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CLIMATE CHANGE AND THE RACE TO SAVE BIODIVERSITY

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Climate change refers to the long-term changes in temperature and weather due to human activities. Enormous increase in the emission of greenhouse gases (CO_2, methane and nitrous oxide) due to burning of coal and fossil fuels, mining activities, intensive farming practices, waste disposal, over-exploitation of natural resources and deforestation are the main drivers of climate change. Marked increase in the frequency and intensity of natural disasters, permafrost/ice melting, rise in sea level, decrease in crop productivity, poverty, displacement of species and loss of biodiversity are the main consequences of climate change. Declining biodiversity poses a significant threat and is a pressing issue now-a-days.

Climate Change as Accelerated by Biodiversity Loss

Other human-induced environmental changes such as habitat loss and degradation, overexploitation of bioresources and introduction of alien species interact with climate change and affect biodiversity and ecosystems. 519 studies on ecological responses to extreme climate events (cyclones, droughts, floods, cold waves and heat waves) between 1941 and 2015 was studied by Maxwell *et al*., 2019, covering amphibians, birds, fish, invertebrates, mammals, reptiles and plants.

Healthy ecosystems like forests, wetlands and coastal mangroves, absorbs carbon dioxide from the atmosphere and act as carbon sinks but biodiversity loss can no longer perform this function and release their stored carbon, primarily as CO_2 and disrupts natural

climate regulation. For example, the degradation of coastal ecosystems is estimated to release 0.45 billion tons of CO_2 annually. The loss of even one species can have a cascading effect on the entire ecosystem, impairing its ability to regulate the climate, control weather patterns, and purify water.

Also, the faunal species like bees and other pollinators are crucial for plant life, and their decline can lead to a collapse of plant populations, impacting the entire food web and reducing the planet's ability to sequester carbon. As climate change intensifies, it further accelerates biodiversity loss. When biodiversity is lost, the ecosystem becomes more vulnerable to climate impacts, creating a vicious cycle.

Impact of Climate Change on Shifting of Species

The disruptions like habitat loss and fragmentation, altering ecological cycles and species interactions, and increasing extreme weather events force species to migrate, fail to reproduce, or starve, while also creating conditions that favor invasive species and increase the spread of diseases, ultimately leading to species extinction. Due to increase in temperature, a shift in distributional range of species and phenological events occur. The timing of crucial ecological events, such as flowering or egg-laying, becomes out of sync with the species that depend on them, like pollinators and birds.

As the temperature gets warmer in their native habitat, species tend to move to higher altitudes and towards the poles in search of suitable temperature and other environmental conditions. For example, many fish and shellfish populations, such as Pacific cod and surf clams shifting their historic ranges toward the poles (northward in the Northern Hemisphere) in search of cooler water. Polar bears rely on sea ice to hunt seals; as the ice melts earlier and forms later, their hunting grounds diminish, leading to starvation and their population declines.

Extinct Species Due to Climate Change

Bramble Cay melomys: This rodent, found on Bramble Cay in Australia, is considered the first mammal to go extinct as a direct result of climate change. Rising sea levels destroyed its habitat and the resulting storms and sea surges wiped out its population.

Golden toad: Native to Costa Rica, this toad's extinction is linked to climate change-driven alterations in its environment. Changing weather patterns led to its breeding pools drying up, which prevented successful reproduction.

Coral reefs: Numerous coral species are declining rapidly worldwide due to climate change. The reasons behind their mass extinction is due to mass bleaching and ocean acidification.

***Snow crabs*:** In the Bering Sea, a massive die-off of snow crabs occurred between 2018 and 2021, potentially linked to climate change causing a lack of food and starvation.

***Humpback whales*:** A large number of humpback whales in the northern Pacific Ocean have died from marine heatwaves in recent years.

Climate-adaptive Conservation Practices

Assisted migration, habitat corridors, and genetic diversity preservation practices help species and ecosystems to adjust with rapid environmental changes.

Assisted migration involves the human-supported deliberate translocation of species to habitats, enabling them to adapt to changing environmental conditions. When intermediate habitats along the migration routes are lacking, these practices can be found effective. (Szamosvári *et al*., 2025). The species facing severe barriers to migration, such as urban development or vast agricultural land can be prevented from extinction by this approach.

Habitat or wildlife corridors are strips of natural habitat that connect isolated patches of land, allowing animals and plants to move between them. These structures facilitate natural movement, seasonal migration, and dispersal, which helps species access food, water, and mates. Genetic exchange can be assured which may be helpful for maintaining healthy and resilient gene pools.

Genetic diversity preservation ensures long-term health and adaptive potential. In situ conservation involves gene flow within and between existing populations and ex-situ methods include seed banks, botanical gardens, and captive breeding programs.

Conclusion

Climate change is indeed a formidable global threat. Human interventions for biodiversity conservation amid climate change involve mitigating greenhouse gas emissions through renewable energy and efficiency, and implementing adaptive conservation strategies, which aim to protect and restore ecosystems that serve as natural carbon sinks, allow species to adapt to shifting ranges, and protect vulnerable habitats from the impacts of a changing climate.

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