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Q Discuss the adverse impact of climate change in Pakistan, including impacts on ecosystem, biodiversity and human health:

1) Introduction:-

Climate change refers to the long-term alteration in global or regional climate patterns, primarily caused by the excessive emission of greenhouse gases from human activities such as industrialization, deforestation, and the burning of fossil fuels. Despite contributing less than 1% to global carbon emissions, Pakistan ranks among the top 10 most climate-vulnerable countries according to the Global Climate Risk Index. Its diverse geography - ranging from glaciers in the north to deserts in the south - make it extremely susceptible to temperature rise, floods, drought, and changing rainfall patterns. Climate change poses severe and multidimensional threats to Pakistan's ecosystem, biodiversity, and human health, disrupting natural balance, undermining livelihoods and endangering sustainable development.

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2) Overview of Climate Change in Pakistan :-

Pakistan faces significant challenges in ensuring the sustainability of its environment, food security, ecosystem and biodiversity. In recent years, the impact of climate change have worsened these challenges and urgent measurements are needed to address them. Moreover, Pakistan's vulnerability to climate change is expected to increase further as Pakistan's projected rise in temperature is 5.3°C , higher than global average of 3.7°C . Pakistan has incurred over \$30 billion in economic loss from climate related disasters like 2022 floods, which displaced millions and decimated infrastructure. According to world Bank 2024, Climate Risk Assessment

"Pakistan stands on the frontline of climate change impact, facing immediate and severe challenges"

3)

Impacts on Ecosystem

Destruction on Natural habitats

Degradation of agricultural land

Reduced freshwater availability

Forest ecosystem imbalance.

- i) Climate change poses a threat to ecosystems, undermines the survival of Natural Habitats :-

Climate change in Pakistan has led to widespread destruction of natural habitats due to flood, drought, deforestation and temperature rise. According to UNDP, 2023, the 2022 floods alone damaged around 9 million acres of cropland and destroyed habitats of endangered species in Sindh and Balochistan. Moreover, according to the World Bank's 2024 climate

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Risk Report, nearly 30% of Pakistan's natural ecosystems are under severe threat from land degradation and altered rainfall patterns, endangering biodiversity and wildlife ecosystem across the Indus delta and northern mountain regions.

ii) Climate change accelerates the degradation of agricultural land:-

Climate change has severely degraded Pakistan's agricultural land through soil erosion, salinity, water scarcity, and extreme weather events. Rising temperatures and erratic rainfall patterns have reduced soil fertility, while repeated flood deposit sediments that make fertile land unusable. According to the World Bank Climate Risk Country Profile 2024 around 40% of Pakistan's agricultural land faces moderate to severe degradation, mainly due to water logging, salinity, and land misuse.

iii) Climate change leads to reduction in availability of fresh water across Pakistan :-

Pakistan is experiencing a severe decline

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in freshwater resources due to changing climate patterns, rising temperatures, and glacial melt. According to World Bank 2024 report, The country's per capita water availability has dropped from 5600 cubic meters in 1951 to less than 1000 cubic meters in 2024, placing it among the most water-stressed nation. Rapid glacial melting in the northern area, combined with erratic rainfall and over-dependence on Indus River System, has intensified seasonal water shortage.

iv) Climate induced disturbance causes imbalance in forest ecosystem :-

Pakistan's forest ecosystems are increasingly disrupted by climate-induced changes such as a rising temperature, irregular rainfall, and prolonged droughts. These disturbance have led to forest degradation, reduced vegetation cover and loss of biodiversity. According to Food and Agriculture Organization (FAO) 2023 report shows that Pakistan loses nearly 27000 hectares of forest cover annually. largely due to climate-related stresses and human exploitation.

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4)

Impact on Biodiversity

Loss of species and habitats

Marine biodiversity threat

Reduction in migratory birds population

- i) Loss of species and habitats are in danger due to severe climatic change:-

Climate change has severely affected Pakistan's biodiversity, threatening the survival of both flora and fauna. Rising temperatures, habitat destruction, and frequent floods have disrupted natural ecosystem and migration patterns. According to the World Wide Fund for Nature 2024, nearly 20% of Pakistan's world wildlife species are at risk of extinction due to climate-induced habitat loss and ecosystem degradation.

(ii) Climate change and rising sea temperature endanger Marine Life in Pakistan :-

Pakistan's coastal and marine ecosystems, particularly along the Arabian Sea, are facing growing threats due to climate change and rising sea temperatures. These changes have disturbed coral reefs, reduced fish population and damaged mangrove forests that serve as breeding grounds for marine species. According to World Bank Climate Risk Report 2024, sea surface temperatures near Pakistan's coast have increased by 1.2°C over the past three decades, resulting in the migration and decline of several fish species.

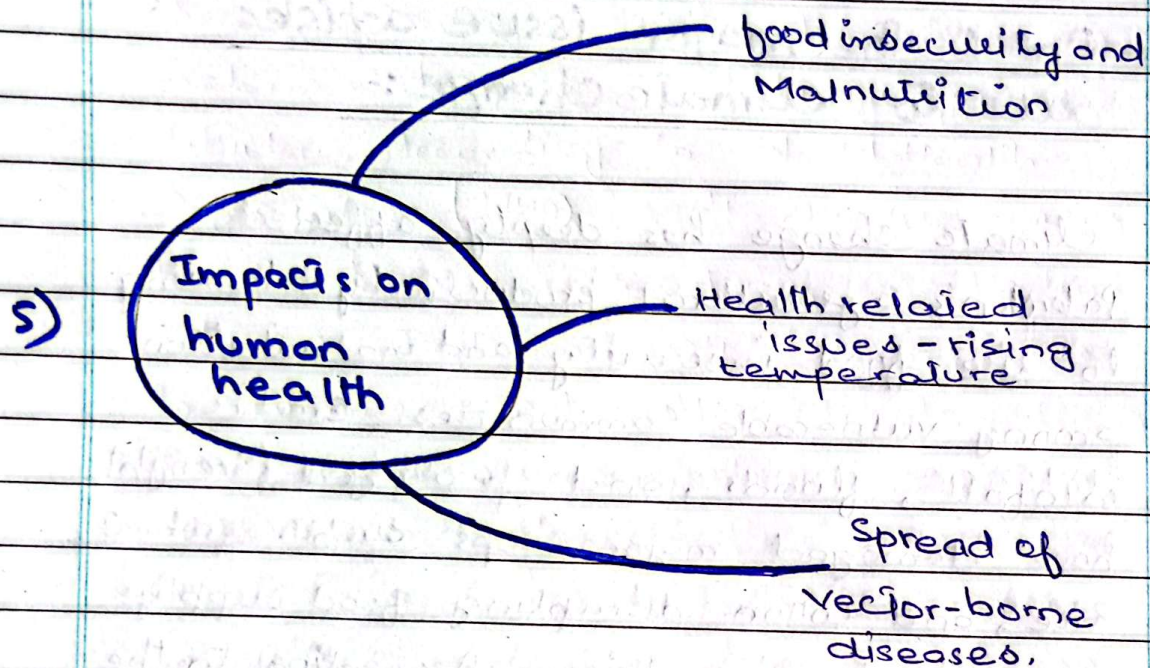
(iii) Global warming due to climate change threaten the survival and Migration of Birds :-

According to the WWF - Pakistan 2024, the number of migratory birds visiting Pakistan's wetlands - particularly the Indus Delta and Haleji Lake - has declined by nearly 35% over the last two decades due to changing climate conditions and habitat

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degradation. This decline signals a severe ecological imbalance that threatens Pakistan's biodiversity and wetland sustainability.



(i) Rising temperatures increase heat-related illness and deaths in Pakistan :-

Pakistan is witnessing a sharp rise in heat related health issues and fatalities as climate change drives up national temperature level. The frequency and intensity of heat-waves have increased, especially in Sindh and Punjab, causing dehydration, heatstroke.

According to World Health Organization 2024, Pakistan recorded a 30% increase

in heat related deaths over the past decade, with extreme temperatures in Jacobabad and Dadu surpassing 52°C in 2024, among the highest on the Earth.

(ii) Food insecurity and Malnutrition -
One of the major issue arises
due to Climate change :-

Climate change has deeply affected Pakistan's agricultural productivity, leading to rise food insecurity and malnutrition among vulnerable communities. Erratic rainfall, floods, and prolonged drought have damaged major crops such as wheat, rice, and cotton disrupting food supply chains and rising prices. According to the World Food Programme 2024, around 37% of Pakistan's population faces moderate to severe food insecurity, largely driven by climate-related agriculture losses. Similarly, according to the Global Hunger Index (2024), places Pakistan in the category of "Serious Hunger" citing climate-induced yield declines and rising poverty as major causes.

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(iii) Climate change become the valid reason for the spread of vector-borne diseases :-

Climate change has intensified the spread of vector-borne diseases such as malaria, dengue, chikungunya across Pakistan. According to World Health Organization (WHO) 2024, dengue cases in Pakistan increased by nearly 40% between 2021 and 2024 largely due to warmer and wetter climate patterns. Rising temperatures, prolonged monsoon seasons, and stagnant flood water have created ideal breeding conditions for mosquitoes and other disease-carrying vectors.

6) Steps taken by government to counter the adverse impact of climate change :-

Pakistan has taken several policy and institutional measures to combat the impacts of climate change.

- 1) National Climate Change Policy :-
NCCP, revised in 2021 provides a

Comprehensive framework for adaptation and mitigation strategies, focusing on water management, agricultural resilience and renewable energy transition.

2) Ten billion Tree Tsunami Project
TBTTP, launched in 2019, remains one of the world's largest initiatives for reforestation, aiming to restore over 1 million hectares of degraded land.

3) UNFCCC Conference of Parties (COP) :-
Pakistan has an active participant of UNFCCC COPs including COP 29 and 28 where it is emphasized the establishment of the loss and damage fund to support climate - vulnerable countries.

7) Conclusion :-

Climate change poses severe and multifaceted threats to Pakistan, including rising temperature, erratic rainfall, flood, drought and glacial melt. Pakistan experience underscores that climate change is a shared global crisis requiring coordinated national policies, international cooperation, and long-term mitigation and adaptation strategies.