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Achievement of SDGS globally in biodiversity conservation and reduction of greenhouse gas emissions by using green energy and maintaining forest cover

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Abstract

The global partnership for sustainable development is well-positioned to combat climate change and its impacts on ecosystems and biodiversity, aligning with the Sustainable Development Goals (SDGs) on climate, oceans, marine resources, forests, biodiversity, and land degradation. This study has assessed and evaluated the status of global forests and biodiversity, greenhouse emissions, and global energy perspectives, synthesizing track progress on goals 13 and 15 targets focusing on climate change trends, forest cover, and biodiversity status. Review and analysis of global forest resource and biodiversity assessment, GHG emission inventories, verification of CO_2 measurement, statistical review of world energy and renewables contributions to reduction of GHG emissions, and applying quantitative data on environmental change to identify impact and implications showed that the targeted SDG goals are able to address the issues needed to build climate resilience: maintaining forests and biodiversity, achieving zero emissions, and adopting renewables.

Forests, which cover 31% of the world's land surface, provide habitat, clean air and water, and help mitigate climate change. However, 13 million hectares are lost each year, resulting in the desertification of 3.6 billion hectares. The world's tree stock has decreased slightly due to a decrease in forest area, with 8% of 8,300 animal breeds extinct and 22% on the verge of extinction, highlighting the importance of sustainable ecosystem management and biodiversity conservation. Global GHG emissions are expected to rise slightly in 2021 to 8 GtCO2e, comparable to or exceeding 2019 levels, and global temperatures could rise over 1.5°C by 2030. Human activities, including greenhouse gas emissions, contribute to global warming, with surface temperatures rising 1.1°C between 2011 and 2020. Mitigation policies expand, but warming may exceed 1.5°C by 2030. The world faces challenges in achieving climate change goals, necessitating increased ambition and implementation. Integrating climate action and sustainable development using renewable energy sources like bioenergy, solar, geothermal, hydropower, and wind is the most effective approach.

Keywords; SDGs; Biodiversity and Forests; Greenhouse Gases; Green Energy; Impact and Implications.

1. Introduction

Forest biological diversity encompasses all life forms found in forested areas as well as the ecological roles they play. It can be viewed at various levels, such as ecosystem, landscape, species, population, and genetic. This complexity enables organisms to adapt to changing environmental conditions while maintaining ecosystem functions. Because many forests are more biodiverse than other ecosystems, forest ecosystems are an important component of the world's biodiversity. Forests cover 31% of the world's land area and provide critical habitat for millions of species. They are vital sources of clean air and water, as well as crucial in the fight against climate change. The world's total forest area is 4.06 billion hectares, or approximately 5,000 m^2 per person, but forests are not evenly distributed (1).

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Forests play an important role in reducing the likelihood of natural disasters such as floods, droughts, landslides, and other extreme events. They also help to reduce climate change by storing carbon and protecting watersheds. However, every year, 13 million hectares of forest are destroyed, and the continued deterioration of drylands has resulted in the desertification of 3.6 billion hectares. Every year, the world's forests absorb 2.4 billion metric tons of CO_2, accounting for one-third of the CO_2 emitted by the combustion of fossil fuels. Forest deterioration releases more carbon into the atmosphere, generating 4.3–5.5 $GtCO_2eq/yr$ annually. Protecting and repairing this massive carbon sink is critical for climate change mitigation (2). In 2018, energy-related CO_2 emissions reached an all-time high of 33.1Gt. According to the IPCC study, renewables are expected to supply 70–80 percent of electricity in 2050 under 1.5°C global warming scenarios (3).

Forests that are sustainably managed provide an important, renewable, and carbon-neutral source of biomass for energy. Wood-based bioenergy plantations, in comparison to other renewables such as solar, hydro, and wind, require comparatively little capital or technological development and could be an especially efficient use of abandoned agricultural land and soils too poor to sustain annual crops. Agriculture, forestry, and other land uses can reduce emissions while also removing and storing carbon dioxide on a huge scale. The study seeks to establish the fact that, globally, the SDGs' implementation in biodiversity conservation and climate change can be reduced by using green energy and maintaining forest cover. However, the global environmental problems remain the same and are challenging to cope with due to climate change issues and the degradation of forests and biodiversity at an alarming rate.

It is crucial to take urgent action to combat climate change and its impacts on the protection of natural ecosystems and biodiversity. The SDGs reflect an integrated, holistic vision for global, national, local, and individual development. The global partnership for sustainable development is ideally positioned to fulfill the SDGs' vision. It supports initiatives in several interconnected global environmental domains that are closely aligned with the SDGs on climate, oceans and marine resources, terrestrial ecosystems, forests, biodiversity, and land degradation. The United Nations Sustainable Development Goals (SDGs) make transformative investments in food security, safe drinking water, energy, infrastructure, cities, sustainable consumption and production, and other areas of concern.

Climate change causes flooding and drought, trapping millions in poverty and hunger and stifling economic growth. Drought alone is expected to cause the displacement of 700 million people by 2030. Global greenhouse gas concentrations reached new highs in 2020, and real-time data indicate that this trend will continue. The global mean temperature in 2021 was approximately 1.1 degrees Celsius higher than the pre-industrial level (from 1850 to 1900). The seven warmest years on record occurred between 2015 and 2021. Combating climate change and its devastating effects is thus critical to saving lives and livelihoods, as well as making the 2030 Agenda for SDGs. Concentrating on Sustainable Development Goal 13 Climate Action Targets, the assessment and evaluation of the study is: How much forest cover was maintained and green energy was promoted globally during the period of SDG implementation?

Similarly, human activity has changed nearly 75% of the earth's surface, squeezing wildlife and nature into a smaller and smaller corner of the planet. Around 1 million animal and plant species are on the verge of extinction, with many facing extinction within the next few decades. Forests are critical to the survival of life on Earth and play an important role in the fight against climate change. Land degradation has reduced productivity on 23% of the world's land area. Pollinator loss threatens between $235 billion and $577 billion in annual global crop output. Drought and desertification cause the loss of 12 million hectares per year (23 hectares per minute). Of the 8,300 known animal breeds, 8% are extinct, and 22% are on the verge of extinction. Less than 1% of the over 80,000 tree species have been studied for potential use. Microorganisms and invertebrates play an important role in ecosystem services, but their contributions are rarely recognized. Goal 15: Life on land sustainably manages forests, combats desertification, halts and reverses land degradation, and halts biodiversity loss. This goal aims to halt deforestation, restore degraded forests, and significantly increase global afforestation and reforestation. Secondly, the study has assessed and evaluated: *what are the achievements and problems remaining with GHG emissions, biodiversity loss, and forest degradation?*

2. Material and Methods

2.1. SDGs Goals and Targets

According to the 2030 Agenda for Sustainable Development, the Sustainable Development Goals (SDGs) are interconnected and indivisible. The interconnected and integrated character of the SDGs are critical in ensuring that the new agenda's aim is realized. This entails identifying potential synergies and trade-offs between the SDGs and their corresponding targets. The SDGs goals and strategy was assessed through reference books, reports, webpages, conference proceedings, and articles regarding the UN SDGs. The method is used based on the SDG progress report, developed by a task force of experts from around 15 regional and international organizations who developed a trend

and level assessment methodology. ***A trend assessment*** to measure progress made towards the target from a baseline year to the most recent data point, and ***a level assessment*** using a gauge meter to measure the current level of development with respect to the distance from its target based on the latest data. Their report includes 36 selected indicators that cover the key targets under each goal and is based on data as of June 2022. The method used to track progress on goals 13 and 15 regarding climate change trends, forest cover, and biodiversity status is analyzed in this study (Table 1).

Table 1 Selected SDGs Targets and Indicators assessed fort this study

SDGs	Targets	Indicators	Methods
Goal 13 Take urgent action to combat climate change and its impacts	13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the UNFCCC	NDCs
		13.2.2 Total greenhouse gas emissions per year	Annual GHG inventory submissions from Annex I Parties, UNFCCC data, Current level and Trend assessment 2021, WMO, Global metadata
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area	Calculated as the forest area in the latest reporting year divided by the total land area in 2015, in percentage
		15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	CAGR by UNSD trend from 2015 to 2021, Strategic Plan for Biodiversity (CBD, 2014), (Tittensor, 2014) and Convention on Biological Diversity's 2010 Target (Butchart, 2010)
	15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management	Progress Data through five sub indicators, annual forest area change, above ground biomass, country reports
	15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red List Index	Red list and regional disaggregation's of the index based on 2022 data

The description of the current level of the methodology applied for measuring the current level at the global level is based on assessments of the World Meteorological Organization's provided data for the year 2021. Both the current level and trend assessments made at the world level only are assessed for this study (4).

2.2. Forest and land area

The FAO defines forests as land over 0.5 hectares with trees over 5 meters and a canopy cover of 10% or more. The Global Forest Resources Assessment compiles country reports based on national government information, literature searches, remote sensing, or a combination of these methods. Land area is collected using the FAO Questionnaire on Land Use, Irrigation, and Agricultural Practices. National statistical yearbooks and other official government data portals can help fill data gaps. National and international sectoral reports supplemented the information. Data with updated time series, including forest area data from 2020 and forest land data from 2022, were used.

2.3. Biodiversity and Ecosystems

Rewilding efforts were explored from a long-term perspective to ensure long-term positive effects on biodiversity and resilient ecosystems for future generations. The study identified protection and management of biodiversity in order to obtain resources for long-term development in terms of preserving species diversity, maintaining life-supporting systems and important ecological processes, and ensuring the sustainable use of species and ecosystems. Both in situ and ex situ biodiversity conservation have identified the variability of life on earth. The important strategies for biodiversity conservation applied worldwide were reviewed and documented. Indicator 15.1.2: Proportion of important sites for terrestrial biodiversity that are covered Current level Description of the methodology applied for measuring current levels: The current level is assessed based on 2021 data. Thresholds were applied for measuring the current level.

2.4. Greenhouse Gas Emission and Reduction

The data contained in GHG emission inventories submitted to the United Nations Framework Convention on Climate Change (UNFCCC), data from the World Bank, and serving as official statistics for international climate policies were evaluated for this study. To calculate annual greenhouse gas emissions per mile, the following methodology was used: The carbon dioxide emitted per mile traveled by a typical passenger vehicle was calculated by dividing the carbon dioxide emissions per gallon of gasoline by the average fuel economy of vehicles. To account for vehicle methane and nitrous oxide emissions, carbon dioxide emissions were divided by the ratio of carbon dioxide emissions to total vehicle greenhouse gas emissions. The CO_2 was calculated and verified from the literature using the formula below. However, due to rounding, the calculations given in the equations below may not yield the exact results shown. The amount of carbon dioxide emitted per gallon of motor fuel burned, measured in "gallons of gasoline consumed," is 8.89 x 10-3 metric tons.

8.89×10^{-3} metric tons CO_2/gallon gasoline × 1/22.2 miles per gallon $_{car/truck\ average}$ × 1 CO_2, CH_4, and N_2O/ 0.994 CO_2 = **4.03×10^{-4} metric tons CO_2E/mile,** (5)**.**

2.5. Clean Energy and Forest Cover

A statistical review of world energy yielded global data for clean energy. The global energy system's problems and uncertainties have reached their peak in nearly 50 years. According to BP's statistics in the Review of World Energy 2022, rising prices and worsening shortages highlight the need for energy "security" and "affordability" with "reduced carbon" when resolving the energy trilemma.

Non-fossil-based electricity consumption figures (nuclear, hydro, wind, solar, geothermal, biomass power, and other renewable sources) were calculated on an "input-equivalent" basis that is, based on the amount of fossil fuel required to generate that amount of electricity in a standard thermal power plant. Primary energy, according to the assessment, includes economically traded fuels such as modern renewables used to generate electricity. Energy from all non-fossil power-producing sources was accounted for on an input-equivalent basis (6).

FRA's global forest resource assessment was comparatively used for a comprehensive view of the world's forests. Indicators of Sustainable Development Goals (SDGs) are evaluated in relation to the world's forests and how resources are changing, including how they are used. Calculating greenhouse gas emissions and sinks; obtaining information on the net change in forest carbon stocks and forest area; Annual Net Change in Carbon Stocks per Area in Year t = (Carbon Stocks (t+1)-Carbon Stocks (t)/Area of land remaining in the same land-use category/Area of land remaining in the same land-use category/ Area of land remaining in the same land-use category.

2.6. Achievements, Impacts and Implications

Climate change's impact on species and ecosystems in the study area was studied. Novel applications of two complementary ecological modeling tools, each of which provides a broad measure of the ecological importance of

future environmental change, yield quantitative data on the scale of environmental change across the continent. The index was used to provide a measure of the potential for future environmental change to drive ecological change. Scaling is difficult because local environments are highly multidimensional and respond to environmental changes in complex ways. The study employed two methodologies to quantify and project an ecological index of environmental change.

To investigate biodiversity patterns across broad taxonomic groups, GDM (generalized dissimilarity modeling) was used. The methods are nearly identical, but they differ in that they use a single index to compare contemporary ecosystems across locations.

3. Result

3.1. Sustainable Development Goals

In 2015, world leaders agreed to 17 Global Goals (officially known as the Sustainable Development Goals or SDGs), these goals have the power to create a better world by 2030. The 17 Global Goals are the world's to-do list, a pre-made route to recovery and reconstruction. It hasn't been – and still isn't – impossible to meet the Global Goals six years after 193 Member States vowed to do so. All UN Member States endorsed the 2030 Agenda for Sustainable Development in 2015, which provides a shared roadmap for peace and prosperity for people and therefore the planet today and within the future. More than 178 countries adopted Agenda 21, a comprehensive plan of action to form a worldwide partnership for sustainable development to improve human lives and protect the environment, in June 1992, during the Earth Summit in Rio de Janeiro, Brazil. Chapter 15 of Agenda 21, which was established at the United Nations Conference on Environment and Development (UNCED) in 1992, is dedicated to biological diversity conservation.

The United Nations Sustainable Development Goals for Life on Land call for sustainable forest management, combating desertification, halting and reversing land degradation, halting biodiversity loss, and taking immediate action to combat climate change and its consequences, all of which play vital roles in addressing the issues. All targeted goals are able to address the issues needed to build climate resilience: maintaining forests and biodiversity, achieving zero emissions, and adopting renewables.

By 2030, the United Nations Development Goal 7 aims to "provide access to affordable, reliable, sustainable, and modern energy for all." The initiatives of the KfW Development Bank aim to increase the share of renewables in the energy mix while also improving energy efficiency. Renewable energy integration into local electricity markets is critical to the success of a worldwide energy transformation. This necessitates significant expenditures in modern energy systems, particularly grid expansion and cross-border electricity trading.

The following results have focused on the SDG targets and achievements and potential threats to climate change and biodiversity in order to achieve the SDGs, with a focus on SDG 13: Take urgent action to combat climate change and its effects on climate action, and SDG 15: Life on Earth; sustainably manage forests; combat desertification; halt and reverse land degradation; and halt biodiversity loss.

3.2. Goal 15 Life on Land

The United Nations established Sustainable Development Goal 15 (SDG 15 or Global Goal 15) in 2015 as one of the 17 Sustainable Development Goals to prevent deforestation, end desertification, restore degraded land, protect biodiversity, and combat poaching and wildlife trafficking. The goal has 12 targets that must be met by 2030. To track progress toward goals, four indicators were used among the 14 indicators. Humans rely on the earth and the oceans to survive. This goal aims to secure long-term livelihoods that will be enjoyed by future generations. Agriculture is a valuable economic resource because it accounts for 80% of the human diet (7). Forests cover 30% of the Earth's surface, provide vital habitat for millions of species, are important sources of clean air and water, and are critical in the fight against climate change.

Achieving SDG 15 will necessitate resolving causes and trade-offs in order to improve land life and accommodate broader community ideals. Climate change may reduce food production in certain areas while creating new opportunities in others (Lobell, 2012), (Lobell D. B., 2013). Between 1990 and 2015, worldwide forest cover fell by 3.1%, to 30.6% of global land area. Deforestation in the tropics remained higher, with 5–6 million ha lost annually during the same period. Since 2010, the rate of loss has reduced, but there remain substantial regional variances (8).

Commercial agriculture has surpassed subsistence farming as the primary driver of change in the tropics and subtropics. In recent years, commercial agriculture has been responsible for 70% of deforestation in Latin America,

compared to 30–35 percent in tropical Asia and Africa (9). In many regions of the world, forest acreage has risen, with most of this due to the spread of industrial tree plantations. Except for Europe and North America, the volume of wood collected is increasing in every location. Addressing rising wood demand in the tropics may eventually necessitate more intensive forest management.

3.3. Goal 13 Climate Action

Climate action is another focus of Sustainable Development Goal 13 (SDG 13 or Global Goal 13), one of 17 Sustainable Development Goals established by the United Nations in 2015. SDG 13 has five targets that must be met by 2030. This goal's official mission statement is to "take immediate action to combat climate change."

In 2021, the global average temperature was approximately 1.1°C higher than pre-industrial levels (from 1850 to 1900). The seven warmest years on record occurred between 2015 and 2021, with the top three being 2016, 2019, and 2020 (10), (11). Switching to renewable energy and improving end-use energy efficiency are two of the most important sources of greenhouse gas savings that countries must prioritize (12).

Greenhouse gas emissions from developed countries and transition economies fell by 6.5% between 2000 and 2018. To meet the Paris Agreement's maximum target of 1.5°C or even 2°C, greenhouse gas emissions must begin to fall by 7.6% per year beginning in 2020 (13).

Forest ecosystems are the most significant terrestrial carbon sinks, absorbing approximately 2 billion metric tons of CO_2 per year. There are numerous approaches to reducing carbon emissions, but the most promising are those that leverage natural synergies between climate preservation and development. Many of these are related to energy demand (e.g., efficiency and conservation, education and awareness), whereas others are related to energy supply (i.e., renewable options).

3.4. Current Status and Achievements

3.4.1. Forests and Biodiversity

Biodiversity refers to the variety and number of living species found in certain areas and across the globe. Biodiversity is a measure of genetic (genetic variability), species (species diversity), and ecosystem (ecosystem diversity) variation (14). **An ecosystem is a collection of living things that live in a certain environment. There are many distinct species in the same habitat, and there are many different ecosystems on the planet.** Of the 8,300 animal breeds recorded, 8% are extinct, and 22% are on the verge of becoming extinct. Less than 1% of the over 80,000 tree species have been examined for their potential uses. Drought and desertification cause the loss of 12 million hectares (23 hectares every minute) per year, which might have produced 20 million tons of grain. Land degradation directly affects 74 percent of the world's poor. Agriculture supports 2.6 billion people, yet soil deterioration affects 52 percent of agricultural land. Forests provide a living for around 1.6 billion people. More than 80% of all terrestrial animal, plant, and insect species can be found in forests. Forests cover 31% of the Earth's land an area of over 4 billion ha encompassing 93% of natural and 7% of planted forests, and, in addition to supplying food and shelter, forest resources are precarious in preventing climate change, safeguarding biodiversity, and providing homes for indigenous people (15). The current status and progress of UN Goal 15-to protect, restore, and promote sustainable use of terrestrial ecosystems; sustainably manage forests; combat desertification; halt and reverse land degradation; and halt biodiversity loss-are assessed focusing on the following targets:

Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

Indicator 15.1.1 Forest area as a proportion of total land area Forest area as a proportion of total land area (Percentage)

Within the context of sustainable development, forest area is a critical component of forest policy and planning. The indicator measures the relative extent of forest cover in a country. Forest area as a percentage of total land area can be used as a rough proxy for how much forest is being conserved or restored. Many countries conduct forest area assessments at irregular intervals. Although access to remote sensing imagery has improved in recent years, remote sensing techniques are not without limitations. Some slow changes, such as forest regrowth, are difficult to detect using remote sensing methods and require long time periods. The majority of the data for this indicator comes from the sources of the United Nations Statistics Division's Open SDG Data Hub.

According to FAO, forests are defined by the presence of trees as well as the absence of other dominant land uses and more than 0.5 hectares of land with trees taller than 5 meters and a canopy cover of more than 10%, or trees capable of reaching these thresholds in situ. It includes areas that are temporarily destocked as a result of clearcutting as part of a forest management practice or natural disasters but are expected to be restocked within 5 years. It excludes land that is primarily used for agriculture or urban development. Accurate data on a country's forest area is essential for forest policy and planning in the context of sustainable development. Adequate forest resources ensure social, economic, and environmental stability, as well as long-term development. The COVID-19 pandemic is expected to put additional strain on forests and contribute to further deforestation.

Over the period 1990–2020, the Forest and Rainforests Report (FRA) examines the status and trends of more than 60 forest-related variables in 236 countries and territories. Data for FRA 2020 were collected in a transparent, traceable reporting process using commonly agreed-upon terms and definitions. More than half (54%) of the world's forests are concentrated in just five countries: Russia, Brazil, Canada, the United States of America, China, and the United States. This equates to 0.52 ha per person, despite the fact that forests are not distributed equally among people or geographically. Since 1990, the world has lost 178 million ha of forest-an area roughly the size of Libya. Net forest loss has decreased from 7.8 million ha per year in the 1990s to 4.7 million ha per year between 2010 and 2020. According to the United Nations Environment Programme, Africa had the highest annual rate of net forest loss from 2010 to 2020, followed by South America (UNEP). Oceania had the greatest net gain in forest area, but Europe and Asia had much lower net gain rates. Between 1990 and 2020, the rate of net forest loss decreased significantly (16). The global forest area proportion fell from 31.9 percent of total land area in 2000 to 31.2 percent in 2020, representing a net loss of nearly 100 million hectares **(Table 2)**. Land conversion to agriculture has resulted in a decrease in forest area in Latin America, sub-Saharan Africa, and south-eastern Asia (17).

Table 2 Forest area as a percentage of total land area

Regions	**2015 (%)**	**2020 (%)**
World	31.3	31.2
Sub-Saharan Africa	28.5	27.6
Northern Africa and Western Asia	4.6	4.6
Northern Africa	3.6	3.5
Western Asia	6.2	6.3
Central and Southern Asia	10.8	11.0
Central Asia	3.2	3.3
Southern Asia	15.5	15.7
Eastern and South-Eastern Asia	29.7	30.0
Eastern Asia	22.6	23.5
South-Eastern Asia	48.2	47.1
Latin America and the Caribbean	46.7	47.4
Oceania	21.7	21.8
Australia and New Zealand	18.0	18.1
Oceania (exc. Australia and New Zealand)	76.7	76.5
Europe and Northern America	41.1	41.2
Europe	45.9	46.0
Northern America	35.5	35.5
Landlocked developing countries	17.0	16.6
Least Developed Countries	27.2	26.3
Small island developing States	73.4	73.3

Source: Global Forest Resources Assessment and FAOSTAT Database, Food and Agriculture Organization of the United Nations (FAO)

Due to a net decrease in forest area, the world's total growing stock of trees decreased slightly, from 560 billion m^3 in 1990 to 557 billion m^3 in 2020. There are approximately 606 gigatonnes of living biomass (above and below ground) and 59 gigatonnes of dead wood in the world's forests. Since 1990, total biomass has decreased slightly, but biomass per unit area has increased. The total carbon stock in forests fell from 668 gigatonnes in 1990 to 662 gigatonnes in 2020, but carbon density increased slightly over the same period, rising from 159 to 163 tons per ha. (fig. 1).

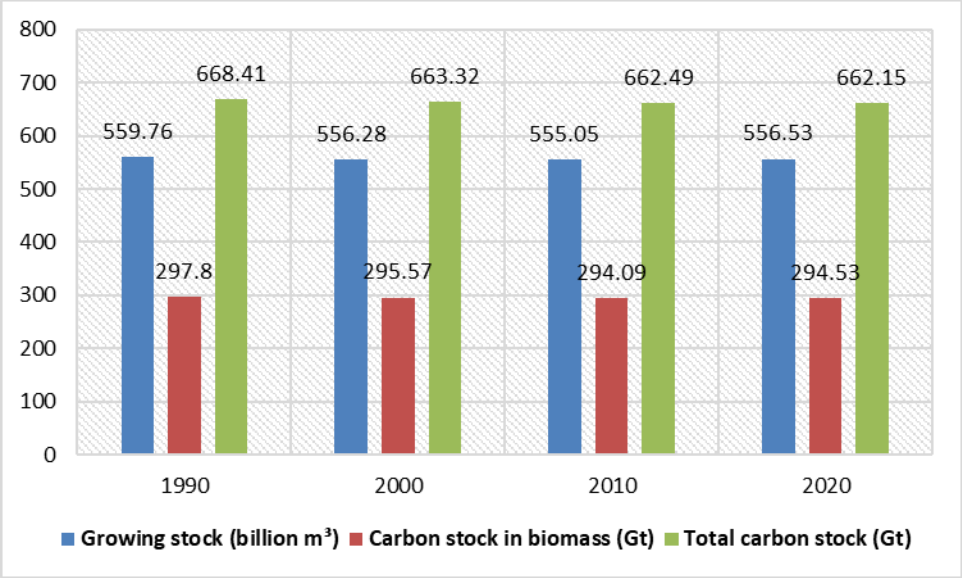

Figure 1 Forest growing stock and carbon (1990-2020)

Indicator 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem types. Protecting key biodiversity areas through the establishment of protected areas or other effective area-based conservation is critical to achieving SDGs 14 and 15. Marine, terrestrial, freshwater, and mountain KBA coverage has increased from about a quarter of each site to nearly half today (Table 3).

Table 3 Mean proportion of Key Biodiversity Areas (KBAs) covered by protected areas and (where available) OECMs[1] (Percentage)

Regions	**2015**	**2020**	**2021**
World	42.1 (42.1-42.2)	44.0 (44.0-44.0)	44.0 (44.0-44.0)
Sub-Saharan Africa	41.0 (40.8-41.1)	43.5 (43.5-43.5)	43.5 (43.5-43.5)
Northern Africa and Western Asia	21.9 (21.8-22.0)	24.1 (24.1-24.1)	24.1 (24.1-24.1)
Northern Africa	35.1 (35.1-35.1)	41.7 (41.7-41.7)	41.7 (41.7-41.7)
Western Asia	17.7 (17.6-17.8)	18.4 (18.4-18.4)	18.4 (18.4-18.4)
Central and Southern Asia	18.6 (18.6-18.6)	19.5 (19.5-19.5)	19.5 (19.5-19.5)
Central Asia	21.1 (21.1-21.1)	22.4 (22.4-22.4)	22.4 (22.4-22.4)
Southern Asia	17.8 (17.8-17.8)	18.6 (18.6-18.6)	18.6 (18.6-18.6)
Eastern and South-Eastern Asia	28.4 (28.2-28.7)	31.6 (31.6-31.6)	31.6 (31.6-31.6)
Eastern Asia	25.4 (25.3-25.4)	26.4 (26.4-26.4)	26.5 (26.5-26.5)
South-Eastern Asia	31.4 (30.9-31.8)	36.6 (36.6-36.6)	36.6 (36.6-36.6)
Latin America and the Caribbean	38.3 (38.2-38.3)	39.9 (39.9-39.9)	39.9 (39.9-39.9)
Oceania	33.2 (33.1-33.2)	35.3 (35.3-35.3)	35.3 (35.3-35.3)
Australia and New Zealand	50.9 (50.6-50.9)	54.2 (54.2-54.2)	54.2 (54.2-54.2)

Oceania (exc. Australia and New Zealand)	15.0 (15.0-15.0)	15.9 (15.9-15.9)	15.9 (15.9-15.9)
Europe and Northern America	60.5 (60.4-60.6)	61.9 (61.9-61.9)	61.9 (61.9-61.9)
Europe	65.7 (65.6-65.8)	67.2 (67.2-67.2)	67.2 (67.2-67.2)
Northern America	33.9 (33.7-34.1)	34.9 (34.9-34.9)	34.9 (34.9-34.9)
Landlocked developing countries	36.1 (36.0-36.2)	38.7 (38.7-38.7)	38.7 (38.7-38.7)
Least Developed Countries	34.5 (34.4-34.6)	38.0 (38.0-38.0)	38.1 (38.1-38.1)
Small island developing States	24.8 (24.6-25.0)	27.0 (27.0-27.0)	27.1 (27.1-27.1)

[1]Based on the spatial overlap of polygons from the World Database of Key Biodiversity Areas and polygons from the World Database of Protected Areas, as well as Other Effective Area-Based Conservation Measures (OECMs; where available) from the World Database of OECMs, Note: Figures for each region are calculated by averaging the proportion of each key biodiversity area covered by protected areas and (where available) OECMs across all key biodiversity areas within the region.

Sources: World Conservation Monitoring Centre of the United Nations Environment Programme (UNEP-WCMC), Bird Life International, and the International Union for Conservation of Nature (IUCN).

Target 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally Indicator 15.2.1 Progress towards sustainable forest management (Table 4)

Table 4 Forest area annual net change rate (percentage)

Regions	**2000-2010 (%)**	**2010-2020 (%)**
World	-0.13	-0.12
Sub-Saharan Africa	-0.49	-0.60
Northern Africa and Western Asia	-0.02	-0.06
Northern Africa	-0.41	-0.57
Western Asia	0.39	0.42
Central and Southern Asia	0.30	0.29
Central Asia	0.30	0.65
Southern Asia	0.30	0.24
Eastern and South-Eastern Asia	0.41	0.15
Eastern Asia	0.97	0.73
South-Eastern Asia	-0.19	-0.55
Latin America and the Caribbean	-0.55	-0.29
Oceania	-0.13	0.23
Australia and New Zealand	-0.16	0.32
Oceania (exc. Australia and New Zealand)	0.01	-0.07
Europe and Northern America	0.10	0.02
Europe	0.12	0.03
Northern America	0.07	0.01
Landlocked developing countries	-0.36	-0.43
Least Developed Countries	-0.52	-0.70
Small island developing States	0.04	-0.04

Source: Global Forest Resources Assessment, Food and Agriculture Organization of the United Nations (FAO)

The global forest area continues to shrink, albeit at a slightly slower rate than in previous decades. From 31.9 percent of total land area in 2000 to 31.2 percent in 2020, forest area has decreased. Despite overall forest loss, the world is making progress toward sustainable forest management. Target 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species Indicator 15.5.1 Red List Index Red List Index1,2. The index has decreased from 0.80 in 2000 to 0.72 in 2022. The Red List Index for each region is a weighted index of aggregate survival probability (the inverse of extinction risk) for all birds, mammals, amphibians, corals, and cycads found in that region. It demonstrates how well or poorly species are conserved in the region in relation to their potential contribution to global species conservation. In parentheses, the lower and upper confidence intervals are indicated (18). The prevalence and rate of extinction risk are particularly high in Central and Southern Asia, as well as Eastern and Southeast Asia. The rate of decline in these regions, as well as in the least developed countries, has been disproportionately rapid (Table 5).

Table 5 Rate of Extinction Risk

Regions	**2015**	**2020**	**2021**
World	0.75 (0.73-0.77)	0.73 (0.70-0.76)	0.72 (0.69-0.76)
Sub-Saharan Africa	0.74 (0.72-0.76)	0.72 (0.69-0.76)	0.72 (0.67-0.76
Northern Africa and Western Asia	0.84 (0.82-0.86)	0.83 (0.79-0.86)	0.83 (0.78-0.86)
Northern Africa	0.88 (0.86-0.90)	0.87 (0.83-0.90)	0.86 (0.82-0.90)
Western Asia	0.82 (0.80-0.84)	0.81 (0.77-0.84)	0.80 (0.77-0.84)
Central and Southern Asia	0.69 (0.67-0.71)	0.67 (0.64-0.71)	0.67 (0.63-0.71)
Central Asia	0.94 (0.86-0.96)	0.93 (0.85-0.97)	0.93 (0.84-0.98)
Southern Asia	0.69 (0.66-0.71)	0.67 (0.63-0.71)	0.66 (0.62-0.71)
Eastern and South-Eastern Asia	0.74 (0.71-0.76)	0.72 (0.67-0.76)	0.71 (0.66-0.76)
Eastern Asia	0.74 (0.72-0.76)	0.73 (0.69-0.76)	0.72 (0.68-0.76)
South-Eastern Asia	0.74 (0.71-0.76)	0.72 (0.67-0.76)	0.71 (0.66-0.76)
Latin America and the Caribbean	0.75 (0.73-0.76))	0.74 (0.72-0.75)	0.73 (0.71-0.75)
Oceania	0.81 (0.79-0.83)	0.79 (0.76-0.82)	0.79 (0.75-0.82)
Australia and New Zealand	0.82 (0.80-0.83))	0.80 (0.77-0.83)	0.79 (0.76-0.83
Oceania (exc. Australia and New Zealand)	0.80 (0.78-0.82)	0.78 (0.75-0.81)	0.78 (0.74-0.81)
Europe and Northern America	0.84 (0.83-0.85)	0.84 (0.81-0.85)	0.83 (0.81-0.85)
Europe	0.85 (0.83-0.87)	0.84 (0.80-0.87)	0.83 (0.79-0.87)
Northern America	0.84 (0.83-0.85)	0.84 (0.82-0.85)	0.84 (0.82-0.85)
Landlocked developing countries	0.80 (0.80-0.81)	0.80 (0.79-0.80)	0.80 (0.79-0.80)
Least Developed Countries	0.76 (0.74-0.78)	0.75 (0.71-0.78)	0.74 (0.70-0.78)
Small island developing States	0.72 (0.70-0.74)	0.70 (0.67-0.73)	0.70 (0.66-0.73)

Source: IUCN Red List Index, International Union for Conservation of Nature (IUCN) in collaboration with Birdlife International (2022).

In June 2019, one million plant and animal species were on the verge of extinction. Since1750, at least 571 plant species have been lost, with many more likely to follow. The primary cause of extinctions is the destruction of natural habitats by human activities such as forest clearing and conversion of land to farming fields (19). According to the 2019 IPBES Global Assessment Report, human activities such as unsustainable fishing, hunting, and logging have resulted in an 82% decline in wild mammal biomass, half-lost ecosystems, and a million species at risk of extinction (20). The report emphasizes that current global goals for conserving and using nature cannot be met and that 2030 goals will necessitate transformative changes in economic, social, political, and technological factors. Progress on four of the 20 Aichi Biodiversity Targets may be missed by 2020, and negative biodiversity trends may jeopardize progress on 80% of SDG targets.

3.5. Greenhouse Gas Emission and Reduction

Global greenhouse gas (GHG) emissions are tentatively estimated to be 8 GtCO2e in 2021, a slight increase over 2019, implying that total global GHG emissions in 2021 will be comparable to or exceed 2019 levels. Methane and nitrous oxide emissions remained stable from 2019 to 2021, while fluorinated gases increased. Global GHG emissions have increased, but at a slower rate than in the previous decade. In 2020, 17 G20 member countries, including China, the United States of America, India, and the EU27, were net sinks in the LULUCF sector. In 2020, the top seven emitters (China, the EU27, India, Indonesia, Brazil, Russia, and the United States) accounted for 55% of global GHG emissions, along with international transportation. Emissions per capita vary greatly across countries. At 14 tCO2e per capita, the United States of America remains far above the global average (21).

For each group of greenhouse gases, average annual emission levels in the last decade (2010–1910) were higher than in any previous decade (high confidence). The magnitude and rate of these increases varied by gas when compared to 1990. CO2 emissions from fossil fuels and industry (FFI) increased by 15 GtCO2-eq yr-1 (67%), while CH4 emissions increased twice as much as emissions from land use (LULUCF) (Table 6).

Table 6 Global net anthropogenic GHG emissions (GtCO2-eq yr–1) 1990–2019

Drivers	2019 emissions (GtCO2-eq)	1990–2019 increase (GtCO2-eq)	Emissions in 2019, relative to 1990 (%)
CO2-FFI	38 ± 3	15	167
CO2-LULUCF	6.6 ± 4.6	1.6	133
CH4	11 ± 3.2	2.4	129
N2O	2.7 ± 1.6	0.65	133
F-gases	1.4 ± 0.41	0.97	354
Total	59 ± 6.6	21	154

In 2018, global carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions all reached new highs. The CO2 increase from 2017 to 2018 was very similar to that observed from 2016 to 2017 and was nearly equal to the average annual increase over the previous decade. Table 7 shows the global annual surface mean abundances and trends of key greenhouse gases as measured by the GAW global GHG monitoring network in 2018. Uncertainties are within 68% confidence limits, and units are dry-air mole fractions (22). GAW Report No. 184 describes the averaging method (23). The analyses are carried out at 129 stations for CO2, 127 for CH4, and 96 for N2O.

Table 7 Global annual surface mean abundances and trends of key greenhouse gases

GHGs	2018 global mean abundance	2018 abundance relative to year 1750*	2017–2018 absolute increase	2017–2018 relative increase	Mean annual absolute increase over the last 10 years
CO_2	407.8±0.1 ppm	147%	2.3 ppm	0.57%	2.26 ppm yr–1
CH_4	1869±2 ppb	259%	10 ppb	0.54%	7.1 ppb yr–1
N_2O	331.1±0.1 ppb	123%	1.2 ppb	0.36%	0.95 ppb yr–1

*Assuming a pre-industrial mole fraction of 278 ppm for CO2, 722 ppb for CH4 and 270 ppb for N2O.

Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries and Indicator 13.1.2: Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 Considering this target reporting period of 2015–2021, 123 countries have a National Disaster Risk Reduction (DRR) Strategy that is aligned with the Sendai Framework. UNDRR actively promoted the use and application of Sendai Framework targets, indicators, and data in various DRR, climate action, and sustainable development mechanisms (24).

Indicator 13.2.2: Total greenhouse gas emissions per year Total greenhouse gas emissions without LULUCF for Parties included in Annex I to the Convention

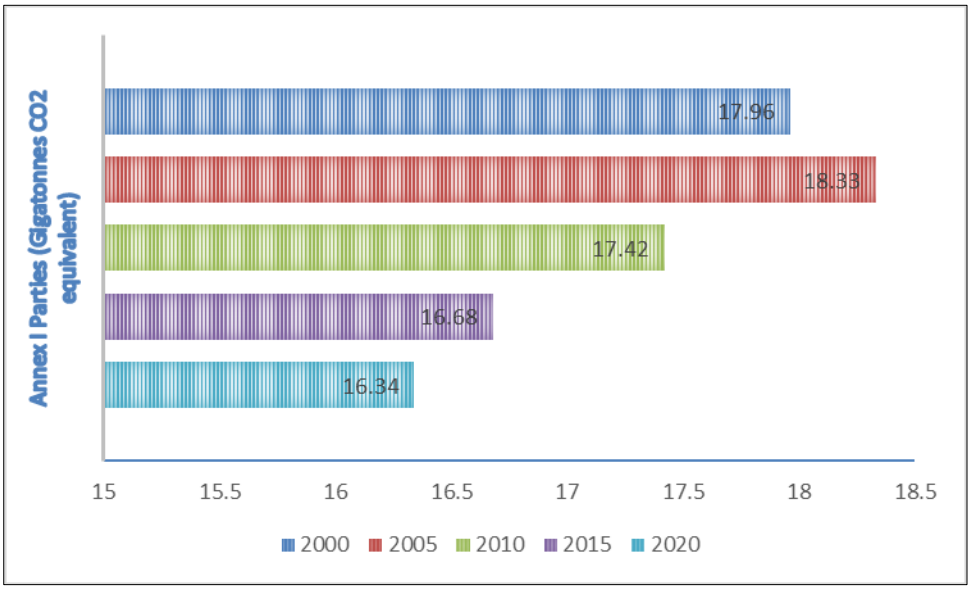

Figure 2 Total greenhouse gas emissions Annex I Parties (Gigatonnes CO2 equivalent)

Source: United Nations Framework Convention on Climate Change (UNFCCC) based on 2021 GHG inventory submissions by Annex I Parties as at 15 April 2021.

The Paris Agreement's 193 Parties cover 94.9 percent of total global emissions in 2019, which are estimated at 52.6 g/eq without LULUCF and around 56.4 g/eq with LULUCF (fig. 2). Total global GHG emissions (excluding LULUCF) are expected to be around 53.4 (51.8–55.0) Gt CO2 eq in 20257 and 52.4 (49.1–55.7) Gt CO2 eq in 2030 if the latest NDCs are implemented. The provided ranges represent low and high emission estimates (25).

"Projected global emissions from NDCs announced prior to COP26 would increase the likelihood of warming exceeding 1.5°C and make it more difficult to limit warming to less than 2°C after 2030" (26). The report concludes that for some scenarios, returning to below 0.85°C in 2100 is impossible, and that mitigation after 2030 can no longer establish a pathway that limits global warming to 1.0°C.

3.6. Clean Energy and Forest Cover

The use of renewable and other ecologically friendly energy sources to generate electricity on-site can reduce greenhouse gas emigrations. Exemplifications include rooftop solar panels, solar water heating, small-scale wind generation, natural gas or renewable hydrogen energy cells, and geothermal energy. Transportation is the largest source of hothouse gas emigrations. Greenhouse gas exoduses come from industry, including from making iron and sword, cement, and aluminum. Exoduses come from crop husbandry, similar to rice or sludge, and from the beast. Further greenhouse gas emigrations in soil and shops than it might emit. Climate change will continue, and accelerate, in the times ahead, with significant impacts on the health of our abysses, timbers, freshwater, and our municipalities and metropolises. While we must reduce hothouse gas emigrations to avoid the worst impacts of climate change, we also have to prepare for impacts, like the ocean- position rise and further frequent and violent extreme rainfall that we can't avoid.

To stop climate change, we need to stop the amount of greenhouse gases, like carbon dioxide, from increasing. There is not one single way to mitigate climate change; instead, we will have to piece together many different solutions. Below are descriptions of the main ways that we can stop the climate from warming. Many of these can be tackled by individual actions, such as using less energy or riding a bike instead of driving. Others involve communities and nations working together to find solutions.

Worldwide, electricity use is responsible for a quarter of all emissions. Taking steps to use less electricity can take a big dent out of greenhouse gas emissions. Renewable energy sources include solar, geothermal, wind turbines, ocean wave and tidal energy, waste and biomass energy, and hydropower. Eating a plant-based diet can keep 65 gigatons of carbon

dioxide out of the atmosphere over 30 years. Reducing food waste could save about 90 gigatsons of CO2 from the atmosphere in the same period. Use of fossil fuels incurs costs that are not directly borne by the user. Burning coal to generate electricity emits harmful pollutants, which can impact nearby communities. CO2 emissions and other greenhouse gases must be regulated or traded at a price that reflects their true environmental and social costs.

Most of the ways we get from place to place currently rely on fossil fuels. Burning fossil fuels for transportation adds up to 14% of global greenhouse gas emissions worldwide. Public transportation, carpooling, biking and walking lead to fewer vehicles on the road and less greenhouse gases in the atmosphere. We can reduce the amount of carbon dioxide that we add to the air, but we can also increase the amount that we remove. The places where carbon dioxide is pulled out of the air are called carbon sinks. Conserving forests, grasslands, peatlands and wetlands are important carbon sink areas. The earth heats up faster and achieves a greater temperature in deforested areas, resulting in localized upward motions that boost cloud formation and, eventually, create more rainfall.

Tropical deforestation accounts for roughly 20% of global greenhouse gas emissions. Deforestation may also result in the release of carbon stored in the soil. Land use mitigation projects that attempt to reduce emissions and improve greenhouse gas removals also aim to improve income, livelihoods, and ecosystem services. Surface water runoff, which moves quicker than subterranean flows, becomes a problem in deforested areas. This can cause flash flooding and more localized flooding.

SDG 7 Affordable and Clean Energy aims to provide all people with affordable, reliable, sustainable, and modern energy. Traditional wood fuels, processed wood fuels, liquid biofuels, and bio power all contribute to this. As traditional wood fuels decline in low- and middle-income countries, processed wood fuels, liquid biofuels, and bio power will become more prevalent in the provision of energy services.

Renewable energy policy, costs, and storage capacity all play a role in the success of forest -based transitions. Only 143 of the 183 parties with renewable energy components in their NDCs had a quantified target: 108 for power and 31 for heating and cooling, transportation, or cooking (27). Some progress is being made, particularly in the power sector, with renewables accounting for 83% of capacity additions and expected to account for 40% of installed power generation globally by 2022. In 2022, 295 gigatonnes (GW) of renewable energy capacity were added globally, representing the largest annual increase in renewable energy capacity. Renewables will account for 40% of global installed power capacity by 2022. Given that renewable energy accounts for half of total capacity, energy planning issues must be addressed in order to establish renewables as the primary source of electricity generation. The year 2022 saw the greatest increase in renewable energy capacity, with 295 GW added, accounting for 83% of global power additions, owing primarily to solar and wind power growth (28).

Transitioning from fossil fuels without carbon capture and storage (CCS) to very low- or zero-carbon energy sources, such as renewables or fossil fuels with CCS, demand-side measures and improving efficiency, reducing non-CO2 GHG emissions, and CDR are among the global mitigation pathways to net zero CO2 and GHG emissions. Land-use change and forestry (via reforestation and reduced deforestation) and the energy supply sector reach net zero CO2 emissions earlier than the buildings, industry, and transportation sectors in most global modelled pathways (29).

Energy-related CO_2 emissions reached 36.6 g/tCO_2 in 2021, the highest annual increase in history (30). NDCs represent the country's efforts to reduce GHG emissions and adapt to the effects of climate change. By September 2022, 194 countries had submitted their first NDCs, and 162 had updated their NDCs in accordance with the Paris Agreement (2015). Renewables are rapidly expanding and outperforming other energy sources in the Stated Policy Scenario (STEPS). Renewable energy generation will increase from 28% in 2021 to 43% in 2030, with wind and solar PV accounting for nearly 90% of the increase. Renewables will provide nearly 50% of global power generation by 2030, outpacing fossil fuel generation. Biofuels are also becoming more popular. Between 2021 and 2030, the NZE scenario predicts a 125 EJ increase in low-emission sources, with modern bioenergy and solar growing the most. Solar and wind energy are expected to grow the most, accounting for less than 20% of the total energy supply by 2050 (31), (Fig. 3).

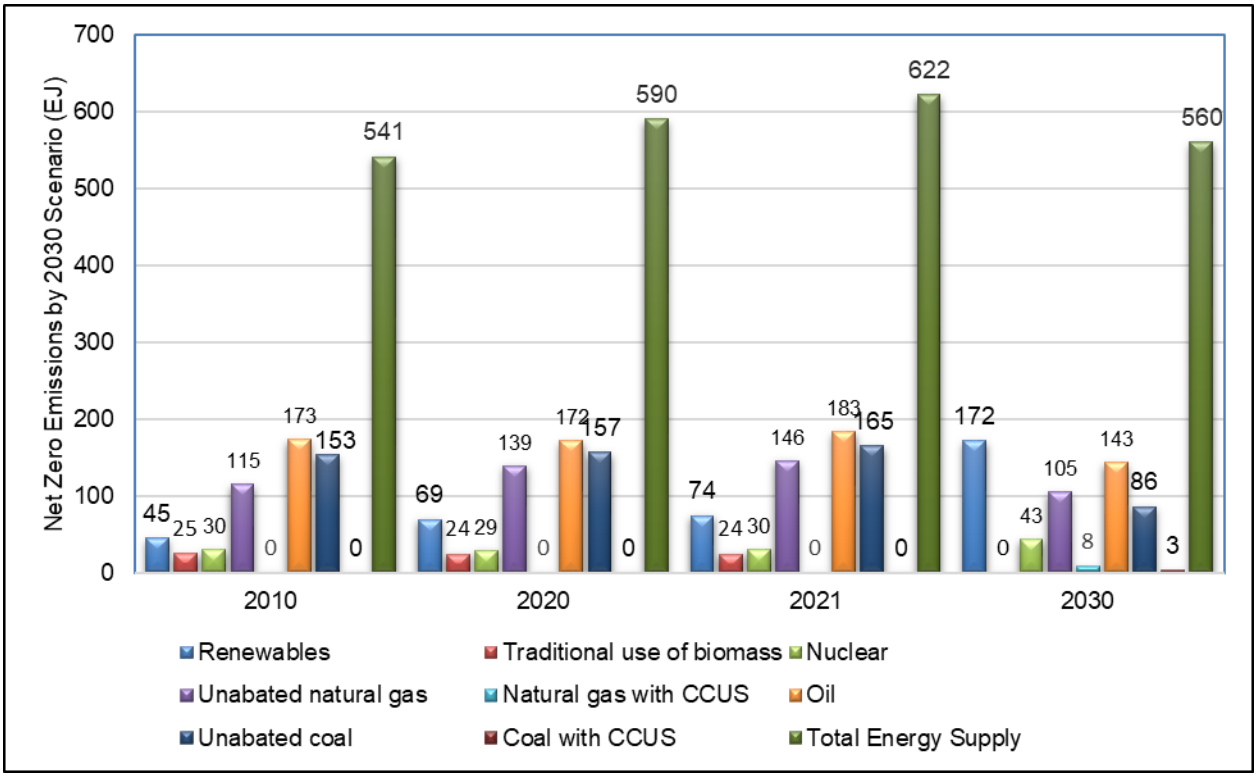

Figure 3 World energy supply

3.7. Impact and Implications

GHG stands for "greenhouse gas," a phrase that refers to a group of airborne substances in the earth's atmosphere that keep heat from escaping into space. The combustion of fossil fuels like coal and oil, as well as deforestation, has resulted in a considerable increase in GHG concentrations in the atmosphere. As a result, global average temperature rises, causing climate change and adverse effects on human and environmental health.

Climate change will create environments that are very different from what is currently occurring in the study area. Land-use intensification in agricultural and forestry sectors as a reaction to climate change remains a major threat to biodiversity. It is expected that alien species capable of modifying fire regimes (such as buffel grass) will spread. Globally, shrinking glaciers, biodiversity loss, shifted plant and animal ranges, and earlier tree flowering, loss of sea ice, extreme weather events, sea level rise, and penetrating heat waves, all have an impact on our reliance on water, energy, terrestrial and aquatic ecosystems, agriculture, and human health. Climate change has had a significant impact on human societies and the natural environment. Future generations will wonder who is to blame for climate change. We also require a natural environment with clean air, water, shelter, and food, as well as taking responsibility for minimizing climate change challenges. Renewable energy sources are the least expensive alternative for increasing power access, reducing air pollution, and lowering carbon dioxide emissions globally.

3.8. Global Warming

Since 1900, the average surface air temperature has risen by about 1°C (1.8°F), with more than half of the rise occurri ng since the mid-1970s. Global temperatures could rise by more than 1.5°C (2.7°F) by 2030 compared to pre-industrial levels (32). Climate change has a significant impact on biodiversity by increasing the intensity and frequency of fires, storms, and droughts. This adds to the already-existing threat to biodiversity posed by other human activities. Rising global temperatures have the potential to change ecosystems over time by altering what can grow and live in them. Mangroves are significant carbon sinks, and the Amazon is a massive carbon store. Protecting these natural carbon sinks from further damage is a critical component of limiting climate change. According to the US National Oceanic and Atmospheric Administration, carbon dioxide emissions from energy use, industrial processes, flaring, and methane (in carbon dioxide equivalent) increased 5.7% in 2021 to 39.0 $GtCO_2e$, close to 2019 levels, and CO_2 peaked at 421 parts per million in May 2022 (33).

The world has entered a new era in our collective efforts to combat climate change, requiring us to step up our ambition and implementation. Pursuing climate action and sustainable development in an integrated and coherent manner provides the most powerful approach for countries to achieve their Paris Agreement and 2030 Agenda for Sustainable Development objectives efficiently and quickly. Urgent action to halt climate change and deal with its consequences is critical to achieving all of the Sustainable Development Goals. The Paris Agreement aims to keep global average temperature rises this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to keep temperature rises to 1.5 degrees Celsius. It also aims to improve countries' ability to adapt to and build resilience to the effects of climate change. The annual High-Level Political Forum (HLPF) reviews progress on the implementation of the 2030 Agenda. There are 17 Sustainable Development Goals and 169 targets, including SDG 13 on climate action. The first in-depth review of SDG 13 will be held at HLPF in July 2019 (34).

Unless significant emission reductions are achieved quickly, the remaining carbon budget for limiting global warming to 1.5°C will be depleted by the end of this decade. In this context, there is growing interest in the potential contributions made by reducing short-lived climate pollutants, particularly methane emissions (35). According to UNEP, reducing methane emissions from fossil fuels and other sources by at least 30% is a critical component of Paris-compatible mitigation strategies. The fossil fuel sector has the greatest potential for reducing methane emissions, followed by the waste and agriculture sectors (36).

Renewable energy sources such as bioenergy, solar energy, geothermal energy, hydropower, and wind energy have the potential to mitigate climate change. The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) concludes that the majority of the observed increase in global average temperature since the mid-20th century is very likely due to anthropogenic greenhouse gas (GHG) emissions. Greenhouse gas emissions from the provision of energy services have significantly contributed to the historic increase in atmospheric GHG concentrations.

3.9. Biodiversity Conservation

Life on Earth goal 15 describes the existing facts as human activity has changed nearly 75% of the earth's surface, squeezing wildlife and nature into a smaller and smaller corner of the planet. Around 1 million animal and plant species are on the verge of extinction, with many facing extinction within the next few decades. The 2019 Global Assessment Report on Biodiversity and Ecosystem Services urged radical changes to restore and protect nature. Human-caused deforestation and desertification, as well as climate change, pose major challenges to sustainable development. Current trajectories cannot meet goals for conserving and using nature sustainably, and goals for 2030 and beyond can only be met through transformative changes in economic, social, political and technological factors. Forests are critical to the survival of life on Earth and play an important role in the fight against climate change. Investing in land restoration is critical for improving livelihoods, decreasing vulnerabilities, and lowering economic risks. The world lost 3.3 million hectares of forest between 2010 and 2015. Poor rural women rely on a common pool of resources and are particularly vulnerable to their depletion. Pollinator loss threatens between $235 billion and $577 billion in annual global crop output. The loss of arable land is estimated to be 30 to 35 times the historical rate, with 12 million hectares lost each year (23 hectares per minute). 20 million tons of grain could have been grown in a year. Globally, 74% of the poor are directly affected by land degradation. Of the 8,300 known animal breeds, 8% are extinct, and 22% are on the verge of extinction. Less than 1% of the over 80,000 tree species have been studied for potential use. Microorganisms and invertebrates play an important role in ecosystem services, but their contributions are rarely recognized (37).

Between 1990 and 2015, the global forest area shrank from 31.7% to 30.7%. This loss was primarily the result of forest conversion to other uses, such as agriculture and infrastructure development. Planting, landscape restoration, and natural expansion returned other areas to forest. Protected areas covered 15.2 percent of the world's terrestrial and freshwater environments in 2014. Key biodiversity areas (KBAs) are places that make a significant contribution to the preservation of global biodiversity. Protecting KBAs around the world is critical for preserving genetic, species, and ecosystem diversity.

As of 2015, over 23,000 plant, fungus, and animal species were known to be on the verge of extinction as a result of forest conversion to other uses, such as agriculture and infrastructure development. Planting, landscape restoration, or natural expansion returned other areas to forest. Protected areas covered 15.2 percent of the world's terrestrial and freshwater environments in 2014. Key biodiversity areas (KBAs) are places that make a significant contribution to the preservation of global biodiversity. Protecting KBAs around the world is critical for preserving genetic, species, and ecosystem diversity. As of 2015, over 23,000 plant, fungus, and animal species were known to be on the verge of extinction. Amphibian populations are rapidly declining in Latin America and the Caribbean. Southeast Asia has seen the greatest increases in the risk of extinction for birds and mammals. Poaching and wildlife trafficking are sabotaging

conservation efforts. At least 7,000 animal and plant species have been reported in illegal trade since 1999, affecting 120 countries. Wildlife trafficking affects all parts of the world, whether as a source, transit point, or destination (38).

4. Discussions

In 2015, all United Nations Member States embraced the UN's 17 Sustainable Development Goals (SDGs). They are an urgent demand for all countries, developed and developing, to work together to reduce poverty and other deprivations, enhance health and education, and promote economic growth, all while combating climate change and striving to protect our oceans and forests. Among the goals, goal 13, climate action, goal 14, life below water, and goal 16, life on land are associated with the reduction of GHG emissions. Besides these, the Biodiversity Convention, Earth Summit in Rio de Janeiro on June 5th, 1992, which entered into force on December 29th, 1993, is also considered an integral part of the study to analyze the achievements of the GHG reduction strategy globally.

The 2030 Agenda for Sustainable Development's Sustainable Development, Goal 15 is to "protect, restore, and promote sustainable use of terrestrial ecosystems." At the Rio+20 Conference, Member States underlined the importance of biological diversity in supporting ecosystems that provide critical services. Chapter 15 of Agenda 21, which was established at the United Nations Conference on Environment and Development (UNCED) in 1992, is dedicated to biological diversity conservation. The Convention went into effect 90 days following the 30th ratification, on December 29, 1993.

The SDG 13, climate action intends to raise $100 billion per year by 2020 to address developing nations' requirements for climate adaptation and low-carbon development. Global warming is producing long-term changes to our climate system, with potentially permanent repercussions if we do nothing. The SDGs for life below water seek to manage and safeguard marine and coastal ecosystems from pollution while also addressing the effects of ocean acidification. Improving conservation and sustainable use of ocean-based resources through international legislation can also aid in mitigating some of the difficulties confronting our seas. Goal 15 asks for immediate action to protect natural ecosystems, limit the loss of natural ecosystems and biodiversity, prevent animal poaching and trafficking, and incorporate ecosystem and biodiversity values into local planning and development processes.

A climate pact that ignores new knowledge on the essential links between climate change and development risks putting many of the world's most vulnerable countries in danger of failing to fulfill the SDG targets by 2030. Strong SDGs and an ambitious climate agreement are inextricably linked, as both require, and will help promote and implement, a more ambitious climate accord.

Climate change is harming billions of people worldwide and is potentially causing irreversible changes in global ecosystems. Global greenhouse gas emissions must peak by 2025 in order to reduce warming to 1.5 degrees Celsius above pre-industrial levels. Countries are developing climate action plans through nationally determined contributions to reduce emissions and adapt to climate impacts by 30% over the next decade. Immediate and deep reductions in emissions are needed across all sectors to move from a tipping point headed to climate calamity to a turning point for a sustainable future. The global mean temperature in 2021 was around 1.11 °C higher than the pre-industrial level (from 1850 to 1900), making it one of the seven warmest years on record. Global greenhouse gas concentrations reached new highs in 2020, and real-time data indicates that this trend will continue (39).

4.1. GHG emissions

In 2020, the top seven emitters (China, the EU27, India, Indonesia, Brazil, the Russian Federation, and the United States) together with international transport accounted for 55% of global GHG emissions. The least developed countries emit an average of 2.3 tCO_2e per capita. High-emitting households exist in all major economies, and there are significant inequalities both within and between countries. Emissions from consumption are also highly unequal between and within countries. The bottom 50% of households emit 1.6 tCO_2e/capita on average and contribute 12% to global GHG emissions.

Global greenhouse gas concentrations reached new highs in 2020, and real-time data indicate that this trend will continue. COVID decreased global carbon dioxide (CO2) emissions by 5.2 percent in 2020, totaling nearly 2 billion metric tons. The global mean temperature in 2021 was about 1.11 degrees Celsius above pre-industrial levels (from 1850 to 1900), making it one of the seven warmest years on record (40).

Using these facts, figure out the targets, the United Nations Environment Programme (UNEP) has released its 2030 Agenda for Sustainable Development, which aims to achieve a world free of land degradation by 2030 and reduce

natural habitat loss by 70% by 2050. It also intends to increase global afforestation and reforestation, combat desertification, and restore degraded land and soil. Take immediate action to end poaching and trafficking of protected flora and fauna, as well as to address both the demand for and supply of illegal wildlife products. Integrate the value of ecosystems and biodiversity into national and local planning, development processes, poverty reduction strategies, and accounting. Mobilize and significantly increase financial resources from all sources to conserve and use biodiversity and ecosystems in a sustainable manner.

The major contributors to climate change are emissions of CO_2 and other GHGs like methane, and nitrous oxide emitted by humans, which are the world's most pressing problems (41). This relationship between global temperatures and greenhouse gas concentrations, particularly CO_2, has existed throughout Earth's history (42).

4.2. Renewable Energy and Forest Cover

The goal is to achieve net zero carbon dioxide emissions by 2050, with the goal of keeping the global temperature rise to 1.5°C. With pledges covering 70% of CO2 emissions, this would leave around 22 billion metric tons of emissions in 2050. The global economy will be 40% larger by 2030, but it will consume 7% less energy as a result of increased energy efficiency efforts. This will result in a 4% annual increase in energy intensity and a 75% reduction in methane emissions from fossil fuel supply. The path envisions rapid growth in solar and wind power, with annual additions of 630 GW and 390 GW by 2030, respectively, more than doubling the 2020 record. This transition is critical for lowering emissions and increasing electric vehicle use (43).

As of September 23, 2022, 88 parties representing 79% of global GHG emissions had adopted net zero pledges, an increase from 74 at COP 26. As part of their long-term strategy, eight parties have set another non-net-zero mitigation target. Net-zero targets for 2050 or earlier cover 36% of global emissions, while net-zero targets for years later than 2050 cover 43%. Currently, net-zero pledges do not cover 21% of global emissions. GHG targets are now included in 146 National Declarations (NDCs) from parties representing 91% of global GHG emissions, up from 128 initial NDCs (89% of global emissions) and 143 NDCs at COP 26 (90.5% of global GHG emissions). These targets include base-year targets as well as baseline scenario targets, with 43 NDCs containing a base-year target, up from 34 initially (44).

Renewable energy is the high impact problem for the feature for the seventh consecutive year in 2016, with a strong perception of reduced uncertainty as a top action for the priority agenda in the energy sector to expand on the relevance of advances in the climatic framework and innovation. The countries' determinant commitment to COP21, toward an increase in the expectation for further scaling up of renewable energies, reinforces the reduced level of uncertainty, as large hydro is understandably an issue closely aligned to localized resource availability and sustainable development 2030 goals for benefiting and adapting to climate change. Hydroelectricity development is the top priority action of global energy leaders, such as those in Latin America, who see the issue as having similar low uncertainty but a comparatively low degree of impact. Energy efficiency is a top goal for all countries (Ramesh, 2017). Although, implementation of hydropower project activities has many associated environmental impacts and implications (46).

Forest degradation and fragmentation, deforestation, pollution and climate change a critical global issue impacting on forest biodiversity and atmospheric carbon flux. More than 1 billion peoples dependency on global forests for livelihoods, forest ecosystem are in threats as its intrinsic role to stabilizing climate, avail food, water, timber, NTFP, ethnobotanical products including medicine as well as role of supporting world’s biodiversity (47). The Glasgow Leaders' Declaration on Forests and Land Use emphasizes the value of forests for long-term development and calls for a reduction in forest loss and land degradation by 2030. This is the goal of the Forest, Agriculture, and Commodity Trade Roadmap. The High Ambition Coalition, which includes nearly 100 countries, advocates for post-2020 biodiversity targets as well as the Global Methane Pledge, which aims to cut methane emissions by 30% below 2020 levels.

Net LULUCF CO2 emissions decreased from 2019 to 2020, owing primarily to large deforestation and degradation fire s in the Amazon, but also due to dry conditions in Indonesia.LULUCF emissions from bookkeeping models are uncertain, varying by global regions (48), (49). Between 2011 and 2020, average emissions were 4.1 ± 2.6 GtCO2, showing a 4%/year decline. However, low confidence in this trend exists due to data limitations (50).

Europe and North America are the primary drivers of deforestation, with emissions concentrated in tropical regions s uch as the Amazon basin, Southeast Asia, and Sub-Saharan Africa, where monitoring and quantification are difficult. National inventories reported stable net LULUCF emissions between 2011 and 2020, with temperate and boreal regions reporting net removals and tropical regions nearing net-zero emissions. The difference in CO2 emissions between inventories and models was approximately 6.1 GtCO2 (51).

"The rates of deforestation are still alarming," with an estimated 10 million hectares per year lost between 2015 and 2020, and the world has only 6.5 years to meet the GFG target of increasing forest area by 3% globally from 2017 to 2030 (52). An integrated approach is required to improve the multiple contributions of forests to the SDGs by harnessing synergies and balancing cross-sectoral tradeoffs between forests and other closely related development issues (53).

5. Conclusions

Agenda 2030 for Sustainable Development and its 17 Sustainable Development Goals were adopted by 193 nations in 2015. The SDGs and their targets comprise a complex, integrated structure with obvious sectoral emphases but also strong interconnections between goals and targets. Forests provide essential ecological services for human well-being and are key to achieving the SDGs. The study has assessed the targeted outcomes for maintaining forest cover and reducing GHG emissions globally.

SDG 7 aspires to ensure that everyone has access to affordable, dependable, sustainable, and modern energy. Forests contribute to SDG 7 in four ways: through the sustainable use of conventional wood fuels; processed wood fuels; liquid biofuels; and bio power. The performance of forest-based clean energy transitions in comparison to other renewable energy technologies was determined by how renewable energy legislation evolves.

Climate change affects forests as well as their ecological activities and ecosystem services. SDG 13 seeks to minimize greenhouse gas emissions that contribute to climate change and to motivate adaptation efforts. Current commitments are insufficient to meet the Paris Agreement's aim of keeping global warming below 2°C. Because it focuses primarily on fisheries, SDG 14 is expected to have a negative impact on forest resources. SDG 14 targets are better suited to oceanic areas than to the complex governance arrangements seen in coastal zones. This means that mangroves may be overlooked, unintentionally harmed, or fall through a "policy gap." SDG 15 calls for the preservation of life on land and supports priorities already defined by international conventions and agreements. Short-term priorities and a "business as usual" mindset risk undermining this. SDG 15 requires greater cross-sectoral integration, not merely sectoral policy reform.

The global forest area is shrinking, from 31.9% in 2000 to 31.2% in 2020. Despite this, progress is being made towards sustainable forest management. Target 15.5 is to reduce habitat degradation and biodiversity loss and protect threatened species by 2020. The Red List Index, a weighted index of survival probability, has decreased from 0.80 in 2000 to 0.72 in 2022. In June 2019, one million plant and animal species were on the brink of extinction, with 571 lost since 1750. Human activities like forest clearing and farming have led to an 82% decline in wild mammal biomass and half-lost ecosystems. The 2019 IPBES Global Assessment Report highlights the need for transformative changes to meet 2030 conservation goals. Since 1900, global surface air temperature has increased by 1°C, with over half of this rise occurring since the mid-1970s. By 2030, global temperatures could reach over 1.5°C. Addressing climate change and sustainable development is crucial for achieving goals efficiently.

Climate change is causing billions of people and ecosystem damage, with global greenhouse gas emissions aiming to peak by 2025. Countries are developing action plans to reduce emissions and adapt to climate impacts by 30% over the next decade. 2021 was one of the warmest years on record, requiring immediate reductions.

In 2021, energy-related CO2 emissions reached 36.6 g/t CO2, representing the highest annual increase in history. The Nationally Determined Contributions (NDCs) represent the country's efforts to reduce GHG emissions and adapt to the effects of climate change. Renewable energy generation is expected to rise from 28% in 2021 to 43% by 2030, with wind and solar PV accounting for nearly 90% of the increase. Transitioning from fossil fuels to very low- or zero-carbon energy sources, such as renewables or fossil fuels, with CCS, demand-side measures, improving efficiency, reducing non-CO2 GHG emissions, and CDR, are among the global mitigation pathways to net zero CO2 and GHG emissions. In most global modeled pathways, land-use change and forestry (via reforestation and reduced deforestation) and the energy supply sector achieve net zero CO2 emissions before the buildings, industry, and transportation sectors.

The assessment of efforts related to climate change, forest cover, and GHG reduction of the SDGs, including implications for restoring the impacts and threats to saving our planet, is through the promotion of renewables. Maintaining a broader perspective is critical, as climate change affects many sectors and issue categories. Quantifying emissions and the processes that drive them is a critical component of management and accountability mechanisms. Accounting for GHG emissions is a significant new topic that is being driven by more rigorous methodology standards in both the public and private sectors. An option is to use systematic integrated evaluations (54), although they take a macro-level view and need quantification of all effects.

Renewable energy sources, such as solar panels, wind turbines, and geothermal heat pumps, can help reduce greenhouse gas emissions. Exoduses are caused primarily by transportation, but industry and crop husbandry also contribute. Climate change will continue to have an impact on our environment, and while reducing greenhouse gas emissions is critical, we must also prepare for unavoidable consequences such as ocean rise and extreme rainfall. Electricity consumption accounts for 25% of total global emissions. Reduced usage has the potential to significantly reduce greenhouse gas emissions. Solar, wind, and biomass energy sources can all be used. A plant-based diet and minimizing food waste can also help. Pollutants are emitted by fossil fuels.

To protect, restore, and promote sustainable use of terrestrial ecosystems; sustainably manage forests; combat desertification; halt and reverse land degradation; and halt biodiversity loss, we must ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems; combat desertification; restore degraded land and soil; and take immediate and significant action to reduce natural habitat degradation and halt biodiversity loss. We must also take immediate action to stop poaching and trafficking of protected species of flora and fauna, as well as incorporate ecosystem and biodiversity values into national and local planning and development.

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