# Introducing the "Human Trusteeship of the Planet" Concept: A Crucial Advancement in General and Environmental Anthropology

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Abstract:- We begin this paper by understanding the history of mankind in relation to the environment. In order to accomplish this, we delve into the history of the Neolithic revolution and the much later emergence of the world's earliest civilizations. We also review the industrial revolution and assess the impact they may have had on the environment. We then provide a high level overview and a brief history of the field and the discipline of anthropology, environmental anthropology included, both in its early days, and in more contemporary times. We consequently also overview the components of earth studies including geology, hydrology, and ecology, and provide and a history of environmental studies as well by interfacing this with environmental anthropology in turn. Definitions of terms such as the biosphere, the lithosphere, hydrosphere and the atmosphere are also provided. This paper is also then interfaced with developmental studies and developmental economics including developmental anthropology and anthropology in development so that a clear amalgam of the two can be brought about. The current state of the environmental movement is assessed, and a review of the current state of technology is also accomplished along with a study of indirect factors such as population management. All these assessments then invariably and inevitably lead us to the key components and principles of the "Human trusteeship of the planet" concept which we believe will heal many wounds, and make the world a better place for all of us to live in.

#### I. INTRODUCTION

Let us permit nature to have her way. She understands her business better than we do – Michel de Montaigne

"Look deep into nature, and then you will understand everything better." —Albert Einstein

"To leave the world better than you found it, sometimes you have to pick up other people's trash." —Bill Nye

We begin this paper by understanding the history of mankind in relation to the environment. In order to accomplish this, we delve into the history of early human activities such as the Neolithic revolution and the much later emergence of the world's earliest civilizations. We also review the first and the second industrial revolutions in all their ramifications and assess the impact they may have had on the environment. We then provide a high level overview and a brief history of the field and the discipline of anthropology, environmental anthropology included, both in its early days, and in more recent and contemporary times. We consequently also overview the components of earth studies including geology, hydrology, and ecology, and provide and a history of environmental studies as well by interfacing this with environmental anthropology in turn. Definitions of terms such as the biosphere, the lithosphere, hydrosphere and the atmosphere are also provided. This paper is also then interfaced with developmental studies and developmental economics including developmental anthropology and anthropology in development so that a clear amalgam of the two can be brought about. The current state of the environmental movement is assessed, and a review of the current state of technology is also accomplished along with a study of indirect factors such as population management.

All these assessments then invariably and inevitably lead us to the key components and principles of the "Human trusteeship of the planet" concept which we believe will heal many wounds, and make the world a better place for all of us to live in. Of course, many related earlier concepts such as the trusteeship principle proposed by Mahatma Gandhi are also reviewed, though this paper is wholly independent of them. Humans have either consciously or unconsciously polluted the planet and the atmosphere since the dawn of human civilization, or even from time immemorial. Contrary to popular perception and popular misconception environmental degradation is not a recent phenomenon, though it has indeed accelerated in recent times. Awareness on environmental issues and environmental considerations too have spiked in fits and starts, though the environmental movement in the modern sense of the term is a more recent phenomenon.

The Neolithic Revolution, which is also sometimes referred to as the "First Agricultural Revolution", was a period marked by widespread and fundamental change in human culture that began around 10,000 BC in the Fertile Crescent region of the Middle East or the Levant region. The term Neolithic revolution was first used by Vere Gordon Childe in 1920. This revolution marked the transition from hunting, gathering, foraging and pastoralism to organized agriculture and permanent human settlements, thereby leading to a huge ripple and multiplier effect. This also in turn led to the domestication of plants and animals, the development of new and more sophisticated tools such as polished ground axes and ground stone axes, (This period also known as the Neolithic age, is the last period of the stone

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age, after which we had the Mesolithic and Chalcolithic age marked by the use of metals such as copper) and the establishment of large permanent settlements, indirectly inducing a more sedentary lifestyle. Needless to say, this also led to deforestation and the destruction and degradation of the environment much more than earlier advances that the invention of fire did. Some agricultural practices such slash and burn agriculture, also known as shifting cultivation or tavy, a traditional farming technique that involves cutting and burning vegetation to clear land for cultivation and the creation of fields called swidden, have particularly caused environmental degradation though it allowed settlers to produce a much greater quantity of food than they could possibly produce through hunting and gathering. This type of agriculture is practiced by some tribal groups in north-east India, where it is variously referred to as jhum, jhoom, or podu.

The Industrial revolution, is often conveniently divided into two industrial revolutions namely, the "First Industrial Revolution" and the subsequent "Second Industrial Revolution", both of which marked a period of a transition of the world economy towards much more widespread, standardized, efficient and stable manufacturing processes, and a greatly enhanced most people's standards of living. This revolution originated in England which was its general birth place, but rapidly and quickly spread to other parts of Europe and North America, from around the year 1760 to around 1840, and more or less followed the French revolution in Europe. As a part of this revolution, there was a transition from primitive and inefficient hand production methods towards greater automation and relatively advanced labour saving machinery and techniques. New chemical manufacturing process steel and iron and production processes were also developed during this period, and there was an increasing use of water power and steam power, though electricity had not yet been developed. The steam engine itself had been developed by James Watt, Richard Trevithick, George Stephenson and others, and played a crucial role in the revolution. The development of machine tools was also an important development during this period along with a rise of the mechanized factory system which employed a large number of workers. Early factories were often less than ideal places to work in, with workers performing tedious, mundane and repetitive tasks in inhuman and unsanitary conditions, and their inadequacies led to the rise of revolutionaries such as Karl Marx.<sup>12</sup>

Industrial output however, increased manifold, and there was an unprecedented rise in population as a result, along with migrations to cities and industrial areas. The success of the British industrial empire was demonstrated and showcased in a fair held in 1851 in the Crystal palace in London. The second industrial revolution, which is sometimes referred to as the technological revolution, was a phase of rapid scientific discovery, standardization, mass production and industrialization which took place from the late nineteenth century into the early twentieth century. New methods to improve the production of steel emerged, and many new inventions came into existence. Electricity, automobiles, telephones, radio, aeroplanes, and electricity also became commonplace and a part of daily life, and automobiles were built on an assembly line since 1914, though the automotive industry itself came into being some fifteen years earlier, producing vehicles on a much smaller scale. The world had been transformed on a scale seen never before and progress was counted in years rather than in centuries, though we were still living in an environmental dark age, because there was very little awareness of environmental issues, and even less environmental responsibility. People took modern civilization for granted, and were yet oblivious of its shortcomings and its drawbacks. This was the general and the unfortunate state of affairs until the 1990's, when the environmental movement took off in a big way. In some cases which were not entirely isolated, man's dominance of nature and the environment was itself seen as a big triumph.3456

#### II. INTRODUCTION TO ANTHROPOLOGY

Anthropology is the formal study of the origin and development of human societies and cultures, not just in one context but all over the world. Anthropology initially originated as the study of so-called primitive peoples and cultures, but that assumption is now being challenged. In its present form, anthropology may be traced to the period of the renaissance, though the ancient Greeks such as Heredotus and Aristotle also contributed to the study of human civilizations. Etymologically speaking, the word "anthropology" is derived from the Greek word "anthropos" which means human being and "logos" which means science. (Barnard, 2000). According to Haviland, Prins, Walrath and McBride, "Anthropology is the study of humankind in all times and places". Langness defines anthropology as "The scientific study of human beings- i.e., of the human creature viewed in the abstract: male, female, all colours and shapes, prehistoric, ancient, and modern." Many other definitions of the term anthropology have been provided throughout the ages, and we had discussed them briefly in our previous papers, particularly those which impact a study of human culture. (Haviland 2011) (Langness 1974)

<sup>&</sup>lt;sup>1</sup> Sankalia, H.D. 1974. Pre-And-Proto-History of India and Pakistan. Poona: Deccan College

<sup>&</sup>lt;sup>2</sup> Singh, P. 1991. The Neolithic Origins, Delhi: Agam Kala Prakashan.

<sup>&</sup>lt;sup>3</sup> Berlanstein, Lenard R., ed. (1992). *The Industrial Revolution and work in nineteenth-century Europe*. London and New York: Routledge

<sup>&</sup>lt;sup>4</sup> Daunton, M.J. (1995). Progress and Poverty: An Economic and Social History of Britain, 1700–1850. Oxford University Press.

<sup>&</sup>lt;sup>5</sup> Green, Constance Mclaughlin (1997). Holyoke Massachusetts A Case History Of The Industrial Revolution In America.

<sup>&</sup>lt;sup>6</sup> *Rider, Christine (2007). Encyclopedia of the Age of the Industrial Revolution, 1700–1920. Oxford University Press.* 

https://doi.org/10.38124/ijisrt/IJISRT24AUG1350 but assumed added significance and added importance when young earth theories were discarded. Later thinkers also developed fundamental principles of geology such as the principle of horizontality and the principle of superposition. Other contributors to geology included Abraham Gottlob Werner, James Hutton, and Charles Lyell. The field of Geology broadly studies the Earth's structure, substance, and processes, and includes a study of the lithosphere, or the solid rocky layer constituting the Earth's surface, including the crust such as the continental crust and oceanic crust, the earth's mantle, the earth's core and various types of rocks such as igneous, sedimentary, and metamorphic rocks. The scope of the field of Geology is fairly vast and incorporates and includes aspects of chemistry, physics, and biology as well and the intersection and interdisciplinarity of various fields of study.

Geology comprises many specialized fields of study too. For example, the subfield of Geochemistry studies various chemical processes and components forming part of the planet Earth including for example, a study of faults and plate tectonics among other things. Geophysics on the other hand, studies and investigates various physical properties of the planet Earth while Paleontology which also interfaces with Anthropology, studies diverse buried fossilized material present beneth the earth's surface. The relatively new field of Geomorphology investigates the origin of landscapes, and the changes that may occur to such landscapes over time. The field of Environmental geology studies how human and nonhuman induced pollution and contaminants may affect soil and rock. Hydrology, which includes hydroecology and other fields is the study of the hydrosphere and the movement of water on, and beneath the Earth's surface including patterns of human use of water bodies and water supplies. Oceanology is another subfield which deals with the study of oceans, while glaciology studies glaciers. Mineralogy refers to the field that studies various aspects of minerals including the study of mineral formation, and the physical and chemical properties of minerals. We have included only a small number of subfields here; of course, there could be many more. 10

# IV. OVERVIEW OF ECOLOGY

Ecology is the formal and the systematized study of the earth's biosphere. The term was coined and first used in the year 1866 by the German scientist Ernst Haeckel, though it was derived from the Greek term "Oikos", meaning habitat. The science of ecology as we know it today however originated with a group of American botanists working in the 1890s. This field also fundamentally includes the study of various forces of nature and of how living things interact with various elements and components of the Earth such as

misunderstood term which may be defined as the acculturated or enculturated behavior of people, including diverse aspects of their society including their languages, religions, belief systems, social structures, social and cultural institutions, and material goods. The broad disciplines of anthropology has spawned many subfields such as physical anthropology, linguistic anthropology, social anthropology, cultural anthropology, archeology, paleontology, and environmental anthropology. Many techniques such as anthropometry, the comparative method, ethnography, and the participant observation method have been developed as a part of physical and cultural anthropology. Anthropology is therefore a holistic, diversified, integrated and a trans disciplinary approach to the study of human prehistory and human civilizations, including a systematic study of humans as biological organisms living in the environment, and the process of hominization or anthropogenesis. The scope of anthropology is so vast and so extensive that it even interfaces with a wide and diversified array of other sciences such as sociology, historiography, psychology, geography, social sciences and economics. Therefore, anthropology has also been greatly shaped and influenced by progress in all allied and conjunct fields and areas of study, (For example, Charles Darwin's "On the origin of species" also influenced anthropology greatly) and continues to evolve as the world becomes more globalized, technologically savvy and environmentally conscious and aware. Progress is however still somewhat tardy from our perspective, and it has not fully shaken off its colonial yoke. We need some more work here. It is also only in the recent past, that environmental anthropology has matured and evolved. It is yet to become a central field in anthropology though, and we expect some meaningful, productive and beneficial changes on this score in the years and decades to come. This can happen only if new paradigms are birthed and gestated, hence, this one. <sup>7 8 9</sup>

Culture is a commonly used, and an often widely

# III. INTRODUCTION TO EARTH SCIENCES

We will now attempt to provide a very brief introduction to the earth sciences. This is an essential and a vital part of this paper, though by no means the most important, and is somewhat peripheral to it. Therefore, those who want a more specialized treatise on various fields and subfields of earth sciences may read other more specialized literature on the subject which is readily available on the internet and elsewhere. Earth sciences or geosciences include many different fields of natural science allied and related to the maintenance and the sustenance of planet Earth, and a study of the forces that shaped and continued to shape earth, but usually exclude a formal study of its life forms with the exception of the field of geobiology. This field began with the works of Greek thinkers such as Erastosthenes and Strabo,

<sup>&</sup>lt;sup>9</sup> Henslin, James M. (1996). *Essentials of Sociology: A Down-to-Earth Approach*. Needham Heights, MA: Allyn and Bacon

<sup>&</sup>lt;sup>10</sup> Seckler, David; Barker, Randolph; Amarasinghe, Upali (1999). "Water Scarcity in the Twenty-first Century". *International Journal of Water Resources Development*. **15** (1–2): 29–42

<sup>&</sup>lt;sup>7</sup> Asad, Talal, ed. (1973). *Anthropology & the Colonial Encounter*. Atlantic Highlands, NJ: Humanities k

<sup>&</sup>lt;sup>8</sup> Gisi, Lucas Marco (2007). Einbildungskraft und Mythologie. Die Verschränkung von Anthropologie und Geschichte im 18. Jahrhundert. Berlin; New York: de Gruyter.

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nutrients and water resources, and the consequences of such an interaction including use and depletion of the earth's natural resources. Therefore, the relationships and dynamic interaction among living organisms, including humans, and their physical environment, are studied in ecology with studies performed and executed at individual, community, population, ecosystem and biosphere levels. The field of ecology assumes added importance because individuals have the capacity and the capability to shape and regulate the environment, and even save or prevent it from potential destruction. Ecology includes various subfields such as productive ecology, population ecology, community ecology, radiation ecology, and space ecology, though a discussion of these would fall outside the scope of this paper. <sup>11</sup>

The biosphere, which is also often referred to as the ecosphere, represents the sum total of all the ecosystems on Earth and on which any form of life exists. Earth is unique and special and is often referred to as the sphere of life. This does not of course discount the possibility that life exists elsewhere in the universe, because there may be trillions of planets in the observable universe, if not more. However, the Drake equation must be applied, and the possibility of existence of intelligent life forms may be small. The biosphere is generally considered to be closed, and selfregulating. It has however evolved gradually over millions of years, and the atmosphere today is different from that of the Hadean or the Archean eon, when atmospheric carbon dioxide was high, and surface temperature were much higher than at present. It has been around for hundreds of millions of years, at the very least, if not possibly more. The biosphere includes all forms of life on the planet, including human beings, and all forms of living organic matter as well. It also comprises all forms of life in the geosphere or the lithosphere, hydrosphere which represents the water mass, and the atmosphere. The biosphere extends from the depths of the oceans over ten kilometers deep to the highest mountain ranges, and includes everything from tiny, unobservable bacteria and blue green algae to large creatures such as whales. Some life forms can exist in extreme temparatures and conditions, and life forms have even been found in deep sea volcanic vents. However, there may be a tipping point, and unregulated human activity may damage the biosphere irreparably.

The tree of life began to be formed because early cyanobacteria had photosynthesizing ability i.e. the ability to convert light energy into chemical energy, and gave out oxygen which was inhaled by other living beings. Thus, a complex variety of different life forms began to exist. A food chain represents a sequence of organisms in which nutrients and energy are transferred from one living organism to another living organism through the process of food intake and consumption. Therefore, all living beings depend on each other for survival, and all life forms are intertwined and interlinked. A food web is a much more complex network of food chains that depicts how different food chains interact in a complex ecosystem. There are many related concepts such as that of an apex predator which represents a being that sits on top of the food chain. We also then have drylands which are characterized by the lack of availability of water, and only transpiration and evaporation take place. Wetlands are areas where the soil is covered with water throughout the year, or for most part of the year. Wetlands support different forms of aquatic species which also may vary based on climatic and soil conditions. Wetlands also incude marshes, swamps, bogs, fens, and riparian ecosystems. the biosphere comprises of three basic components. These three components are the abiotic (comprising physical and inorganic) components which is other words is non-living matter; secondly, biotic (or organic) components which represents living matter comprising plants, animals and microorganisms, and thirdly, energy components comprising of mineral nutrients and water. We also then have the concept of a habitat which is a natural environment where an organism lives and grows. We also then have the concept of an ecological niche; this is the role an organism plays in the larger and grander scheme of things, including its interaction patterns with other species.

# V. INTRODUCTION TO ENVIRONMENTAL STUDIES

The field of Environmental studies refers to, or is taken to mean, a multidisciplinary or even a transdisciplinary academic field which systematically studies and investigates all processes pertaining to, and related to human interaction with the environment. This is done using holistic approaches, and keeping in mind long-term perspectives. This field is sometimes referred to as environmentalism, or less commonly, ecologism. The rapidly growing and diversifying field environmental studies collates principles and concepts from diverse fields such as the physical sciences, economics, various fields and subfields of the humanities and the social sciences to address a diverse set of complex contemporary environmental issues. The latter may includes fields such as law, social justice, pollution control, political science, natural resource management, etc. It is a broad field of study that includes the natural environment, the man made environment, and the relationship between the two including a formal study and investigation between man, and other forms of plant and animal life. This is necessary to maintain a healthy and a harmonious balance between different forms of live and the natural environment. As cosy sound, there have been critics of as this mav environmentalism. Such critics accuse climate change advocates of alarmism, and projecting exaggerated versions of man made climate change. This is sometimes referred to as green washing.

<sup>&</sup>lt;sup>11</sup> S. E. Kingsland, "Foundational Papers: Defining Ecology as a Science", in L. A. Real and J. H. Brown, eds., *Foundations of Ecology: Classic Papers with Commentaries*. Chicago: U of Chicago Press, 1991

<sup>&</sup>lt;sup>12</sup> Stadler, B.; Michalzik, B.; Müller, T. (1998). "Linking aphid ecology with nutrient fluxes in a coniferous forest". *Ecology*. **79** (5): 1514–1525

#### VI. HISTORY OF THE ENVIRONMENTAL MOVEMENT

The environmental movement is a prominent social, cultural and environmental movement whose core aim and objective is to protect the planet and other life forms on it (including indeed mankind itself) from man-led or anthropogenic climate change and environmental degradation in order to create a sustainable way of life, as opposed to mindless economic growth and environmental degradation. The latter represents an obsolete and an outdated view when a smokestack was a symbol of a healthy economy. Individuals who care for the environment are known as and environmentalists such individuals advocate the management of natural resources with long-term objectives in mind. Stewardship of the environment through suitable changes in public policy and consumption patterns is also recommended by environmentalists, along with greater global collaboration among nations. Many individuals, forprofit and non-profit organizations, specialized professionals, politicians, scientists, have become dedicated and committed environmentalists and the movement is growing by leaps and bounds and getting stronger by the day. Environmentalists advocate sustainable development which is an approach to economic growth and human development that "aims to meet the needs of the present generation without compromising the ability of future generations to meet their own social, cultural and economic needs, or to preserve their own standards of living". This definition is from Our Common Future, also known as the Brundtland Report. This is no longer even a pipe dream; it is rapidly becoming a reality, and many from the present generation may even live to see it.

Some environmental activism can be traced to the nineteenth century; The Alkali acts were passed in 1863 to combat pollution caused by soda ash production. In 1865, the commons preservation society sought to protect rural areas from the ravages of industrialization. Two individuals by name Robert Hunter, and John Ruskin blocked construction of railways in unspoilt rural regions. In the 1870's, the amenity movement in Britain was a reaction to worsening air and water pollution, besides environmental degradation. In 1893 Hill, Hunter and Rawnsley set up a national body to coordinate environmental conservation efforts across England, Wales and Northern Ireland; the resultant "National Trust for Places of Historic Interest or Natural Beauty" was launched in 1894. Over the years, back to nature movements we launched by individuals such as John Ruskin, William Morris, and Edward Carpenter. These were inspired in part by romantic ideals. In the late nineteenth century, individuals such as John Muir and Henry David Thoreau launched similar movements in the USA. In the USA, attempts were also made to save the Bison from extinction, and national parks were launched on a large scale. The "Great Smog of London" choked the city of London for five days, from December 5 to December 9, in 1952, and resulted in thousands of deaths. This was primarily caused by industrial pollution and high-pressure weather conditions. The smoke and fog brought London to a near standstill and resulted in

thousands of deaths. This event also sparked a greater interest in environmentalism in the UK.

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The idea of sustainable development is a holistic, longterm and a comprehensive approach to development which seeks to advance the interests of large sections of the population, and was first popularized by the the Brundtland Report ("Our common future" report) released by the World Commission on Environment and Development in 1987, and the Rio earth summit at Rio de Janerio in 1992. The latter is also known as the United Nations Conference on Environment and Development. United Nations climate change conferences are also held in different parts of the world with unfailing regularity, and all these advance the goals of various climate change mitigation missions and measures. These approaches are however, loosely based on earlier and simpler concepts that emanated in Europe and elsewhere in the seventeenth and eighteenth centuries such as afforestation and water management programs. Examples of non-sustainable development and the rapid deforestation of the Amazon rain forest, and the melting of the Himalayan glaciers to the north of India. Rapid population growth is also at odds with sustainable development, just as resourceintensive developmental models are. Another pillar of this approach and concept is the "tragedy of common" problem. In 1968, the ecologist and philosopher Garret Harding wrote the essay, "The tragedy of the Commons", according to which he stated that if individuals pursued their own goals and interests selfishly and recklessly, they would eventually act against community interests, or the interests of the common good. This is based on the analogy of drawing water from a common source to suit one's own requirements.

Systematic and structured environmental studies began as early as the late 19th century, particularly in Britain as a reaction to rapid industrialization, emergence of great factories, movement of populations to cities, and worsening air and water pollution. Under increasing pressure from the populace, the first environmental laws were enacted in the form of Britain's Alkali Acts, which we had discussed previously in this paper. These were intended to regulate the worsening air pollution caused by rapid industrialization and its effects on human health. There were mini environmental movements in India too, and some date all the way back to the British era; afforestation movements were also subsequently initiated there in due course. We had the Chipko movement in India as well as the Narmada Bachao Andolan. James Ranald Martin, Alexander Gibson, Dietrich Brandis and others sought to promote large scale afforestation programs as a counter weight to industrialization and manmade degradation of the environment. The government under Governor-General Lord Dalhousie also introduced the first permanent and large-scale forest conservation programme in the world in 1855, a model that soon spread to other colonies, as well as to the United States in due course.

The first Earth Day was celebrated in 1970. Its founder, former Wisconsin Senator Gaylord Nelson, was inspired to create this day of environmental education and awareness after witnessing an oil spill off the coast of Santa Barbara in 1969. Greenpeace was created in 1971 to promote nonviolent action for environmental causes. 1980 saw the creation of Earth First!, a group with an ecocentric view of the world - believing in equality between the rights of humans and the rights of all other species to flourish along with the rights of life-sustaining systems as well. Paul R. Ehrlich's, book The Population Bomb which was published in 1968 greatly increased concerns about the impact of exponential population growth, particularly in developing countries. Since the 1970s, public awareness, environmental sciences, ecology, and technology have advanced to include contemporary issues such as ozone depletion, global climate change, sustainable technologies, genetically modified crops and genetically modified livestock.

Rachel Carson's environmental science book "Silent Spring" which was published in 1962, also sought to generate awareness on the environment. This book sold widely, and served its purpose. Kenneth E. Boulding, in his 1966 essay "The Economics of the Coming Spaceship Earth", spoke about the need for the economic system to fit itself to the ecological system with its limited pools of resources. In the early 1970s. "Strategy of Progress", a 1972 book by Ernst Basler, explained the importance of preserving forests, and its role in environmental protection. A classic report on the "Limits to Growth" and the need for ecological balance and harmony, was commissioned by the Club of Rome and written by a group of scientists led by Dennis and Donella Meadows of the Massachusetts Institute of Technology. Jorgen Randers, William W. Behrens, and others. Its findings are recommendations were presented at Moscow and Rio de Janerio in 1971. Other research groups like an MIT research group assessed the implication of growth on the environment. In 1980, the International Union for Conservation of Nature published a world conservation strategy and explained the need for sustainable development as a global priority

The concept of sustainability may also be defined as "an economy in equilibrium and harmony with basic ecological support systems". Thus, as per this approach, harmony with the ecology and the environment are also emphasized to a high degree, in the short-term, medium-term, and the longterm, along with social harmony and well-being. Sustainable development overlaps with the idea of sustainability to a certain degree. According to UNESCO the distinction between the two concepts as follows: "Sustainability is often thought of as a long-term goal (i.e. a more sustainable world), while sustainable development refers to the many processes and pathways to achieve it." In 2015 the United Nations General Assembly adopted seventeen Sustainable Development Goals for the year 2030. These development goals address various global challenges, including for example poverty, climate change, biodiversity loss, and peace. The idea of sustainability has several planes such as economic, environmental, social and cultural planes. These planes overlap to varying degrees. Sustainable development

also reduces the greenhouse effect. The greenhouse effect occurs when greenhouse gases in the earth's atmosphere trap heat, thereby raising its surface temperature.

Industry, farming, and agribusinesses, all cause environmental degradation to varying degrees. Solution strategies may include afforestation, sustainable forest management, organic farming, preservation of biodiversity, modulation of human consumption patterns, and reducing deforestation. Some others have called for vegetarianism, and a reduction of meat consumption as a solution. Non-renewable energy sources are being replaced by new forms of environmentally energy such as solar and wind energy. ICE engines and fossil fuel automotive engines may be replaced by hydrogen and electric engines. All these will reduce the emission of green house gases greatly, and arrest runaway global warming. Corporate sustainability, and corporate social responsibility practices are also important to achieving sustainable development. Afforestation in India has been carried out by Indian states in a big way, particularly Uttar Pradesh and Telengana. Water conservation programs and rainwater harvesting programs have also been implemented in India by many states. Population control has been successful in many states, and one should not listen to pronatalist arguments. The International Solar Alliance has been proposed by India, and is headquartered in the Indian state of Haryana near New Delhi. The MNREGA, a program by the Indian government, also has among its missions, conservation of resources, and rural infrastructure creation.

These would also be aligned to the seventeen SDG's or sustainable development goals. These are based on the 2030 Agenda for Sustainable Development, adopted by all United Nations members in 2015, The seventeen adopted SDGs are: No poverty (SDG or sustainable development goal 1), Zero hunger (SDG or sustainable development goal 2), Good health and well-being (SDG or sustainable development goal 3), Quality education (SDG or sustainable development goal 4), Gender equality (SDG or sustainable development goal 5), Clean water and sanitation (SDG or sustainable development goal 6), Affordable and clean energy (SDG or sustainable development goal 7), Decent work and economic growth (SDG or sustainable development goal 8), Industry, innovation and infrastructure (SDG or sustainable development goal 9), Reduced inequalities (SDG or sustainable development goal 10), Sustainable cities and communities (SDG or sustainable development goal 11), Responsible consumption and production (SDG or sustainable development goal 12), Climate action (SDG or sustainable development goal 13), Life below water (SDG or sustainable development goal 14), Life on land (SDG or sustainable development goal 15), Peace, justice, and strong institutions (SDG or sustainable development goal 16), andPartnerships for the goals (SDG or sustainable development goal 17).

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#### VII. INTRODUCTION TO ENVIRONMENTAL ANTHROPOLOGY

Humans have naturally interacted with their immediate environment since time immemorial. Humans were subsequently possessed by wanderlust, and travelled to other shores trading with their immediate and distant neighbours in the process. Anthropology, particularly the component of which specialized in bio-cultural study of humans, studied such interactions formally right from its inception. The interaction between humans and their environment is also studied by ecological anthropologists. Studies included a study of social, political, economic and cultural factors as well, all of which were examined critically in a holistic fashion. This observation holds good partly for ancient Greek thinkers as well, though the discipline has developed in leaps and bounds since then. For example, we have had the idea of Environmental determinism in the recent past as opposed to cultural determinism, which states that the physical environment, such as climate and terrain, impacts human activities and outcomes significantly and substantially, thereby determining social and economic development as well. This concept is said to have originated with the ideas of Greek thinkers Hippocrates and Aristotle and was dominant in Western academia some one hundred and odd years ago. The idea of environmental determinism in its strict and canonical form is obsolete; however, contemporary environmental anthropologists study and explore how humans adjust and adapt to their natural environment. A revival of such theories has also been attempted by Jared Diamond, Jeffrey Herbst, Ian Morris, and other social scientists in the recent past. Environmental anthropology is now a vital sub-branch of socio-cultural anthropology, and focusses on basic scientific and academic research on the relationship between people and their environment. The role of culture in this relationship is also explored, among a wide variety of other factors. Many other fields such as primate ecology, human ethnoecology (proposed and pioneered by Brent Berlin, Charles Frake, Harold Conklin, and others), evolutionary ecology, historical ecology, ecofeminism, environmental justice, political ecology, traditional ecological knowledge, and environmental conservation, have also been proposed, and most of them are interdisciplinary. More recently, the ecosystems approach, cultural materialism, and processual human ecology have also been developed.

A more reasonable stand is environmental possiblism. Environmental possibilism is the position that while the environment influences human culture, human initiative, creativity, and various other aspects such as technology also play a role in shaping a culture in relation to its environment. The idea of "cultural ecology" was developed by the American anthropologist Julian Steward in the 1950's who is also associated with neo-evolution, and was influenced by Carl Sauer. Cultural ecology is a field that formally studies human adaptations to social and physical environments. Human adaptation may refer to both biological and cultural processes that allow a population to survive, thrive and prosper within a given environment.. This kind of a analysis may either be carried out diachronically (by

examining entities across different epochs), or synchronically (examining a present system and its components). We had discussed the twin ideas of diachronic and synchronic analysis in our different paper. We also have other fields in environmental anthropology such as political ecology (This field examines how economic structures and power relations drive environmental change), ethnoecology (this field studies how people in different cultures understand and relate to the world around them) and behavioral ecology (This is a study of how humans and other living beings behave and make decisions to adapt and be successful in the world around them). These fields are however, relatively much less important. Leslie A White also spoke of the age of high mass consumption in spite of being an anthropologist. This suggests that anthropology and environmental studies did not coevolve, and are still in many ways, on divergent and separate paths. During the cultural revolution in China, the environment was not given a tinker's dam as trees were cut for use as fuel in foundries that produced shoddy, low-quality steel. However, a respect for the environment has accelerated greatly in recent times in the region, as new concepts such as permaculture have taken root.

#### VIII. INTRODUCTION TO DEVELOPMENTAL STUDIES

The field of "Developmental studies" is a growing, and a very vital multidisciplinary and transdisciplinary field of study that examines and analyzes how societies change and evolve at different levels such as local, sub-regional, national, pan-regional, and global levels, often in response to different forms of stimuli such as environmental and nonenvironmental stimuli. It also examines how developmental leads to different social and cultural outcomes. This field of study first developed in the 1990's (even though its antecessors hark back to efforts made since the 1940's. For example, the UK colonial office carried out some developmental studies in its colonies in the 1940's) but has made rapid strides ever since, especially after decolonization, and is being taught in many universities of eminent repute. This field of study examines the continuing interplay and interaction between various forms of social, cultural, political, technological, economic, environmental and ecological factors to further understand and analyze how all these factors impact social and cultural change. Needless to say, the entire objective of this rapidly evolving and maturing field of study is to conceptualize and create solutions to various problems observed in the real-world such as poverty, social inequality and injustice, inequitable allocation of resources, ecological imbalance, and environmental degradation. Institutes specializing in developmental studies include the European Association of Development Research and Training Institutes (EADI), Consejo Latinoamericano de Ciencias Sociales (CLACSO), Asian Political and International Studies Association (APISA), Arab Institutes and Centers for Economic and Social Development Research (AICARDES), and the Council for the Development of Social Science Research in Africa (CODESRIA) and Organization for Social Science Research in Eastern and Southern Africa (OSSREA). However, developmental studies must be integrated with environmental studies, and we have already

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sounded the bugle in this regard. Some concepts in development studies such as the classification of nations into first world countries, second world countries and third world countries, and aid-dependant development models are also obsolete because developing nations have made rapid strides in the recent past. There are also no standard successful models yet pursuing holistic ecologically-friendly development models, and we have yet to find exemplars in this regard.

Development economics is a rapidly growing and ever evolving branch and subfield of economics that studies the economic aspects of development particularly in less developed economies and in low- and middle-income countries. The entire approach of this field of study hinges on improving the economic, fiscal, and social conditions of these countries by focusing on aspects such as health, education, labour supply, and other macroeconomic and microeconomic aspects of development. Consequently, the role played by individuals, households, firms, and governments in determining economic outcomes is also assessed. It focuses on holistic well-being rather than economic growth alone, and treats the two as being two distinct features. Therefore, development as proposed by Amartya Sen and other developmental experts, is seen as being far more comprehensive and wide-ranging than growth alone. The former also studies structural changes in the composition of output, shifts in the allocation of productive resources, and the total elimination or reduction of poverty and want, social and cultural inequalities and unemployment. Theories and concepts of economic development must also be approached from a holistic perspective, and root cause analysis performed for underperformance and inequalities. Various development indices, metrics and parameters are also developed as a part of this approach. Examples of these include the Human development index and the GINI coefficient.

Developmental anthropology is another new field that seeks to identify concepts in anthropology and apply them to developmental processes. This field was developed by the anthropologist Glynn Cochrane, Thayer Scudder, Michael Horowitz, David Brokensha, Bob Berg and others. In another paper published by us several years ago, we had also attempted to merge the concepts in anthropology and economics by introducing a new field of study called anthropological economics. This proposed field is however different from developmental anthropology. vastly Developmental anthropology seeks to correct earlier drawbacks of economic development policies and programs in that the contribution of anthropologies in this score was rather limited, even if non-existent. Anthropologists, particularly social and cultural anthropologists, are adept in aspects such as social and cultural amelioration and social impact assessments, and these skills are greatly harnessed and properly put to use. They also see issues and considerations from the perspective of people in developing countries, and loathe the idea of imposing external considerations on them. It is also natural that anthropologies are more concerned and preoccupied with environmental considerations than mainstream economists. The latter see preoccupation with environmental considerations as an intrinsic conflict of interest. Some theorists such as Escobar have also sought to distinguish between anthropology of development and developmental anthropology, though this distinction is somewhat obsolete, misleading. However. and developmental anthropology may subscribe to more conventional norms of development, while development in anthropology may propose more heterodox views. Many sociologists, anthropologists and developmental economists (examples being the likes of Max Weber, Daniel Learner, Everett Hagen, Neil Smelser, Gunnar Myrdal, and some others) have conceptualized modernization theories to move traditional societies away from illiteracy and conservatism towards more modern and pragmatic thought. In the Indian context, relationships between tradition and development were investigated by Milton Singer and Scarlett Epstein. Other anthropologists and researchers have proposed concepts such as participatory development, action anthropology, social justice advocacy, and the sustainable livelihoods approach both for rural and holistic development programs. 13 14 15

Emic perspectives are also of course, extremely important. Pioneering research on the perspective of the colonized was carried out by Northcote Thomas in Nigeria in 1908, and others. In the USA, anthropologists began to get involved in anthropological studies with the Indian Reorganisation Act of the New Deal and the Bureau of Indian Affairs in the 1930's and offered advice on the creation of reservations for the Indians and the creation of tribal charters and constitutions. In the early 1940's the anthropologist Laura Thompson also brought about meaningful changes in the Hopi administration. The Hopi are a native tribe who live in Arizona. This paper is an essential part of our globalization of science movement. We have touched upon this concept very briefly in our paper on Anthropological economics. our ten mantras would therefore, be as follows:

- Must not blindly ape western centric development models, or impose them on other societies as ground realities in different countries may be fundamentally different from one another. Therefore, local-specific solutions are always extremely important.
- Issue-based, problem-based, and context-based solutions must always be developed and gestated.
- We must always listen to more and more voices from diverse social and cultural spectrums, and implement solutions accordingly.

<sup>&</sup>lt;sup>13</sup> William Easterly (2003), "Can Foreign Aid Buy Growth?" in *Journal of Economic Perspectives* 17(3), pp. 23 – 48

 <sup>&</sup>lt;sup>14</sup> Gerschenkron, Alexander (1962). *Economic Backwardness in Historical Perspective*. Cambridge, MA:
Harvard University Press

<sup>&</sup>lt;sup>15</sup> Simon Kuznets (1966). *Modern Economic Growth: Rate, Structure and Spread*, Yale University Press, New Haven, Connecticut

- we must always offer constructive criticism, and not criticism for the sake of criticism.
- Non-ideology based approaches must be adhered to, and counter-ideologies must also not be slavishly followed. Therefore, we must always adopt agile and creative thinking.
- Wherever course-corrections are required, they must be made.
- We must always learn from our past mistakes, and learn from each other.
- Efficiency, economy and productivity along with outputcriteria driven economic measures must be adopted.
- The concept and maxim of benefit to maximum number of people must always be adopted.
- Pragmatism is the cornerstone of success.

#### IX. HUMAN CAUSED POLLUTION

Human caused pollution is caused by a wide range of human activities such as agriculture, transportation and industry. Agriculture encompasses a wide range of activities that include for example, crop and livestock production, irrigation, fisheries, aquaculture, domestication of animals, horticulture, and forestry for both food and non-food products. Agriculture is the backbone of many different economies all over the world, and as was discussed, originated during the Neolithic revolution some ten thousand years ago. Some crops are extremely land intensive, and some others such as paddy are extremely water intensive. In sum, agriculture has a fairly large environmental footprint, and is responsible for greenhouse gas emissions and destruction of the environment including deforestation. Some decades ago, there was a talk of using scarce land for biodiesel production through the cultivation of jatropha, but this would have been environmentally highly destructive. This concept largely failed on a commercial scale as there were too many logistical imponderables and challenges involved. Sustainable agriculture is a fairly new concept, and has matured and come of only recently. Sustainable age agriculture involves farming and agriculture in sustainable ways that helps meet humanity's present needs, without in any way compromising the ability of future meet their own and generations to needs requirements. Sustainable agriculture is often achieved and accomplished through the use of many new methods and techniques, and best practices are only now being gradually developed in this regard. We still have a long way to go, though there is a faint glimmer and beacon of hope. It is hoped fervently that this paper will go some way in encouraging the introduction of new theoretical concepts. concepts such as agroforestry, mixed New farming, permaculture. drip irrigation for precision agriculture, organic farming through the use of compost and

green manure, multiple cropping, and crop rotation have also been developed, and new technologies such as vertical farming, the use of drones, and solar powered fields have also been developed. <sup>16</sup>

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Organic farming can be defined as an agricultural process that uses biological fertilizers, pesitcides and insecticides derived from animal or plant waste such as compost manure, green manure instead of synthetic and chemical fertilizers. Organic farming has taken off in a big way in Sikkim, though it had failed in Sri Lanka due to a hurried implementation and a sudden transition there. Water conservation techniques are also being increasingly adopted by farmers, in a process that is often driven by selfish interests. This includes techniques such as rainwater harvesting and ground water management techniques too. The slogan more crop per drop was introduced and popularized by the then Indian Prime Minister Manmohan Singh. This catch phrase implies that water is the natural constraint for farming, particularly fresh water supplies. Consequently, some Indian states such as Haryana are driving the transition to more environmentally friendly crops. Permaculture is another new approach to land management that adopts whole-system principles derived from natural ecosystems and includes a harmonious integration of many subcomponents in a way that is only found in nature. The term was coined in 1978 by Bill Mollison and David Holmgren, who formulated the concept in opposition to modern industrialized methods, instead adopting a more traditional or "natural" approach to agriculture. Organizations such as the PAANI foundation are actively involved in water conservation in Western India. There are also major afforestation initiatives under way in states such as Telangana and Tamil Nadu. These are being organized by both governments and private initiatives, and the pace is now quickening. Some of these are farmerdriven social forestry projects. Solar energy, wind energy, and to a lesser extent, tidal energy are also gaining traction. Sustainable transportation may eventually materialize as electric batteries improve, and become cheaper as well in the process. Meat production and meat consumption (particularly production of red meat) are also large contributors to green house gases, more that agriculture itself. One solution to this problem is the adoption of vegetarianism, or even veganism. This may not however, catch on for cultural reasons. One alternative solution is to developed plant-based meat substitutes. This is slowly catching on in Europe and in the USA with several private firms offering attractive products, but may never become mainstream. Humans also lead to species endangerment and extinction, and this is caused by overhunting or over harvesting, introduction of non-native species, and habitat degradation or loss. Hunting also causes extinction or near-extinction as evidenced by the Dodo and the American Bison. 17 18

<sup>18</sup> Loofs, Mona. *Permaculture, Ecology and Agriculture: An investigation into Permaculture theory and practice using two case studies in northern New South Wales* Honours thesis, Human Ecology Program, Department of Geography, Australian National University 1993

<sup>&</sup>lt;sup>16</sup> Waters, Tony (2007). *The Persistence of Subsistence Agriculture: life beneath the level of the marketplace*. Lexington Books

<sup>&</sup>lt;sup>17</sup> Paull, John (2011). "Biodynamic Agriculture: The Journey from Koberwitz to the World, 1924-1938". *Journal of Organic Systems*. **6** (1): 27–41

https://doi.org/10.38124/ijisrt/IJISRT24AUG1350 primarily used in electricity generation. Coal also has the most varied history of human usage and exploitation. Coal has been used for heating since the cave man. There is evidence that people in China used coal for heating from at least 3500 BC. Archeologists have also found evidence that the Romans in England used it in the second and third centuries (100- 200 AD). Among the world's first coal mines was opened in 1575 by Sir George Bruce of Carnock in Scotland. New techniques in coal mining were developed in the seventeenth century and several notable advances were made.

The Industrial Revolution, was а highly transformational revolution with began in Great Britain in the eighteenth century, and later spread to Europe and North America, particularly the USA. This revolution was largely based on the ready availability of coal to power stationary steam engines and locomotives. It is worth mentioning here that the first railway line in was built in the year 1825 by George Stephenson and it connected the towns of Stockton and Darlington in England. Steamships also became common-place and these provided a fast way to cross the Atlantic. This led to the rapid expansion of trade also because coal was much cheaper and much more efficient than wood for transportation. In Great Britain, many coal mines operated in central and northern England, as well as Wales and Scotland due to the abundance of coal in these regions. As coal became exhausted, coal extraction techniques rapidly progressed from surface extraction to deep shaft mining. Coal mining also spread to distant regions of the planet as steam ships travelled to these regions, and needed to be refueled to complete their often very long voyages.

As would be obvious to anyone possessing a fair degree of common sense, coal is among the dirtiest of fossil fuels known to man. Since the time of the industrial revolution, coal has been used for transport which eventually became one of its chief and primary uses. However, the arrival of diesel engines and electrification of railway networks since the 1940's meant that coal was no longer used for transportation. Electricity also replaced coal-based power generation as the primary source of power for industry beginning around 1905. Coal mining is also often done in extremely dangerous conditions, and coal miners are exposed to all kinds of diseases such as Coal workers' pneumoconiosis and Silicosis. Coal miners are also often exploited, and receive very less pay. Donald Trump and others have spoken about clean coal, but this is largely a myth. Capturing gases from smokestacks is prohibitively expensive, and often unviable. However, the good news is that various forms of renewable energy are becoming cheaper and cheaper, and will displace coal eventually. 21

to global warming. Pollution has been defined variously by the US Environmental Protection Agency and by the United Nations. Industrial pollution is said to take place when factories, mines and transportation release greenhouse gases such as carbon dioxide and other toxic flue gases into the atmosphere. These may be classified into point-source emissions and non-points source emissions based on the point of generation of atmospheric pollution. Often, major polluting industries are located close to cities, and consequently countries like India have among the most polluted cities in the world. Industrial pollution is detrimental to human health, and may also cause lung and respiratory problems and diseases besides other airborne diseases. It can also cause premature death. Some countries such as China are combating polluting through legislation, but we are in the nascent stages yet. Industries often dump pollutants into lakes and rivers, endangering marine ecosystems and marine life in the process. Plastics and polymers are also non biodegradable and cause irreparable damage to ecosystems. There is a new concept of bioplastics which is the production of plastic from renewable biomass resources, but this has yet to take off on a large scale. Bioplastics do not have a zero environmental footprint either. Nuclear power is also dangerous in its own way, and has caused deaths from radiation. Transportation releases carbon dioxide into the atmosphere, and it is only in the recent past that internal combustion engines have become relatively more environmentally friendly, driven by legislation and pollution standards and norms. There are also limits as to how far IC engines can be developed, but even electric vehicles come at an environmental cost. Among the most polluting industries in the world include lead and acid battery recycling, mining and extractive metallurgy, artisanal mining, dyeing, tanning, chemical manufacturing, and lead smelting. Many of these are legacy industries, but cannot be eliminated completely. 19 20

Pollution caused by industry is also a major contributor

Coal is one of the oldest fossil fuels known to mankind, and also one of the most important. As a naturally occurring energy source, it is also the world's most abundant and plentiful. Coal is believed to have been formed hundreds of millions of years ago from the remnants of organic material was buried deep within the earth's crust, and the energy stored by plants led to the energy content present within coal. Over a period in time, these were covered by thick layers of dirt and the weight of these layers, combined with several other factors such as heat and pressure, created coal. This was an extremely slow process, and took millions of years to happen. It is not only a dirty energy source, but also a non-renewable one. This is because coal cannot be recreated or reproduced quickly. Coal formed from peat which is a precursor to coal, and the different types of coal are anthracite or hard coal, bituminous coal, subbituminous coal, and lignite. Lignite is also known as brown coal, and is

<sup>&</sup>lt;sup>21</sup> Cleal, C. J.; Thomas, B. A. (2005). "Palaeozoic tropical rainforests and their effect on global climates: is the past the key to the present?". *Geobiology*. **3** (1): 13–31

<sup>&</sup>lt;sup>19</sup> Hunter, Louis C. (1985). *A History of Industrial Power in the United States, 1730–1930, Vol. 2: Steam Power.* Charlottesville: University Press of Virginia. p. 18.

<sup>&</sup>lt;sup>20</sup> Nye, David E. (1990). *Electrifying America: Social Meanings of a New Technology*. Cambridge, Massachusetts, United States and London, England: The MIT Press

According to an estimate carried out by the International Energy Agency (or the IEA) coal is responsible for over 30% of the average global temperature increase since the dawn of the industrial revolution, putting it far ahead of both fossil fuels and natural gas in terms of pollution generation. It has been reliably estimated that coal-fired generation puts out well twice as much carbon dioxide per megawatt hour generated compared to electricity generated from other sources such as natural gas. Phasing out coal is therefore an extremely important component of the fight against pollution and global warming. To be fair, coal usage is indeed dying out. The USA also has shuttered many coal plants in the last few years, and in the UK coal usage is next to nothing for power generation. Countries like Germany may phase out coal use by the 2030's, while coal usage in countries such as India and China continues to be strong. India continues to be a laggard in this regard, and steam locomotives were phased out in the country only in the 1990's. As of 2022, over twenty countries have already committed to phase out coal, most of them being high income ones.

A fossil fuel may be defined as a carbon compound, or in more technical terms, a hydrocarbon-containing and preserving material (more common examples being coal and natural gas) which were formed naturally beneath the Earth's crust from the fossilized remains of early organisms over a protracted span of time stretching several millions of years, perhaps a much longer period under high pressure conditions. This observation was first made by Andreas Libavius in 1597, and later by Mikhail Lomonosov as well. These fuels contain vast reserves of energy, and are used to power cars, buses and trucks in several of their forms, besides aiding in stationary power generation as well. Fossil fuels are classified as non-renewable sources of energy and are highly polluting too, just behind coal. Fossil fuels were referred to as hydrocarbons in some contexts in the late nineteenth century when it was just beginning to be used as a motive power, but was later referred to as petrol or diesel, and gas in the USA. Petrol-driven automobiles were produced in extremely small quantities in the late 1890's, and the technology itself came of age between 1900 and 1905. The Ford Motor company was established in 1902, and the Ford Model T was introduced in 1908. The assembly line production was introduced in 1914, making it a viable means of transportation for the masses. Cars effectively replaced horses, but the drawbacks of industrial pollution were not widely acknowledged then. Petrol and diesel cars remain dominant as of 2024, though they are now being increasingly challenged by electric vehicles. Fossil fuels also provide for around 80% of the world's energy. Since the dawn of the environmental movement, the term "fossil fuel" has begun to acquire a pejorative connotation, and calls are being made to

phase them out from all facets of life in order to achieve a transition to a carbon-free economy.

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A lithium-ion also known as a Li-ion battery is a type of rechargeable battery that has many applications and is widely used today in many different walks of life. These batteries typically have a high energy density and are used in mobile phones and electric cars. Stanley Whittingham did some pioneering work that led to the development of lithium ion batteries, though John Goodenough, also performed groundbreaking work on the invention of this type of battery, and was even awarded the Nobel prize for it. Contributions were also made by Akira Yoshino and others. Lithium ion batteries were commercially introduced in 1991. Since then they have improved greatly. Lithium is however a rare earth material, and is found only in some parts of the earth. Cobalt is also a rare earth material, and is associated with child labour in Congo. In sum, despite their widespread usage, lithium ion batteries have a relatively large environmental footprint. Sodium Ions promise to be much cheaper because sodium is abundant in the earth's crust. It is however heavier in comparison, and has a lower energy density despite the fact that it is less inflammable than lithium ion batteries. BYD of China has commercialized them since 2024. Other new promising technologies are solid state batteries and aluminum ion batteries. These are however some years away from mainstream adoption. Another potential technology is that of hydrogen and fuel cell electric vehicles, but these may never reach mainstream production. This technology is not entirely <sup>22</sup>environmentally friendly either. Aviation also has a large environmental footprint, but commercial electric aircraft may take decades to materialize. Ups and downs notwithstanding, humanity appears to be moving in the right direction. <sup>23 24</sup>

#### X. POPULATION MANAGEMENT

The term "Total fertility rate" also often abbreviated to TFR is a widely used, though somewhat misunderstood term today. But what exactly is a total fertility rate? To put it in simple terms, the term "total fertility rate", (which is a purely synthetic rate) in the average number of children a woman could be expected to bear in her lifetime based on age-specific birth rates, assuming that she lives till the end of her childbearing age. The total fertility rate depends on a large number of factors including cultural and economic factors and varies widely from country to country, and region to region. It ranges from a high of 6.6 children per woman in Niger, to 0.90 children per woman in South Korea (both figures are estimates for 2024 by the United Nations population fund). There are of course, several variants of the basic theme. Sometimes, age group-specific fertility rates are also calculated, though this is relatively less common. Total fertility rates are computed or calculated annually for

<sup>&</sup>lt;sup>22</sup> Fergus, J.W. (2010). "Ceramic and polymeric solid electrolytes for lithium-ion batteries". *Journal of Power Sources*. **195** (15): 4554–4569

<sup>&</sup>lt;sup>23</sup> Yao, X.L.; Xie, S.; Chen, C.; Wang, Q.S.; Sun, J.; Wang, Q.S.; Sun, J. (2004). "Comparative study of trimethyl phosphite and trimethyl phosphate as electrolyte additives in

lithium ion batteries". *Journal of Power Sources*. **144**: 170–175

<sup>&</sup>lt;sup>24</sup> Xu, Haofeng; He, Yiou; Strobel, Kieran L.; Gilmore, Christopher K.; Kelley, Sean P.; Hennick, Cooper C.; Sebastian, Thomas; Woolston, Mark R.; Perreault, David J.; Barrett, Steven R. H. (2018-11-21). "Flight of an aeroplane with solid-state propulsion". *Nature*. **563** (7732): 532–535

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different countries, territories, or geographical areas, and mid-year estimated values are most commonly taken into consideration for this purpose. Total fertility rates may often be used to prepare population projections for a given region, and commonly low variant, medium variant, and high variant projections are also prepared.

Another useful but interesting and interrelated concept is that of replacement total fertility rate. The replacement level total fertility rate is that TFR which is required for a population to exactly replace itself. Even though common sense warrants and dictates that the replacement TFR is exactly two children per woman, this is not most commonly the case; this is because all children may not live till maturity or child-bearing age. Therefore, the replacement level TFR is most often considered to be 2.1 children per woman; this figure is generally true of more developed regions and economies. In less developed societies and economies, the replacement level TFR may be somewhat higher that this, say 2.2 to 2.3 children per woman. Any country or society which achieves a replacement level TFR, can be expected to maintain its population in the long-term. The term long-term is extremely important here, and must be carefully emphasized. We must use the word long-term because there is always a population momentum, and population stabilization occurs only a few decades after, replacement level TFR is attained, usually two or three. Population momentum can be said to occur, because it is not only the number of children per woman that determine population growth, but also the number of women in the reproductive age group or bracket. Population therefore only stops growing when the number of births equals to the number of deaths. The time taken for population stabilization or zero population growth would also depend on other factors such as the intensity of decline of the TFR after it has crossed the replacement threshold, though two or three decades is a reliable mean number.

In the field of demography, the theory of demographic transition is a theory which has been widely attested to by empirical data in various societies and cultures over the past two or three centuries. It was initially developed based on observations made by Warren Thompson, Adolphe Landry, and others. This theory refers to, and reflects a historical shift from high birth rates and high death rates in traditional or backward societies with a low level of technological percolation, a low level education, women's empowerment, and economic development, (in primitive and backward societies, death rates were also high due to wars, famines, droughts, and internecine strife) to a state of low birth rates and low death rates in societies with much more advanced levels of technology, high education, women's empowerment, and economic development. This theory also maps the different intermediary stages between these two extreme scenarios. For example, in early years populations remained stable because of high birth and death rates however, a sudden reduction of death rates due to an improvement of medical facilities for example, led to a population explosion. Many countries have now successfully and effectively transitioned to the last state where both birth and death rates are low, or even where birth rates are lower

than death rates; thus, doomsayers have been effectively proved wrong. Birth rates have fallen from around five children per woman in the middle of the nineteenth century, to slightly over two children per woman today.

Almost half the world's population today lives in countries with below replacement birth rates, and birth rates are falling or plummeting everywhere. The only significant exceptions and outliers can be said to be much of Sub-Saharan Africa, and isolated pockets of Asia such as Afghanistan and the Phillipines. Even in these regions or countries, total fertility rates are gradually falling, and it is only a matter of time that these regions or countries reach replacement fertility rates, as and when there is greater economic prosperity, an enhanced standard of living, and women's empowerment and education, including more employment opportunities for women. Birth rates also decline people more and more people appreciate, and warm up to the importance of education as a vital game changer. Low TFR's are in many ways a good thing, because it boosts per capita land stock, increases investment in human capital in general, and reduces environmental degradation. Many people who proposed that religious, cultural and economic factors would play a major role in determining fertility rates have also been partly proven wrong. Birth rates are falling everywhere, including in developing countries, thereby boosting socio-economic progress to a great degree. The corelation between the two is very nearly an established fact, and the correlation between these two factors is often bidirectional and multidimensional.

In India, the importance of family planning was realized by some early thinkers such as Raghunath Dhondo Karve way back in the 1920's. At that time however, the merits of birth control were not widely realized, and contemporary thinkers such as Mahatma Gandhi and Periyar EVR had a diversity of opinions on the issue of birth control. In 1952, India under Jawaharlal Nehru, became practically the first country in the entire developing world to implement an intensive government-sponsored family planning program, also called the National Family Planning Program. This program was even built into India's early five year plans. Among the program's objectives was to reduce total fertility rates in order to slow down population growth, and accelerate the process of economic progress. In keeping with the demographic ideals of the nation, the program was purely voluntary. Hence, initial progress was slow, and the demographic transition in India took place much more slowly than it did in China, and other countries. In India, the TFR in the early 1950's was around six children per women, very high of course, but way lower that some countries in Sub-Saharan Africa at that time. By 2023, India had already reached its replacement level of fertility, and took over seventy five years after independence, to do so. One mistake early planners may have made was to discount the importance education could play in bringing down birth rates. Thus, literacy rates, particularly women's literacy rates remained low in the early decades of India's independence. India's literacy rate was estimated to be 34% in 1971, and 43% in 1981 according to decadal census figures, which is extremely low indeed. It was not until the 2000's that more meaningful universalization of

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education programs such as the Sarva Siksha Abhiyan were launched, and began to have a substantial and a significant impact on various aspects and facets of daily life. The right to education act was not passed by the Indian government until the year 2009.

India at that time also pursued a semi-Stalinist planned economic programme, and it is even said that some planners even believed that India would not be able to produce or generate enough jobs if too many of its people were highly educated. India therefore pursued a "vertical approach" to family planning, and neglected additional factors such as education, women's empowerment, poverty reduction, rapid economic development etc. According to some other sources, the importance and the ideals of family planning were also not properly communicated to the masses. While nobody today considers India's family planning programme to be an absolute or a dismal failure, progress was initially slow and tardy, and the TFR was brought down only very gradually, at least in the initial years. There were also wide variations by region and community, and such disparities were initially not sought to be addressed. In some states, people with over two children were disincentivized from holding government jobs. Monetary incentives were also provided, though these were small. To make matters worse, forced sterilization programmes and campaigns were launched during the emergency of the mid-1970's, and these appear to have boomeranged and backfired horribly, setting India's family planning programmes by several years at least, if not several decades.

However, birth rates have since steadily fallen; Kerala was the first to achieve replacement TFR in 1988, followed by Tamilnadu in 1993, and many other states followed in quick succession. As of 2024, even Rajasthan and Madhya Pradesh have reached replacement level fertility, while fertility rates in parts of north India such as Punjab, Uttarakhand and Himachal Pradesh are even lower than that of the south. Uttar Pradesh may not reach a replacement level figure until 2027, in spite of the recent announcement of a new population control policy there, while Bihar and Meghalaya may not reach replacement TFR until the 2030's. There is a gap between Hindus and Muslims, which slowly appears to be narrowing. An interesting case is however, Jammu and Kashmir which, despite being Muslim majority now has a total fertility rate that is well below replacement. Therefore, we must never over-simplify issues; there will always be a wide range of parameters to be considered. A grounds up and a data driven approach must also always be carried out.

Of late, some groups of people in India (those belonging to different parts of India, as a matter of fact) have begun to draw inspiration from concerns raised by people in different parts of the West and the Far East where birth rates are far, far lower than they presently are in India, and have begun to advocate for higher birth rates. This argument is fallacious, if not outright dangerous. This argument is known as pronatalism, and draws heavily from highly neoliberal interpretations of economic development which blindly (and often fallaciously) equate faster economic development with higher populations. This philosophy also translates into government policy such as incentives for more children, and is contrasted sharply and starkly with antinatalism. This is not only bad for the environment, but is bound to put a heavy strain on natural resources. Such people have also invoked the idea of a "demographic dividend" from time to time. This concept is sometimes heavily misunderstood, and is somewhat of a misnomer. According to the idea of a dividend, sometimes known as the demographic demographic gift, the economy of a country stands to benefit if it has a large number of people, or a large proportion of the population in the working age group. However, there is a caveat here; people must be sufficiently trained and skilled to contribute meaningfully to the economy. Studies have repeatedly shown that parents with smaller families tend to take care of their children better and educate them better. This idea and notion has also been reinforced with data from countries such as China and South Korea. Children born to such parents are then also able to contribute to government taxes better, and even take care of their parents better in such cases. Therefore, all dimensions of any issue must be taken into account and consideration at all times, with data and case studies culled from all parts of the world, and from all cultures, and not just from one narrow geographical region. While we do agree that extremely low birth rates can have negative economic consequences, India is nowhere near that stage yet. In most Indian states, total fertility rates are around 1.7 to 1.8 children per woman (a rate or figure most people would consider ideal), while in some other states, total fertility rates are even higher than that. If birth rates fall to much, much lower levels, than can we begin to worry. Let us not put the cart before the horse.

It is indeed very difficult to define or determine what constitutes an ideal total fertility rate, or a low fertility rate, but we believe it is always necessary to take a local-specific approach. There can be no one size fits all approach. This realization lies at the heart of our strategy. This realization would also, in our view, lead to the fixation and the determination of what we may call the "Ideal TFR". This we believe, must be fixed by local and national governments in different contexts, and must be determined using a localized and a bottom up approach. It may also be revised from time to time. The Ideal TFR, we could be determined by several factors such as the following.

- Population density of a particular state, country, or region, including a consideration of interstate and intrastate variations, and current growth rates in population.
- Environmental conditions (Vulnerability and susceptibility to global warming) For example, countries like India and the Maldives are generally considered to be more exposed to the dangers of global warming than Russia.
- Natural resources: The availability or non-availability of different types and different forms of natural resources must also always be taken into account and consideration. Examples of this include arable land, rainfall, and groundwater availability.

- Economic factors: Economic factors such as per capita income, and current or anticipated standards of living would also be a useful determinant.
- Geopolitical factors: Last but not the least geopolitical factors such as the geopolitical stability or the geopolitical instability in the neighbourhood, including perceived threats of aggression must also always be taken into account and consideration at all times.

We also propose that that the terms "Population management", and "Demographic management" he popularized, as these would be far more handy and comprehensive than more restrictive terms such and birth control or population control. Factors comprising population management would comprise and encompass a wider variety or local and overarching non-local factors too. As always we need bottom up research, bottom up gestation of ideas and thought processes - not those that are slavishly and mindlessly borrowed from other contexts and cultures- this realization is the cornerstone of our approach, and forms the bedrock of our philosophy. This approach can also if properly conceptualized and executed, provide a fulcrum and a springboard for meaningful action and progress, and could lead to faster and more equitable development benefiting a larger cross-section of the population. <sup>25</sup> 26 27 28 29 30

#### XI. MAHATMA GANDHI'S TRUSTEESHIP PRINCIPLE

We also now review Mahatma Gandhi's trusteeship principle, an idea that we do not wholeheartedly endorse. We also admit that this idea is not entire practical, and suffers several lacunae, drawbacks and deficiencies. Gandhi's theory of trusteeship is an idea that wealthy people should consider themselves lucky as they were blessed by God, and manage their property and their wealth manage as "trustees" on behalf of the poor. In other words, this theory endorses and legitimates the positions of the wealthy (including capitalists and landlords) in society, as long as they acted as "trustees" on behalf of the poor, the needy, and the destitute. This approach is purely voluntary, and not obligatory or binding on behalf of the rich. However, the rich could at times be persuaded to part with their wealth. Gandhi's ideas on this matter were first developed between 1888 and 1891 based on John Ruskin's economic ideas. A draft explaining the tenets of Gandhi's principle formula was put down in writing by two of Gandhi's co-workers, namely Narhari Parikh and Kishorelal Mashruwala. It was later refined and fine-tuned by

M.L. Dantwala. It is also said that JRD Tata was greatly inspired and influenced by Gandhi's trusteeship principle.

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Our approach draws some inspiration from Gandhi's trusteeship principle, and is only at best, indirectly related to it. There must be no plans for the colonization of planet Mars, other planets at present. Let us put such plans on the backburner for the time being, and defer them for posterity. Let us put our own house in order first. Man has an intellect and is a superior intellect. He must use his intellect for common good. It is only man who will stand to benefit in the long-run. As an extension of this principle, man must also act as a custodian of other species, and as their guardian, steward, and caretaker based on the principle of a win-win paradigm.<sup>31</sup>

#### XII. KEY COMPONENTS AND PRINCIPLES OF THE "HUMAN TRUSTEESHIP OF THE PLANET" CONCEPT

- The Following Are Therefore, The Core And The Key Components And Principles Of The "Human Trusteeship Of The Planet" Concept
- This must be instituted as a core component in general and environmental anthropology as it will be a harbinger of meaningful action and change. This may take ages and aeons to accomplish, but it must set the general direction and the general agenda for change. We must not lose hope at any cost and under any circumstances, and must not give up midway through. All future paradigms and future thought must be anchored on this basic and foundational principle. This is like an environmental management plan, and an environmental resource management plan, but operates more at a global level, and on a much longer horizon.
- Humans must combat anthropogenic environmental degradation and stop anthropogenic climate change. This can be done by acquiescing the fact that humans are the key drivers and the key architects of global warning. We have raw and hard data to evidence this. For example, the ozone layer has been depleted, and ozone holes formed. A significant and a steady reduction in the consumption of ozone-depleting substances has however been already achieved globally since the mid-1980's driven in large part by the 1987 United Nations Environment Programme's Montreal Protocol.

<sup>28</sup> Bruce K Caldwell; Pat Caldwell; Peter F McDonald; Thomas Schindlmayr (2006). *Demographic Transition Theory*. Dordrecht, the Netherlands: Springer.

<sup>&</sup>lt;sup>25</sup> Espenshade TJ, Guzman JC, Westoff CF (2003). "The surprising global variation in replacement fertility". *Population Research and Policy Review*.

<sup>&</sup>lt;sup>26</sup> Craig, J (1994). "Replacement level fertility and future population growth". *Population Trends* (78): 20–22. PMID 7834459

<sup>&</sup>lt;sup>27</sup> Caldwell, John C. (1976). "Toward a restatement of demographic transition theory". *Population and Development Review*.

<sup>&</sup>lt;sup>29</sup> Rabindra Nath Pati (2003). Socio-cultural dimensions of reproductive child health. APH Publishing. p. 51.

<sup>&</sup>lt;sup>30</sup> Mandani, Mahmood (1972). *The Myth of Population Control: Family, Caste, and Class in an Indian Village*, in series, *Modern Reader*. First Modern Reader Pbk. ed. New York: Monthly Review Press, 1973

<sup>&</sup>lt;sup>31</sup> Ahmed, Talat (2018). *Mohandas Gandhi: Experiments in Civil Disobedience* 

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- Humans must pursue sustainable development: Sustainable development is not a distant pipe dream; it is already a reality, and is knocking on our door. Sustainable development is a form of development that is conducted without a depletion of natural resources. A formal definition of Sustainable development is that sustainable development is an approach to economic growth and human development that aims to fulfill and satisfy the wants and the needs of the present generation without compromising the ability of future generations to meet their own needs. We have already transcended the first barrier because enormous progress has been made in generating widespread environmental awareness of the issue of global warming among the general public and the common man.
- Humans must protect biodiversity: Biodiversity is the variety, diversity and variability found within different forms of life on Earth. It can be measured though the use and adoption of measures such as species diversity, genetic variability, ecosystem diversity and phylogenetic diversity. Diversity is not naturally distributed evenly on Earth, and some ecosystems and habitats have a greater diversity than some other do.
- Humans must protect ecosystems and habitats of species: An ecosystem is a biological community of organisms as they interact with their physical environment. This definition is drawn from the standard definition of an ecosystem which is a complex network of interconnected parts. A habitat in this case is the natural home of a plant, animal or any other species or organism.
- Progress in climate change mitigation must not based on CO2 emissions alone: a more holistic approach is required, and we have discussed other unhealthy ramifications of human driven climate change in this paper. We would therefore look forward to more meaningful contributions and research papers by other researchers on this issue, as this issue is far from easy, simple or straightforward, and it has a lot more going to it than meets the eye. Humans damage the environment in more ways than one.
- This is where anthropologists must pitch in and set the agenda. Anthropologists are uniquely poised to understand issues from a long-term perspective and from a transdisciplinary perspective given the fact that anthropology is by itself a very transdisciplinary science, and interfaces deeply and fundamentally with a whole gamut of other related sciences. Anthropologists must also collaborate with technology experts and other domain experts as necessary in order to fulfill their long-term perspective. Transnational collaboration is also of extreme importance, but we have already made a great deal of progress on this score, as most nations and governments all over the world have already been bought in on this issue.

- Population management is necessary: Population management is a term that we propose. The importance and the role of population management in fighting global warming must not be discounted or played down at any cost, or under any circumstances. We have devoted and dedicated an entire section of this paper to the idea of population management.
- If possible all action must lead us to a better earth. An eventual reversion to pre-industrial and pre-human levels must be attempted, and we can of course set much more ambitious goals too. This is by no means easy, but we must now take baby steps in this regard, and set the ball rolling.
- This is a purely long term approach may take several decades to achieve. This concept is tied to our concept of aeternitism, and to a lesser extent, to the idea of omnimodism. A long-term vision is an utmost necessity and a pre-requisite for planning and for progress, but is a quality that few people have, and most people lack. One is reminded of China's long-term approach to issues including climate change, and the support provided by its government to the nascent and the budding electric car industry. This is just a stray and an isolated example; China does this all the time. The concepts tied to aeternitism must be inculcated by sheer force and dint of habit, and this is an exercise that must be attempted seriously and inculcated in others as well as a part of the process.
- This must translate into action, even if the formulation of action plans are fraught with challenges and complications: We therefore, need a new generation of ecowarriors to fight our battles. The term eco-warrior is a handy moniker for an environmental activist who adopts a "hands-on" effort to fight for environmental causes. For example, we had the Swedish activist Greta Thurberg, who pressurized and convinced many world leaders to take the issue of global warming seriously. Even if their technical contributions are limited, ecowarriors play a crucial role in escalating general awareness on issues. Readers may also read our paper on science activism for greater clarity.
- There are many potential and hidden benefits of this approach. For one, it will enable a holistic and a variegated approach; it will also enable a long-term approach, and a more proactive approach. It will make humans more environmentally aware and more environmentally conscious, and will be the springboard for further research and for further meaningful action. For starters, we look forward to more research being carried out in the field of environmental science. It is early days yet, and we have a long way to go.

#### XIII. CONCLUSION

We had begun this paper by tracing the long and complex history of mankind in relation to his environment. In order to accomplish this, we had begun from the history of the twelve thousand years old Neolithic revolution and the much later emergence of the world's earliest advanced civilizations. We also then briefly overviewed the industrial revolution and assessed the impact it certainly had on the environment, pollution, and environmental degradation. We then also provided a brief and a high level overview of the field and the discipline of anthropology, environmental anthropology included, both in its early days, and in more recent and contemporary times. We consequently also reviewed the various core components of earth studies including geology, hydrology, and ecology, and provide and a history of environmental studies as well by interfacing this with environmental anthropology too. Definitions of terms such as the biosphere, the lithosphere, hydrosphere and the atmosphere were also therefore provided, and many other related concepts overviewed. This paper was also then interfaced with developmental studies and developmental economics including developmental anthropology and anthropology in development so that a clear amalgam of the two could be brought out and accomplished. The current state of the environmental movement was also reviewed, and a review of the current state of technology is also accomplished along with a brief assessment of various other indirect factors such as population management. All these assessments then invariably and inevitably led us to the key components and principles of the "Human trusteeship of the planet" concept which we then laid bare. We believe that this approach will heal many wounds, and make the world a better place for all of us to live in, at least in the long-term.