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Climate Change, Famine Of 1876-78 And Effects On Biodiversity

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There has been a growing concern about climate change for the last thirty years due to human intervention in the naturally built environment. Due to heavy industrialization and comfortable life styles the natural environment is undergoing changes which posed a great threat to the flora and fauna. Climate change is of two types: Natural and Man Made. This paper deals with natural climate change, 1876-78 famine and its impact on biodiversity.

The life on the earth started at around 4.5 billion years ago. From then till today life has been evolving on the planet earth [1]. There are different stages in this long journey of life on earth. Apart from other phases in life's history, we can divide earth's history simply in three phases- Paleozoic era, Mesojoic era and Cenozoic era. In these phases different types of flora and fauna dominated. For example reptiles dominated in Mesozoic era, especially Dinosaurs [2]. The climatic conditions have also been different in different ages. Ice age and warm ages alternatively changing the life on earth. Thus the climatic conditions as we see today were different in yester phases of earths history [3].In other words the natural climatic conditions on the planet earth have been changing naturally in evolutionary process. We can apply Darwin's theory of Evolution of Life in all stages of life on earth. Particular climatic conditions are suitable for different flora and fauna to successfully survive. From this particular context the climate change and its influence on South India during the period 1876-78 has to be analyzed.

A different climatic condition over eastern and western Pacific ocean changes the monsoon mechanism in Asia. If we confine to India, India is endowed with seasonal mechanism of rainfall called as monsoon. The south-western monsoon provides India with 75 percent of monsoon rains [4]. Because of this seasonal mechanism of monsoons, agriculture thrives in India and Indian farmers habituated to these rains for growing crops. If the monsoon fails India has been vulnerable to famines, sometimes deadly famines like 1876-78 famine. There has been a cycle of droughts and floods in India. Because there is a naturally built

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climatic cycle over eastern and western Pacific ocean resulting in opposite phenomenon called El Nino and La Nino [5].If we confine to India El Nino leads to failure of south-west monsoon leading to droughts. During La Nino conditions over western Pacific ocean the south-west monsoon in India is very strong leading to heavy rains, floods and all the associated things.

India has been experiencing seasonal drought conditions in some areas. If it is more severe, it leads to famines. To understand the seasonal climatic changes over eastern and western Pacific and the resulting phenomenon of El Nino and La Nino, we should understand concepts like surface sea temperature, surface sea pressure, southern oscillation, trade winds and ITCZ (Inter Tropical Convergence Zone).The surface sea temperatures over eastern and western Pacific leads to different climatic conditions in surrounding areas. If the surface sea temperature in western Pacific is in between 25-26 degrees Celsius and in western Pacific 29-30 degrees Celsius, it leads to El Nino conditions in India; if the temperatures reverse it leads to La Niño [6]. The La Nino condition creates high pressure (1008-1012 Pascal) gradient in western Pacific which leads to heavy rainfall in India. This pressure gradient will be low (1000-1002 Pascal) during El Nino conditions in Eastern Pacific [7].

Another aspect is Southern Oscillation. The lower than average temperatures in western Pacific leads to high pressure gradient in Western Indian Ocean and vice versa [8]. The concept of Southern oscillation confines only to Indian Ocean. The positive southern oscillation leads to heavy rains in India's south-west monsoon belt. Trade winds are also a naturally built climatic mechanism which heavily influences south-west monsoon in India. Trade winds are regularly blowing easterly winds that blow towards the equator from the north-east in the northern hemisphere and the south east in the southern hemisphere [9]. The monsoon winds are eastern winds that turns towards India under particular circumstances. They are very key component in the formation of south-west monsoon in India. During normal conditions the eastern winds are dry and carry very little moisture [10]. There is a link between ITCZ and eastern winds.ITCZ is also a natural phenomenon which influences monsoon mechanism.

The ITCZ is formed near equator which creates low pressure zone. This low pressure near equator in western Indian ocean diverts the eastern winds towards Indian sub-continent where the high pressure zone is formed. Here the pressure is higher than that at ITCZ zone [11]. Therefore the diverted easterly winds, coming towards Indian sub-continent, bring lot of moisture from Indian ocean resulting in heavy precipitation on the land [12]. Thus this naturally built system of climate change because of the above mentioned five factors- SST and SSP in western Pacific ocean, Southern Oscillation in western Pacific ocean and western Indian ocean, the East side blowing trade winds and the ITCZ- and their frequent reversal leads to repeated floods and droughts. From this explanation we can understand that the agriculture in India has been heavily dependent upon monsoon rains. If the monsoon fails it leads to drought conditions, and if these drought conditions continue for prolonged time, from 15 to 20 months, that leads to famines [13]. The second most severe famine of 1876-78 in history is one of such famine.

Famine has been defined as a state of extreme hunger suffered by the population of a region as a result of failure of accustomed food supply. It is like a calamity before 20 th century [14].The deadliest famine of 1876-78 led to death of nearly 60 lakh people in South India. In Telugu regions the seeded districts were heavily effected resulting in great loss of life of people , animals and other species [15].Famines are not new to India. There was mention of famines in literary works from Ancient India. The Arthasastra of Kautilya mentioned about occurrence of famines and the measures to be taken during famines [16].Jahangirnama written by Moghal king Jahangir also mentioned about famines in Medieval India [17].The 1876-78 famine

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was caused by El Nino conditions which led to failure of monsoon. This failure of rains and drought continued from November 1876 to October 1878 [18].Apart from failure of monsoon for two years, the policies of the British administration also is another reason for massive deaths. Even during famine the colonial government exported food grains from north India and Burma. The best example for inhuman attitude of the government is that the British viceroy of India Lord Litton ,while reacting to the criticism about lakhs of deaths ,commented that famine deaths would bring population numbers back into line with food supplies [19]

.Religious superstitions also made the conditions worse during famines. Myths and legends of peasants and tribal societies make frequent reference to drought and famine as the cause of corrupt Kali era. For example, the 1876-78 famine in Deccan was attributed to the angry of Durgadevi who has lot of destructive power. That is why the people easily forget the disaster [20] . Thus, these reasons created the famine of 1876-78.Lakhs of people and cattle died. Describing the tragedy condition of human dead bodies in the Krishna river, the British surveyor general Gordon Mackenzie said that the vultures, foxes and dogs vied among themselves for human flesh, tore apart the dead bodies and fed on the human corpses. There were no people with life but only dead bodies are seen everywhere [21].

The climate change and the famine not only led to the death of lakhs of human beings and cattle but had a great impact on biodiversity. The more than normal sea surface temperatures heavily impact on flora and fauna in the oceans'. Rise in mean average temperature , for example two degrees, affect temperature sensitive species like Plankton, coral reefs and fish and related sensitive species [22].The increase in mean temperature led to more concentration of CO_2 and reduces the quantity of dissolved oxygen. This results in lowering of pH of ocean water. The low pH levels weaken the shells and skeletons of ocean species. For example,planktons,corals mollusks and so on [23].This phenomenon affects the ocean food chain. Fish and other ocean mammals living under a particular temperature migrate to other ideal areas in the ocean causing pressure on the local food which led to clash for food and death of weak species.

Plankton is the foundation of marine food cycle. The ocean food productivity will be decreased due to disruption in upwelling of water and the underwater nutrients. This damages plankton. This affects many species like fish, whales and other marine species. Salinity shifts, fluctuating temperatures, sea level changes affect the habitats like coral reefs, sea grass meadows, and marine forests which are crucial for marine ecosystems [24].

As said above the famines are caused by climate change and rise in mean average temperatures. On land biodiversity this impact is more. Forest ecosystems are damaged due to high temperatures and prolonged drought conditions. Forests are home to diverse ecosystem than land. The over grazing of forests during famines and forest fires lead to massive damage to forest ecosystem. Mammals like cattle and others die because of shortage of food and water. Especially, the pollinators like butterflies, bees and birds will die as the drought reduces the availability of flowers and nectar [25].The existing plants and crops face difficulty to reproduce which affects seed and plant production [26].Thus the already food crisis further will worsen resulting in heavy loss of flora and fauna. Thus the reduction in the pollination agents reduces the seeds, plants and crops resulting in massive decline in animal population. When compare with loss of human life the loss will be manifold in case of plants and animals.

Rising temperatures during famine reduces the fertility and moisture of the soil [27].The human loss was mainly because of this factor during famines. The rise in temperatures cause forest fires because of hot and dry conditions. The forests will be destroyed killing many forest animal and plant species. The recent forest

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fires in Australia and California on the west coast of the U.S.A are best examples .The rich forest ecosystems take many years to recover the loss. Some sensitive plants and animal species will extinct in particular forest ecosystems which are home for few species which are not found anywhere in the world. For example, point arena mountain beaver, California spotted owl which are founded only in north coast of California are not seen anywhere in the world. Such isolated species are not suitable for habitat changes [28].

The invasive species may increase in number in a particular area due to their migration caused by loss of food in their habitats because of famine affected loss of their food web [29].Generally the availability of food and water will be decreased during famines. The invasive species are strong and aggressive and can adapt easily in all types of ecosystems. For example, Africa is home to Tilapia, a protein rich plant, and it was introduced in India during famine driven food shortage to provide an easy source of protein. But it became invasive in lakes,canals,streams and rivers and competed with local fish for food and breeding grounds and thus damaged domestic ecosystems [30].Parthenium plant species came to India through import of food grains from Africa unknowingly and unintentionally during drought situation in India. This plant rapidly spread across crop lands, it is toxic to humans and animals and massively replaced local grasses and crops [31].There are many types of losses to biodiversity during famines caused by high temperatures as we keep on discussing like this.

Thus the natural climate changes and resulting high temperatures have been often resulting in great loss of human life, flora and fauna. The natural climate change cannot be controlled by man and he can reduce loss with the help of development activities, proper public distribution system, and developing technology to cope with the negative consequences which have been arising due to drought conditions. Today the drought warning systems have been developing and they will fore cast the rainfall situation in advance and the governments can take precautionary measures to get the food available. But our efforts can save the people, not the biodiversity.

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