

## **Influence of Climate Change on Plant Biodiversity and Agriculture: A Review from a Sub-Tropical Perspective**

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### **ABSTRACT**

Climate change is a very severe problem, in particular for plant biodiversity. Climate change refers to an important change in worldwide temperature, precipitation, and wind patterns that occurs due to human activities, especially in recent decades. Biodiversity is threatened by climatic patterns due to changes in the ecosystem. Biological diversity is home to many living things. Biodiversity is classified into three levels, such as genetic, species, and ecosystem diversity. The several usages of biodiversity comprise consumptive use (75%), productive use, social value, aesthetic value, ecosystem service value, scientific value, and evolutionary value. Several dangers influence biodiversity, and land use plays a major role. Afghanistan is retrieving population data, estimated to be 42.239 million people, and has yearly 2.6% growth. Subtropical countries such as Afghanistan are the most vulnerable to climate change because they are characterized by terrible droughts, repeated floods, water deficiencies, and an overall undesirable environmental sustainability balance. That it's important to study about the influence of climate change on plant biodiversity, an instance particularly of Afghanistan, and to declare the problems for future mitigation and to create better reservations and cures by best of suggestions techniques.

**Keywords:** Climate Change, Biodiversity, Agriculture, Sub-tropics, Ecosystem

### **INTRODUCTION**

Climate change refers to significant changes in global temperature, precipitation, wind patterns, and other measures of climate that occur over several decades or longer. Biodiversity states the variety of life on Earth at all levels, from genes to ecosystems, and may cover evolutionary, ecological, and cultural progressions (AMNH, 2023). Biodiversity is categorized into three levels, such as genetic, species, and ecosystem diversity (Verma, 2016). The American Museum of Natural History gives value to biodiversity for many reasons, including some utilitarian (biodiversity-based; basic needs such as food, fuel, shelter, and medicine) and some intrinsic. Additionally, ecosystems provide key services (pollination, seed spreading, climate regulation, water decontamination, nutrient cycling, and agricultural pest control) (AMNH, 2023). The several uses of biodiversity include consumptive use (75% of the world's population), productive use, social value, aesthetic value, ecosystem service value, scientific value, and evolutionary value (Verma, 2016). Numerous threats influence biodiversity. Currently, land use plays a major role (Schulte to Bühne et al., 2021). Climate change is a universal developing threat to biodiversity, ecosystems, and their services, which may continue at the level of individuals, populations, and species. Changes in performance vary by morphology, phenology, and range at the ecosystem level. through changes in primary production, species interactions, and emergent properties, are extreme events (Weiskopf et al., 2020). Agreeing with the Intergovernmental Panel on Climate Change, the period between the 19<sup>th</sup> and 21<sup>st</sup> centuries experienced the most warming as it increased by 1.1°C and will rise to 2.7°C at the end of this century (IFAW, 2022). Afghanistan is retrieving population data, estimated to be 42.239 million people; however, more than half a million immigrants return from Pakistan and Iran (UNHCR, 2023). Afghanistan is a subtropical country and is the most vulnerable country to climate change influences, as it is characterized by terrible droughts, repeated floods, water deficiencies, and an overall undesirable environmental sustainability balance. (Mehrad, 2020). According to the German Watch 2021 Climate Risk Index, Afghanistan came in sixth place as the most climate-vulnerable country in the world (Ecktein, Kunzel & Schafer 2021). For better understanding, we decided to write about the Influence of climate change on Biodiversity: A Review from

a Sub-Tropical Perspective, an instance particularly of Afghanistan, and to declare the problems for future mitigation and to create better reservations and cures by best of suggestions techniques.

## THE MOST VULNERABLE AND SUFFERING ECOSYSTEMS FROM CLIMATE

Table 1. shows the main vulnerable and suffering Region and countries of the world.

Behavioral aspects	Region	Country (ies)	Citation
Temperature, Water availability and Cover Cloud	Arctic tundra	Parts of Europe and Canada's boreal forest	(E360)
	Tropical rainforests	South America, and eastern Australia	
	Southern and Southeast Asia, Western and Central Europe		Monogabay, 2013
	Eastern South America, Southern Australia		
Temperature rise Drought, Flooding, Food and Water Scarcity, and displacement	tropical	Mozambique 1 <sup>st</sup> , Zimbabwe 2 <sup>nd</sup> , Bahamas 3 <sup>rd</sup> , and Malawi 5 <sup>th</sup> ,	Monogabay, 2013; Ecktein, Kunzel & Schafer 2021)
	Subtropical	Japan 4 <sup>th</sup> , and Afghanistan 6 <sup>th</sup>	UNEP, 2023; Ecktein, Kunzel & Schafer 2021

From them, In Afghanistan the adverse effects of severe droughts, leading to food and water scarcity, loss of income, and displacement of millions of people, which leading to conflicts over depleting natural resources. Agriculture provides almost 80% of populations' livelihoods, mostly affected by the drought (IFRC, 2021).

### CLIMATE CHANGE INFLUENCES ON AGRICULTURE AND YIELDS)

Climate change is likely to have an important effect on universal agricultural yields. NASA has expressed that globally, crop average yields of corn will decrease by 24% by the late 21st century if current climate change tendencies remain. Wheat, in contrast, might realize an increase in crop yields of approximately 17% (NASA's Scientific Visualization Studio, 2023). Climate change could lessen global crop yields by 3-12% and 11-25% respectively by the mid and end of the century under a strong warming scenario (EESM, 2021). These factors make it more difficult to grow maize in the tropics and subtropics and expand wheat's growing range. These projections are based on present trends and are subject to change. However, it is clear that climate change will have a significant impact on global agricultural production in the coming years and beyond (NASA's Scientific Visualization Studio, 2023; EESM, 2021). Seasonal temperature increases may adversely affect agricultural productivity. Only in Afghanistan, from 1901 to 2016, has the average temperature increased by 1.8 oC, and in the southern part of the country, the temperature has increased by 2.4. As the temperature increased by 1.4 oC, the patterns of evapotranspiration increased by 3.5%, making it clear that extra water is beneficial for agriculture. With the mentioned changes, the time of harvest likewise adversely changed, which caused the period of growth to shorten and caused changes in ecosystems. In the last two decades, in developing countries, the expansion of cropland due to drought irregularities has accounted for about 9%. Afghanistan's agricultural area was 5% irrigated and 7% rain-fed. Besides Karise's and canals, for more than 20 years, people have taken water from the wheels by water pumps, and every year the usage of that derives increases for agriculture and other purposes, and now it's augmented to thousands, and the inexpensive source of power (the solar system) is taking place of petroleum, for which agricultural lands and pastures are usurped and changed to cultivated areas, causing a decrease in water table level in many areas to more than 100 meters deep, and many areas do not have more water channels; therefore, thousands of households migrated to other areas with water, and the migration will continue. Generally, estimation of the number of given pressures, their impact on daily life, and damage to agricultural crops are the main effects of climate change and environmental variation in Afghanistan (FAO, UNICEF, WFP, & WHO, 2018). After the other service sectors, which accounted for 53% of Afghanistan's economy in 2020, agriculture accounted for the largest part of GDP, at 30.6% in 2020 (World Bank, 2021).

### CLIMATE CHANGE IMPACTS ON PLANTS

A growing number of plant-belonging studies in subtropical regions in the last decade have been organized (Sharma et al., 2022). According to new findings, between 1982 and 2020, global plant photosynthesis grew by 12%, and CO<sub>2</sub> levels in the atmosphere rose by 17%. The massive majority of this increase in photosynthesis was due to CO<sub>2</sub> fertilization. Increased photosynthesis results in additional growth for some plants. (State of the Planet, 2022). The rising temperature and changing weather patterns are causing

more repeated droughts, wildfires, and invasive pest outbreaks, leading to the loss of plant species. Climate change increases stressors that weaken plant resilience, disrupting forest structure and ecosystem services (National Park Service, 2023). Above the high concentrations of CO<sub>2</sub>, during the process of photosynthesis, plants use a smaller amount of water. With the rise of CO<sub>2</sub>, plants are keeping a high rate of photosynthesis, closing their stomata incompletely, and decreasing their water losses by 5 to 20%; however, this results in more growth in some plants, about 21%, and below ground increases by 28%; some plant yields, such as wheat, rice, and soybeans, increase by 12 to 14%. While some grasses and other plants, such as maize, sugar cane, sorghum, and millet, weren't influenced by CO<sub>2</sub> increases (State of the Planet, 2022). Many crops start to experience stress at temperature above 32° to 35°C, although this depends on crop type and water availability. Models show that each degree of added warmth can cause a 3–7% loss in the yields of some important crops, such as corn and soybeans. In addition, an increase in temperature speeds up the plant lifecycle so that as the plant matures more quickly, it has less time for photosynthesis and consequently produces fewer grains and smaller yields (State of the Planet, 2022).

## CONCLUSION

Climate change is a major driver of biodiversity erosion, and loss of biodiversity correspondingly accelerates climate change processes as the capacity of degraded ecosystems to assimilate and store CO<sub>2</sub> tends to decrease. Generally, climate change affects health of ecosystems, influencing modifications in the distribution of plants, viruses, animals, and even human settlements (UN, 2023). Measures include conserving and restoring natural spaces and the biodiversity they contain, which is essential for limiting emissions and adapting to climate impacts. Eliminating subsidies that support local and national activities harmful to biodiversity, such as deforestation, over-fertilization, and over-fishing, can also support climate change mitigation and adaptation by changing individual consumption patterns, reducing loss and waste, and shifting diets, especially in advanced countries, toward more plant-based choices (The Royal Society, 2023). Simi arid region as Afghanistan should change irrigation pattern to modern irrigation as drip and sprinkler for better water use efficiency and crevices.

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