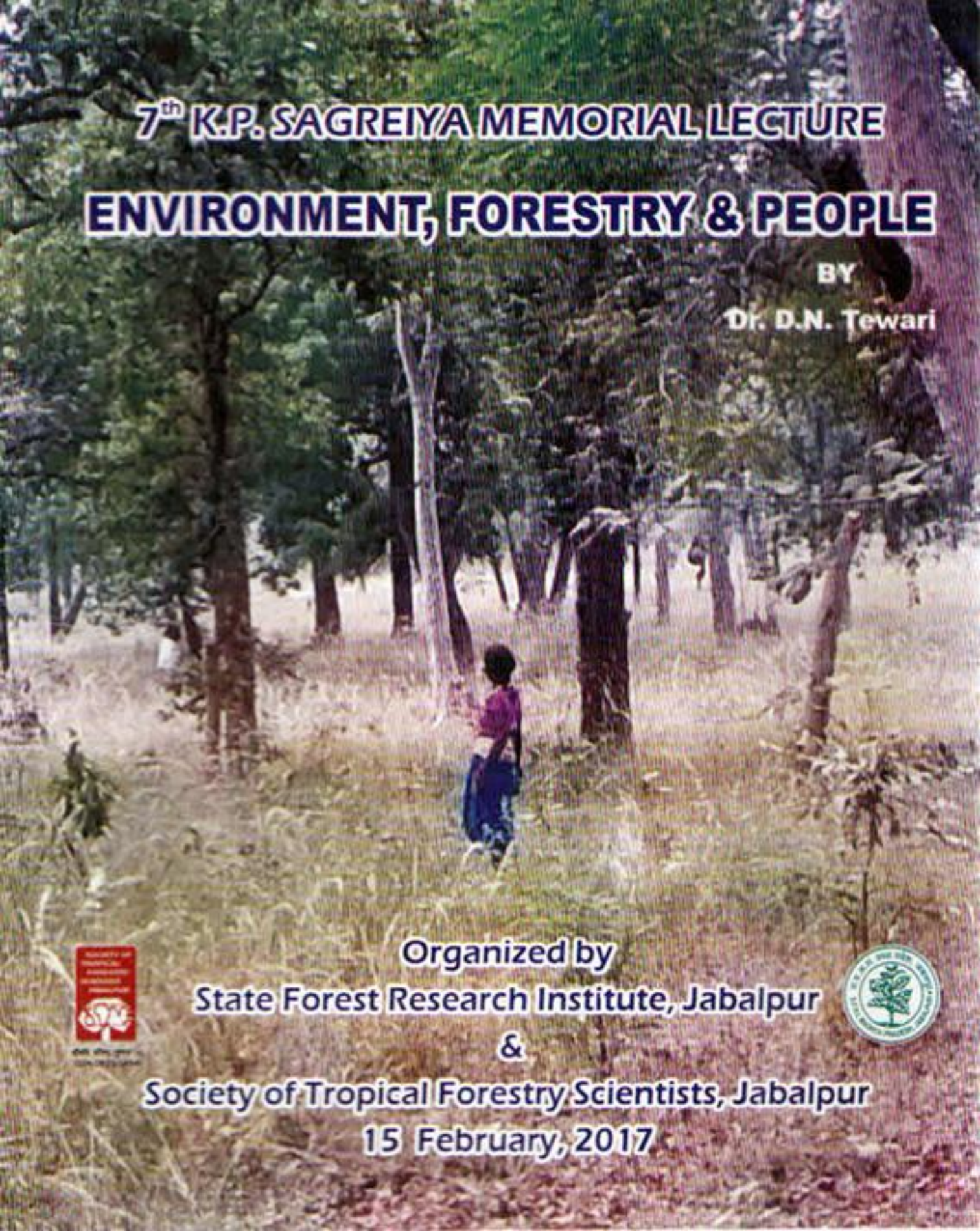

7th K.P. SAGREIYA MEMORIAL LECTURE

ENVIRONMENT, FORESTRY & PEOPLE

BY

Dr. D.N. Tewari

Organized by

State Forest Research Institute, Jabalpur

&

Society of Tropical Forestry Scientists, Jabalpur

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Late Shri Kamta Prasda Sagreiya
10th February 1904 - 19th May 1984

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Father's Name	Prof. V. B. Tewari (both the parents were freedom fighters)

Educational Qualifications

- Master of Science in Chemistry from University of Allahabad.
- Post Graduation Diploma in Planning & Industrial Development Sweden.
- Ph.D in Social Anthropology, from Gujarat Vidyapeeth Ahmedabad.
- D.Sc. (*Honoris causa*) by number of universities.

Present Position Holding

- President Vigyan Parishad (Science Council) Prayag, Allahabad.
- President, Utthan, Centre for Sustainable Development and Poverty Alleviation.

Important positions held in the past

- Member, Board of trustees ICRAF Nairobi
- Chairman GPI of World Agroforestry Center Nairobi.
- Vice Chairman, Planning Commission, Chhattisgarh, Raipur.
- Member, Planning Commission, GoI, New Delhi.
- Chairman Supreme Court monitoring Committee for rehabilitation of ravaged mined areas in Himalaya and cleaning of rivers.
- Member, Planning Commission, Uttar Pradesh.
- Chairman, National Commission on Integrated Water Resources Development Plan, (Environment) GoI, New Delhi.
- Chairman of project on conservation and development of Himalaya (an IDRC project involving Afghanistan, Pakistan, India, China, Nepal and Bhutan).
- Chancellor, FRI (Deemed), University Dehradun.
- First Director General of Indian Council of Forestry Research and Education, GoI
- Vice-Chancellor, GG Central University Bilaspur M.P.
- Director, SC & ST Development, Govt. of India, New Delhi
- Director, National Wastelands Development Board, GoI
- Chairman FAO Panel of Experts on Genetic Resources, Rome, Italy.
- Advisor to INBAR, FAO & CIFOR.

Publications

Wrote 104 books in English, Hindi and Swedish languages.

Distinctions, Prizes and Awards

- World Bamboo Pioneer Award 2015 at Damyang, Korea.
- Sitaram Jindal Prize of Rs. Twenty Five Lakhs for Rural Development & Poverty Alleviation in 2012.
- J.R.D. Tata Award for "Best Agronomist of Jatropha in 2008.
- Alcan Prize for Sustainability 2007 of USD one million.
- Global Ratna Award for Environmental Sustainability in 2005.
- WHO Award for promoting herbal products for health and nutrition in 2003.
- President of India appreciation letter for developing Jatropha & Biofuel production in 2003.
- Schilch Prize for Sustained livelihoods to Primitive Tribes of India in 2001.
- Brandis Prize for developing Forest Villagers & Shifting Cultivators in 2000.
- Himalayan Society Award for 'Rehabilitation of Musoorie-Dehradun Phosphorite Mines in 1999.
- Common wealth forestry Award for promoting Sustainable forestry in 1998.
- 'Life Time Award' by Indian Society of Soil Science for land cares in 1998.
- *Sindi Sai Baba Gold Medal for promoting education in 1995*
- Gold Medal awarded by Govt of Madhya Pradesh for developing Pendari Kanan for ecotourism in 1981.

ENVIRONMENT, FORESTS & PEOPLE

Dr. Dina Nath Tewari *

"One of the major global problem before humanity is the pollution and degradation of environment". – **Global worming Reduction Centre.**

"There are only two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle". - **Albert Einstein.**

"Forests cover the major themes of landscape restoration, soil health, water and energy, and their close relationship with human and environmental health and well - being".

"Forests play a key role in the water cycle, soil conservation, carbon sequestration and Habitat protection, including for pollinators. Their sustainable management is crucial for sustainable agriculture and food security". - **State of the World's Forests 2016, FAO Rome.**

"In the last 300 years the global forest area has shrunk by approximately 40%. Conserving forest avoids greenhouse gas emissions worth US$ 3.7 trillion. Between US$ 2 to 4.5 trillion of natural capital is lost from deforestation every year – a trend that poses significant business and social risks". - **TEEB (www.teebcreb.org).**

"The year 2015 will be remembered as a turning point for the environmental agenda. The international community set pivtol trackes for sustainability by adopting the 2030 Agenda for Sustainable Development, the Paris Agreement on climate change, the Sendai Framework for Disaster Risk Reduction and the Addis Ababa Action Agenda on financing for development- demonstrating a unity of purpose that places us more firmly on the path to a sustainable future". - **Achim Steiner (UNEP Executive Director).**

ENVIRONMENT

The environment on which we all depend, is under threat from growing levels of greenhouse gas emissions, biodiversity loss, and acidifying oceans. One of the major problem before humanity is the pollution and degradation of our environment. Sustainable development is the only viable path forward, based on integrated approaches to economic and social development and environmental protection.

Environmental threats such as climate change, land degradation, desertification, deforestation, biodiversity loss, air and water pollutions and natural disasters affect everyone, but they hurt poor countries and poor communities most. Climate change is already exacerbating

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chronic environmental threats and ecosystem losses are constraining livelihood opportunities, especially for poor people. A clean and safe environment should be seen as a right, not a privilege.

Environmental degradation is one of the largest threats that are being looked at the world today. The United Nations international strategy for Disaster Reduction characterizes environmental degradation as the lessening of the limit of the earth to meet social and environmental destinations, and needs. Environmental degradation can happen in the number of ways. At the point when environments are wrecked or common assets are exhausted, the environment is considered to be corrupted and harmed. There are a number of different techniques that are being used to prevent this, including environmental resource protection and general protection efforts.

United Nations Environment Assembly 2014, accords importance of environmental issues similar to those of peace, security, finance and trade. Ecological balance is non-negotiable to save the future and prosperity of mankind. The unsustainable development, prevalent poverty and environmental degradation represent significant challenges to a lasting global peace in the modern world. The threat to the environment has grown a lot over the last decade and the over exploitation of natural resources have degraded the ecosystems and reduced the services they provide, such as food, water, pollination and climate regulation.

A healthy and stable environment is vital for the future of humankind. Since the start of the new millennium, due to environmental hazards, the world has witnessed over 40 major conflicts and 2500 disasters killing millions and affecting over 2 billion people. Inclusive and sustainable development can minimize risks from disasters and conflicts and environmental hazards.

Ecosystem

the complex interdependent webs of living organisms and natural resources – play a crucial role in supporting human wellbeing and driving economic growth through the valuable services they provide such as food, water for drinking and irrigation, pollination and climate regulation. Yet human society has systematically undermined these natural allies, treating forests, trees, land and rivers as though they are inexhaustible. In his work on ecosystem management Dr Tewari focused on: building knowledge and enabling condition & productivilty of terrestrial ecosystsm.

Land Degradation

Land degradation is a process in which the value of the biophysical environment is affected by a combination of human-induced processes acting upon the land. It is viewed as any change or disturbance to the land perceived to be deleterious or undesirable. Natural hazards are excluded as a cause; however human activities can indirectly affect phenomena such as floods and bush fires.

This is considered to be an important topic of the 21st century due to the implications land degradation has upon agronomic productivity, the environment, and its effects on food security. It is estimated that up to 40% of the world's agricultural land is seriously degraded.

Desertification

Desertification is a type of land degradation in which a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife. It is caused by a variety of factors, such as climate change and human activities. Desertification is a significant global ecological and environmental problem.

Areas affected

Drylands occupy approximately 40–41% of Earth's land area and are home to more than 2 billion people. It has been estimated that some 10–20% of drylands are already degraded, the total area affected by desertification being between 6 and 12 million square kilometres, that is about 1–6% of the inhabitants of drylands live in desertified areas, and that a billion people are under threat from further desertification.

Biodiversity Loss

The number and variety of plants, animals and other organisms that exist is known as biodiversity. It is an essential component of nature and it ensures the survival of human species by providing food, fuel, shelter, medicines and other resources to mankind. The richness of biodiversity depends on the climatic conditions and area of the region. All species of plants taken together are known as flora and about 70,000 species of plants are known to date. All species of animals taken together are known as fauna which includes birds, mammals, fish, reptiles, insects, crustaceans, molluses, etc.

Biodiversity is not evenly distributed, rather it varies greatly across the globe as well as within regions. Among other factors, the diversity of all living things (biota) depends on

temperature, precipitation, altitude, soils, geography and the presence of other species. The study of the spatial distribution of organisms, species and ecosystems, is the science of biogeography.

A biodiversity hotspot is a region with a high level of endemic species that is under threat from humans. The term hotspot was introduced in 1988 by Norman Myers. While hotspots are spread all over the world, the majority are in forest areas and most are located in the tropics.

Biodiversity and ecological services

Biodiversity supports many ecosystem services: "there is now unequivocal evidence that biodiversity loss reduces the efficiency by which ecological communities capture biologically essential resources, produce biomass, decompose and recycle biologically essential nutrients... There is mounting evidence that biodiversity increases the stability of ecosystem functions through time... Diverse communities are more productive because they contain key species that have a large influence on productivity and differences in functional traits among organisms increase total resource capture... The impacts of diversity loss on ecological processes might be sufficiently large to rival the impacts of many other global drivers of environmental change... Maintaining multiple ecosystem processes at multiple places and times requires higher levels of biodiversity than does a single process at a single place and time."

It plays a part in regulating the chemistry of our atmosphere and water supply. Biodiversity is directly involved in water purification, recycling nutrients and providing fertile soils. Experiments with controlled environments have shown that humans cannot easily build ecosystems to support human needs; for example insect pollination cannot be mimicked, and that activity alone represented between $2.1-14.6 billions in 2003.

The Convention on Biological Diversity is a commitment to achieving a significant reduction in the current rate of biodiversity loss at the global, regional and national level by 2010. The current rate is estimated to be up to 100 times the natural rate. This unprecedented biodiversity loss is being exacerbated by the negative impact of climate change. According to the IUCN Red List of Threatened Species, between 12 and 52 per cent of species within groups such as birds or mammals are threatened with extinction of 83 and up to 30 per cent of all known species may disappear before the end of this century because of climate change.

In ratifying the Convention on Biological Diversity, developed countries have also committed themselves to providing financial resources to ensure that developing countries can implement the Convention. In adopting the Declaration on the Rights of Indigenous Peoples,

states have recognized a similar obligation to "establish and implement assistance programmes for indigenous peoples for such conservation and protection without discrimination".

This funding, which can be made through bilateral, regional or multilateral donations, is channelled through the Global Environment Facility (GEF), the financial mechanism of the UN environmental conventions and the largest funder of projects to improve the global environment. Indigenous peoples' involvement in the GEF policy processes is limited, although they participate in the GEF assembly and council meetings and have their own focal point within the NGO network that is part of the GEF structure.

Air Pollution

Air pollution is the introduction of particulates, biological molecules, or other harmful materials into Earth's atmosphere, causing diseases, allergies, death to humans, damage to other living organisms such as animals and food crops, or the natural or built environment. Air pollution may come from anthropogenic or natural sources.

The atmosphere is a complex natural gaseous system that is essential to support life on planet Earth.

Indoor air pollution and urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report. According to the 2014 WHO report, air pollution in 2012 caused the deaths of around 7 million people worldwide.

An air pollutant is a substance in the air that can have adverse effects on humans and the ecosystem. The substance can be solid particles, liquid droplets, or gases. A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary. Primary pollutants are usually produced from a process, such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhaust, or the sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants.

Water Pollution

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater). This form of environmental degradation occurs when pollutants are directly or

indirectly discharged into water bodies without adequate treatment to remove harmful compounds.

Water pollution affects the entire biosphere – plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and population, but also to the natural biological communities,

Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water pollution is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. An estimated 580 people in India die of water pollution related illness every day. About 90 percent of the water in the cities of China is polluted. As of 2007, half a billion Chinese had no access to safe drinking water. In addition to the acute problems of water pollution in developing countries, developed countries also continue to struggle with pollution problems.

For example, in the most recent national report on water quality in the United States, 44 percent of assessed stream miles, 64 percent of assessed lake acres, and 30 percent of assessed bays and estuarine square miles were classified as polluted. The head of China's national development agency said in 2007 that one quarter the length of China's seven main rivers were so poisoned that the water harmed the skin.

Although interrelated, surface water and groundwater have often been studied and managed as separate resources. Surface water seeps through the soil and becomes groundwater.

Conversely, groundwater can also feed surface water sources. Sources of surface water pollution are generally grouped into two categories based on their origin.

Groundwater pollution

Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, also referred to as groundwater contamination, is not as easily classified as surface water pollution. By its very nature, groundwater aquifers are susceptible to contamination from sources that may not directly affect surface water bodies, and the distinction of point vs. non-point source may be irrelevant. A spill or ongoing release of chemical or radionuclide contaminants into soil (located away from a surface water body) may not create point or non-point source pollution but can contaminate the aquifer below, creating a toxic plume. The movement of the plume, called a plume front, may be analyzed through a hydrological transport model or groundwater model. Analysis of groundwater contamination

may focus on soil characteristics and site geology, hydrogeology, hydrology, and the nature of the contaminants.

Climate Change

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as global warming

Causes of climate change include anthropogenic greenhouse gases emission, which have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

Climate change, in recent decades have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.

Impacts of climate change threaten to undermine decades of development gains and risk future development paths. Many of the main drivers of poverty in developing countries are interwined with climate change, such as increased droughts and more erratic storms.

In his work on combating climate change, Dr Tewari focuses on three areas:

- Climate resilience – Supporting countries in using ecosystem-based approaches to adapt and build resilience to climate change.
- Low-emission growth – Supporting countries to reduce greenhouse gas emissions, adopt renewable energy, increase energy efficiency measures and reduce air pollution.
- REDD+ – Enabling countries to seize investment opportunities that reduce greenhouse emissions from deforestation and forest degradation with adequate social and environmental safeguards

Disasters and Conflicts

In his work on disasters and conflicts, which aims to minimize threats to human well-being from environmental degradation, Dr Tewari focuses on achieving results in two areas:

- **Risk reduction** – Improving countries' ability to use environmental management to prevent and reduce the risks of natural hazards, industrial disasters and conflict.
- **Response and recovery** – Supporting countries in the aftermath of a disaster or conflict to identify and address environmental risks that could have serious social and economic impacts.

Chemical and Waste

To achieve sound management of chemicals and waste, essential to the attainment of Sustainable Development Goal 3 on healthy people, he focuses on three areas:

- **The enabling environment**

  Supporting countries to build the institutional capacity and policies to manage chemicals and waste soundly.

- **Chemicals**

  Assisting countries, including major groups and stakeholders, to implement sound chemicals management and the related Multilateral Environmental Agreements (MEAs).

- **Waste**

  Assisting countries, including major groups and stakeholders, to implement sound waste management and the related MEAs.

Ocean

The ocean has a significant effect on the biosphere. Oceanic evaporation, as a phase of the water cycle, is the source of most rainfall, and ocean temperatures determine climate and wind patterns that affect life on land. Life within the ocean evolved 3 billion years prior to life on land. Both the depth and the distance from shore strongly influence the biodiversity of the plants and animals present in each region. One of the most dramatic forms of weather occurs over the oceans: tropical cyclones (also called "typhoons" and "hurricanes" depending upon where the system forms).

Sustainable Development

Sustainable development is a process for meeting human development goals while sustaining the ability of natural systems to continue to provide the natural resources and ecosystem services upon which the economy and society depend. While the

modern concept of sustainable development is derived most strongly from the 1987 Brundtland Report, it is rooted in earlier ideas about sustainable forest management and twentieth century environmental concerns. As the concept developed, it has shifted to focus more on economic development, social development and environmental protection.

Sustainable development is the organizing principle for sustaining finite resources necessary to provide for the needs of future generations of life on the planet. It is a process that envisions a desirable future state for human societies in which living conditions and resource-use continue to meet human needs without undermining the "integrity, stability and beauty" of natural biotic systems.

On September 2015, the United Nations General Assembly formally adopted the "universal, integrated and transformative 2030 Agenda for Sustainable Development, and a set of 17 Sustainable Development Goals (SDGs)". The goals are to be implemented and achieved in every country from the year 2016 to 2030.

About half of the SDGs are directly environmental in focus or address the sustainability of natural resources: poverty, health, food and agriculture, water and sanitation, human settlements, energy, climate change, sustainable consumption and production, oceans, and terrestrial ecosystems.

Dr Tewari promotes environmental sustainability as a crucial enabling factor in ensuring the health of our planet, and is committed to working with all parties to ensure the success of the ambitious agenda.

Environment, Forest & People are inextricably linked having symbiotic relationship. For their integrated development, Dr. Tewari helped in formulation of "National Forest Policy of India (1988)", "National environment Policy of India (2006)", "National Tribal Policy of India (2005)", "Resettlement & Rehabilitation Policy" and supported legislative enactment of "Forest Right Act (2006)". These policies and act allowed indigenous peoples (Tribals) to use forests for their socio-economic development while resolving conflicts and struggle for justice non-violently.

FOREST

Forests currently cover nearly one third of the earth's surface, mitigate climate change, protect soil and water resources, harbor more than 75 percent of the world's biodiversity, and provide important ecosystems services as well as important market products, such as paper and timber. Sustainable Forest Management (SFM) is essential for achieving Sustainable

Development Goals (SDGs) as a critical means to eradicate poverty, significantly reduce deforestation, halt the loss of forest biodiversity and land degradation, and improve food security and access to safe drinking water and affordable energy.

About 1.6 billion people, including more than 2,000 indigenous cultures, are dependent on forests for their livelihoods, including food, fodder, fuel, fibre, shelter and income. The 2015 international agreements about Sustainable Development Goals (SDGs) and Climate Change have boosted understanding about the role of forestry in the globe and it was timely that the Earth Day 2016 was devoted to the theme "Trees for Earth". The event kicked off a global goal to plant 7.8 billion trees by 2020, and all should work together so that even more is done, now and hereafter.

With a growing global population, a changing climate, movement from rural to urban areas, and complex political, economic, social and environmental challenges, especially in developing countries inflicted by deforestation and land degradation, there is ever greater need for multi-stakeholder support and cross-sectoral strategies for valorizing the earth's forests. Major global policy developments in the UN system's 2014–2015 biennium acknowledged the role of forests and trees in efforts to ensure food and water security, mitigate and adapt to climate change, alleviate poverty, and address other correlated issues of sustainable development. In September 2014, various governments, companies and civil-society organizations endorsed the New York Declaration on Forests, which aims to cut natural forest loss in half by 2020 and end it by 2030.

We need to highlight the multiple benefits of both natural and planted forests and trees outside forests and their contribution to the well-being of the planet and humanity through partnerships among governments and various stakeholders, including farmers, local communities, private sector and civil society. Enhanced political commitment is warranted to achieve Sustainable Forest Management (SFM) globally and to deliver the related SDGs. Leadership should create and strengthen partnerships and international cooperation to facilitate the provision of increased financial resources, ethical trade, forest law enforcement and governance, and recognize and support indigenous and community-based forest management systems to ensure their full and effective participation in SFM.

An agreement on Climate Change was adopted by all the 196 Parties to the UN Framework Convention on Climate Change at COP21 in Paris on 12 December 2015. They agreed to work to limit global temperature rise to well below 2 degrees Celsius, and given the

grave risks, to strive for 1.5 degrees Celsius. The Paris Agreement was ratified at UN Headquarters in April 2016. And it was noted that its implementation is "essential to achieve the Sustainable Development Goals". More than 90 countries highlighted the need for actions to reduce the impact of deforestation, forest degradation and land use change in their Nationally Determined Contributions to the COP21 climate agreement in Paris (PCCA).

Forests are at the forefront of climate change Mitigation, Adaption and Development (MAD) challenge. Forests have a unique ability to simultaneously reduce greenhouse gas emissions, capture carbon, and reduce the vulnerability of people and ecosystems to climate change. Forests store a vast amount of carbon. Conserving this store by reducing deforestation and forest degradation and promoting SFM must be one of the world's highest priorities. Restoring forests and planting new forests greatly increase the forest-based carbon store. Sustainably managed forests not only retain their carbon, they also support the livelihoods of millions of rural people and deliver many products and ecosystem services, such as the clean water and wildlife habitat that societies need in line with SDGs. Sustainably harvested forest products and wood-based bio-energy can reduce greenhouse gases by substituting high emission materials such as petrol, steel or concrete by neutral or low emission renewable products.

REDD+ Programme has given a new hope to the global community to seriously address the 17.4 percent of global emissions that is caused by deforestation and forest degradation. Important aspects of National Forest Monitoring System comprising MRV and Safeguards Information systems have to be dealt with lucidly. Countries should join UN-REDD+ Programme and the WBG FCPF to seek technical and financial assistance for REDD+ preparation. Capacity building covering all stakeholders, especially for MRV that deals with measurement, review and monitoring systems is necessary to assess national and local level REDD+ performance with third party verification of enhanced forest carbon stocks under REDD+ with reasonable transaction costs. Reducing emissions is not only about mitigating emissions from our industrial sectors; it is also about protecting our forests and for the forests to actively sequester carbon dioxide, given that deforestation currently accounts for about 10 per cent of annual emissions, almost as much as the total output of all cars and trucks on the planet. Protecting forests could eliminate these emissions entirely and reduce them by at least another 2 percent through carbon sequestration. The nearly $6 billion pledged to forest conservation in ten key countries under the UN REDD+ is successfully targeting nations and provinces with high levels of deforestation and associated carbon emissions. These findings, recently from a

comprehensive analysis to date of the "geography" of REDD+ funding, are a major boost for a programme that many conservationists consider critical to global efforts to curb deforestation, which is a significant contributor to climate change.

Forested watersheds and wetlands supply 75 percent of the world's accessible fresh water for domestic, agricultural, industrial and ecological needs. Forests are a key component of watershed management, especially with an integrated approach of using natural resources in a given geographical area drained by a water course. About one-third of the world's largest cities obtain a significant portion of their drinking water directly from forested protected areas. Forests act as natural water filters, minimize soil erosion on site, reduce sediment in water bodies (wetlands, ponds, lakes, streams, rivers) and trap or filter water pollutants in the forest litter.

Forest ecosystems are fundamental to maintaining the water cycle. Forested areas provide a high proportion of the world's accessible fresh water. Forests are also major water users, utilizing water for the generation of biomass, storing water in soils and displacing water from one location to another through evapotranspiration and subsequent precipitation. The ratio of water used versus water conserved, purified and delivered downstream by forests varies over time and is influenced by climate, topography, soil, forest structure and forest management practices. A key challenge is how to optimize the trade-offs between water use, water yield, forest products and the wide range of water-related ecosystem services provided by forests.

Forests and trees support sustainable agriculture, stabilize soils and climate, regulate water flows, give shade and shelter, and provide a habitat for pollinators and the natural predators of agricultural pests. They also contribute to the food security of hundreds of millions of people, for whom they are important sources of food, energy and income. Indeed, it is possible to increase agricultural productivity and food security while halting or even reversing deforestation, highlighting the successful efforts of Costa Rica, Chile, China, Ghana, Tunisia and Viet Nam. Integrated land-use planning is the key to balancing land uses, underpinned by the right policy instruments to promote both sustainable forests and agriculture, while inter-alia drawing upon Payment for Environmental Services (PES) potential for motivating and involving local communities.

The inter - relationship between forestry, poverty alleviation and food security is now being better understood, taking note of diverse forest foods, the forest biodiversity base for farmed food products, and the role of sustainable forest management in preventing land degradation and conserving soil and managing watersheds. In this context, agro-forestry could be

given heightened attention for augmenting food supplies, for complementing forestry and farming and conserving natural assets, especially in fragile landscapes and marginal agricultural areas. Agroforestry can significantly enhance yields of smallholder farmers. With about 842 million people suffering from chronic hunger, the role of forests for timber must not overlook their important contribution to feeding millions of poor people. Also need to note that forests and trees on farms are an important source of food and income for over a billion poor people.

The contribution of forests to the well-being of humankind are extraordinarily vast and far-reaching. Forests play a fundamental role in combating rural poverty, ensuring food security and providing decent livelihoods; they offer promising mid-term green growth opportunities; and they deliver vital long-term environmental services such as clean air and water, conservation of biodiversity and mitigation of climate change.

The role of forests as terrestrial sinks and sources of carbon dioxide has received increasing attention. The World's forests store an estimated 296 Gigaton (Gt.) of carbon in both above-and below-ground biomass which contains almost half of the total carbon stored. Over the past 25 years the carbon stocks in forest biomass decreased by almost 17.4 Gt., equivalent to a reduction of 697 million tonnes per year or about 2.5 Gt. of carbon dioxide (CO_2).

People must realise that life is precious, unique and rare, and is in constant danger due to habitat and biodiversity loss. Life support system is endangered. The endangering process is also irreversible. Forests account for 75% of the gross primary productivity of the Earth's biosphere, and contain 80 per cent of the Earth's Plant biomass and bulk of wild-lives.

Maintenance of biodiversity through conservation and protected areas allows species to survive, evolve and dynamically adapt to changing environmental conditions. It also enhances plant and animal gene pools and provides genetic reservoirs for tree breeding. Conserving biodiversity is thus crucial for the long-term health and sustainable productivity of the world's forests. Reliable data on forest biological diversity provides an indication of countries where biodiversity may be increasing or decreasing.

Forests area primarily designated for biodiversity conservation accounts for 13 per cent of the World's forests or 524 million ha, with largest areas reported in Brazil and the United States of America. Although more areas of forests will probably be designated for biodiversity conservation, tangible results will be achieved only through integration of conservation policies into broader national and local development programmes and through more systematic

consideration of trade-off between biodiversity conservation and other needs of society. The expansion of sustainable forest management practices will also enhance biodiversity.

Forests deliver protection or conservation of natural resources, including soil and water, and other environmental services. Forests minimise soil erosion and soil fertility decline and enhance protection of water quality while assuring stable water quantity. Forests can protect soils from wind and water erosion, avalanches and landslides.

Considerable Challenges remain from persistent poverty and grinding inequalities to climate change and environmental unsustainability in general, and to conflict and instability. These all create barrier to people fully engaging in promoting Sustainable Forest Management and achieving Sustainable Development Goals (SDGs). Human development and sustainability are essential components of the same ethic of the unversalism of live claims. Forests management promotes sustained, inclusive and sustainable economic growth, full and productive employment and work for forest-dwellers.

Deforestation is the conversion of forest to other land uses or the permanent reduction of the tree canopy cover below the minimum 10 percent threshold. Over the past 25 years, forest area has changed from 4.1 billion ha to just under 4 billion ha, a decrease of 3.1 per cent. The rate of global forest area change has slowed by more than 50 per cent between 1990 and 2015.

Halting the loss of forests will benefit hundreds of millions of people, including many of the world's poorest people, whose livelihoods depend on forest goods and environmental services. It will also help combat climate change, protect habitats for more than 75 percent of the world's terrestrial biodiversity, and maintain ecosystem resilience – thereby supporting sustainable agriculture. Good resource management can enhance numerous benefits received from urban forests, including improved air and water quality; reduced air temperatures, noise, and ultraviolet radiation at ground level, and building energy use; improved wildlife habitat; increased psychological, physiological, and community well-being; enhanced aesthetics; improved outdoor recreation, and increased worker productivity and property values.

Agroforestry is believed to be one of the sensitive substitutes which has got the potential to reverse land degradation (to achieve a land degradation-neutral world), conserve water, sequester carbon, protect and prevent the extinction of threatened species and recover site productivity through interactions among trees, soil, agricultural crops and livestock and thus restore environment and enhance productivity and profitability of farmer's land.

Green investment in natural forests and plantations will boost the economy and employment besides generating public benefits in terms of food, energy, water, health, shelter and recreation at relatively low cost. Sustainable Forest Management would promote cleaning, greening and making a worth living Earth planet for survival of mankind.

Hence future forest development should promote implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally. It is necessary to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities.

The forest villages are often left out or marginalized in development programmes. Poor farming infrastructure and extension services, crop depredation by wild animals and lack of quality education and vocational skills make them prone to becoming trapped in poverty. Urgent steps should be taken to provide additional financial, technical and community mobilization support to transform the villages by creating state-of-the-art physical, social and economic infrastructure and eliminating poverty. Implementation of ongoing national, state and local level development programmes should be prioritized and converged in these villages.

Sustainable forest management should integrate climate change concerns by managing forest catchments and watersheds, expanding urban greens and agroforestry, reducing deforestation and forest fires. We need to actively promote reforms in supply side, make green industry bigger and stronger and increase effective supply of forest products. We need to improve the standards for forest eco-subsidiary. We also need to hire poor labours as forest worker, offering a stable employment and a career dedicated to eco-protection to lift them out of poverty.

Modernized equipment and high-caliber teams of talents are the distinctive mark and the ultimate guarantee of modernized forestry. To promote it, we must tackle the weakest link: the poor infrastructure in forest areas, so that we can comprehensively improve coordinated development of forestry. We need to put the supportive sheltering system for forestry in place, improve infrastructure in forest areas, apply modernized forest equipments for better fire-prevention, speed up "the Internet+" and the constructions of grass-root stations, grow the teams of professionals and talents and improve the basic supportive capacity for forestry to improve environmental sustainability.

PEOPLES

About 1.6 billion people, including more than 2,000 indigenous cultures, are dependent on forests for their livelihoods, including food, fodder, fuel, fibre, shelter and income. The 2015 international agreements about SDGs and Climate Change have boosted understanding about the role of forestry in the globe and it was timely that the Earth Day 2016 was devoted to the theme "Trees for Earth". The event kicked off a global goal to plant 7.8 billion trees by 2020, and all should work together so that even more is done, now and hereafter.

Indigenous peoples constituting about 6% of the world's population yet accounting for more than 15% of the global poor. United Nations noted that, "Indigenous peoples face systematic discrimination and exclusion from political and economic powers; they continue to be overreprented among the poorest; the illiterate, the destitute, dispossessed of their ancestral lands and deprived of their resources for survival, both physical and cultural; and they are roobed of their very right to life". For their security and safety we have to ensure health care, quality education reduce poverty, hunger, inequality, discrimination, marginalization, recognize human rights, gender equality, promote culture of peace and non-violence.

The challenge of feeding a global population projected to increase from more than 7 billion people today to more than 9 billion by 2050 is made more difficult by the threats of climate change, growing water and land scarcity, and soil and land degradation. In addition to helping mitigate climate change and protect soils and water, forests hold more than 75 percent of the world's terrestrial biodiversity, provide many products and services that contribute to socioeconomic development, and are particularly important for hundreds of millions of people in rural areas, including many of the world's poorest people (FAO, 2014a). Poor rural women are especially dependent on forest resources for their subsistence (World Bank, FAO and International Fund for Agricultural Development, 2009).

Bold but prudent reforms of four critical enabling factors were needed to help empower the indigenous communities to use forests as one path way out of poverty. The reforms included achieving more secure tenure and management rights for them; strengthening forest management, monitoring and control systems; providing access to more efficient market systems; and developing more effective and flexible institutional models.

Resilient forests and agroforests systems are quite essential part of improving the livelihood of the poor people. Approaches to enhancing productivity and profitability of forestry and agroforestry systems, the development and dissemination of improved germplasms and the

creation and application of tools for monitoring and conserving ecosystem services were urgently required.

For conserving, managing and using forest sustainably, adoption of fiscal and economic policies were necessary. The policy reforms guided the policy-makers on best bet for governance (participatory), and institutions that will enable the equitable participation of poor people to derive income in managing forest through sale of forest products, in REDD+ projects, and in payment for ecosystems services (PES).

Ambiguity in policies, ineffective or inconsistent law enforcement, corruption and overall weakness in the rule of law are preventing many countries from realising the full socio-economic development and environmental benefits from the use of forests. As a result of our demand, forest policy & forest right act have been adopted, improving participation of indigenous communities, in forest management with tenurial rights and legal framework to get income and employment.

Dr. Tewari successfully implemented following schemes for eradication of poverty, livelihoods security and environmental sustainability without pushing our climate out of control:-

- For restoration of degraded forests, started sustainable community forestry programme. It restored forest resources and associated biodiversity; improved local livelihoods of all indigenous peoples. By universalizing this programme increased resilience to climate change and provided more eco-benefits, building beautiful home with bluer sky, greener land and cleaner air & water.
- Empowered indigenous communities by recognizing their rights on Non-Wood Forest Produce (NWFP). Formation of cooperative/societies and their affiliation with Minor Forest Produce (MFP) Federations or Tribal Cooperative Development Federation optimized collection, value addition and marketing of NWFPs , removed conflicts in NWFP collection and improved economy of indigenous communities.
- Encouraged establishment and growth of micro, small and medium sized forest enterprises through access to financial services and micro-finance and helped people to create their own solutions to poverty eradication.
- Achieved higher levels of economic productivity through diversification, technological upgrading and innovation with a focus on high-value added and labour intensive sectors.
- Swiden farming was responsible for deforestation, land degradation, climate change, biodiversity erosion and water scarcity. Special schemes such as Rubber Plantation,

Medicinal Plants cultivation, Settlement and Rehabilitation of people, reduced forest burning and environmental hazards.

- For making villages inclusive, safe, resilient and sustainable, developed 10,000 Forest villages as Eco-villages. Ensured access to adequate, safe and affordable housing, connectivity, and basic services and upgraded unsafe human settlements. Supported positive, economic, social and environmental links between Urban, Peri-urban and Rural areas by strengthening development planning for holistic disaster risk management at all levels.
- For achieving lasting peace, ensured internationally guaranteed human rights – the rights to food, water, sanitation, clean air, health and education for millions of poor people. Due to poverty eradication, people are able to fulfil their basic needs, and enjoy equal opportunity.
- Helped Govt. of India to enact "Forest Right Act" and restored alienated lands of indigenous peoples. They were provided inputs, technology, financial services and markets for raising sustainable agriculture and agroforests. It helped more than 10 million families to come out of poverty, hunger and inequality.
- REDD+ fundings are a major boost to curb deforestation which is a significant contributor to climate change. It increases the income of participating people in implementation of the project.
- Assisted poor people to increase their benefits from forest resources by helping them to access markets, acquire processing skills, obtain improved varieties of germplasms, adopt agroforestry, and formed associations to jointly manage resources, strengthen negotiating power and market products.
- Creating enabling environments to encourage investment and inspiring people to bring forth a thriving, just and sustainable world.
- Promoting efficient production and processing of agricultural and forest products, and related waste reduction and recycling.
- There is a need to stimulate growth in the forest based industry sector. This sector being labour intensive can create green jobs while mitigating climate change. The forest based industries face constraints in ensuring an assured supply of raw material along with licensing issues and as a consequence imports of timber logs are on the rise. The forest corporations and industrial units need to step up forestry plantations for meeting the demand of raw material without directly competing with farmers. They also need to induct young professionals in their workforce to mainstream new technical and management

advancements. Forest based industries have already established captive plantations in partnership with the farmers. This partnership needs to be further expanded to ensure an assured supply of raw material to the industries with mutually beneficial arrangements.

- Measures to enhance and promote recreation and ecotourism to improve livelihoods of forest-dwellers. Tourism offers the potential to provide economic development and plays an important role, through the provision of increased income and employment in conserving nature and generating fund for the maintenance of the area.
- Payments for ecosystem services (PES), *ab-initio*, have been focused on maintaining or restoring ecosystem and environmental services. However, efforts to link PES and poverty reduction have evolved during the recent 20 years. The understanding and practices of implementation of PES have developed as a compensatory incentive for the ownership and stewardship of local communities to protect and plant trees, say for watershed management, rainwater harvesting and to balance conservation objectives and socio-economic imperatives. Involving local residents or users of natural resources in conservation efforts and providing incentives to local communities to support and participate in conservation efforts is now a cost-effective practical option. Under a typical PES scheme, the party supplying the environmental services agrees to manage the corresponding resource or the service that provides a flow of benefits to another party according to certain requirements, in return for compensation. An example is improving watershed management and providing hydrological resource for remunerative power plants. Majority of existing schemes operate in the areas of watershed services and biodiversity conservation. The precise design of the payments systems influences the distribution of the payments across participating and non-participating groups; hence, PES can serve those furthest behind. In other words, carefully designed PES schemes can become more focused on those left behind, i.e., the poorest and those unable to cross above the poverty line and on critical environmental issues of climate change and water vagaries.
- Building a better future with forests. There is growing interest in using wood products in green buildings. Because of their reduced impact and the contribution that this makes to improve quality of life. Similarly the benefits of forests for health are being increasingly recognised, with rising demand for medicinal plants and natural organic food, not to mention growing numbers of people visiting forests for exercise, recreation and entertainment.

- Agroforestry has the potential to sequester nearly 600 million metric tons of carbon a year by 2040, compared with about 120 million metric tons for cropland. Given that deforestation and agriculture together account for about 25 percent of greenhouse gas emissions, farmers in the South, who are at risk from climate change, should be able to improve their livelihoods through carbon emissions trading. Carbon payments to farmers could encourage them to change their practices in ways that benefit the globe while also helping to enhance their incomes. But to achieve these goals, agroforestry and agricultural land use change should be inclusive and coordinated as eligible activities, procedures for gaining payments for afforestation and reforestation. Agro-foresters, farm foresters and related communities and societies need to be aware and supported as to how do they get more value from their trees crop -not only for food, fuel or fibre, but *inter-alia* as carbon assets. That should encourage local processes to clarify and strengthen tenure, property, and carbon right with substantial additional funding and resource mobilization.

CONCLUSION

One of the global problem before humanity is the pollution and degradation of environment. We want healthy environment to pursue shared prosperity, peace and partnership for protecting the planet and securing live of dignity for all including indigenous peoples who are most bulnerables.

Sustainable Development Goals (SDGs) were adopted encompassing universal aspiration centred on People, Planet, Peace and Partnership with endeavour to reach the furthest behind first. The SDGs aim to end poverty, protect the planet and ensure peace and prosperity for all.

Environmental Sustainability is not an impediment to, but a driver of development. Forests currently cover nearly one third of earth's surface, mitigate climate change, protect soil and water resources, harbor more than 75 percent biodiversity and support livelihoods of over 370 million indigenous peoples. With more than 2000 indigenous cultures about 500 are vulnerable and few have become extinct.

While forests are directly referenced in SDG15 about Life on Land, it is part of many other SDGs, given that Sustainable Forest Management (SFM) is much more than just an environmental issue. It also addresses the social, economic and cultural dimensions of sustainability at the core of the 17 SDGs. Forests are also explicitly addressed in the SDG6 target 6.6 on water and are crucial to achieving many of the other SDGs and associated targets. This includes poverty eradication (SDG1), food security and nutrition (SDG2), health (SDG3), gender

equality (SDG5), sustainable energy (SDG7), sustainable economic growth (SDG8), infrastructure and innovation (SDG9), sustainable consumption and production (SDG12), climate change (SDG13), peaceful and inclusive societies, justice, accountable institutions (SDG16), and means of implementation (SDG17). For example, forests contribute to poverty elimination and livelihoods through providing an estimated income of around US$ 125 billion from the informal production of forest products alone, apart from about US$ 108 billion a year of medicinal plants from tropical forests (SDG1). Forests also supply at least 3.6 million tons of animal protein each year and important, micronutrient rich forest foods -such a fruits, nuts, seeds, vegetables and wild meat (SDG2). Wood energy provides over half of all energy supply in at least 29 countries and about 2.4 billion people cook with wood fuel (SDG7). They provide a raw material source for 1.3 billion people that live in homes where forest products are the main material used for the floor, roof or walls, directly relevant for a discussion on sustainable consumption and production (SDG12).

Reference

1. Book on "Forest and People" 2017 by Dr Dina Nath Tewari Pages 371, Ocean Books (P) Ltd., 4/19 Asaf Ali Road New Delhi 110002.