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IMPACTS OF CLIMATE CHANGE ON PLANTS

DR. PRAKASH B. HOLER
Assistant Professor & Head
Department of Geography
Shri Kumareswhar Arts & Commerce College
HANGAL – 581 104 Di: Haveri (Karnataka)
Email- prakashholer@gmail.com
Cell no. 9448923395

Introduction

Today, changes in the climate are undoubtedly leaving a strong impact on human life and it is usually associated with large scale phenomenon. Due to climate change global food security threat is create and it is one of the most important challenges in the 21st century. Continuous increase in population in the stressed environment is raising a strong question how to supply sufficient food? Assessment of WHO stated that 60% of the world population depends on traditional medicines which are basically obtained from plants. Anthropogenic activities plays important role and contributing towards climate change around the world. Due to sessile nature, plants cannot move from adverse conditions like all of us. That's why plants have to go for other alternative mechanism. Metabolic changes more specifically we can say variation in secondary metabolites content is considered to be one of the plant's defense mechanism toward unfavorable conditions. Secondary metabolites are compounds are not essential for plant normal activities, but these compounds such as alkaloids, terpenes and cyangenic glycosides collectively makes plant immune system.

Climate change can change the quality of natural product and its affect the taste and medicinal value of some Arctic plants. Although it was reported that such changes could either be positive or negative. Production of secondary metabolites is increased in stressed conditions; however production of secondary metabolites is influenced by many factors such as competition between the plants, light, soil and humidity etc..

Medicinal and aromatic plants are less immune to the climate change as compare to the other living organisms. Climate changes are causing significant impact on lifecycles and distributions of plants, therefore many medicinal plants becomes endemic to particular geographic regions, for example rain, temperature, and snowfall. The results obtained after the analysis were very much surprising, above 60% of plants changes their distributions and shifted towards warmer region, all plants within a region regardless of species moved in the same direction. Climate change could lead to the globally widespread loss of plants occurred around the world. Rachel Warren, of the Tyndall Centre at University of East Anglia, United Kingdom said "average plant will experience significant range loss under climate change. Some common plants such as chocolate, coffee, sugar maple, teak, pineapple and cotton all show large contractions in their climatic ranges under the baseline climate change scenario. The climactic range is defined as a habitat where species exist and faces lots of challenges to survive with competitors.

The research concluded that reduction in emission of greenhouse gases is urgently needed and this could be minimized widespread losses that cause climate change. Climate scientists estimated that emission of carbon dioxide should prevent from crossing the 400

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parts per million thresholds.

Climatic Factors:

Plants are dependent on certain factor such as temperature, light, carbon dioxide (CO_2), rainfall and moisture to produce the crop products which are essential for human nutrition as well as health. The amount of these factors varies between locations. Crop management is therefore a huge challenge because it is always highly dependent on climate and environmental factors. A successful rate of crop production affected the net exporters, net importers and consumers, as well as for national and global food security. Plant growth and its development are strongly dependent upon the temperature, each species has an optimum or specific temperature range to survive and flourish in particular environment. Crop production also provides the food, fodder and fiber for cloths. Continuous increases in population create plenty of burdens on earth and this is the one of the major factor affecting climate. Climate change has pronounced effect on biogeography, temperature, rainfall, soil and herbivore..

Table 1: List of some climatic factors

S.No.	Climatic factors	Effect of climate change
1	Rainfall	Due to climate change increase in rainfall and snowfall is reported all over the world.
2	Drought	Extreme Droughts is related to climate change. Due to more release of green house gases into the air, air temperature is increased. Rise in temperatures enhances the rate of evaporation. Dry soil is less capable to absorb water from soil.
3	Air Pollution	The CO_2 emissions is the main source of atmospheric pollution, beside this some other air pollutant, also responsible for climate change. These pollutants are known as short-lived climate-forcing pollutants (SLCPs) such as black carbon, methane, sulfate aerosols and ground-level ozone. Black carbon and methane are significant contributors after CO_2.

Table 2: List of major factor affecting Climate

S.No.	Factors	Description
1	Elevation or Altitude effect climate	At high altitude climatic conditions become colder.
2	Prevailing global wind patterns	There are different wind patterns in Northern and Southern hemisphere although wind pattern associated with seasonal variations.
3	Topography	The topography of the particular area can strongly affect the climate. Mountains ranges are known as natural barriers of air movement.
4	Effects of Geography	Geography of a zone (town and city) i.e. distances from mountains and substantial areas of water plays important role in determination of climate. Location of area determines its wind pattern.

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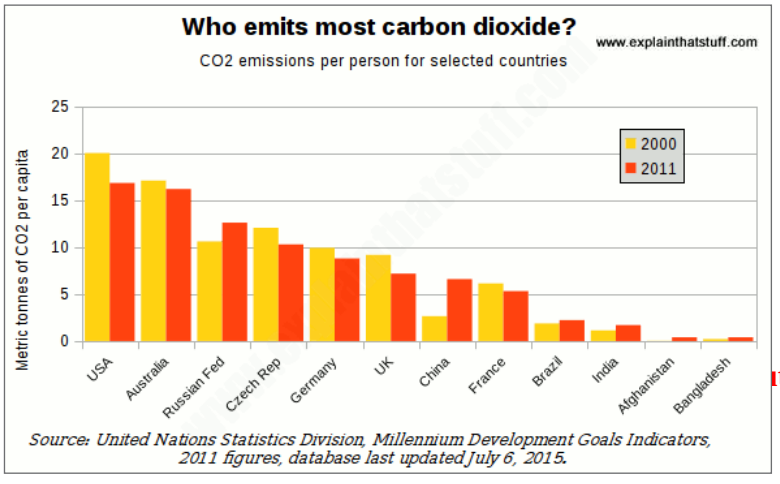
5	Surface of the Earth	The quantity of sunlight absorbed or reflected through surface, determines the amount of atmospheric heating occurs. Highly vegetated areas are better good absorbers in comparison to snow and ice-covered area. Snow areas are generally are good reflectors.
6	Climate change over time	Cold and warm conditions are main variant on earth, sometimes changes in these conditions (cold or warm) are very short but sometimes it may takes hundred to thousand years.

Effect Of Climate Change To Field Crops:

Increase in root to shoot ratios was observed under elevated CO_2 condition; in this condition plant synthesize larger number of chloroplasts, mesophyll cell, longer stems and extended diameter, length and number of large roots, more lateral root production with changes in branching patterns. Some annual C_3 field crops such as soybean, peanut, and rice cultivars etc. showed positive responses in high concentration of [CO_2] growth and development of rice cultivar is increased and higher grain yield with improve quality was also obtained. On contrary in maize, a C_4 plant reduction in yield observed under elevated [CO_2] condition. Whereas a cotton crop showed increase in harvested yield (48 %) and biomass yield (37 %) in under elevated (550 ppm) [CO_2] level. The different plant species responses towards elevated CO_2 level might be due to variation in soil, water, temperature and nutrient availability.

Effect Of Climate Change To Forest Trees:

Interaction of forest ecosystems with climate is a complex issue due to variation in different processes. An elevated ambient CO_2 concentration could reduce the stomata opening that subsequently reduce the rate of transpiration of the trees. These could increase the efficiency of water use by forest plants and increase productivity to some extent. Trees have capacity to acclimatize according to warmer climate, however different species responded differently. Usually forest trees are governed by the C_3 photosynthetic path way, so their productivity and need for nutrient is extremely affected through atmospheric CO_2 and temperature. Trees growing under high CO_2 level showed large productivity (if combination of absorption and increased nutrient use efficiency is achieved) as compare to crops. In temperate bog and forest ecosystems, enhancement in temperature caused photo- inhibition stress and drought.



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Global Food Security Threat:

Due to climate change reduction in food security is among the major challenges, farmers have to deal with changes in frequency and intensity of weather and it keeps farming always on high risk. Climate change influence food utilization through two ways one is through disturbance in supply chain, and other its affect the health that mediates nutritional outcomes. Elevation in temperature is also reducing food safety due to increased in microbial growth.

Significant increase in population growth and shifting of majority of people towards a more 'westernized' diet in developing countries enhances the demand for food approximately 50% from 2010 to 2050. Temperature variation (either extreme high or low) is highly dangerous to many important crops, beside Surface ozone, is phototoxic and damaging to various crop yields. Degradation of land is major threat to the environment and soil plays a major role in determining the crop productivity, its disturbance causes major food security threat. Soil erosion is the principle cause of land degradation and water as well as wind both is involved in soil erosion.

Climate Change - Threat On Health Sectors Due To Affect On Plants:

The assessment of climate change can be possible by experiencing changes in precipitation, warming temperatures, increases in the frequency or intensity of some severe weather events and in large scale rise in sea levels. These changes influence our health by the affecting constituent of our environment such as food, water, air and weather. The direct damage costs to health are approximately between US$ 2-4 billion/year by 2030. Strong infrastructure for health sector is mandatory requirement in developing countries. Emissions of greenhouse gases can be control through improve transport etc. and it will be reduced air pollution .

Report of the Intergovernmental Panel on Climate Change (IPCC) mentioned that a warming of 0.85 º C temperatures from the period 1880 to 2012 was reported over combined land and ocean surface as well. Global climate change is responsible for infectious and parasitic diseases and it is affecting badly or majorly our healthcare. Climate change specially temperature shifted the life cycle of pathogens and vectors, concentration of pathogens is also increases in water because of changes in precipitation in urban settings. These changes affected the natural flora of our ecosystem, and depletion in plant population creates a major threat to our health sector.

UVB (Ultraviolet) radiation altered the physiological and developmental processes of plants. Although plants have mechanisms to cope up with environmental stresses but only with certain extent, further increase in radiation can directly affect the plant growth. Indirect changes caused by UVB affect the distribution of nutrients, secondary metabolism and timing of developmental phases and may be equally or sometimes more important than damaging effects of UVB.

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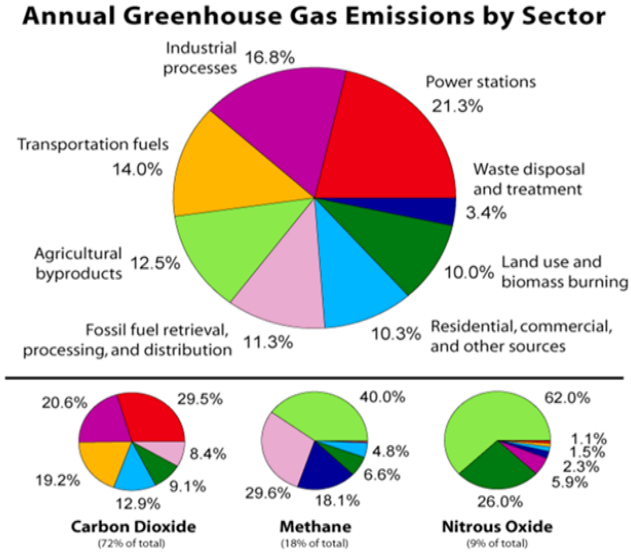
Government Policies For Plants Against Harmful Effect Of Climate:



Source- http://www.global warming art.com/wiki

Policymakers of all over world especially of developing country should learn from previous success and failures for making future strategies or plans and focused on successful implementation of these methods. The National Action Plan on Climate Change (NAPCC) of India is focus on eight major targets these are as follows:

i. **National Solar Mission:** The NAPCC target to promote the use of solar energy for power generation. It aims to development of solar research center, increased focus on technology development, promotes more international collaboration and enhancement of government funding in this area.

ii. **National Mission for Enhanced Energy Efficiency:** The NAPCC strongly recommends reduction in energy consumption in large energy-consuming industries. It also promote these industries for energy-saving certificates, increasing public–private partnerships to cut off energy consumption via demand-side management methods in various sector like the municipal, agricultural sectors and reduction in taxes on energy-efficient appliances.

iii. **National Mission on Sustainable Habitat:** The NAPCC also aims and promote waste management, recycling and enhance the purchase of efficient vehicles for public transportation.

iv. **National Water Mission:** The NAPCC plans for a 20% improvement in water use efficiency by pricing and other measures. This strategy is deal with the water scarcity arises due to climate change.

v. **National Mission for Sustaining the Himalayan Ecosystem:** This target prevents melting of the Himalayan glaciers and helps to protect biodiversity in the Himalayan region.

vi. **Green India Mission:** The NAPCC set a goal for afforestation of 6 million hectares of forest lands and by this mode it will expand the forest cover from 23 to 33% in India.

vii. **National Mission for Sustainable Agriculture:** The NAPCC target to help agriculture

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sector in climate adaptation through the development of climate-resilient crops, increasing the number of weather broadcasting mechanisms and also by many agricultural practices.

viii. **National Mission on Strategic Knowledge for Climate Change:** The aim of this mission is to improve the knowledge of climate science, its effect and consequences. This plan also gives emphasis on generation of a new Climate Science Research Fund, improved in climate modeling and enhancement in international collaboration.

Suggestions And Recommendations:

In the present time awareness of climate change is high, there are two main approaches to cope up with climate change these are- Mitigation and adaptation.

- Mitigation is reducing emissions of and stabilizing the levels of greenhouse gases in the atmosphere.
- Adaptation is adaptation to the climate change already in the pipeline.
- The use of renewable energy is increase, our energy system have to be less dependent on coal and other fossil fuels.
- Vehicle fuel efficiency should be increase and time to time chekup for vehicle should be mandatory.
- Place limits on the amount of carbon that polluters are allowed to emit.
- Build a clean energy economy by investment in the area of efficient and clean energy technologies and industries should be increase.
- Deforestation must be reduced or restricted.

To control the threat of global warming, we must gain support from our elected leaders to make a strong policy and strict Law to achieve complete solution for climate change.

Conclusion:

Global warming is the major issue among all climate change challenges, it is well known fact that to completely address global warming, we have to reduce the quantity of heat-trapping harmful emissions from the atmosphere. Fortunately awareness and technology in terms of practical solutions is now available. Individual to Individuals, action is required to reduce the carbon emissions. There are some points which must be considered.

