. In our homes, things as little as replacing incandescent bulbs with more efficient compact fluorescents can help reduce heat energy produced in our home. If every home in Nigeria was to change such energy producing bulbs in their homes, at the end of every year, we would be doing our share to cut back on heat pollution and we'll save money on electric bills and light bulbs. Making sure our vehicles are in good shape would also help prevent carbon dioxide emissions.



Having a good waste management system is also appropriate as burning of garbage increases the emissions of greenhouse gases in the atmosphere. Buying good wood is also appropriate. When buying wood, check for the source of timber. Supporting forests that are managed in a sustainable fashion makes sense for biodiversity and also for the climate. Forests that are well managed are more likely to store carbon effectively because more trees are left standing and carbon storing soils are less disturbed. Plant a tree. Planting trees in our homes is also a very effective way to reduce the greenhouse effect. In addition to storing carbon, trees planted in urban areas and residences can provide much needed shade during the dry season.

Global warming continues to pose a threat to our planet and to the inhabitants. Through our daily activities we all contribute one way or the other to the causes of global warming. We can and we should all try our possible best to reduce the effects global warming has on our environment. Plants also play their part. We should all make efforts in preserving our planet earth and prevent the adverse effects of global warming in years to come.

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