

Defaunation during Great Acceleration Period of Anthropocene Epoch: India

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Abstract: The defaunation of aboriginal species accompanied by the invasion of new is a continuous process on the earth. The growth of numbers of species depends upon climate change, the growth of invasive alien species, loss of habitat and paucity in food availability. But in the human forcing in Anthropocene Epoch became a major adjoining parameter to the process. The IUCN had studied 91523 items and found 25821 numbers had been threatened species by major groups of organisms. Trade, transport, globalization and trouble are added to the prime drivers of dealing invasive species are the trails in the Anthropocene Epoch. Not all species became extinct at once or due to the same combination of causes. The percentage of increase of species is of vertebrates, non-vertebrates and plants, are 152.69%, 158.75% and 134.7% respectively. The overall percentage of defaunation is 155.7% within the years 1997 to 2017 which is alarming. The total numbers of fauna loss were 67 numbers between the years 1945 to 1979 whereas it was 219 between the great acceleration periods of Anthropocene epoch i.e. from 1980 to 2017. Bi-decadal trend in red listed endangered population, vertebrates, invertebrates and plants of India shows an increasing trend.

Key words: Anthropocene • Defaunation • Extinction • Endangered • Invasive species

INTRODUCTION

In childhood, during our life in villages, our watch was the jackals, those used to howl dividing the night into four parts (Prahars). The sound of the Cuckoos tells about the approach of the spring. We had ponds for daily uses but not for pisci culture but the paddy field was supplying fishes for three to four months a year and rest period we are catching fishes from swamps. Similarly, the red beautiful Kaincha (Gunja, *Abrus precatorius*) is not found in the fence (Fig. 1).

Anthropocene Working Group (AWG) has claimed present epoch as Anthropocene, basing upon the earth's biotic, geo-chronologic and chrono-stratigraphic configuration [1]. The entry of the Anthropocene epoch and exit of Holocene epoch was counted from the year of first atomic explosion [2]. The last glaciation on the earth lasted till 11700 YBP as glaciation increases the risk of vulnerability. The Homosapiens are in the stage of great acceleration of the Anthropocene Epoch. Extinction, entry of native/alien and invasive species are continuous processes on the earth. Some new/alien species develop



Fig. 1: (a) Gunja, *Abrus precatorius*, (b) Velvet mite (*Trombidium grandissimum*), (c) Vulture (*Gyps indicus*), the beautiful extinct species in India.

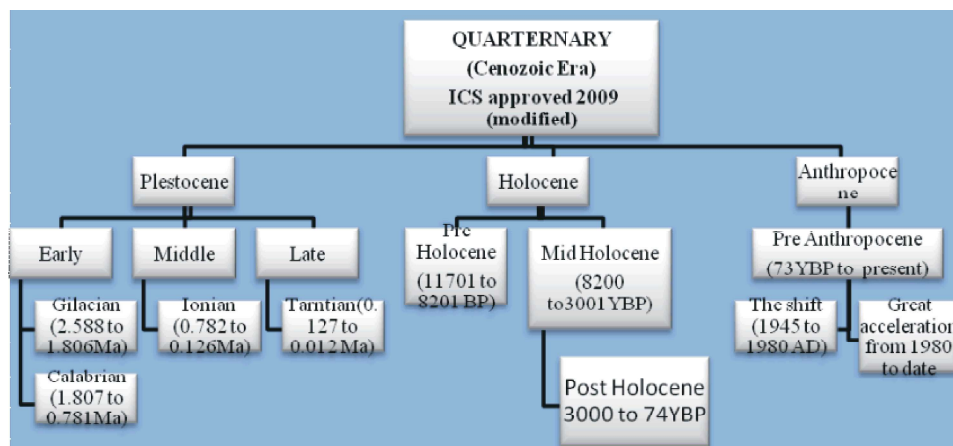


Fig. 2: The geological time scale quaternary of Cenozoic era approved by ICS -2009.

toxicity, become invasive and some native plants undergo in existent, which is how biological balance is maintained. In each epoch the process of extinction and evolution is as usual. Major mass extinction events are the spatial annihilation of a large number of known species living inland or ocean depending upon the gravity of the causes. In some periods it is studied that the mass extinction had gone beyond 75% of species such type of extermination had occurred five times on this earth. The geological division of quaternary period of Cenozoic Era as approved by International Commission on Stratigraphy (ICS) in 2009 is given (Fig. 2).

Mass extinction is an intricate and long-term continuous process. To locate the venue, the date and the causes of exterminations is always assorted and misleading. At times catastrophic events cause the strata to become extinct if the endangered species are congregated in a small area like islands or any specific hardcore area. The events like climate anomalies, meteorological extremes, asteroid strikes, volcanic eruptions, tsunamis and anthropogenic activities trigger the process. [3] had predicted that if the current rate of extinction continues, then 75% of vertebrates (mammals) shall disappear in coming 3 centuries. Present the mammals who are extinction in the wild, endangered and threatened shall cover the present extinction list. In about 300 years from the present, 75% of all mammal species will disappear from this planet. Barnosky further reported that if the current rates of extinction continue and the animals already threatened or endangered shall wipe out from the earth in this century.

The earth has an area of 510 million square kilometers out of which 70.8% water and rest are land. The population of the earth as at present is increasing and has

touched 7 billion. Out of 7 continental land masses, Asia is the largest in population. Average marine depth in the globe is 3729 m whereas the average continental elevation is 840 m. Similarly, the deepest deep-sea trench (the Mariana Trench) is 11022 m and the highest inland mountain is Mt. Everest at 8850m. The demography of India is the 2nd largest constituting 17.74% of the earth's demography housing in an area of 2973190 km² with an average population density of 455 km².

Review of Literature: [4] reported about five great mass exterminations in the oceanic domain such as the Ordovician, Devonian, Permian, Triassic, Cretaceous and Pleistocene (Holocene). The Anthropocene is the recent geological time unit which controlled the stratigraphy, biology, hydrology and iso-chronology by the Homosapiens, [5, 6] have written that invasions of all species aggravate environmental degradation under climate change. The significance of invasive theory during contemporary evolution is less studied, particularly for plants [7-9] reported about explosion human forcing on nature has a negative impact on present biodiversity. [10] mentioned about 5th mass extinction in K-Pg, 66 Mya followed by a rapid winter. [11] proved many illustrations of demographic peak/decline during the Holocene epoch (rise during ≈4000–3500 BCE, fall towards end of Neolithic era, rise during Bronze Age ≈2000 BCE declined at fag end of the era ≈1000–800BCE, peak at the end of Iron Age ≈250 BCE and finally in medieval period ≈1250 CE being triggered by climatic vagaries, insolation activities, food yield strategies and abrupt changes in socio-political responses. [12], reported that Von Humboldt, the father of Environmental Science, was the first to correlate between climate, ecology and

theory of evolution by telling the existence of richness of species gradient from tropics to the pole. Energy is violent (4 times) in the tropics and tranquil at the poles being the cause of latitudinal diversity patterns [13]. Two to three alien species/ year found in Port Phillip Bay, Australia and one species/ 63 day in San Francisco Bay, California, USA WWF International, (2009). About 99% of species kingdom, (five billion species extinct and present today about 10 to 14 million), that ever lived on Earth, [14-18]. The book “Essentials of conservation biology”, [19] reported that the past and the present extinction rate of species is one species/year. Centre for Agriculture and Biosciences International (CABI) have enumerated 2000 species and reported that it includes 35% plants (aquatic and terrestrial), 30% environmental pests (terrestrial), 15% aquatic animals, 15% animal pathogens and 5% vertebrates. The principal causes are habitat loss, degradation and fragmentation, nonnative Invasion of species, climate change, pollution and evil quartet with a prediction of 25% species lost by 2200AD. CABI, <https://www.cabi.org/news-and-media/2014/workshop-held-on-future-of-invasive-species-compendium/>

Invasion Invites Extinction: [20] reported that during late Devonian there were shallow basins of about 10 million to 14 million interbasinal and shallow oceanic species were in the invasion in Laurentia, North America. They affected biodiversity by the expansion of natural generalists and eliminating the geographical separation of a population (Vicariance), the main path for new species formation. [21] had reported plants inclusive (trees, herbs, shrubs and climbers) of 89 invasive alien species (IAS) in Western Ghats areas, Kerala via export of Bamboo and food grains from Trinidad, Brazil, Costa Rica, Mexico and Chile and throwing 19 plants to high risk of vulnerability. Convention of biological diversity has reported that the IAS has the characteristics of fast reproduction and growth, high scattering ability, phenotypic flexibility to a new environment and capable of surviving under local food varieties and in sporadic environmental settings. <https://www.cbd.int/invasive/WhatareIAS.shtm>. [22] reported that the invasive non-native species causes 5% total loss to the yield of India CBD 2006. Globally, INNS have contributed to 40% of the animal extinctions that have occurred in the last 400 years as per CBD, (2006). Rodents (mice) are the prominent invasive species in almost all islands of the globe covering 80% of its population. [23] have reported that even 20-30% of all non-native invasive species in the globe cause problems in biological diversity. The globe has 232 marine hotspots

or eco-regions whereas 84% of the species are invasive alien species [24]. About 10 non-native alien species per year are found in Europe and the numbers are rising for invertebrates [25, 26] reported that the biodiversity decrease as we move from the equator to pole termed as latitudinal biodiversity gradient (LBG) with deviation. The scenario persisted from the Phanerozoic-Palaeozoic era for the past 30 million years. A recent study has reported the occurrence of 1,599 alien plant species belonging to 841 genera in 161 families in India and the alien flora thus represents 8.5% of the total Indian vascular flora. India has 1,599 species of alien plants of 841 genera and 161 families [13]. About 111 Forest Invasive Species (FIS) have been identified but no systematic investigations have been conducted in India so far apfism.net/sites/default/files/India.pdf. The lag phase of species and its invasion is about 50 years or less but still shorter in case of the species in the tropics than the temperate region [27]. The vigorous growth of *Fallopia japonica* (Japanese Knotweed) @ up to a meter/month and used to grow in concrete, drains and pavements causing damage and huge expenditure annually to remove CABI, (2014) <https://www.cabi.org/isc/about>.

Reasons for Study: Homosapiens, the most prominent agents to leave their topographic imprints on the crustal floor altering landscape by urbanization, industrialization, agriculture, waste disposal and mining by not leaving any corner of geo, hydro, bio and atmosphere. The change was initiated in Holocene epoch and accelerated in Anthropocene Epoch. The present cataclysmic disappearance of many species like a golden frog from Africa, migration/ extinct of some rainforest species like rhinos, elephants, royal Bengal tigers in east India are the examples. Meteorological extremes and tectonic havocs tagged with anthropogenic advancements have imprints of the signs of the sixth extinction from the post-Holocene period. A single example was Tsunami 26th Dec. 2004 which exterminated 250000 Homosapiens hammering 5 million people only. The related biodiversity loss is yet to be calculated. As per IUCN report 2006, 66.67% of earth's rivers ranks as degraded worldwide, ecosystem services are sick by 15 to 24% on the globe and 14 of 17% aqua resources are in debility. Almost all the deltas are sinking shrinking, polluted and under subsidence as result of dams and hydraulic structures [28]. As a result, biodiversity is seriously affected.

Table 1: The sample sizes of species taken by IUCN of all the taxas on the earth.

	Sample size as per IUCN-2017	Invertebrate Animals	Sample size IUCN-2017	Plants	Sample size IUCN-2017
Vertebrate Animal					
Mammals	5490	Insects	1000000	Flowering plants	281821
Birds	9998	Spiders/ scorpions	102248	Conifers	1021
Reptiles	9084	Mollusks	85000	Ferns/ horsetails	12000
Amphibians	6433	Crustaceans	47000	Mosses	16236
Fishes	31300	Corals	2175	Red/ green algae	10134
		Others	68827	Others(mushroom,	51563
Total	62305	Total	1305250	Total	732775

Table 2: The numbers of Threatened Species on earth in last 2 decades (1997-2017) IUCN Red List 2017

Name of genera Known	No of species Known	No species are taken by IUCN	1997	2002	2007	2012	2017	% of increase
Vertebrates	68574	46092	3314	3251	5742	7108	8374	152.69
Non-vertebrates	1305250	21130	1891	1932	2109	3507	4893	158.75
Plants	310442	24230	5328	5714	5448	9390	12505	134.7
Fungus/ Protists	52280	71	-	-	09	09	12	
Total	1736546	91523	10533	11167	16308	20219	25821	145.14

The studies of cataloging species were started by IUCN from 1963 (the first red data book). However, the updated data was presented at the Rio+20 conferences in June'12. The numbers of species recorded in 2012 were 63,837 and reported 12.5% were under the process of extinction. But the list included threatened species (31%), amphibians (41%), reef-building corals (33%), mammals (25%), birds (13%) and conifers (30%). The sample size of the species taken by IUCN on earth during 2017 is given in Table 1.

There are 1736546 species exists on earth out of which the IUCN include 91523 numbers. Out of 91523, the categorization is done as Critically Endangered, 81 as Extinct, 63 as Extinct in the Wild. In the lower risk categories, there were 5766 species in Endangered, 10,104 in Vulnerable and 4,467 in Near Threatened categories. Scientific data regarding 10,497 species were not available and hence classified as data deficient, the report said. The data deficient species are numerous constituting mostly marine species and microorganisms. The IUCN has shocked the world with the news about world's biodiversity in 2004 (threatened species 15589 a figure sobering), that the rate of extinction had become 100-1,000 times that suggested by the fossil records before humans. The sampling enumeration of species for the period 1997 to 2017 is given in Table 2.

There is a percentage of increase of species of vertebrates, non-vertebrates and plants, are 152.69%, 158.75% and 134.7% respectively. The overall percentage of defaunation is 155.7% within the years 1997 to 2017 which is alarming.

MATERIALS AND METHODS

The IUCN Red List is intended to regulate the relative risk of extinction. The IUCN Red List prepares the catalog and highlights those species (plants and animals) that have a higher risk of extermination (Extinct, Extinct in the wild, Critically Endangered, Endangered and Vulnerable and data deficient taxes on plants and animals that are either close to meeting the threatened or nearly threatened) (Fig. 3). Zoological Survey of India (ZSI), one of the custodians of statistics of animals have reported that animals new discovered 313 species and entered the record 81 species in the year 2016 from India whereas it was 176 in 2015 including 93 invertebrates. The 2015 ZSI list contains fishes 23 species, amphibian 24 species (frogs, toads, etc), reptiles 2 species, of Arachnida (spiders) 12 species and crustacean 12 species (crabs, lobsters, shrimps, etc). <https://economictimes.indiatimes.com/ magazines/panache/176-new-species-of-animals-discovered-in-india/ article show/4753731>

The data received from Departmental sources, web nets, ZSI, WWF and IUCN red list have been collected and a time series had been framed. Using the Excel a trend line graph is plotted. The curve line fitting and regression statistical modeling are done to find the best fitting equations. The graphs tested are linear, exponential, logarithmic and power functions. The R^2 -values, the coefficient of determination are calculated by using Excel where this statistical measure exhibits how close the time

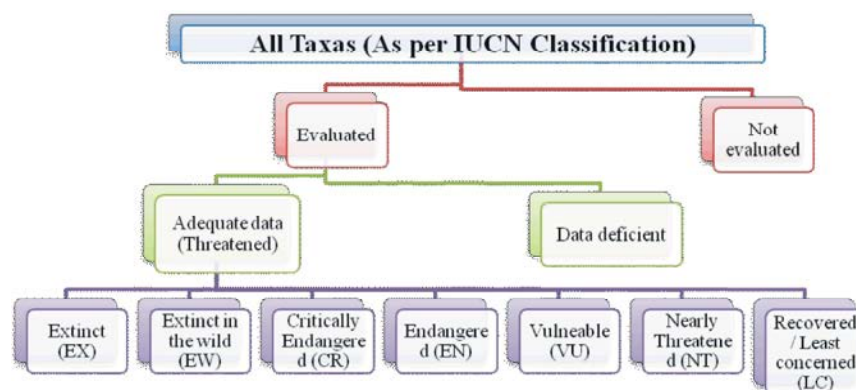


Fig. 3: The taxonomic classification of different threatened species of the earth (IUCN list-2017).

Table 3: Earth's major sixth mass extinction events due to biological annihilations in past (Raup et al. 2014).

Name of extinction	Event period (MYBP)	% of all families/ genera/species lost	Probable causes	Extinct/ Endangered Species	Prob. Invasive species/ major survivals	Resources
Quaternary -Pleistocene	14000 to 73YBP	To be assessed	Climatic change, Short but severe cold spell inPaleolithic Ice Age, Bolling-Allerodinterstadial Baltic Ice Lake de-glaciation in younger Dryas	Climate change & Hyper diseases	Slow summer monsoon intensified initially but slowed down gradually.Homosapiens	www.theguardian.com/environment/2017/jul/10/earths-sixth-mass-extinction-event-already-underway-scientists-warn
Holocene-Anthropocene	73YBP (1945to2017)	To be assessed	About half of sample size 177 mammals lost (> 80%) of spread	Human forcing, Climate change, Global warming and earthquake activities, GHG riseetc.	The 48 mammal species have become EX/EW in Tables 4-7	

series data are to the fitted regression line. It is also known as the coefficient of determination and the value lies between 0-100 percent. It is the response percentage of the mutable variation of a linear model and lower values (<50%) then the prediction of human physical processes are unpredictable whereas a high R²-values indicate the regression model has a very nice goodness of fit.

The literature reveals to maintain the sustainability the rate of birth and death of species should be equal. Considering the anthropogenic pressure, there shall be a correlation with the rate of demographic growth and the rate of defaunation of vertebrates, invertebrates and plants. The rate of increase has been correlated with the rate of decrease of species and the best-fit trend equation is given.

The Prehistoric five Extinctions: For the last 4.6 billion years of the globe, from the date of inception, a mass extinction occurred when the earth moved farthest away from the center of the sun and provokes great ice ages on the earth. Statistically, paleontologists have estimated 5 great mass extinctions in the marine strata and inland (Table 1), Cretaceous-Tertiary (or K-T) extinction event was the most devastator as Dinosaurs became extinct and about 95% species were wiped out.

The Sixth Extinction: The calculation of defaunation activities results in there is 100-1000 times above normal loss of species. This 6th extinction is a combined upshot of anthropogenic, climatic, hydrologic and geomorphic catastrophes claimed by [32]. The defaunation process The Anthropocene extinction is due to overhunting, poaching, pollution, habitat loss and climatic changes. The American Museum of Natural History, 1998, in their topic "Biodiversity in the Next Millennium," by Louis Harris and Associates, Inc., has reported that the Sixth Extinction is in process. Ellen V. Futter, the president of the museum has declared there shall be 50% species extinction by 2028 and some recovery can be achieved by reducing the natural and human-induced disasters, non-polluted air and water, increasing herbal medicines/cosmetics by preserving nature. [33] have told the earth is in the precipice of the earth's sixth mass extinction (Initiated from 1500AD) and the current extinction is @200 times that of past i.e. 2 E/MSY (extinctions of 2 mammals/ 10,000 species/ 100 years. The biological annihilation process is highest in Asia followed by Australia and Africa. The EX/EW in Holocene Anthropocene epoch is given in Table 3.

The extinction in Holocene-Anthropocene epoch had started within the defaunation process since long. The prominence of the surge was well felt in an early 20th

Table 8: Number of species in Extinct and extinct in the wild (probably extinct) of reptiles in the earth the spatial process of defaunation (IUCN Red List-2017).

SINo	Name of the group	Total Years assessment	Numbers of species Post Holocene (till the year 1944)	Numbers of species Pre Anthropocene (the Year 1945-1979)	Post Anthropocene (Great acceleration) (1980 to 2017)
1	Mammals	1890-2017	15	14	28
2	Birds	1850-2017	8	3	13
3	Reptiles	1830-2017	19	13	9
4	Fish	1850-2017	6	12	82
5	Amphibians	1840-2017	6	25	97
6	Total		54	67	229

century. The humans started enumerating the extinct species in everywhere inland, ocean, mountains and glaciers. The main organization's they help in keeping statistics of extinct/endangered/vulnerable species number and their development are IRF (The International Rhino Fund), IUCN (International Union for the conservation of nature), The WWF (The world wildlife fund), International Fund for Animal Welfare (IFAW) and many others, ZSI (The Zoological Survey of India).

From analysis of the data it is observed that the extinction of mammals is in full swing during the Holocene-Anthropocene epoch. The extinction of mammals is more in the post Holocene period (year 1890 to 1944) was found to be 15 numbers, pre Anthropocene epoch i.e. 1945 to 1980 it was 14 in numbers and in the great acceleration period of the Anthropocene epoch was 28 in numbers and the process is continuing.

The Avifauna: Since 1500, over 190 species of birds have become extinct. Currently, there are approximately 10,000 species of birds, with an estimated 1,200 considered to be under threat of extinction [https:// en.wikipedia.org/wiki/List_of_recently_extinct_bird_species](https://en.wikipedia.org/wiki/List_of_recently_extinct_bird_species). IUCN has enumerated 11122 birds and found 1107 number 1996-98 to 1469 in the year 2017 of birds are threatened.

It is observed that in the post-Holocene period from the 95 years data there only 8 birds EX/EW, it may be due to the prevalence of cold/normal years with less anthropogenic intervention on nature. It is interesting to observe that 13 birds were extinct and EW from 1980 to 2017 till from the date of great acceleration.

The Reptiles: The IUCN had assessed in 2017 that out of 10450 reptiles, the 6278 numbers were assessed. There were 253 numbers only were evaluated as threatened species in 1996-98. It was increased to 1215 in the year 2017. This high rise of increased in the threatened species was due to habitat loss, invasive fishes, water pollution, environmental contamination (pesticides, fertilizers and predators) and the outbreak of new

pathogens. On analysis, it was found that the sixth extinction process had started from the post-Holocene period but it has increased multifold during the period of great acceleration of Anthropocene epoch i.e. from the year 1980 to 2017. Though data is scanty in comparison to the total available species it is clear that we are running in the process of the great sixth defaunation. The total numbers of fauna loss was 67 numbers between the years 1945 to 1979 whereas it was 229 between the great acceleration periods of Anthropocene epoch (1980 to 2017) (Table 4).

Drivers in Sixth Mass Extinction: Changing climate is the result of combined effect of geodynamic processes, cosmic radiation, the oceanic bio-chemical composition and nature, mean sea level, plate tectonics (Tsunamis), volcanic activity and meteorites slamming and meteorological extremes and sun-earth geometry. The drivers may be Climate, Habitat loss, Invasive species, over-exploitation, Pollution, Eutrophication using fertilizers and pesticides, Greenhouse gases, solar irradiation (Global warming), Mean Sea Level Fluctuations. In addition, the catalysts are carbon cycle, Herbivory (overgrazing), litter decomposition and soil respiration, seed dispersal, water pollution, waste disposal, Pollination/ regeneration, trampling, soil/ light/ noise pollution, mass diseases and many others. The Earth's 40% land mass is used for agriculture. The anthropogenic uses have decimated the tropical forest on the earth, including 20% of the Amazon rainforest. [https://theness.com /neurological/index. php/the-sixth-extinction/](https://theness.com/neurological/index.php/the-sixth-extinction/). Not all species became extinct at the same time or due to the same combination of causes.

Invasive Species: World resources institute (WRI) has expressed their concern in 1980 about the drastic biodiversity of non-native invasive alien insect's species. There exist about 1.4 and 1.8 million species in the globe. The rate of extinction of species is 0.01 to 0.1% of all species/year [http:// wwf.panda.org/ about_our_earth/](http://wwf.panda.org/about_our_earth/)

biodiversity/biodiversity. CABI reported in 2017 that Invasive species deplete global economy about US\$1.4 trillion/year and have adverse effects on the livings of vulnerable communities which increase the food insecurity and deflate-pipeline development particularly rural livelihood in Africa and Asia.

Scientists have identified 212 non-native plants in the Masai-Mara National Reserve, Kenya in 2017. Grass and prey are essential food for the mammals. Food unavailability, habitat loss and forced by the predators, some species are forced to be displaced from their native place which is the Great Migration causing biodiversity crisis. The bio-system have a negative impact due to invasive allied species (IAS) are predation, competition and herbivory; habitat change, crossbreeding (Hybridization), impacts on the health of native species, Toxicity, Vectors for parasites and pathogens. They affect nutrient flow and local food web. The most concerned is the HIS (Harmful invasive species). The annual fiscal damage made by IAS (invasive or noninvasive) throughout the globe is \$1.4 trillion/year. Among alien invasive marine species are genus Ascidia (31 numbers of species), Arthropods (26), Annelids (16), Cnidarian (11), Bryozoans (6), Mollusks' (5), Ctenophores (3) and Entoprocta [https:// www.usatoday.com/story/news/nation-now/2015/06/26/wildlife-statistics-extinction/29245459/](https://www.usatoday.com/story/news/nation-now/2015/06/26/wildlife-statistics-extinction/29245459/).

The ZSI has reported about 157 invasive species (58 inland/ freshwater, + 99 marines) in India in 2017. Among 58 invasive inland species, the major vertebrates are fish (19 numbers), arthropods (31 numbers), mollusks (3), birds (1), reptile and mammals (2 each). Those invasive species are Papaya Mealy Bug (*Paracoccus marginatus*) of Central America has destroyed, it is believed to have destroyed huge crops of papaya in Assam, West Bengal and Tamil Nadu. Cotton Mealy Bug (*Phenacoccus Solenopsis*): Native to North America, it has severely affected cotton crops in Deccan. Amazon sailfin catfish (*Pterygoplichthys pardalis*) is responsible for destroying the fish population in the wetlands of Kolkata. <https://www.indiatoday.in/education-today/gk-current-affairs/story/zsi-alien-invasive-species-list-india-1108621-2017-12-19>

Forest Invasive species (FIS) may not be threatening, but have shattering effects on wildlife of that forest. The 111 FIS species of different categories have been identified as flora, insects and fungi. No systematic studies have been conducted to inventories them [http:// apfism.net/ sites/default/files/India.pdf](http://apfism.net/sites/default/files/India.pdf).

Animal-Human Conflicts: The people animal conflict have succumbed 426 and 446 deaths of human by elephants only in the year 2014-15 and 2015-16 indicating @ one people/day in India. The animals and human are fighting for their existence. The number of humans killed annually by different species, mosquitoes (725000), between human-human (475000), snakebite (50000) and rabies (25000) on this earth every year which is eye-catching.

Global Warming and Extinction of Species: The last Global warming started from about 14,000 YBP interrupted during 10000 to 8500 YBP. The warming was restarted by 8500 BC (the younger-dryas event). It was significant as there was a rapid climatic change which incurred a lot of species loss. All species are comfortable with slow and steady climatic changes in the biome. Swift changes in macroclimate shall summons their destruction. Glacier retreat resulting from global warming shall increase the status of endemic species pollinators [http://dinopedia \(wikia.com/wiki/Conodont\)](http://dinopedia.wikia.com/wiki/Conodont).

It is observed the marine species, animals of different taxa's in islands and along the coastal corridor are the worst affected by changes in MSL. IPCC has predicted that there shall be a rise in average temperature of 40C by the year 2100. The temperature rise shall melt ice at poles, glaciers and at higher latitudes.

The Extinction in the 21st Century: From the above graphs for the different category from human to plants, the trend exhibits, the critically endangered species rate is increasing in the 21st century. The coefficient of determinations of the time series data is found between 0.67 for mammals to 0.999 for the human population. The pertinent regression equations are the power functions having highest R² value and considered to be the best fit.

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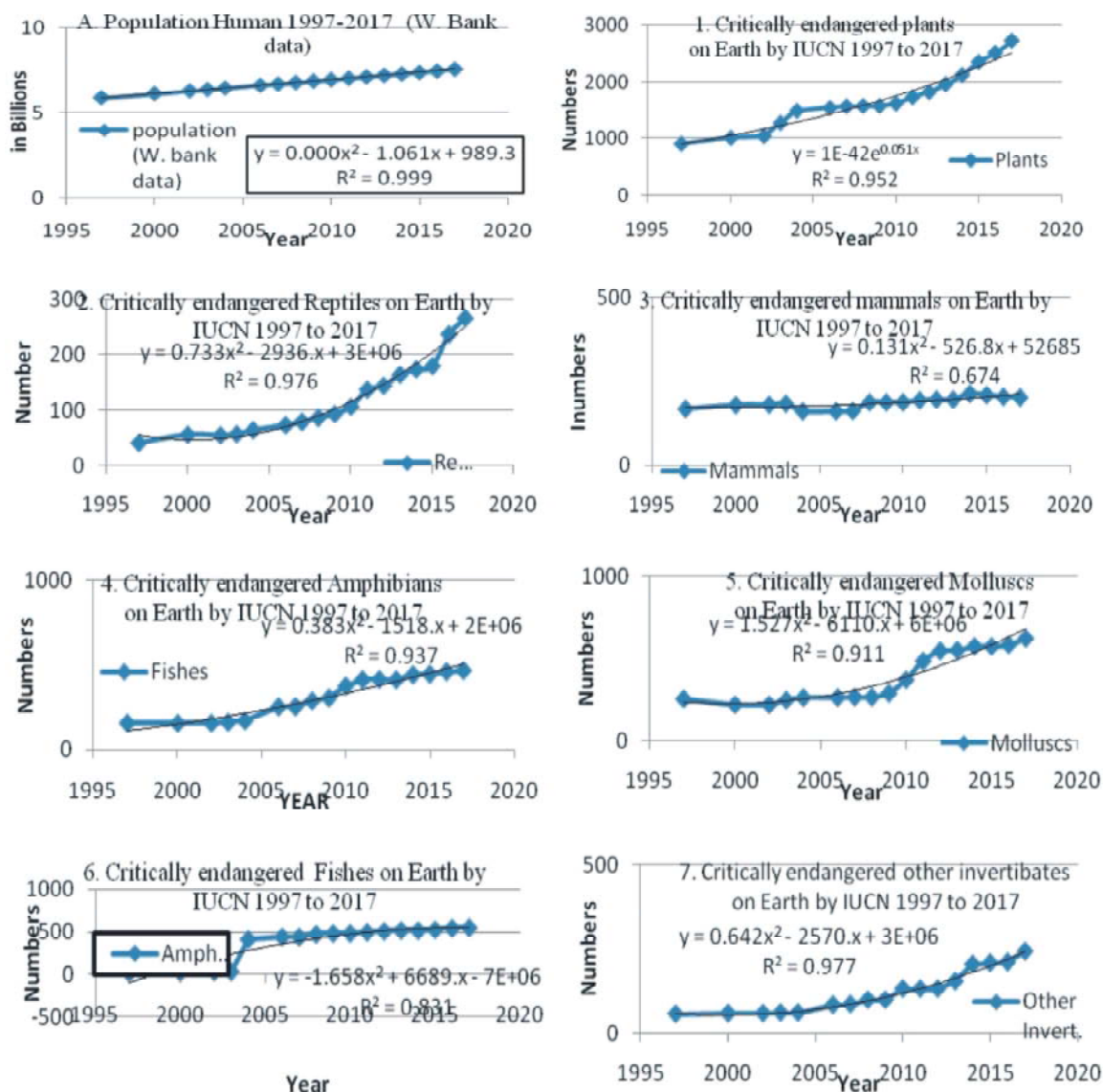


Fig. 3: The trend of critically endangered vertebrates on earth demographic, mammals, reptiles, amphibians, invertebrates, plants and mollusks.

(wikia.com/wiki/Conodont). It is observed the marine species, animals of different taxa's in islands and along the coastal corridor are the worst affected by changes in MSL. IPCC has predicted that there shall be a rise in average temperature of 40°C by the year 2100 (Fig. 4). The temperature rise shall melt ice at poles, glaciers and at higher latitudes. The process of defaunation caused by tectonic uplift, extreme meteorological events, increased GHG, ocean acidification and coastal erosion shall increase in future increasing defaunation and coral bleaching leading biodiversity depletion. Apart from the above cause's habitat destruction by damming,

industrialization, urbanization, over pollution can be the cause of biodiversity drop.

The major modern human activities result in habitat loss, climate change, Green House Gases (mainly CO₂, CH₄ and N₂O, displacement of endemic species by invasive/aliens species (predation, rivalry, habitat intrusion and contamination. Both sea, surface (70%) and groundwater is critically polluted. The other major issue with defaunation is over-exploitation of resources both oceanic and inland (hunting, Poaching, fishing and piling) in the 21st century as reported by World Wide Fund for Nature (WWF).

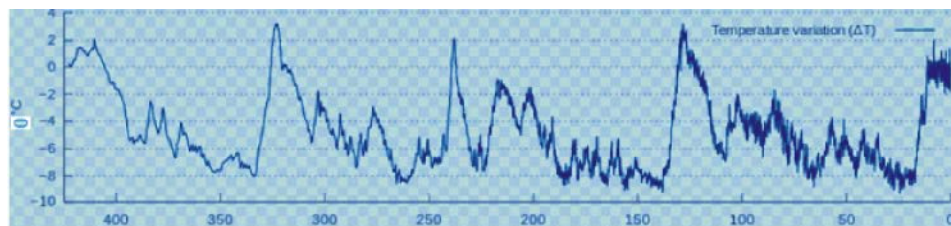


Fig. 4: Temperature, the major meteorological factor responsible for defaunation of species (Source: Google)

Recovered Category: After organizational framework for the protection of the extinct/vulnerable/endangered species and people's awareness, some endangered species have recovered from extinction to free-ranging by successful reintroduction. For example, Przewalski's horse (Takhi) in Mongolia which was extinct in 1960's is in the class of free-ranging in 2017 declared. Gallotiauaritae, (La Palma Giant Lizard) was declared extinct in 2006 by IUCN and further reported endangered in 2008 list.

India's Mega-diversity: India is 3214 km from north to south and 2933 km from east to west. It has a land border of 15,106.7 km and coastline of 7516.5 km. The land area of India is 3287263 km² and the 7th largest country which is 2.4% of the world's area. It's strategic isolation by the Himalayas from north, peninsular landmass surrounded by the Arabian Sea on the west to the Bay of Bengal on the east and Ceylon in the south. From 328.7Mha land use is \approx 3.05Mha (93%). About 264 Mha of land is available for agriculture, forestry and allied uses. As per Conservation International (2006) had demarcated 34 global 'Biodiversity Hotspots' on the earth. Indian Territory has Himalaya, Western Ghats, Indo-Burma and Sundaland were declared as biodiversity hotspots.

The megadiversity country includes 45000 plants (17000 flowering plants) and 91000 other species which is 7-8% of world's recorded species. In 2017 the defaunation statistics there were extinct (801), extinct in the wild (64), critically endangered (3879), endangered (5689), vulnerable 10002, nearly threatened 4389 and the animals who are out of risk and least concerned are 27124 <https://www.statisticbrain.com/endangered-species-statistics/jan-2018>. Lizards are endemic to India. The Western Ghats is the site of maximum endemism. It is the center of origin. The endemic list includes 5,000 species of flowering plants, 166 species of cropping plants and 320 species of wild relatives of cultivated crops have their origin in India. Regards marine diversity of India, it has 7500 km long coastline having (mangroves, estuaries, coral reefs, black waters) rich biodiversity. More than 340 species of corals are found in India. The biome is rich in Mollusks, crustaceans, polychaetes, corals in 93

major wetlands and in large forest cover (Roy et al. 1999). They identified in highly fragmented forests of India, nourishing of a large number of endemic species are needed. India is losing its biodiversity and wildlife treasure at a recorded pace. The contamination by the effluents of industrial and municipal water and use of fertilizers have caused desertification of about 25% and degraded by 33%. Globalization and our consumption pattern shaping the world towards land, water and forest degradation reported by Mr. Ravi Singh, CEO (WWF India).

Triggering Mass Extinction: Human has stripped out the frustum of the earth either by balding the vegetation, mining or adding man mediated minerals. Vicious use of man arbitrated plastic (335MMT in 2016), concrete (4100MMT in 2017) and alumina (\approx 87MMT) and use of nuclear explosions and fossil fuel for energy generation have invited change in climate and biological deterioration <<https://www.statista.com/statistics>> Since last 1990, The Wild animals, species have been struggling to find habitation and squeezed in 25% land mass which was in 50% area in 1980's. The loss habitat has made the species to become vulnerable and extinction. The possibility that alters/ aggravates the extinction process of species loss is climate change, global warming, habitat loss, bycatch, unsustainable trade, native or alien invasive species, pollutions due to, GHG gasses, water, air, light and human-animal conflict (Fig. 5).

India has 988 endangered species in 2015, 973 in 2014 as per IUCN 'Red List'. India has added 15 more species to the "Red List" of threatened species [973 in 2014].

The bi-decadal trend in red listed endangered population, vertebrates, invertebrates and plants of India (Data source: IUCN and for population) follow power function having R²- values above 0.95 which indicate the time series distribution is very good. If this trend continues the panic in loss of red-listed endangered population of vertebrates, invertebrates, plants inclusive human population shall become either extinct during the 21st century.

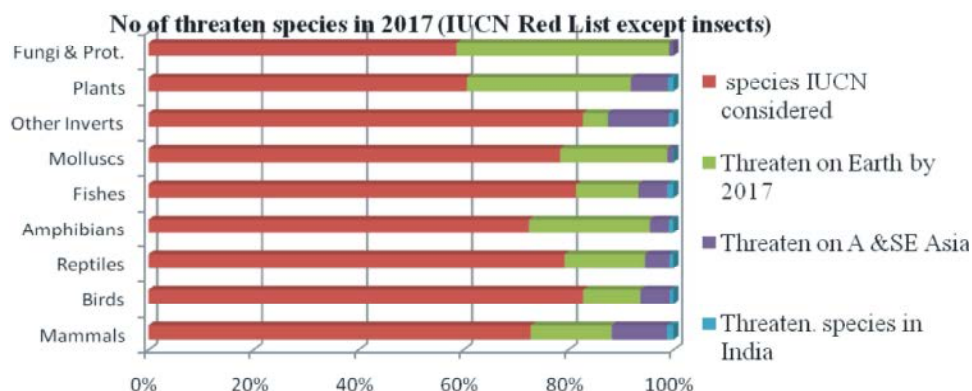


Fig. 5: The numbers of threatened species on earth compared with the list considered by 2017, for Asia, SE Asia and India.

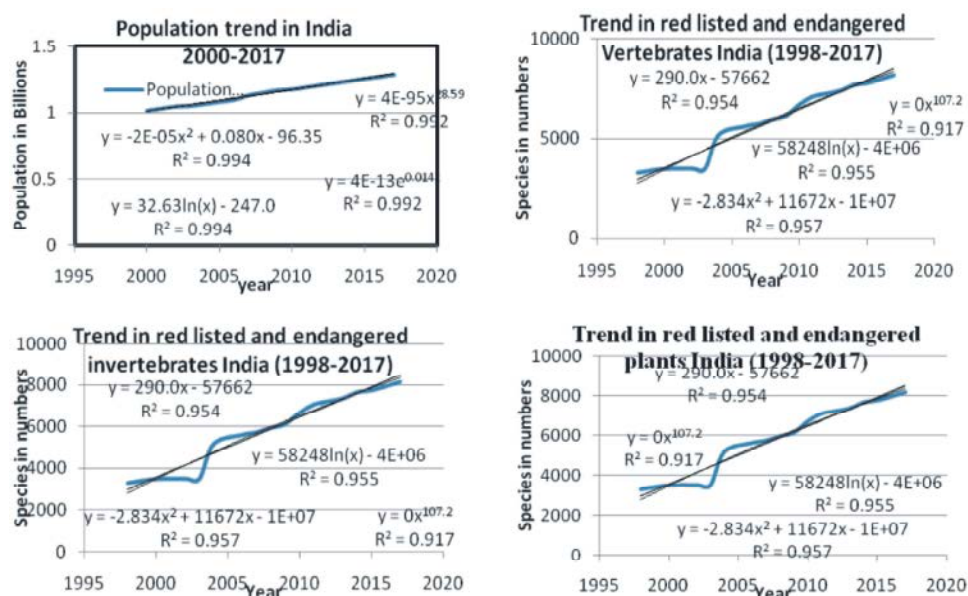


Fig 6: Bi-decadal trend in red listed endangered population, vertebrates, invertebrates and plants of India (Data source: IUCN and for population <https://www.indexmundi.com/g/g.aspx?c=in&v=21>)

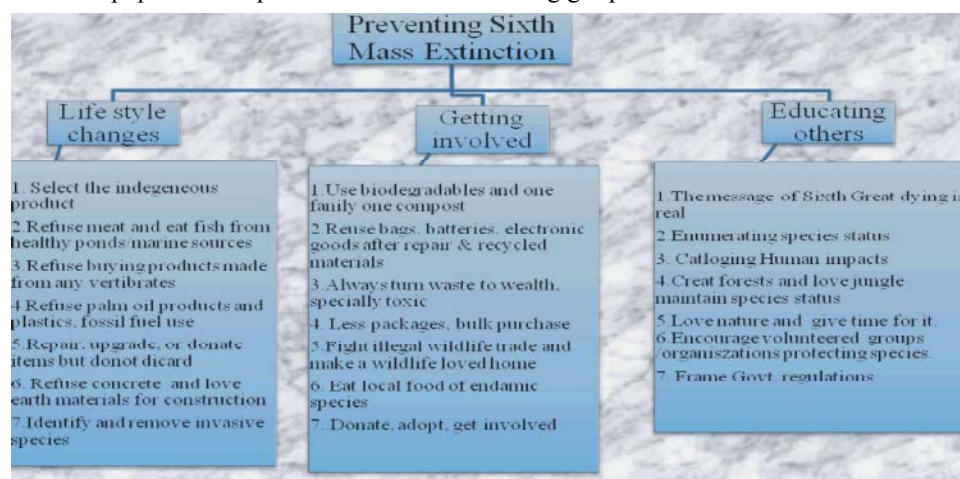


Fig. 7: Some steps to ameliorate six mass extinction of the earth and attempt to slow down the process.

What Homosapiens can do for their Nature's Survival?

Preparing for the preservation of the species and their sustenance is a herculean task at present. To prevent mass extinction the four actions are very important i.e. refuse, reuse and recirculate. Major options are refuge buying plastic commodities, disposables and only but not those items which are toxic to humans and other species. In name of religion preach the sermon that sixth mass extinction is real and a great dying and shall bring a dooms day for all the Homosapiens and other species. To save the extinction we must have to protect the Earth's land and oceans. Nature and its belongings are not always renewable. It should be given importance so that the consumed materials should return back to it to maintain sustainability. Our views towards conservation of flora and fauna should always be conserved. Pleistocene Parks (as in Siberia) has are to be built up to successfully protect our endangered, vulnerable and extinct in the wild species. The astounding question today is can we prevent the sixth mass extinction is a billion dollar question? However, we should try to delay the process to save our ancestors.

CONCLUSION

The current study presents the understanding and targeted mitigation of the human processes driving geo-chemo-biologic changes with a critical review. During the development of the epoch, the alterations help to guide for future research directions to alarm the human progress in the field of geochronology, mineralogy, stratigraphy and biota leading to human cataclysm. It has been attempted to find the type of growth/decay curve of the taxa/ genera of the Ex/EW/ VU/ EN species and it is found all the curves are showing an increasing trend of the defaunation. Invader species should not be allowed. Endemic species are to be protected. Planting native species instead of foreign one, boats and vessels needs to be cleaned before rowing in a foreign water body, never cross breed between different classes, clean clothes, boots before entering the different ecosystem, clear off invasive species in your area and before introducing any new seeds get it thoroughly checked native or invasive. An attempt has been made to find out a solution to be taken by humans to ameliorate/delay the process of the apocalyptic Anthropocene epoch (period of great acceleration) and its management in the earth and so also the globe.

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