Review Article

Climate Change: A Charismatic to Traumatic path of Indian Biodiversity

Abstract:

Climate change has become a customary part of a study in all sciences. This review article aims at studying the climate change and its impact on the biodiversity in India. Climate change mainly alters biodiversity in terms of extinction of species. Climate change and biodiversity are parallel lines of the tracks on which human is running his exploitative train of greed. This article focuses on the biodiversity in India, importance and threats. Article also suggests the measures to overcome the climate change and biodiversity loss in India.

Key words: Climate change, Biodiversity, Environment and Ecosystem.

Introduction

If one looks closely at nature, each species is a unique masterpiece of itself, exclusively adapted to the environment in which it has been surviving. Who are we to destroy or even to diminish? When the last fish is caught, the plate would be empty; when the last tree is cut, the air would be foul and when the last lake is polluted, what we are left with is to drink the sewage. When Mumbai was inundated in a hour, many parts of western India were parching; furthermore, when a forest in Uttarakhand caught fire and many species lost their habitat, a cyclone in eastern India incessantly sprinkled raindrops and forced people to evacuate. Moreover, a man in Delhi died due to a shivering cold in December and, subsequently, his wife died in May. The capitalistic world will, sooner or later, realise that the wealth is not at the stroke of the bank account number because climate change is happening right now. Biodiversity loss and climate change are like the wheels of a catastrophic truck which are tucked to the same axel, in which, if one-wheel moves, the other will also start moving along. Recently, during G-7 Summit held in the United Kingdom, noting the fact that climate change and biodiversity cannot be solved in isolation, leading experts across the globe, supported by the two intergovernmental bodies, have alarmed that the "narrowly-focused approaches to combat climate change can, directly and indirectly, harm nature and vice-versa".

The concept of climate change has become a customary part of a study in all sciences. From a study of components and repercussions of climate change in biological sciences to its implications in policy making and value estimates in social sciences, the study has become an integral and indispensable part of every research. The interference of climate change with the biodiversity of the Earth encompasses various aspects that can affect not only human health but also the existence of the planet itself. The study of biodiversity within the context of climate change is vital in the sense that it actually entails the phenological evolution and adaptation processes of the various species across the dimensions of the Earth revealing the future prospects and choices that nature would make to sustain itself. In these intricate phenomena, the role of humans has been assessed in various studies from local to global levels.

Biodiversity and India

Biodiversity is defined as the variability among living organisms from all sources, including inter alia, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which these are a part; this includes intraspecies, interspecies and that of the ecosystem [1&5]. Generally, biodiversity is viewed at three levels, which are, ecosystem diversity, species diversity and genetic diversity. The greater the interlinking between these levels, the greater is the resilience to climate change and the denser the intricacies behove.

Genetic diversity is concerned with the variation in genes within a particular species. The breeders and the specialists at the seed banks consider the seed to be the time capsule that explains the genetic diversity. They firmly believe that genetic diversity is the hedge between humans and global famine. Diversity is the risk management strategy of nature just like the stockists diversifying their investments to reduce the risk. However, just 17 of the 190 world's countries contain 70 % of its biodiversity, earning them the title "megadiverse". India is one of these megadiverse countries with 2.4 % of the land area, accounting for 7-8 % of the world's species, including about 91,000 species of animals and 45,500 species of plants, which have been documented in its ten biogeographic regions. Of these 12.6 % of mammals, 4.5 % of birds, 45.8 % of reptiles, 55.8 % of amphibians and 33 % of Indian plants are endemic, being found nowhere else in the world[3&4]. Figure 1 represents the endemic content of biodiversity in India (India Biodiversity Portal).

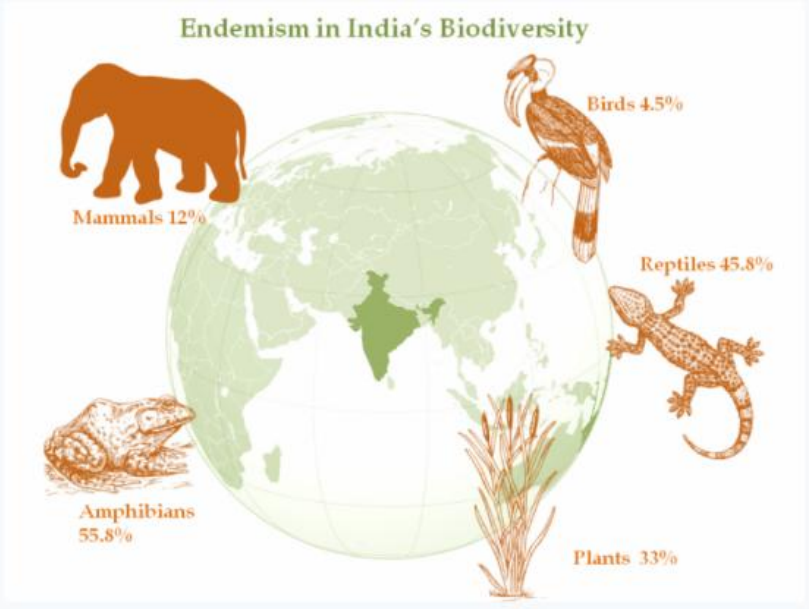


Figure 1: Species wise endemic content of Biodiversity in India

The biodiversity hotspot concept was put forth by Norman Myers in 1988. To qualify as a hotspot, a region must meet two strict criteria:

1. Species endemism - it must contain at least 1,500 species of vascular plants (> 0.5 % of the world's total) as endemics.

2. Degree of threat - it has to have lost at least 70% of its original habitat.

Over 50 % of the world's plant species and 42 % of all terrestrial vertebrate species are endemic to the 35 biodiversity hotspots. There are four biodiversity hotspots present in India. They are the Himalayas, Indo-Burma, the Western Ghats & Sri Lanka and Sundaland (Andaman & Nicobar). Of the eight hottest hotspots of the world, the two belong to India, which include the Western Ghats and Indo-Burma region.

However, the Himalayas, the Western Ghats, the Sundarbans, the coastal and marine ecosystem, the forests, the riverine ecosystem and the desert life too are undergoing huge phenological changes that are pacing up the rate of vulnerability among different species. Evidence from literature shows that India has lost 90 % of the area under its four biodiversity hotspots[13]. The Indo-Burma hotspot is the worst hit - the extent of vegetation in the region has been reduced from 2,373,057 sq. km to a mere 118,653 sq. km, a loss of 95 %. Twenty-five species have also gone extinct in these hotspots. The International Union for Conservation of Nature's (IUCN) Red List monitors 1,212 animal species in India – the

IUCN says over 12 % of them are endangered. Of the 148 endangered species, 69 are mammals, 456 amphibians and 23 reptiles [4].

The figures testify to the actions of humans on Earth. It goes without saying that the biodiversity on Earth is the art of nature and particularly, Indian biodiversity is distinctively remarkable!

Namdapha flying squirrel doesn't really fly. It jumps from high in the trees and glides through the air like a kite. This flying squirrel is unique to India. Also, an old-world monkey, the Golden Langur, and the very cute Red Panda are distributed over a very few regions in India, whereas, the Barasingha (twelve horned) is found exclusively in Kanha Tiger Reserve. Nevertheless, the Indian leopard, Clouded leopard, Snow leopard (Ghost of mountains) and the Black panther are in a class by themselves, while, the mating dance of the Bengal Florican is just incomparable.

No matter how many more significant species are tabulated, the worrying scenario is that most of them are catalogued under IUCN Red List such as all those amazing species mentioned above. This clearly indicates not only the threatened status of biodiversity but also elucidates the vulnerability of our being on the Earth.

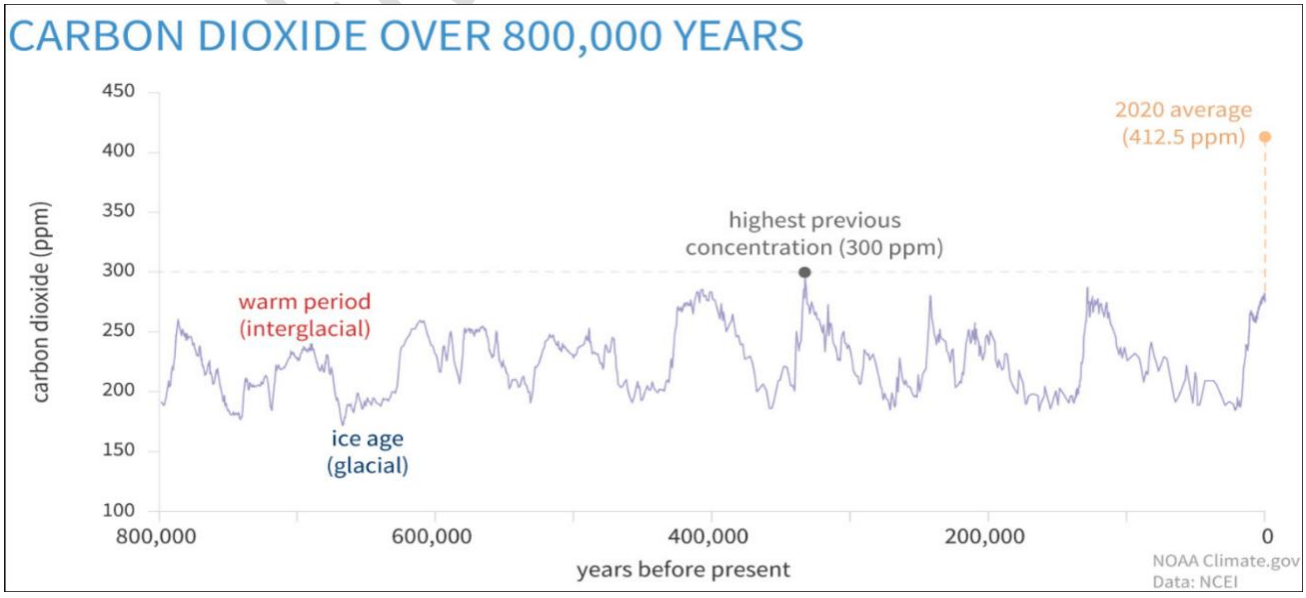
Importance of Biodiversity

Biodiversity is essential to both climate change mitigation and adaptation. Preserving biological diversity at every level, from genes to biomes, is the most effective way of facilitating the rapid changes necessary for human societies to adapt to future climate change. The diversity of responses in various species that perform the same ecosystem function is a critical factor in maintaining ecosystem resilience to changes in the environment, particularly when ecosystems are reorganising [7]. This clarifies the fact that even in the absence of one, the function of an ecosystem would sustain because of the diversity. The diversity of responses would keep life going. Climate change threatens water resources via changes in flow regimes and increased air temperature [8&18]. This has been the prime mover of the shift in habitats of species like honey bees and other cool weather species to move towards the higher altitudes, where the temperature is relatively lower. The river ecosystems too are in grave danger. The industry effluents are untreated before their release and the ceremonial activities related to rivers not only pollute the aquatic systems, but also decrease the life actions of the water ecosystem by depleting the aquatic biodiversity[6]. Finding a balance

between the multiple ways rivers can be used (e.g., to maintain ecological functions and generate electricity) is tricky [12], and the changing climate only makes the need for such balance more urgent [11]. Similar challenges are prevalent in forest management also. Biodiversity in forests is closely (positively) related to ecosystem productivity, stability and resilience [16], and tropical forests are among the most biologically diverse and productive ecosystems on Earth.

Threats to Biodiversity

Indian biodiversity faces a variety of direct and indirect effects and challenges. National Forest Commission reported that the amount of these effects and challenges are very high, with as many as a third of all endemic species facing the threat of extinction [2]. The key threats confronting India's biological resources are similar to the ones faced globally, viz., habitat loss, fragmentation and degradation; unsustainable use and overexploitation; pollution; invasive alien species; climate change and desertification. Climate change has been emphasised as serious threat to biodiversity which are likely to be adversative for biodiversity. Variation in precipitation and temperature are two important aspects of climate variability that are likely to have a direct and significant effect on India's biodiversity[14]. Thuiller (2007)[17] has stated that each 10°C rise in temperature will lead to shifting the zone of occurrence of several specialist species by 160 meters vertically and 160 km horizontally. However, the specific impact of climate change on India's natural resources area wise is yet to be studied. Sukumar (1995)[15] reported that endemic mammals like the Nilgiri Tahr face



an increased risk of extinction.

Source: NOAA

Figure 2: Carbon dioxide emissions

An increase in greenhouse gases, especially, carbon dioxide (CO_2) in the recent past has immensely contributed to global warming, rising sea levels, and thereupon affects the health of the whole ecosystem of the Earth. Figure 2 explains that the increase in carbon dioxide levels is not a new trend. However, the human-activity influenced rate of increase in CO_2 levels is much larger reaching nearly an average of 412.5 ppm concentration in the atmosphere. An increase in CO_2 inside the water bodies react with water molecules to form carbonic acid and consequently, changing the pH of the water bodies, especially, increasing the pH. When this phenomenon occurs inside the oceans, it is termed as ocean acidification, which affects marine life and the associated livelihoods dwelling in the country's coastlines.

The optimism favours the opinion that there is still a space for recovery and time for a second chance. Recently, Orca, the largest direct-air carbon capture facility, started operations in Iceland. It will pull CO_2 from the air and trap it in the ground at the rate of 4,000 tonnes of CO_2 per year, which is the amount the world would release in four seconds[9]. The Indian State of Forest Report 2019 has reported that the Mangrove cover in the country has increased by 54 sq. km and there has been an increase of 42.6 million tonnes of carbon stock. Although numbers indicate a meagre change in terms of %, nonetheless, it is the improvement on a small scale that is better than zero efforts.

Way forward

We cannot deny the fact that climate change is happening right now. Biodiversity loss is occurring at a faster pace. Also, the studies of its consequences are not yet complete. The limitless humans have stipulated the negotiations among themselves at the cost of nature's misery. The presently available choices are to either accept the consequences or to tackle them with care for a sustainable future. The loss of biodiversity roots from the disposal of plastic to the emission of harmful gases. Therefore, our actions will determine our choices. Public participation to improve ecological health even in very small ways like avoiding plastic disposal, recycling the plastics, saving electricity and water when not in use, maintaining biological systems like micro kitchen gardens etc. will indeed have a positive impact on environmental health. The role of Environmental Impact Assessment should be made politics-free to internalise the externalities and increase the cost of environment-

affecting-based projects[10]. However, the role of private entities should not be ignored. They have equal potential for development and also conservation. The policies, will hence, determine the way of functioning of these private entities and their long-term impacts on environment. The Hardin's theory also justifies that the best way to tackle the Tragedy of Commons is by privatization, either by individual owners or by a strong state management body. Education too has a vital role in tackling climate change. The inclusion of the subject of climate change into the school academic curriculum can assist the young generation to acquire better awareness of its impacts, as unfortunately, it is the future generation that is going to be the witness of the climate change effects. The climate change which is happening right now has altered to the climate crisis to which biodiversity loss is the prime component.

Climate change and biodiversity are parallel lines of the tracks on which human is running his exploitative train of greed. Biodiversity is the totality of all the inherited variation in the Earth's life forms, of which we humans are just one of those species. It is our responsibility to study and save to the greater benefit of ourselves. Unfortunately, we have been ignoring and degrading it to our great peril. The resilience that biodiversity brings to our ecosystem is of surmountable value, which is a prerequisite for the climate that has put it under extreme pressure with continuous changes; its wanton destruction is like setting fire to our own lifeboat.

Conclusion:

The biodiversity of India is unique in itself. It has been playing a vital role in maintaining ecological health and also supporting the livelihoods of thousands of people in India. However, the climate change has affected species composition, disturbing the ecosystem balance. The major threat to biodiversity is human intervention. The scientists are still not aware of the mysterious consequences that people will have to confront because of climate change. Therefore, the nation can address such a challenge by integrating various domains of existing knowledge towards a resilient approach.

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