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The Effect of Climate Change on Ecological Life Cycle of Pakistan

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Abstract

Ecosystem comprised by the combination of Humans, animals, plants, microorganisms and several abiotic factors. Humans completely depends on their ecosystem for food, fuel, fiber and regulatory functions like climate regulation and disease management. This ecosystem is becoming effected day by day due to increasing climate change. Climate change cause rise in temperature, elevation of caron dioxide, green house gas emissions, glaciers melting, rise in sea level. These factors cause loss of biodiversity which is important for maintenance of Agroecosystem and human environment interaction. In this article we are discussing about effects of climate change on Ecological Life Cycle of Pakistan. Pakistan is a developing country and more vulnerable to Global warming and climate changes. Pakistan blessed with rich agricultural land but this land going to become disturbed because of rising temperature, irregular pattren of rainfall, causing water shortage for crops. This leads to shortage of crop production and food deficiency in Pakistan. Disturbance of ecosystem cause migration and extinction of many plant and animal species. The most effective areas of Pakistan ecosystem includes Indus river belt and coastal areas of Karachi.There should be some starategies from institutes and policymakers to keep balance in all components of ecosystem to mitigate the effects of climate change.

Key Words: *Ecological Life Cycle, Climate Change, Pakistan*

Introduction

An ecosystem is a dynamic complex comprising communities of bacteria, fungi, plants, and animals that are linked to an abiotic environment. Humans are an essential component of ecosystems. Ecosystems differ in terms of their size and composition, and there is a relationship between biodiversity and the size and health of an ecosystem. Biodiversity is impacted by human activity on both terrestrial and marine habitats. Human populations rely on the ecosystem to provide them with goods like food, fuel, and fiber; regulatory functions like disease management and climate regulation; and nonmaterial advantages like spiritual or aesthetic satisfaction. The ultimate water sources for ecosystems are precipitation and glaciers, and any changes brought about by climate change will eventually have an impact on people. The degradation of habitats due to land use changes poses a danger to biodiversity alongside over-exploitation of resources, pollution, invasions by non-native species, biological effects of elevated atmospheric carbon dioxide levels, and climate change. Climate change generally has gradual, hard-to-measure effects on the ecology and ecosystem, most of which are irreversible. It is anticipated that as time goes on, the consequences of climate change will probably become more pronounced than those of other variables. Urbanization, deforestation, rapid industrialization, increased use of fossil fuels in transportation and industry, and population growth are examples of human effects. The rise in greenhouse gas (GHG) emissions, primarily of carbon dioxide (CO2), methane (CH4), and nitrous oxide (N_2O), is the true cause of climate change, sometimes referred to as global warming (IPCC, 2007).

Biodiversity

The variety of life on Earth is referred to as biodiversity. As to the United Nations Convention on Biological variety, biological variety encompasses a wide range of species, genes, habitats, and corresponding ecological processes. The average abundance of the original species at a particular period relative to its original abundance when ecosystems were barely influenced by humans is another definition of biodiversity (UNEP, 2004). All biological variety that is relevant to food and agriculture as well as all biological diversity that makes up the agroecosystem is collectively referred to as agricultural biodiversity. It encompasses the genetic, species, and ecological diversity and variability of plants, animals, and microbes that are essential to maintaining the essential functions, structure, and processes of the agro-ecosystem.

Consequences of Climate Change on Biodiversity

Certain plant and animal species may survive, thrive, and reproduce depending largely on temperature and rainfall. It is well known that an organism's physiology is directly impacted by its temperature. One illustration is how temperature affects the sex of growing turtle and alligator embryos. There are direct and indirect consequences of climate change on ecosystems and species. Climate change has several direct effects on ecosystems and species.

It is anticipated that the worldwide forest cover will shift in response to climate change. There will be changes in the biomes or vegetation zones. There will also be changes to the species makeup and ranges of several species. The physiology, phenology, and interactions between species will all be impacted by climatic changes, which will alter species distribution patterns. Changes in plant phenology, or the timing of reproduction and duration of growing seasons, have the potential to upset significant ecological connections. The long-term alterations in the biological events or phenology of plants and animals have been extensively studied. The distribution and number of species are directly impacted by precipitation as well.

Changes in Ecosystem functioning

Variations in temperature and water availability due to climate change have an impact on animal physiology, as well as alter the functioning of ecosystems. The interactions between respiration, carbon dioxide fixation, nitrification, litter decomposition, etc., are essential to the ecosystem's ability to operate. Climate change has the potential to impact ecosystem functioning by decreasing biodiversity because of species extinction or migration. In addition, invasive and opportunistic species will outnumber endemic or native species and have wider ranges. Rising sea levels will cause changes in the habitat of estuaries and the shoreline.

Mangroves, coastal wetlands, corals, and seagrass populations will all be impacted differently, depending on how well they are able to withstand erosion, depositional processes, and subsequent changes in the shoreline. According to scientific data, these alterations are already taking place in tandem with the century-long warming trends (Qureshi & Ali, 2011). Although the exact type and rate of change for species and ecosystems is unknown, these changes are anticipated to pick up speed and become more noticeable over the course of the next several decades. Pakistan is blessed by nature with a diverse range of landscapes, populations, climates, seasons, ecosystems, and other features. The regions' topography varies from snow-capped peaks in the Himalayan Range in the north to the Arabian Sea coastline in the south; from lush, green plains with canal irrigation to scorching, arid deserts in Sindh and Baluchistan; from well below freezing points in the HKH mountainous region to as hot as 520 °C in the inland areas; and from more than 1000 mm of precipitation per year in the humid, northern areas to less than 150 mm in the hyper-arid regions of Baluchistan. Numerous living things, such as flora, fauna, animals, birds, insects, etc., have arisen because of this diversity, and they offer economic advantages and services to human civilization in addition to ecological, recreational, cultural, and aesthetic aspects.

The effects of climate change vary throughout the world, but in developing nations, they are more severe (Rahman & Lateh, 2017). This is due to a variety of factors, including low institutional capacity, a lack of awareness and knowledge about effective measures, a lack of resources and their improper use, and unfavorable economic conditions (Ullah et al., 2019). In the upcoming years, the Intergovernmental Panel on Climate Change (IPCC) has projected that it will have a detrimental influence on natural resource depletion, human actions, and natural disasters. Globally, the hydrologic reserves and biological systems were affected by El Nino and La Nina. Between 1895 and 1995, the temperature increased by 0.4 °C. Severe weather conditions such as heat waves and relatively hotter days and nights have been brought on by the rising temperatures (Meehl and Tebaldi, 2004; Rauf et al., 2017). Due to its rapidly melting glaciers, declining hydrological reserves, floods, and droughts, Pakistan will likewise bear the burden of climate change (Chaudhry et al., 2009).

From 2020 to 2050, Pakistan's temperature is expected to increase from 0.9 to 1.5 °C. The worst droughts to ever hit Pakistan occurred in 1998 and 2004 (Hussain & Mumtaz, 2014). The country's largest province, Baluchistan, was particularly hard hit, with 84% of its people directly affected and 76% of its livestock killed. Because in individual provinces, the entire nation suffered greatly from massive floods that forced many people to flee their homes in both the northern and central regions (Chang 2014; Ullah et al., 2018). Hussain et al. (2018) state that extreme heat, severe droughts, pest illnesses, health issues, and lifestyle changes are expected to persist in the upcoming years. Due to its geographical position, increased reliance on agriculture, increased dependency on water resources, and inadequate ability to handle climate emergencies, Pakistan is poised to become a victim of the consequences of climate change (Balkhair et al., 2018; Malik et al., 2012). Furthermore, it is unlikely that climate change will have a uniform impact on all regions (Malik et al., 2012). There is worrying evidence that poor farmers in rural areas will be disproportionately affected by climate change (Ali & Erenstein, 2017) and the 2010–2011 floods highlight the vulnerabilities that these farmers face (Gorst et al., 2015).

Many people who live in mountainous regions of developing nations rely on natural resources for their livelihood. Therefore, according to Mukwada & Manatsa (2018), climate change poses a serious threat to the country's economy and rural life. According to Baloch & Suad (2018), Pakistan is among the top nations anticipated to face climate issues, despite its small and inconsequential share of global greenhouse gas emissions. The issue is particularly bad in Pakistan because of the nation's lengthy history of uncontrolled growth, which has had a detrimental effect on the socioeconomic structure of the nation, particularly in metropolitan areas (Hussain et al., 2018). In Pakistan, certain crops such as rice, wheat, cereals, vegetables, spices, and grains are sensitive to the climate. Reduced agricultural production, increasing temperatures, and irregular rainfall patterns are all contributing factors to the challenge of food security (Li & Yap, 2011).

Examples from Pakistan Distribution of Marine Turtles in Pakistan

A vital group of reptiles that frequent the nearby sandy beaches from Sindh's coast to Baluchistan's coast are marine turtles. During their mating season, they often go from the deeper water to the coastal regions to deposit their eggs. The Olive Ridley (Lepidochelys olivacea) and Green (Chelonia mydas) sea turtle species are often sighted in Pakistan's coastal regions, but the Loggerhead and Hawksbill turtle species are less frequently seen (Firdous, 2001). The wildlife agency conducted long-term research on the distribution and ecological characteristics of the subject, starting with Karachi's coastal areas (Firdous, 2001).

The IUCN Red List of Threatened Species includes the green turtle. As a signatory to the Conservation on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Sindh Wildlife Protection Ordinance 1972 offers protection for turtles under its regulatory provisions. Additionally, the Federal Ministry of Food, Agriculture, and Livestock, Government of Pakistan, has prohibited the export and domestic consumption of any aquatic turtles through clause 5 of the Pakistan Fish Inspection and Quality Act 1997.Long-term research (1981–1997) of the distribution of these turtles' nesting occurrences reveals a tendency toward fewer egg-laying females being observed in Sandspit for both C. mydas and L. olivacea; this can be linked to human effects such as pollution and degradation of habitat.

Avian biodiversity

Ali (2005) conducted research on the impact of climate change on bird diversity and the available management choices in a Pakistani wetland complex classified as a Ramsar site. Pakistan's physical and strategic location makes it possible for it to act as a bird migratory route from the Palearctic to Asia. Pakistan's rivers all contribute to this important bird migratory route, which is ranked as the fourth most significant in terms of importance. Seasonal birds in flight; winter and summer visitors descend in large numbers from northern mountain regions.

The Uchalli Wetland Complex, which was designated as a Ramsar site in 1996, is made up of the three separate wetlands of Uchalli, Khabbaki, and Jahlar. These wetlands are visited by many globally endangered bird species (Ali, 2005). The study demonstrated that a variety of factors, such as variations in water level year-round in response to precipitation, sustain wetland features. The weather varies from season to season. However, drought conditions returned after 1997, with a recorded 50% decrease in rainfall. The morphology of the Uchalli Wetlands Complex revealed a decline, with just 27% (336 ha) of the water area there as opposed to 1,243 ha.

This had a significant effect on the number of migrating birds (Ali, 2005). In this wetlands complex, there was a strong positive link between the number of birds and the precipitation. Wetlands alternate between a wet and dry condition due to both short- and long-term climate trends: Salinity and other aspects of wetland water chemistry are influenced by the interactions between surface and ground water, rocks, and soils. Climate change's physical effects on lakes include increased evapo-transpiration brought on by high temperatures, prolonged growth seasons, and longer ice-free periods. Lake levels rise as precipitation increases while evapotranspiration increases reduce water levels.

The Indus River

Variations in the weather and climate have a significant impact on aquatic systems. Global climate change is a result of greenhouse gas accumulation in the atmosphere, which also affects freshwater availability and quality through precipitation patterns, evaporation, snowpack, floods, and droughts (IPCC, 2001a). Because of its heavy reliance on glacial water, the Indus River is vulnerable to climate change, much like other rivers throughout the world. More than any other river in Asia, the Indus flows seasonally, with most of its water coming from the melting of the Himalayan glaciers (70–80%) (Kiani, 2005).

The Indus Basin is in an arid region with little rainfall; yet, the monsoon season, which produces 51% of the yearly flow, is characterized by substantial flow. Due to excessive extraction for agriculture, the Indus basin already suffers from acute water shortage, which is producing saline water intrusion in the delta (WRI, 2003). Furthermore, according to Revenga et al. (1998) and WRI (2003), the Indus basin has already lost more than 90% of its natural forest cover.

Evaluating the minimal freshwater release and sediment bad or alternative delta progradation engineering solutions is urgently needed. The Indus River should be managed holistically, considering all habitats, not only the coastal zone from the delta's source in the catchment region. The Indus Delta will see a greater manifestation of the negative effects of sea level rise. According to Tabrez et al. (2008), the sea level rise rate along the Karachi coast (1.1 mm per year) is predicted to double in the next century, resulting in a 20–50 cm rise in sea level.

If current trends continue, the Indus Delta will become a transgressive beach like to San Francisco because of the influence of high intensity waves on erosion and a lack of sediment intake (Haq, 1999). To assess the corresponding effects on the water inflows into our rivers, as well as the productivity and health of various ecosystems, it is necessary to develop an adaptation strategy that takes climate change into account. This strategy will be based on short- and long-term monitoring studies as well as modeling projections of expected climate changes in Pakistan over the coming decades. Strategies and procedures for climate change mitigation and adaptation should be developed through a collaborative and coordinated effort involving governmental institutions, lawmakers, officials, environmental groups, and community people.

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