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Population Growth and its Impact on Natural Resources: A Sociological Perspective on Need for Sustainability

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Abstract: Global population growth has immense implications for natural resources, altering ecological balances and leading to environmental deterioration. As the population explosion has multiple consequences for land, water, forests, and energy resources, the need to study its various dimensions and sustainable practices becomes highly relevant. Though the burden of resource scarcity is felt more in low-income regions, both developed and underdeveloped countries face these challenges. This research aims to examine agricultural land degradation, water scarcity, and biodiversity loss in the Indian context. It also examines global and national initiatives, such as population policies, that address these issues. The study further focuses on the transition from non-renewable to renewable energy sources as a measure for achieving ecological stability and intergenerational sustainability. The research emphasises an integrated approach to population management and resource conservation for a sustainable future.

Keywords: Natural resources; Population growth; Environmental implications; Sustainability; Renewable energy

I. Introduction

Population growth significantly impacts natural resources in several ways. Overpopulation and environmental degradation have always been interrelated, and their relationship has been complex. Overpopulation refers to a situation in which the population of an area is so large that people experience negative consequences. In other words, it means that the population has grown to such an extent that it surpasses the area's carrying capacity, which is the maximum number of people that an area can sustain without suffering significant environmental damage. This

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population growth, or overpopulation, degrades the environment and impacts our natural resources.

Our natural resources are being overexploited due to rapid global population growth. Most of the time, though, developed countries are responsible for the continued degradation of the environment and the depletion of natural resources, and developing and underdeveloped countries often face adverse consequences. Technological developments in these countries also have negative impacts on the natural realm. This pressure is not only threatening the global environment and natural ecosystems but also acting as a significant obstacle to the continuation of life in a sustainable manner across the planet.

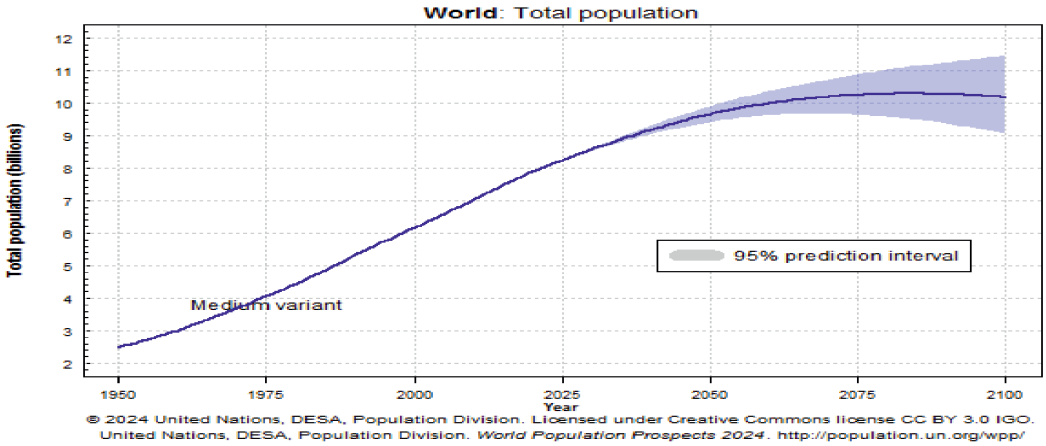
The issue of rising global temperatures is one of the most significant environmental problems linked to population growth. The effects of Global warming, along with a rise in severe weather, are substantial concerns highlighted by experts associated with this phenomenon. To make room for the ever-increasing human population, forest clearance has increased sharply. Humans continue to place significant demand on the natural resources available. The unregulated consumption of fuel and energy is depleting numerous non-renewable resources. In many regions of the world, people are unable to obtain sufficient food and water and population expansion further strains already limited resources.

The rise in the number of people living on the planet is negatively impacting the environment through various activities that degrade it. These issues must be addressed in the coming century to ensure a sustainable future for life on Earth. Rising population, increased consumption, overuse of resources and improper management of waste reduced the Earth's capacity to support life. One of the crucial factors in determining environmental impact is population size. Therefore, it's essential to study the human population growth and its impact on natural resources, along with measures to regulate.

I.1. Global Population Trends and Environmental implications

Major path or world's population from 1950, with projections through 2100 is show below, which is based on the data from United Nations World population prospects 2024.(UN DESA 2024).It shows growth of past century and projected slowdown.

As of October 21, 2025, based on the United Nations' data, the current population of the world is 8.23billion.The world population is projected to surpass 9 billion in 2037 and reach 10 billion in 2058. From a historical point of view, in



1963 the peak of global population growth occurred, when the annual growth rate reached 2.28 %. Growth rates remained above 2 % for a period thereafter. The most significant population increase occurred in 1990, with nearly 93.7 million people added worldwide.

In 2024, the world population is expected to increase by approximately 69.26 million people,, roughly equivalent to the UK's entire population, which ranks 22nd globally. However, the annual growth rate is steadily declining. It is anticipated that the global population in 2025 will rise at the rate of 0.84% per year. The annual population growth is projected to keep declining; potentially dropping to 0.5% b 2046.By 2084, the world may begin to experience annual population declines.

The rapid demographic expansion discussed above has not taken place in a vacuum; it has a significant impact on the planet's ecological balance. The loss of land, forest removal, reduction in vegetation cover etc. is the consequences of massive population growth. With the upsurge in population growth, environmental pollution intensified due to the increasing number of vehicles, ultimately resulting in respiratory diseases like asthma and lung cancer etc. There is a significant impact of regional population growth on carbon dioxide emissions and urban land use in India.

The Physical environment- meaning the land water or air is harmfully and severely diluted because of excessive population growth. With more population, there has been increased use of advanced machinery, which in fact has increased the application of fertilizers and pesticides, which make the soil infertile. Besides pollution, overpopulation also accelerates broader ecological crises such as global

warming and deforestation.Runoff water containing pesticides and fertilisers from agricultural lands contaminates water bodies, thereby increasing water pollution. India has forest cover of about 72.5 sq.km, while only 63.34 is considered actual forest cover. With a larger population, there is a loss of forest cover.

There has been massive species extinction due to population growth, particularly in biodiversity hotspots, where populations are surging at 1.8 per cent annually. Research found that increasing population, poverty, and lack of awareness among people are solely responsible for environmental hazards. Illiteracy and poor hygiene practices often lead to careless dumping of waste, causing harmful chemicals to deplete the natural resources, air, water and soil, thus resulting in biodiversity loss and harmful health consequences.

Recognizing the gravity of the environmental repercussions of population growth, several global efforts have been made to address the population crisis. The Millennium Development Goals (MDGs) and India's national population control policy were established ever since the population started increasing. The International Conference on Population and Development (ICPD) started putting forward new goals to set up to control population impact on the environment. As overpopulation is highly correlated to environmental degradation, there is a need for the strict implementation of population control laws to ensure sustainable access to resources for future generations.

In the Indian context, population explosion has particularly severe implications for land use and agriculture. At that time, India was experiencing a severe food crisis due to its inability to produce enough food to feed its rapidly growing population.((Dyson, 2010; Dreze & Sen, 2013;). To address this challenge, the Green Revolution was introduced, with the introduction of high-yielding seed varieties and increased use of insecticides and fertilizers to promote agricultural development. While food shortages were temporarily addressed, these chemical inputs caused long-term impacts on the ecosystem, contaminating water and destroying soil microorganisms essential for plant growth. Currently, around 175 million hectares of India's 328.7 million hectares of land are classified as degraded, posing challenges for small farmers who rely on agriculture for their livelihoods. (Mythili 2016)

When rural areas struggle with soil degradation and declining agricultural capacity, urban regions face parallel pressures from overpopulation, including air pollution, sanitation issues, and the expansion of informal settlements. With population expansion, the net availability of food grains per person declined. With

urbanization, emergence of slums also increased, leading to again strain on urban infrastructure and natural resources.

In the Universal Declaration on the Eradication of Hunger and Malnutrition, the right to an adequate standard of living was first recognized as a fundamental human right. Though it should be considered one of the most essential rights, it has been violated in most countries due to extreme poverty, conflict, and climate change, regardless of whether they are developed or underdeveloped. Despite global progress, over 800 million people remain undernourished, and this number may rise to 2 billion by 2050. Another critical dimension of sustainability availability of freshwater resources is closely related to food insecurity. As it is closely linked to the Sustainable Development Goals, urgent collaboration among governments and stakeholders are essential to ensure food security and the eradication of hunger and malnutrition,, thereby leading to sustainable resource management.

While the second part of the 20th century witnessed rapid population growth and food production, placing excessive strain on land, water, and energy resources, making sustainable agricultural practices more critical. According to World Bank and UN reports, around 1 to 2 billion population face malnutrition and insufficient food distribution due to poverty and inequality –both directly related to population explosion. As the population expands, the pressure on arable land, water, energy, and biological resources intensifies. In fewer than 50 years, the world population is expected to triple (Pimentel et al., 1994), potentially leaving around 3 billion hungry.

In the light of these increasing challenges, Royal Society and National Academy of Sciences scientists issued a joint statement expressing concern about the world's population and natural resources. The increasing trend in food production over the last few decades suggests that the Malthusian tenets are no longer valid at the all-India level (RS&NAS, 1992).Population growth, however, continues to place a significant stress on natural resources, especially water, despite the progress. One of the main factors driving the growing water demand is rapid population growth, changing living standards and consumption habits, and the rapid expansion of irrigated agriculture. The continued pressure on water resources leads to undesirable consequences, including imbalances between demand and availability, degradation of water quality, competition between sectors, and even regional and international conflicts (United Nations, 2018; World Bank, 2016; Falkenmark & Rockström, 2004).

Given this growing concern over water scarcity, it becomes important to understand the nature of this critical natural resource. According to the World Wide

Fund for Nature, by 2025 over two-thirds of the world's population may experience water shortages. The unchecked increase in the human population is recognized as the most significant factor influencing this impending catastrophe, despite other factors such as changing weather patterns and increased pollution.

1.2. Statement of Problem

There has been tremendous increase in the population not only nationally but also globally. This, in turn, has affected our natural resources and raised concerns, as it has continually degraded our environment. The pressure exerted on the environment, on resources such as air, water, and land, is posing an increasing threat to the natural environment. This is further exacerbated by urbanization, industrialization, changing lifestyles, and unsustainable consumption patterns. This situation is further resulting in serious challenges to maintaining ecological balance and achieving sustainable development. Hence it through this research, an attempt is made to study the following objectives:

1. To examine the impact of Population Growth on Natural Resources.
2. To analyze the importance of the shift from non-renewable to renewable sources of energy.

II. Review of Literature

There have been many studies on the impact of population growth on natural resources. This review briefly discusses the various effects of population growth on natural resources and the environment.

There exist numerous research articles that have been conducted with the objective of analyzing the impact of population growth on resource depletion, especially in countries where low-income farmers struggle to cope with climatic changes. Though serious efforts have been made to use natural resources sustainably, environmental degradation continues to pose a potential threat to our natural resources (Maja & Ayano, 2021)

Overexploitation of natural resources, intensive farming, and land fragmentation all negatively impact the quality and quantity of those resources. When many people are living in one location, there is limited land that can be utilized for farming, making food production challenging A low income from small farms not only makes it more difficult for farmers to obtain sufficient food, but it also makes it

more difficult for farmers to adopt particular technology that can assist them in adapting to climate change. To improve the intersection among population, natural resources, climate change, and adaptability, there is a pressing need for stakeholders to take action.

Population growth impacts the food supply along with the environment in a very adverse manner. According to the World Bank and the United Nations estimate between one and two billion people on the planet are malnourished. (Pimentel et al., 1997) This is likely due to a variety of factors, including low earnings, inadequate food distribution, and limited availability. This is the most significant number of starving people ever recorded in human history. About 80 million people in China are currently suffering from hunger and malnutrition. It is estimated that, within the next half-century, the global population will more than double from approximately 6 billion to more than 12 billion, exacerbating the food crisis. The oceans and other aquatic environments contribute less than 1% of the world's total food supply, while land-based ecosystems account for more than 99%. The continuous production of an adequate food supply depends on the availability of ample fertile land, clean water, and energy, as well as the protection of biological diversity. The increasing demands placed on these resources are directly proportional to the expansion of the human population. Even in the unlikely event that these resources are never fully used, their per capita availability will be dramatically reduced as a direct result of the growing human population.

An increasing population is placing ever-growing pressure on limited, depleting natural resources. Even subsistence-level living trains these resources (Dewaram & Nagdeve, n.d.). The pressure the population places on arable land contributes to its degradation. In countries like India, increased energy production and consumption patterns subsequently lead to environmental repercussions -such as the contamination of groundwater and surface water, as well as air pollution, thereby resulting in global warming.

Population growth puts greater pressure on the global environment, threatening its ability to provide sufficient food, water, and energy while maintaining a healthy environment. (Pimentel, 1991) The concentration of carbon dioxide and other greenhouse gases in the atmosphere is rising as a result of humans' expanding use of fossil fuels, ongoing deforestation, and other activities. It is anticipated that global warming will lead to an overall increase in temperatures, as well as a reduction in rainfall and available water for crops, particularly in the more temperate zones. The

adverse effects of global warming on agriculture may be mitigated to some extent through the conservation of soil and water, the modification of crop varieties, the improvement of pest control technologies, the implementation of crop rotations, and the employment of other ecologically responsible practises and technologies for the use of agricultural resources.

The ways in which global environmental changes influence the long-term useutilization of resources are also negatively affecting the environment. (Kattumuri, 2018) The environmental resources the world relies on are under increasing strain, driven by the expanding human population and rapid urbanization in developing countries and emerging economies. Extreme effects on ecosystems are a long-term concern in both urban and rural areas, as evidenced by water scarcity, food insecurity, and poor air quality.

Extreme consequences for the ecosystem pose long-term concerns, evident in both urban and rural communities and reflected in issues such as food security and pollution. These issues highlight the need for improved methods for collecting and using evidence, as well as the various channels through which researchers can influence the formulation of policy and its implementation. Coordinated efforts across disciplines and national borders can yield more robust knowledge and evidence to guide policymakers, empower citizens, and promote sustainable development that meets the needs of current and future generations.

The reality is that there are numerous reasons why environmental deterioration is caused by overpopulation, not just one. (Sehgal, 2020) . There has been a loss of fresh water in the rivers and oceans, resulting in the depletion of fresh water arising from industrial and domestic activities. Ganga River, despite being an Indian holy river, faces severe contamination with factory wastes and domestic sources contributing 80 per cent of pollution load according to research by the World Health Organisation. Hindus regard the water as the most sacred because it comes from the Himalayas. The river was once crystal-clear and a fantastic source of fresh water, but as soon as it reaches the plains and the cities, it becomes contaminated.

A study published in Nature Communications on Asia's growing population and its environmental impact points to rising sea levels as one of the greatest dangers. It objects that by 2050, annual flooding will occur in coastal regions home to 300 million people. Because of Asia's high population and extremely low elevation, countries like Bangladesh, India, China, Vietnam, Thailand, and Indonesia are among the most at risk of flooding due to climate change. There are already over 30

million people living in Jakarta and its surrounding suburbs, and it is anticipated that the city will be entirely submerged by the year 2050. The constant pumping of groundwater accelerated land subsidence, prompting the Indonesian government to consider relocating the nation's capital.

The issue of overpopulation and its effects on the environment is not new; it has roots that go back to ancient times and continue to the present day. Scientists have long discussed "overpopulation" throughout history and projected potential consequences of unsustainable environmental practices. Despite this, Migration contributed to population expansion and environmental problems. (Baus, 2017) Urbanisation destroys natural habitats and increases carbon dioxide emissions, contributing to climate change. Global inequality, including unequal access to food, water, jobs, education and natural resources , further exacerbates poverty and environmental degradation . Implementing national policies in accordance with international recommendations is the key to eliminating overpopulation, reduce Inequality and ensuring sustainable use of resources

III. Effects of Population Growth on Land, Forest and Water Resources:

From the above review of the literature, it is clear that population growth can have damaging effects on our natural resources. The most basic environmental resources are degrading due to population growth. Under this objective, the researcher will examine the impact of population growth on specific natural resources, including land, soil, forests, and water.

However, first, it is important to understand India's population growth. According to reports, India grew from 450.55 million to 1.39 billion people between 1960 and 2021. In 61 years, this is a growth of 209.3%. The most growth was seen in India in 1974, when it went up by 2.36 per cent. With 0.97%, 2021 has the smallest rise. During the same period, the world's population grew by 158.5%. About 35% of the country's population lives in its larger cities. This trend toward more people living in cities (urbanization) grows by 2.3% each year. Keeping this information in mind, the impact of a growing population on natural resources can be better explained.

Soils provide a lot of different ecosystem services that people need. But for many centuries, human activities have had direct and indirect effects on soils, causing significant damage and depletion. Feeding a growing population with changing tastes in food is a challenge for soil resources that has never been seen before. It

was also said that the demand for other services, driven by population pressure, speeds up processes such as soil erosion, loss of fertility, acidification, salinisation, and compaction. Because of population growth, there is less land that can be used to grow crops. This means soils are being used more often and more intensively, which is harmful to the soil. In locations with high population density and limited vacant arable land, the frequency of harvests increases, shortening the fallow period. In point of fact, the practice of farming is no longer viable in some areas, as available land is so limited. The continuous collection of biomass for cooking and animal husbandry significantly depletes soil nutrient pools and damages soil physicochemical properties.

Next, the world's forests, which account for one-third of the planet's land area, are responsible for the production of a wide variety of useful goods, such as crops, medicines, cattle, fibres, building materials, fencing, and furniture. In addition to these functions, forests are important because they store carbon, provide a habitat for diverse organisms, filter water, and help to moderate the effects of climate change.

In spite of all the different functions that forests perform, there is a rapid loss of forest cover. The most important factor in the destruction of forests and the degradation of agricultural land is a heavy reliance on wood fuel for cooking and other uses.

The growing population necessitates the establishment of a greater number of manufacturing facilities. These factories are the source of numerous types of pollution, including pollution of the water supply. In addition to this, because India is primarily an agricultural nation, a significant amount of water pollution is caused by the use of pesticides in agricultural settings. As can be seen, a larger population increases pollution, which, in turn, creates an environment less hospitable to human beings. This vicious cycle makes the world a less desirable place to live.

In addition, unchecked population growth has led to an enormous increase in water demand and further strained the already scarce resources of the globe. One of the most valuable natural resources in the world, water is essential to the existence of all organisms. Even though there are many sources of water, such as oceans and seas, less than 1% of the water on the planet is genuinely suitable for basic human needs. This rather small quantity must be divided among numerous rival users. Freshwater, which can be used for drinking and other purposes, can be found in rivers, lakes, the ground, and rainwater rather than in our oceans.

As demand for this non-renewable natural resource rises, a growing population has created an imbalance between demand and availability, leading to water scarcity practically everywhere. Over the past few decades, water demand has risen meteorically to meet domestic, industrial, agricultural, and municipal needs, as well as for waste removal. The regions with the fewest water resources, a population density already rather high, and a much higher population growth rate are often the most water-scarce. A growing population will undoubtedly further affect the amount of water available. Although there may appear to be an abundance of water sources, fewer than 1% of the water on the planet is usable for human needs. This meagre sum has to be split among a large number of users who are competing for it. The stress on freshwater supplies due to increased demand has already led to water scarcity in several locations. According to the World Wide Fund for Nature (WWF), by 2025, over two-thirds of the world's population could be at risk of water shortages. (Sharma et al., 2017)

Deliveries of water services can fail, adversely affecting people's sense of political inclusion, quality of life, social relationships, career opportunities, and education.The majority of Indian slums suffer from poor water availability, which has a detrimental effect on their inhabitants' health.(Anand,2011). Until recently, most research on the provision of water services in slums focused on water quality and health outcomes, particularly diarrhoeal diseases.

IV. Shift from Non-Renewable to Renewable Sources of Energy: A Path Towards Sustainability:

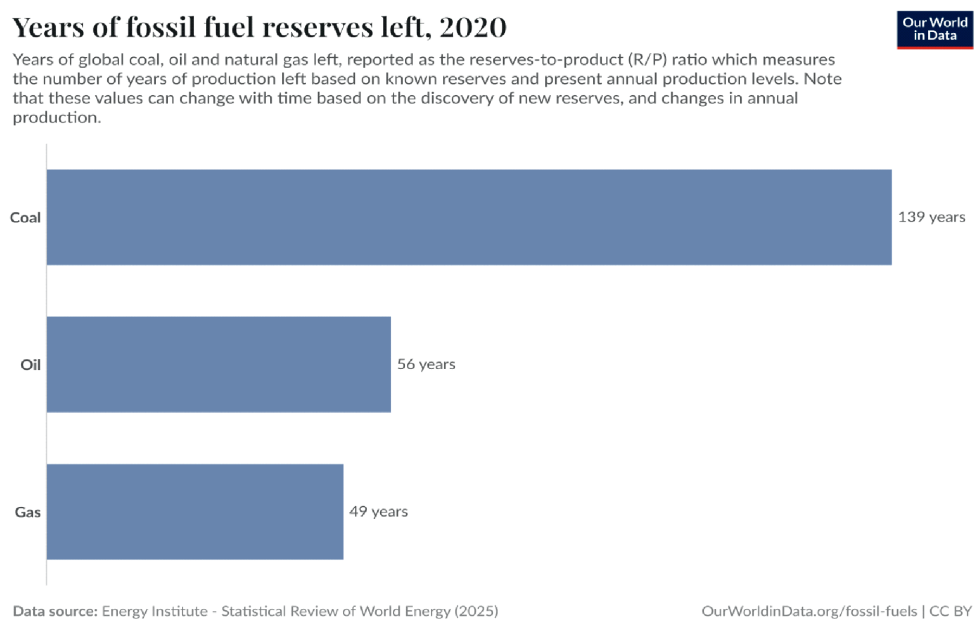
As per the UN definition, "energy that is obtained from natural sources and that can be replenished at a faster rate than it can be used is referred to as renewable energy." Renewable energy sources are abundant and can be found everywhere. Major renewable energy sources include solar and wind, which can be replenished continuously.

While renewable energy is sustainable, fossil fuels which include coal, oil, and gas, are limited resources that do not regenerate and instead require hundreds of millions to billions of years to form. Usually fossil fuels release dangerous gases like carbon dioxide and other greenhouse gases, which directly or indirectly accelerate the consequences of climate change. Thus, for environmental sustainability, it becomes essential to transition to renewable sources.

Once, fossil fuels were sufficient to meet human needs, but due to the population explosion, the era of cheap, abundant fossil fuels is coming to an end.This clearly

indicates that greater investments in renewable energy system is no longer optional, but is something that is very crucial for ensuring long-term environmental and economic stability (Randolph & Masters,2018)

The graph above clearly indicates the rapid depletion of fossil fuel reserves, driven by population growth and industrial demand. It can be observed that coal is the most abundant fossil fuel, estimated to last around 139 years, though it remains the most polluting energy source. When it comes to oil resources, they are expected to be exhausted in approximately 56 years, indicating a significant dependence on a fuel that contributes heavily to greenhouse emissions. Natural gas, although considered a cleaner fossil fuel, has a limited lifespan of around 49 years. The data clearly indicates a global energy consumption pattern that is unsustainable, underlining the urgent need to invest in a renewable energy system that is much cleaner, cheaper, and more sustainable. Without such as shift, countries will face severe energy insecurity and economic volatility as fossil fuel reserves continue to deplete.



Producing power from renewable sources reduces greenhouse gas emissions and ensures long-term energy security. To unravel the climate crisis, we must move away from fossil fuels, which are responsible for most emissions, and toward renewable energy such as solar, wind and hydropower.

(a) Solar energy, which is one of the most common sources of renewable energy, can even be used when it's cloudy. It can be used in multiple ways to offer heat, cool air, natural light, and electricity. The most common methods used to convert sun's rays to electricity is by either using photovoltaic panels or mirrors that help in energy conversion In the last 10 years, the cost of making solar panels has fallen significantly, making them not only affordable but often the cheapest way to get electricity. Solar panels last about 30 years and come in different colours depending on the material used to make them. Even so, various schemes are available for the commoner to avail themselves of these solar panels at affordable rates.

(b) Hydropower is considered renewable because it is a source of energy that is naturally replenished by the water cycle. But its sustainability depends upon how wisely it is managed and developed. Usually, hydropower uses the energy of water flowing downhill from higher elevations, often from lakes, rivers, and other bodies of water. Run-of-river hydropower plants get their energy from the flow of the river, whereas reservoir hydropower plants use water stored in a reservoir. Hydropower often serves more than one purpose, providing drinking water, irrigation water, flood and drought control, navigation services, and energy. (U.S. Geological Survey [USGS], n.d.; International Energy Agency [IEA], 2024.) Hydropower is currently the largest source of renewable energy in the electricity industry. It depends on stable rain patterns.

(c) Wind energy uses big wind turbines on land (onshore) or in seawater or freshwater to use the energy of moving air (offshore). Wind energy has been used for thousands of years, but in the last few years, both onshore and offshore wind energy technologies have improved to make the most electricity possible. This is done by making the turbines taller and the rotors bigger. Although average wind speeds vary significantly from place to place, the world's technical potential for wind energy far exceeds current electricity production, and most regions have adequate potential for large-scale wind energy development. (IPCC, 2011; IRENA, 2024).

We need to shift from non-renewable to renewable energy sources, as they are a key part of ensuring energy is sustainable and has low emissions. It is already known that renewable energy technologies could help meet much of the world's electricity needs and reduce pollution. In recent years, the country has found a way to obtain

sustainable energy. Citizens have been told how important it is to save energy so that more solar, wind, biomass, waste, and hydropower can be used. Clean energy is less harmful and often cheaper.

V. Conclusion

The Earth's environment is limited and if population growth is unchecked, it could face the irreversible damage. Immediate attention is required to fix the current problems of deforestation, desertification, declining farmland, water pollution, ozone layer depletion, and the greenhouse effect. To achieve this, it is essential to keep population growth in check and to ensure that all efforts are made to shift from non-renewable to renewable energy sources.

More investment is needed to provide women with resources and education necessary to create awareness to take appropriate decisions and avoid unintended pregnancies, both in cities and in rural areas. Future population control efforts will depend on how well women are educated and how effectively they can access and utilize contraception. Changing people's attitudes toward prominent families, especially in rural areas, could slow growth, stop land loss, and reduce migration to slums in cities. To prevent environmental degradation and ensure there is enough food for everyone, landless farmers must be moved to areas with available land and favourable climates. Farmers should have the right to own their land so that they can be more involved in sustainable adaptation practises. It should also be clear that these measures will not completely solve all the problems listed above, but it would definitely reduce them.

For thousands of years, the human population did not increase at a rate that strained natural resources. But in recent centuries, this rate has increased drastically. Over the past 200 years, the population growth has become exponential, with different geographical areas being affected unequally.

Regions that lack the most water resources often have relatively high current population densities and considerably higher population growth rates. Inspiring people to take meaningful actions to address water scarcity lays the foundation for significant change and promotes environmental balance. Thus the link between population growth and climate change should not hinder but rather strengthen our efforts to encourage water conservation and sustainable living.

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