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Editorial

Impact of Global Climate Change and Mitigation Strategies

Subhash Chand*

Division of Soil Science, SKUAST-K, Shalimar, 190025, UT of J & K

***Corresponding Author:** Subhash Chand, Division of Soil Science, SKUAST-K, Shalimar, 190025, UT of J & K.

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Global climate change is means an overall increase in temperature of universe. The eleven of the last twelve years (1995-2006) rank is warmest years in the instrumental records of global surface temperature (since 1850). The 100 year linear warming trend (1906-2006) of 0.7 °C is larger than the corresponding trend of 0.6 °C (1901 -2000). The linear warming trend over last 50 years from 1906 to 2005 (0.13 °C per decades) Observational evidence from all continents and most ocean shows that many natural systems are being affected by regional changes, particularly temperature increases. Climate change means variations in the climate in term of temperature, relative humidity, sunshine hours, wind velocity and other climatic parameters resulting changes in soil biodiversity, ground water level, soil degradation, erratic and uneven rainfall, frequent droughts and floods. Some common examples of climate change are [2]:

- States like Bihar, Assam, and part of Karnataka are experiencing dry spell, whereas Southern Gujarat, Maharashtara, part of Bihar, Andhra Pradesh, Ladakh and Western Karnataka were hit by the floods.
- In 2007 alone, 17 million people had born the burnt of floods.
- During the year 2006, the Kashmir Valley is witness of most severe summer in three decades.
- Snowfall pattern of the Kashmir Valley Changes, During January and February no snowfall or less snowfall where as early snowfall in November and Late in March (2008-09).
- Charapuji known for highest rainfall had less in 2005. Mosinram experiences highest rainfall.
- Mumbai, for consequent 3-4 years, had heavy down pour, almost dipping the city.
- Unusual rainfall (60 cm. in 5 days, August19-23, 2006) in Barmer district of Rajasthan in 2006, was not recorded in the past 200 years.
- Evidences of loss of biodiversity (flora and fauna), genetic materials, soil microorganism at many places.

Causes of Climate Change

Global green house (GHGs) emission due to human activities have gone since pre industrial times,with an increase of 70 per cent between 1970 to 2004. Carbondioxide is most important anthropogenic GHGs. Its annual emissions have grown between 1970 and 2004 by about 80 per cent. The largest growth of GHG emission between 1970 to 1994 has come from industry, energy supply, transport, forestry including deforestation, agricultural growth have been decreasing. Global GHGs have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years.

Impact of Climate Change on Agriculture and Systems

Climatic change is affecting all countries of the world Asian, South East Asia or South Asia, European and African in big way. The poor country would be affected be in bigger way however they are contributing less in climate change. Himalayan ecosystem in which Kashmir Valley is situated is not a distant example from the impact of climate change. There is a direct link between the rise of global temperature (1 or 2 °C) and damage to ecosystems. About 130 millian hectare land is under going different levels of degradation, namely water erosion (32.8 mha.), wind erosion (10.8 mha), salinisation (7.0 mha.), desertification (68.1 m.ha.), water logging (8.5 m.ha) and nutrient depletion (3.2 mha.) [2]. It has serious impact on the decreasing food productivity due to attack of insect and pest on crop, heavy rainfall, early or late maturity of crop. Small and marginal farmers with small land holding will be more vulnerability to climate change.

Figure 1: a) View of Kashmir Hillock with Snow Cover (b) Rise in temperature induces early maturity in several crops.

The resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change and associated disturbances (flooding, drought, wildfire, insects, and ocean acidification) and other global change drivers (e.g. land use change, pollution, fragmentation of natural systems, overexploitation of natural resources). Over the course of this century, net carbon uptake by terrestrial ecosystems is likely to peak before mid century and than weaken or reverse. Approximately 20-30 percent of plant and animal species assessed so far are likely to be at increased risk of extinction if increase in global average temperature exceeds 1.5 °C to 2.5 °C. At lower altitude, especially in seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increases (1-2 °C), which would increase the risk of hunger. The increase in atmospheric carbon concentration leads to further acidification of atmosphere and earth. Anthropogenic warming could lead to some extended impact depending upon magnitude of climate change. Uneven and erratic snowfall since last five years had disturbed Himalayan ecosystem.

Climate Change and Water

It is supposed to suppress water resources. On regional scales, mountain snow, glaciers, and small ice caps play a crucial role in freshwater availability. Widespread mass losses from glaciers and reduction in snow cover over recent decades are projecting to accelerate throughout the 21 centaury, reducing water availability and hydropower potential, and changing seasonality of flows in regions supplied by melt water from major mountain range like Hindukush and Himalayas, where one-sixth of the world population currently lives. Changes in precipitation and temperature leads to changes in runoff and water availability. Runoff is projected to increase by 10-40 percent by mid century at a higher latitudes and in some wet tropical areas, including populous areas in East and South East Asia and, decrease by 10-30 percent over some dry tropics areas due to decrease in rainfall and higher rate of evapotranspiration. Drought affected area are projected to increase in extent, with the potential for adverse impacts on multiple sectors, e.g. agriculture, water supply, energy production and health. Large demand of water in urban areas for domestic purpose is on front and in rural areas for agriculture like irrigation of crops, rarering livestock.

Mitigation and Adaptation Strategies for Combating Global Climate Change

There should be two fold approaches to mitigate the climate stress –firstly by reducing greenhouse gas emission (GHGs), the main culprit of climate change and secondly, by adopting necessary farming practices like sustainable forestry systems, diversified cropping systems, carbon sequestration, recourse conserving technologies (RCTs) like zero tillage, minimum tillage or no till system, clean development mechanism (CDM), use biogas slurry, use or organic manure as a source of plant nutrients and introduction of resistant varieties to droughts, frost, insect pest and logging etc. Uses of improved farming practices helps in increasing the carbon pool of soils which have been lowered due to overexploitation and soil stress.

Land Uses Practices (LUPs)

Faulty land use practices like shifting cultivation, free-range grazing by cattle, growing crops along with the slope, cultivation of erosion permitting crops etc. may cause removal of top soil by erosion. Organic matter has low density than soil solids hence subjected to easily losses through wind and water erosion. It is clear that the OM loss under 3% slope is around 46 kg/ha in Kerala. Cultivation of soil and consequent aeration stimulate more microbiological activities and promote the oxidation of organic matter i.e. increase the rate of disappearance of soil organic carbon. Intensive cultivation stimulates decomposition of Soil Organic Matter (SOM). Organic carbon status usually remains low in cultivated soils. It is clear that in all the soil zones, the organic matter content is very high in virgin soil.

Integrated Soil Fertility Management (ISFM)

Over the last few years, the concept of integrated soil fertility management (ISFM) and integrated plant nutrient management (IPNM) has been gaining acceptance. It advocates the careful management of nutrient stocks and flows in a way that leads to profitable and sustained production. The ISFM emphasises management of nutrient flows, but does not ignore other important aspects of the soil complex, such as maintaining organic matter content, soil structure and soil biodiversity. Soil biodiversity reflects the mix and populations of diverse living organisms in the soil – the myriad of invisible microbes to the more familiar macro-fauna such as earthworms and termites. These organisms interact with one another and with plants and animals forming a web of biological activity. Environmental factors, including temperature, moisture, acidity and several chemical components of the soil affect soil biological activity. Clearly, for a productive sustainable agriculture, the complex interaction among these factors must be understood so that they can be managed as an integrated system.

Soil biota and soil ecosystem health soil health can be defined as the continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity and maintain their water quality as well as plant, animal, and human health [1]. The concept of soil health includes the ecological attributes of the soil, which have implications beyond its quality or capacity to produce a particular crop. These attributes are chiefly those associated with the soil biota; its diversity, its food web structure, its activity and the range of functions it performs. For example, soil biodiversity per se may not be a soil property that is critical for the production of a given crop, but it is a property that may be vital for the continued capacity of the soil to produce that crop.

Biological Management of Soil Fertility (BMSF)

It is central paradigm for the biological management of soil fertility is to utilise farmer's management practices to influence soil biological populations and processes in such a way as to achieve desirable effects on soil productivity [1]. Biological populations and processes influence soil fertility and structure in a variety of ways, each of which can have an ameliorating effect on the main soil-based constraints to productivity: symbionts such as rhizobia and mycorrhiza increase the efficiency of nutrient acquisition by plants; a wide range of fungi, bacteria, and animals participate in the process of decomposition, mineralization, and nutrient immobilisation and therefore influence the efficiency of nutrient cycles; soil organisms mediate both the synthesis and decomposition of soil organic matter and therefore influence cation exchange capacity, the soil N,S, and P reserve, soil acidity and toxicity; and soil water holding capacity; the burrowing and particle transport activities of soil fauna, and the aggregation of soil particles by fungi and bacteria, influence soil structure and soil water regime.

Role of Biodiversity

The role of soil biota/biodiversity in sustaining the productivity of agricultural systems a fundamental shift is taking place worldwide in agricultural research and food production in climate change scenario [1]. In the past, the principal driving force was to increase the yield potential of food crops and to maximise productivity. Today, the drive for productivity is increasingly combined with a desire and even a demand for sustainability [1]. Sustainable agriculture involves the successful management of agricultural resources to satisfy human needs while maintaining or enhancing environmental quality and conserving natural for future generations. Improvement in agricultural sustainability will require the optimal use and management of soil physical properties. Both rely on soil biological process and soil biodiversity. This implies management practices that enhance soil biological activity and thereby build up long-term soil productivity and health. Such practices are of major importance in marginal lands to avoid degradation, in degraded lands in need of restoration and in regions where high external input agriculture is not feasible.

Resources Conserving Technologies (RCTs)

RCTs are very important for increasing the carbon pool in soils. Zero tillage system offer minimum soil disturbances during sowing of crops. Zero tillage, raise bed planting, cover crops, crop residue management and mulching proves unique opportunities for restoration of soil organic carbon in agricultural lands. Combating climate change in time, it is imperative to use renewable energy sources at domestic level. The uses of refrigerators shall be restricted to reduce the emission of gases. Carbon sequestration by composting, rising of green legumes and uses of manure is an important activity in agricultural production systems. Effort must be made at all levels of societies, institutions, NGOs and other youth forms. People must sensitise to use less combustive vehicles preference shall be given to CNG (Compressed natural gases) vehicles. The use of renewable energy sources like solar torch, solar batteries, solar water heating system must be recognised for energy saving and reducing GHG emission.

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