



## EFFECTS OF CLIMATE CHANGE ON AGRICULTURE AND BIODIVERSITY: A REVIEW

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### ABSTRACT

About one-third of the world's area is under cultivation. Climate change leads to variability in rainfall patterns, heat stress, spread of pests and diseases and shortening of the crop cycle and affecting plant growth and production. Biodiversity plays a direct role in climate regulation. It is evident that the loss in biodiversity is due the change in environment. Human activities like deforestation, pollution, overpopulation are ultimately responsible for habitat destruction that in turn caused the loss of biodiversity. Biodiversity conservation will lead in strengthening of ecosystem resilience and improve the ability of ecosystem to provide important services during increasing climate pressures.

**Keywords:** Agriculture, Biodiversity, Climate change.

### INTRODUCTION

The word climate refers to the long-term weather patterns within a defined region including temperature, humidity, wind and amount and types of precipitation. The term climate change refers to significant and long term changes to a region's occurs over time usually about 30 years, whether due to natural causes or as a result of human activities. It alters the entire ecosystems along with all of animals and plants including agricultural crops. When a climatic change occurs gradually, ecosystems and species are able to evolve together because during gradual changes species gets opportunity to adapt to new conditions. The climate change has a huge impact on biodiversity (Prakash and Srivastava, 2019).

Agriculture always has both positive and negative effects. In India, both sustainable and unsustainable agriculture are

practiced. The unsustainable agriculture exerts many negative effects (Roberts and Marsh 1987; Verma 2017a) such as land conversion, habitat loss, wasteful water consumption, soil erosion, genetic erosion, degradation as well as pollution. It disturbs the ecological balance (Verma 2018a). The agriculture has positive correlation with Sarus Crane (Verma 2018b) and helps to maintain the biodiversity. The biodiversity has values (Verma 2016a) and explored at three levels namely: ecosystem diversity, species diversity and genetic diversity. The genetic diversity acts as a buffer for biodiversity (Verma, 2017b). The biodiversity helps to maintain the ecological balance. There is a necessity of ecological balance for widespread biodiversity (Verma 2017c) and the biodiversity loss has ecological impact (Kumar Ajay *et al.*, 2017). The ecological balance is an indispensable need for human survival (Verma 2018c). Perfect agriculture is the current need for overall sustainable development (2019a).

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In order to understand the agriculture practices of a particular area, study of limnological and hydrobiological parameters are accomplished. A number of researchers including Verma (2016b, 2019b) and Prakash *et al.*, (2015) did a lot on this field.

Climate change results due to both; natural and anthropogenic drivers. Natural drivers involves earth's climate variability caused by changes in the solar radiations, volcanic eruption, plate tectonics, ocean circulations, earthquakes and so on (Kunzig, 2008). Anthropogenic drivers involves the contribution of human activities to increasing the emission of green house gases like carbon dioxide, methane and nitrous oxide into the atmosphere at an alarming rate in different sectors such as in energy supply (25.9%), industrial sector (19.4%), deforestation (17.4%), agricultural (13.5%), transportation (13.1%), urbanization (7.9%) and waste (2.8%) (Rathore and Jasral, 2013).

#### **Impact of Climate change on Agriculture**

Depending on the agricultural practice and location, there are several possible negative effects of modern agriculture. As the demand for food rises, there are more and more intensive single-crop farms, leading to a loss of biodiversity. When natural vegetation is removed and converted to agricultural land, erosion occurs and carries away fertile soil. Use of fertilizers and pesticides can lead to groundwater source pollution. Using genetically uniform varieties damages the genetic diversity of food, meaning less adaptation and survivability potential. Agriculture in this way not only affects food supplies and ecosystems but also the biodiversity.

Multiple effects from unsustainable agriculture and climate change are land conversion, soil erosion and degradation, wasteful water consumption, pollution, genetic erosion and so on. The main effects come from clearing natural habitats for agriculture and aquaculture especially for intensive monocultures. The increasing demand and need of food and other agricultural products due to rapid growth of human population has caused a large-scale clearing and conversion of natural habitats to agricultural sites.

Soil erosion commonly occurs after conversion of natural vegetation to agricultural land. It carries away

fertile soil, fertilizers, pesticides and other agrochemicals. This leads to reduced soil fertility and degraded land (WWF, 2006). Soil carried off in rain or irrigation water can lead to sedimentation of rivers, lakes and coastal areas. The sedimentation causes serious damage to freshwater and marine habitats as well as the local communities that depend upon these habitats.

At the same time, agriculture has been shown to produce significant effects on climate change, primarily through the production and release of greenhouse gases such as carbon dioxide, methane, and nitrous oxide. Agricultural practices are responsible for around 14% of global greenhouse gas emissions (IPCC, 2007). Due to climate change, pests (Pine wood nematode, pith canker, red palm weevil, virus, aphids, and fungi) have increased in number. The aphids are harmful insects (Singh *et al.*, 2019). Variation in temperature and precipitation patterns can result in more frequent droughts a indigenous plants more vulnerable to pests and diseases (Rathore and Jasral, 2013).

Climate change leads to variability in rainfall patterns, heat stress, spread of pests and diseases and shortening of the crop cycle and affecting plant growth and production. Biodiversity loss has impacted the fishing and hunting practices by indigenous people posing an implication on their only source of food. By the middle of the century, crop yields could decrease by 30% in Central and South Asia, while by 20% in East and Southeast Asia (Prakash and Srivastava, 2019).

The increasing concern over food and environmental quality at global level has led to the development of a completely new agricultural concept, commonly classified as 'sustainable agriculture' (Bergström *et al* 2005). Sustainable agriculture, which is a goal rather than a distinct set of practices, was defined by Benbrook (1991) as a system of food and fibre production: (i) improves the productivity of soil, water and other natural resources and cropping systems so that farmers can meet increasing levels of demand in agreement with population and economic growth; (ii) produces food that is safe, wholesome and nutritious, thereby promoting human health; (iii) ensures an

adequate net farm income to support an acceptable standard of living for farmers; (iv) complies with community standards and meets social expectations.

### Impact of Climate change on Biodiversity

The changes in climatic factors have a huge impact on the biodiversity of a region. Only a small change in pattern of climate has severe impact on the ecosystems and biodiversity, altering the habitats of the species and presenting a threat for their survival, making them vulnerable to extinction. The increasing amount of greenhouse gases like carbon dioxide is putting huge stress on the ecosystems in the form of increasing temperatures, rising sea levels, decreased snow cover etc.

Rising temperature also causes extreme climatic conditions and disturbances as droughts etc. Extreme climatic conditions lead to changes in patterns of rainfall. Rising temperatures has been a significant factor in pushing many species in vulnerable category and several have been listed as endangered, resulting in loss of biodiversity.

Rising sea level presents extreme threat to marine ecosystems which can lead to disturbance in habitat and patterns of survival of marine species leading to extinction of various species and many species have been categorized as vulnerable or are at point of being declared extinct. Wetlands and coastal ecosystems are at a huge risk due to increasing sea levels.

Factors such as deforestation, large scale development and construction like dams and other big developmental projects, clearing of forest land for agriculture and other non- agricultural uses have significantly impacted the biodiversity. The protection of biodiversity becomes crucial in present time. It is therefore important to understand the impacts of climate change on the biodiversity and mitigation strategies should be undertaken to reduce the damage caused by adverse effects of climatic change on biodiversity.

### CONCLUSION

It is evident that the loss in agricultural productivity and biodiversity are due to the changes in environment. All these changes in environment, adversely affecting the agriculture and biodiversity, are due to the climate

change, caused mainly by human activities. Moreover, the global climate changes have major implications on human health also.

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