Impact of Climate Change on Biodiversity

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Abstract- ***The impact of climate change on biodiversity has become a burgeoning subject of study. Predictions are useful for alerting scientists and decision-makers to potential future hazards, as well as for bolstering the attribution of biological changes to climate change and for assisting in the creation of proactive initiatives to mitigate climate change's effects on biodiversity.***

I. INTRODUCTION

The term 'climate' refers to long-term weather patterns, such as temperature, humidity, rainfall, and wind speed, within a specific region. Climate is measured in years, decades, centuries, and millennia, whereas weather refers to daily or weekly changes in the atmosphere. Today, the phrase "climate change" is used to describe any change in climate through time, whether caused by natural factors or human activity. Significant and long-term changes in a region's climate are referred to as climate change. These changes can take decades or millions of years to occur. Climate change affects entire ecosystems, as well as all living organisms inside them. All living animals have had to adapt, shift, or die out as the environment has changed over Earth's history. Ecosystems and species can evolve together when these changes occur gradually. A gradual transition also allows organisms to adapt to changing conditions. When these changes happen swiftly, the species tries to adapt as soon as possible in a suitable site. Invasive species will be able to expand on new land in new ways as a result of climate change.

II. GREEN HOUSE GASES AND ITS IMPACT

Green House Gases (GHGs), such as CO2, CH4, O3, and water vapours, are responsible for the gradual but necessary increase in earth's temperature. Anthropogenic activities, on the other hand, are currently continuously increasing the quantities of greenhouse gases in the atmosphere. Increasing the amount of greenhouse gases in the atmosphere helps to trap more heat in the atmosphere. Industries, fossil fuel combustion, and transportation all produce and release greenhouse gases such as carbon dioxide (CO2) and methane (CH4). Volcanic eruptions and forest fires emit large volumes of greenhouse gases every day. Greenhouse gases from all sources combine in the atmosphere, affecting everyone on the planet. Svante Arrhenius, a Nobel Laureate, predicted that increased CO2 levels in the atmosphere from the burning of fossil fuels would result in global warming in 1896. He estimated that doubling CO2 concentrations in the atmosphere would elevate global temperatures by 2 to 6 degrees Celsius.

III. GLOBAL WARMING AND ITS EFFECTS

Regional climates are altered in many ways as the Earth warms and temperatures rise. Less melting snow pouring into rivers, reservoirs, and lakes for fish and animals, as well as less water available for drinking and agriculture, means less snowpack and receding glaciers in the mountains. The Himalayan Mountains' glaciers provide year-round water to almost 2 billion people. Warmer temperatures result in more evaporation, which results in more rain and snowfall. However, the extra precipitation is dispersed unevenly, resulting in higher rainfall in some areas and drought in others. Snowstorms that are heavier, hurricanes that are stronger, heat waves that are more intense, and catastrophic rainstorms that result in flash floods are all becoming more common around the world (IFAW, 2013).

Warmer air temperatures result in warmer ocean temperatures, which influence global ocean currents and associated weather patterns. The Gulf Stream, a strong ocean current that transports warm water from the equator up the east coast of North America and over the North Atlantic to northern Europe, keeping winters in the United Kingdom up to 9 degrees Fahrenheit (5 degrees Celsius) warmer than they would be otherwise (IFAW, 2013).

IV. IMPACT ON ANIMALS

Warmer land and sea temperatures, more violent storms and floods, lower snow cover and more frequent droughts, and rising sea levels: how will these climatic changes effect life on Earth? Species have evolved to be able to exist in specific temperature ranges and to handle weather fluctuations. Some species may be pushed to the brink of extinction as a result of climate change, while others may thrive.

Warmer spring temperatures may cause birds to begin seasonal migrations or nesting earlier than usual, as well as bears to emerge from hibernation earlier than usual. When bears emerge before their typical food supplies are accessible, they may starve or travel into towns in search of food, as plants account for 80% of their diet. Warmer, drier summers may influence the capacity of animals that rely on late summer plants to survive through the winter to locate enough food.

V. SEX DETERMINATION IN REPTILES

Temperature-dependent sex determination (TSD) is a type of environmental sex determination in which the temperatures experienced during embryonic development determine the sex of the offspring. It is most prevalent and common among amniote vertebrates that are classified under the reptile class. TSD differs from the chromosomalsex-determination systems common among vertebrates. The eggs are affected by the temperature at which they are incubated during the middle one-third of embryonic development. This critical period of incubation is known as the ther mosensitive period (TSP). The warming of the habitats of species exhibiting TSD are beginning to affect their behavior and may soon start affecting their physiology. Many species begun to nest earlier and earlier in the year to preserve the sex ratio. It is likely that climate change will outpace the ability of many animals to adapt, and many will likely go extinct.

The health of Kaziranga National Park and the protected creatures that reside there, such as elephants, rhinoceroses, and tigers, has long been dependent on the annual flooding of the Brahmaputra River in India's northwest corner. In recent years, the increasing intensity of Asian monsoons has resulted in more floods, displacing people and killing animals. In addition, a 2012 study discovered that climate change may have a greater impact on Asia's dwindling elephant population than previously thought. According to the findings, young elephants are especially vulnerable to rising temperatures, which can double their mortality risk. Elephants, like humans, reproduce later in life, so if calves die before they have a chance to mate, the species will perish. As the temperature in their home regions rises, animals that prefer colder temperatures migrate to higher elevations or to the poles. The American pika, a small mammal related to rabbits and hares, has adapted to alpine life. They are particularly temperature sensitive and can perish at temperatures as low as 78°F to 85°F (25.6°C to 29.5°C) (IFAW, 2012). Though the full impact of climate change on India's natural resources has yet to be determined, preliminary research indicates that endemic species such as the Nilgiri tahr are at risk of extinction (Sukumar et al., 1995). Furthermore, there have been reports of specific species (e.g., the Black-and-rufous flycatcher (Ficedula nigrorufa) relocating their lower distribution boundaries to higher reaches, as well as sporadic death of sections of Shola woods as ambient surface temperatures rise. The arctic fox is a predator of lemmings and voles that burrow underground and lives in the open tundra. Mild winters with melting snow lower the population of lemmings and voles by forcing their burrows to collapse, limiting the arctic fox's main source of food.

VI. OCEAN ACIDIFICATION

Oceans absorb approximately a third of the carbon emitted into the atmosphere as a result of human activities, and we can only blame ourselves for the 30% drop in pH. Some crabs and coral are unable to create their protective shells and skeletons as a result of the acidity. Coral reefs, which provide habitat for thousands of marine species, are being bleached as a result of rising ocean acidity. This loss of marine life poses a hazard to the entire ecosystem, including humans.

VII. EXTREME WEATHER EVENTS

Massive heat waves and droughts have already grown more common around the world, and they are

predicted to get worse if the warming trend continues. Habitats are altered in drought-stricken areas, and plants and woodlands suffer as a result of the lack of water. Wildfire activity has increased as a result of the hot, dry weather, posing a threat to wildlife's safety. It devastates crucial wildlife habitats, such as the Mexican spotted owls' breeding habitat and the forest habitat of endangered Amur tigers and critically endangered Amur leopards in Russia. Storms that are stronger and more frequent have an impact on the distribution and concentration of plankton and krill, which has a domino effect on many ocean organisms.

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VIII. MELTING SEA ICE

Temperatures in the Arctic are rising twice as fast as the rest of the world, and sea ice is vanishing at an alarming rate. Melting sea ice puts strain on some of the world's most iconic animals, including polar bears, ringed seals, emperor penguins, and beluga whales. The food chain, hunting behaviour, breeding, predator protection, and the ability to move great distances—in other words, the fundamentals of this and other species' existence—are all disrupted as ice melts.

IX. SEA-LEVEL RISE

Because coastal wetlands are among the most productive of all natural ecosystems (Day et al., 1989), the effects of climate change will be particularly significant in coastal areas, with far-reaching consequences. Climate change poses a new hazard to animals and plants in coastal ecosystems, in addition to the effects of rising temperatures and changes in rainfall. This is due to the melting of polar ice caps, ice sheets, and montane glaciers, as well as thermal expansion, in which warm water takes up more space than cold water. According to the IPCC, average sea level will rise 0.18–0.59 m in the next century, compared to 1980–1999 levels (Parry et al., 2007). Other climate models predict a rise of 0.5–1.4 m, which would completely inundate many low-lying places. In many circumstances, human population and development pressures will prevent coastal ecosystems from spreading inland, resulting in net habitat loss. Many wildlife species may suffer direct consequences as a result of these changes (e.g. Michener et al., 1997). As their breeding sites are flooded, sea turtle populations are expected to suffer. A 0.5-meter rise in sea level is expected to result in the loss of 32% of sea turtle nesting habitats (Fischlin et al., 2007). Mangrove forests appear to be pre-adapted to flooding, as they grow in coastal areas below high tide, where their stilt roots are constantly submerged in saltwater water. However, due to rising sea levels, they are unable to endure permanent submersion, and mangrove die-off has been documented in several sites (Ellison, 1993). According to models, the Sundarbans might lose up to 96 percent of ideal tiger habitat in the next 50–90 years (Loucks et al., 2010).

X. DISEASE AND PESTS

Climate change not only affects disease in human populations, but it also affects disease behaviour in animals. Many amphibian populations are decreasing or extinct due to the fatal amphibian disease chytrid fungus, which is likely exacerbated by rising temperatures. Warmer weather allows seasonal pests, such as bark beetles in the United States, to breed longer, and parched, drought-stricken trees are more prone to infestation. Temperatures in the Himalayan ecosystem are rising at a pace of 0.9 degrees Celsius each decade, far faster than the global average of 0.7 degrees Celsius per decade. Changes in the environment, for example, have necessitated the use of mosquito nets in Lhasa, the administrative capital of China's Tibet Autonomous Region. Mosquitoes have been seen for the first time in the city, which is 3 490 metres above sea level. Similar reports of flies have been made from Nepal's Mount Everest base camp. The prevalence of these insects means that vectorborne diseases such as malaria and dengue fever

may be spreading to locations where people were previously sheltered from these threats by lower temperatures (FAO, 2012).

XI. RANGE SHIFT

As the earth warms, "biomes," or ecological communities of plant and animal species, are altering. Some species can adapt and move, but others cannot, and as a result, they will become extinct when their environment disappears. Scientists indicate that oak woods in northern India's Mandakini Valley have been invaded by pine trees (between 1 000 and 1 600 m), particularly on south-facing slopes. This phenomenon may also be seen in several of the region's valleys. Because of the decreasing oak trees and invading pines, many water sources, such as springs, have dried up (FAO, 2012).

XII. NEW SPECIES INTERACTIONS

Previously unacquainted species come into contact with one other as a result of climate-induced range shifts and accompanying biome alterations. This leads to resource rivalry and changes in how predators interact with their prey. Red foxes, for example, have travelled northward toward a warming tundra, where they compete with native Arctic foxes for prey.

XIII. INVASIVE SPECIES

Two primary threats to biodiversity are climate change and invasive species. When you combine the two, the consequences are expected to be far-reaching. Invasive species will be able to expand on new land in new ways as a result of climate change. Natural disasters such as storm surges and high winds, which are becoming more common and severe as the world heats, spread non-native plants and insects to new areas. Cactus moths, for example, were likely brought to Mexico by the winds of the 2005 hurricane season, posing a threat to unique cactus species. Almost all ecosystems in the world, including India, have been invaded by the major taxonomic groups. Lantana camara, Eupatorium odoratum, Eupatorium adenophorum, Parthenium hysterophorus, Ageratum conyzoides, Mikania micrantha, Prosopis juliflora, and Cytisus scoparius are among the most common invasive alien plant species.

XIV. INTERRUPTED SEASONAL CYCLES

Many species rely on climate to determine their life rhythms, such as mating, reproduction, hibernation, and migration, to mention a few. As these patterns vary in response to changing climate, it has a cascading impact that threatens the ecosystem's overall health. Weather-dependent animal habits, such as bird migration, bear hibernation, bat hibernation, and even alligator hibernation, will result in mismatched timing between species and their food supplies. An earlier blossoming season of their plant food source, for example, has disturbed caribou movement patterns, resulting in a food scarcity late in the season and a reduced number of young. Indian agriculture, which is sometimes referred to as a "monsoon gamble," would become even more subject to weather patterns. Survival and productivity of agri-horticultural crops would suffer as a result of reduced precipitation and higher evapotranspiration. Salinization of coastal soils and aquifers would occur, putting basic food crops like paddy under severe stress. Rice and wheat yields decline with every 1°C increase in temperature. The mortality of fish and their geographic dispersion will be affected by rising sea water temperatures (Swaminatha and Keshvan , 2012).

CONCLUSION

Decision-makers are increasingly realising that biodiversity is not an afterthought in human affairs, but rather the essential core of our existence. Furthermore, biodiversity protection that is suited to changing climatic conditions is not only required to assist species and ecosystems in adapting to change, but it is also likely to mitigate climate change (FAO, 2012). There is a need for climate-resilient farming systems in agriculture. Climate literacy should be promoted, and localities should establish a cadre of Community Climate Risk Managers. Climate change disasters should be turned into opportunities to create and expand climate-resilient farming techniques and systems (Swaminathan and Keshvan, 2012).

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