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FEATURE ARTICLE

Is man Developing or Destroying the Planet Earth?

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Natural Resources, an invaluable gift from Mother Nature

Mother Nature bestowed upon us a Blue Green Earth in which all living things could live comfortably in harmony with one another. Viewed from outer space Astronauts saw it as a shining blue globe and aptly named it the "Blue Planet". An Earth surrounded by clear blue skies, having vast blue oceans, clean lakes and reservoirs of different hues of blue, together with beautiful waterfalls flowing down as clear blue rivers and streams. Fed by such water resources, the terrestrial Earth is a repository of natural forests, wetlands and grasslands presenting a beautiful myriad of green ecosystems.

These natural blue-green ecosystems are repositories of diverse flora and fauna of indescribable beauty. Even within the small resplendent island of Sri Lanka of 6,570,134 ha, we could find a wide variety of ecosystems ranging from littoral and sandy beaches, dry mixed evergreen forests, mid-country wet zone rain forests, highland cloud forests together with specialized ecosystems such as mangroves, swamps, riverine and aquatic vegetation. These diverse ecosystems possess an equally diverse and fascinating biodiversity of plants and animals (flowers, fruits, mammals, birds, reptiles and butterflies). If one considered the entire Earth consisting of several biomes, they would possess an enormous ecosystem and species diversity of unimaginable scale. This is the bio-wealth that Mother Nature had bestowed upon man (arguably the most intelligent species among all animals), for his aesthetic living. Therefore, we have started life in a pristine blue green planet full of natural wealth and it is our bounden duty and responsibility to protect and utilize it sustainably.

Have we utilized this bio-wealth in that manner? No, we have overexploited and abused natural resources. To extract timber we log our forests, to mine minerals including sand, we damage the ecosystems, we overharvest our ocean and freshwater fish populations, we destroy natural resources sometimes beyond repair and in doing so environment pollution is aggravated. In the name of development, we have embarked upon ill-conceived pathways with scant regard

to nature. The Industrial Revolution, which commenced in the 18th century, started to exploit natural resources without any limits or restraints, releasing industrial wastes to the atmosphere, oceans, freshwater and terrestrial environments with hardly any attention to environmental pollution. Since the 1950s, such development has undergone a colossal acceleration. The 'Great Acceleration Curve' of Steffen, 2005 clearly illustrates this (Figure 1).

Unrestricted logging of natural forests leads to wet and dry erosion of the topsoil causing silting and pollution of rivers and water bodies that get loaded with nutrients and other pollutants (Figure 2).

Construction of skyscrapers some of which stand even above the clouds, exhaust fumes of thousands of vehicles traversing superhighways, super jets flying across continents reverberating and polluting the atmosphere and industrial cities, have become the icons of development. Such developments have converted the once serene green vegetation into concrete jungles. These have caused severe damage to natural biodiversity and sometimes even leading to extinction of certain species of animals and plants. They have also produced vast extents of 'dead zones' in the oceans. A dead zone starts with the discharge of an enormous amount of organic matter into the ocean that undergoes rapid microbial decomposition. During this process, a large quantity of oxygen is consumed by the decomposing microbes resulting in the creation of vast anoxic areas in the oceans where no life can exist. Such areas, called dead zones, are rapidly increasing and from 1960 (commencement of the green revolution) up to 2008, 400 dead zones have been recorded (Diaz and Rosenberg, 2008).

In response to such severe battering, Mother Nature had resorted to retaliate. Significant increases in atmospheric moisture, CO_2 and other greenhouse gases that also damage the protective ozone layer, gave rise to increase in temperature, rise of sea levels and climate change. These retaliations express themselves in the form of severe storms, hurricanes, tornadoes, tsunamis, flash floods as well as unprecedented, prolonged droughts and earthquakes. These ferocious natural disasters result in significant loss of life and irreparable damage to vast areas of land and human settlements. Occurrences of such natural disasters are today becoming more and more frequent. In certain countries, these have led to widespread famine and uncontrollable spread of diseases. Damage to the protective ozone layer permitted higher infiltration of mutagenic solar irradiation resulting in rapid mutations of contagious pathogens. The rapid proliferation of Covid virus variants is a good example. These have resulted in mass population migrations, even leading to armed conflicts.

Awareness and attempts at remedial measures

Realizing the impending dangers of such unrestrained development, certain scientists and naturalists took the initiative to organize international discussions. Among them, the United Nations Conference on Environment and Development (UNCED) or the 'Earth Summit' in 1992 held in the city of Rio de Janeiro, Brazil, is noteworthy. It highlighted the impacts of unsustainable use of natural resources and formulated the Convention on Biodiversity. This convention was ratified by many countries; but it took quite some time for the USA and China to ratify it. It accepted that man is largely responsible for climate change and decided to take steps to mitigate unrestrained development. In 2013, the International Panel on Climate Change confirmed that humans are responsible for climate change. In March 2014, the impacts of rising temperature were identified and, in April, recommendations for mitigation were formulated. At the UN Secretary General's summit meeting held in September 2014 pledges on emission cuts were obtained and at

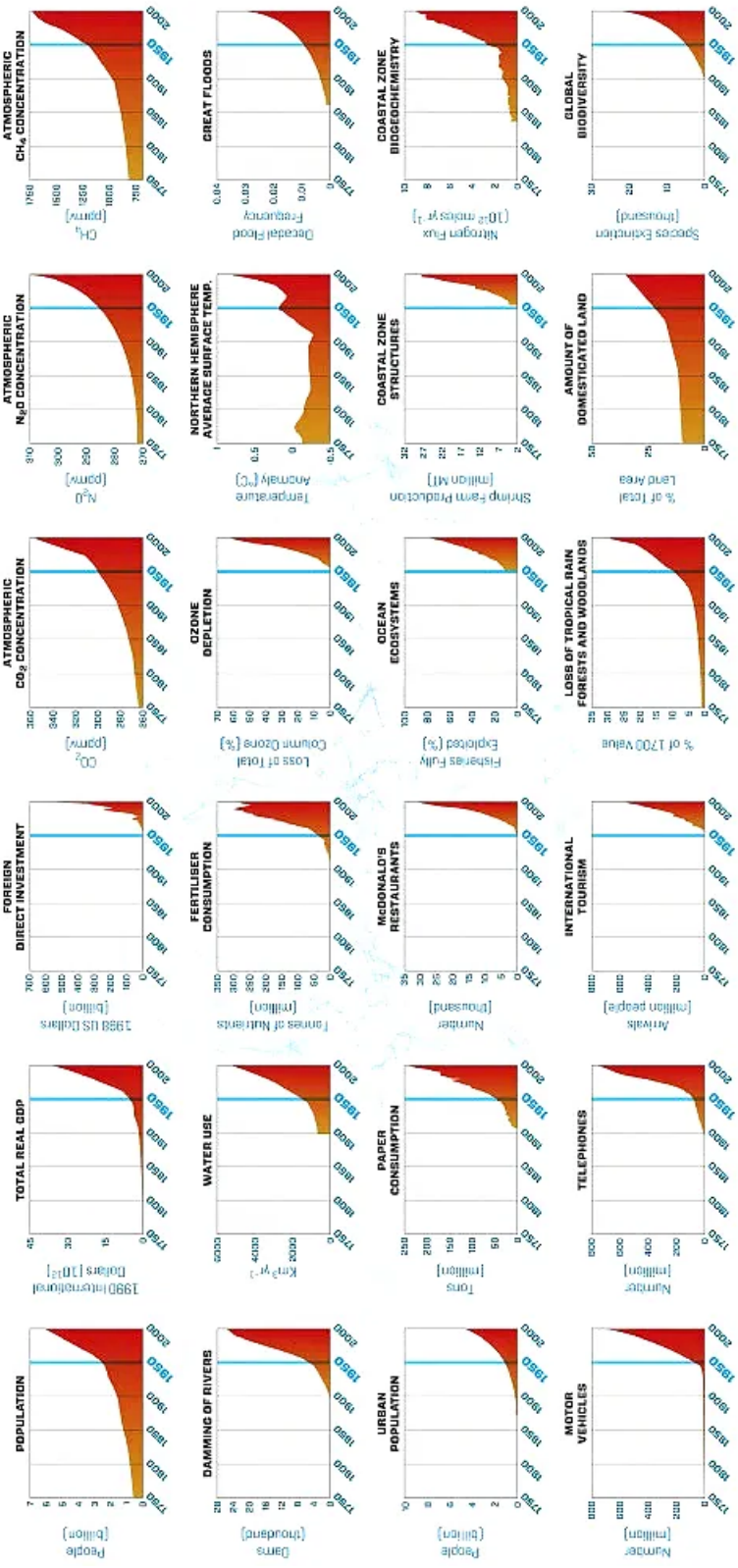

Figure 1. The great acceleration curve of global development (Steffen, 2005). The year 1950 had been a turning point.

Figure 2. Logging of forests (left), topsoil erosion (middle) and silting of rivers (right).

the Paris meeting end of 2015, legally binding agreements were secured. Unfortunately, many countries have failed to take meaningful steps to implement these resolutions. The United Nations (UN) Human Development Index (HDI) still considers health, education and income as the major factors for the ranking of nations. A strong suggestion made to adopt a new ranking system allocating negative points for the exploitation of natural resources and increasing pollution is yet to be implemented. This system aptly termed Human Sustainable Development Index (HSDI) if adopted would drop Australia, United States of America and Canada from its present HDI ranks of 2, 4 and 6 to HSDI ranks of 26, 28 and 24.

The Sri Lankan scenario

The Convention on Biodiversity (CBD) formulated and adopted at the Earth Summit of 1992 was ratified by Sri Lanka in 1994. Accordingly, the Parliament of Sri Lanka adopted a Biodiversity Conservation Action Plan (BCAP) in 1998. This led to the establishment of the Biodiversity Secretariat (BS) under the Ministry of Environment. By 2007, the BS prepared and published several addenda to the BCAP in which specific actions to be taken were spelt out. The same year a Red List of threatened fauna and flora including the need to protect specific groups prepared by the IUCN (Sri Lanka) and the Ministry of Environment was published, and this list was expanded in 2012 on conservation concerns. In 2014, the Biodiversity Secretariat, in consultation with relevant experts prepared and published the Butterfly Conservation Action Plan. Finally, a six-year National Biodiversity Strategic Action Plan (2016 to 2022), prepared by the BS was published by the Ministry of Environment. These reports show that Sri Lanka, as a signatory to the Conservation of Biodiversity, has taken significant steps within its capability to mitigate this global problem. Although it is a laudable contribution from a small developing island, its impact on the global scale problem would be minimal if bigger countries such as the USA, China, India, European Union, Central South Americas, Australia and Africa do not meet their obligations and contributions.

Microorganisms: The group that has received relatively less attention

So far, most of the attention has been given to above ground living things, plants and animals that are visible to us. However, there are inestimable populations of organisms that are not visible to the unaided eye. This group, termed microorganisms, contains the most numerous, most widely distributed, and most

ancient living organisms that have existed on Earth for 3.8 billion years undergoing adaptation and natural selection against all types of abiotic transformations of the Earth. The microbial biodiversity that existed on Earth as the sole inhabitants for more than two billion years is an invaluable repository of our original, natural germplasm. This is evident from the fact that all other living things that have evolved subsequently show some form of association with them. It is noteworthy to record that the microbial population associated with human beings is more numerous than the number of cells in all our body tissues. Moreover, if we look for a living organism to serve any human need, it should be possible to find one or more microorganisms that may meet with our requirement. These range from brewery, bakery, cosmetic and pharmaceutical industries to recycling of nutrients and sustainment of soil fertility, biological nitrogen fixation, sewage treatment, mining of minerals to the production of fuel cells. In terms of the conservation of microorganisms, the most effective method is the protection of their natural habitats or ecosystems. Thus, all the steps recommended to conserve and protect nature and Mother Earth would automatically protect and conserve microorganisms. However, what is required is the observation, identification, enumeration and estimations of the microbial populations, keeping records of their natural habitats and distribution, and wherever possible the establishment of their germplasm collections. Modern molecular techniques based primarily on DNA sequencing has enabled the identification of millions of so far unculturable and unidentified microorganisms.

The way forward

If we examine the global changes on a geological scale, the ice age ended some 12,000 years ago and with the receding of the ice sheets the warmer and more stable climate enabled man to extend his footprint to northern Europe. We have now entered the Anthropocene era where the adverse impacts of human activities have affected the Earth at the magnitude of the Ice Ages but over a much shorter period. We know a lot about our footprint on Earth, but what we do not know are the threshold values and the tipping points that should not be crossed. Based upon such realizations, most nations have accepted (at least on principle) to adopt conservation strategies and protection of natural resources and biodiversity and minimize pollution. Otherwise, there is a lurking danger that we would be leading ourselves to self-extinction.

Fortunately, many nations have now embarked upon programs to return to the Blue Green eras, but the pace of change is going to be slow and tedious, depending upon their national needs for financial, social and political progress and stability.

Nonetheless, it is necessary to realize that it would be extremely difficult to immediately adopt certain steps to mitigate such effects, especially for small countries such as Sri Lanka, which do not possess adequate natural resources, particularly fossil fuel energy. Currently, it would be unrealistic to expect Sri Lanka to shut down its coal and fossil fuel run electricity generation facilities. However, the country should immediately embark upon the rapid development and adoption of renewable resource-based generation of energy. For example, we could accelerate development strategies targeted to the adoption of at least 20% renewable energy production by 2030.

The Global utilization of Earth's natural resources and energy has been grossly unequal. Nearly 80% of them had been used by 20% of the industrialized countries. Fortunately, this has been realized and accepted with reluctance at many of the international fora and discussions mediated by the United Nation's Organizations. Historically, populations of the wealthy nations had got used to lifestyles

of heavy consumption and waste production. It is not easy to change lifestyles; however, significant changes are warranted if we are to save the Earth. If everyone on Earth wants to enjoy the standard of living of an average American citizen, it would require four more planet Earths to support the world population (Costanza et al., 2017). Similarly, Mahatma Gandhi of India pronounced, "There are enough resources for man's needs, but not his greed".

Man claims to be the most intelligent among all living animals. The human species should earn its leadership position by playing a more benevolent role towards other living things and their habitats. This appears to be the way forward to ensure that the Anthropocene era does not end with the extinction of man.

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