



# GREEN INSIGHTS

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Newsletter on "Environment Literacy - Eco-labelling and Eco-friendly Products"



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## **Invisible Protectors: Understanding Ozone and Ozone Depleting Substances (ODS)**



Sponsored by:

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**Environment Literacy - Eco-labelling and Eco-friendly Products**

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## Foreword

The preservation of our planet’s atmosphere is a critical concern for humanity. The ozone layer, a vital component of the stratosphere, serves as Earth’s natural shield against harmful ultraviolet (UV) radiation. However, this protective layer has been compromised by human activities, particularly the release of ozone-depleting substances (ODS) such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and other similar chemicals. The resulting depletion of ozone has led to severe environmental and health consequences, including increased risks of skin cancer, cataracts, and ecological disruptions.

This newsletter provides an in-depth exploration of the atmosphere’s role, the

significance of the ozone layer, the destructive impact of ODS, and the international efforts undertaken to mitigate this damage through agreements like the Montreal Protocol. It also highlights the ongoing challenges and the innovative responses by leading companies that have adopted environmentally friendly alternatives to ODS in their products. These efforts are essential as we continue to seek sustainable solutions to protect the ozone layer and, by extension, all life on Earth.

The information herein underscores the importance of continued vigilance, innovation, and global cooperation in safeguarding our planet’s future.

# Ozone and Ozone Depleting Substance (ODS)

The Atmosphere and Ozone Layer



**Source:** <https://www.business-standard.com/about/what-is-ozone-layer>

Our planet, the small blue and green sphere we call home, is extraordinarily unique. It is the only known planet in our solar system—and possibly the entire galaxy—where life exists. Life thrives within a thin layer of air, water, and soil that extends about 15 kilometers deep. This life-sustaining layer is known as the biosphere, which can be divided into three main components: the atmosphere (air), the hydrosphere (water), and the lithosphere (rock and soil). The distinctive qualities of Earth's atmosphere make it a liveable environment for humans, animals, microbes, and plants.

The atmosphere is a blend of gases and particles enveloping our planet. From space, it appears as a delicate, dark blue rim on the Earth's curved horizon. This atmospheric layer extends several hundred kilometers above the Earth, with 99% of its mass concentrated in the first 50 kilometers above the surface, divided between the troposphere and the stratosphere. The stratosphere extends beyond the troposphere, reaching up to approximately 50 kilometers above the Earth's surface.

## Ozone

Ozone is a form of oxygen. Oxygen occurs in three different forms in the atmosphere; as oxygen atoms (O), as oxygen molecules (O<sub>2</sub>) and as ozone (O<sub>3</sub>).

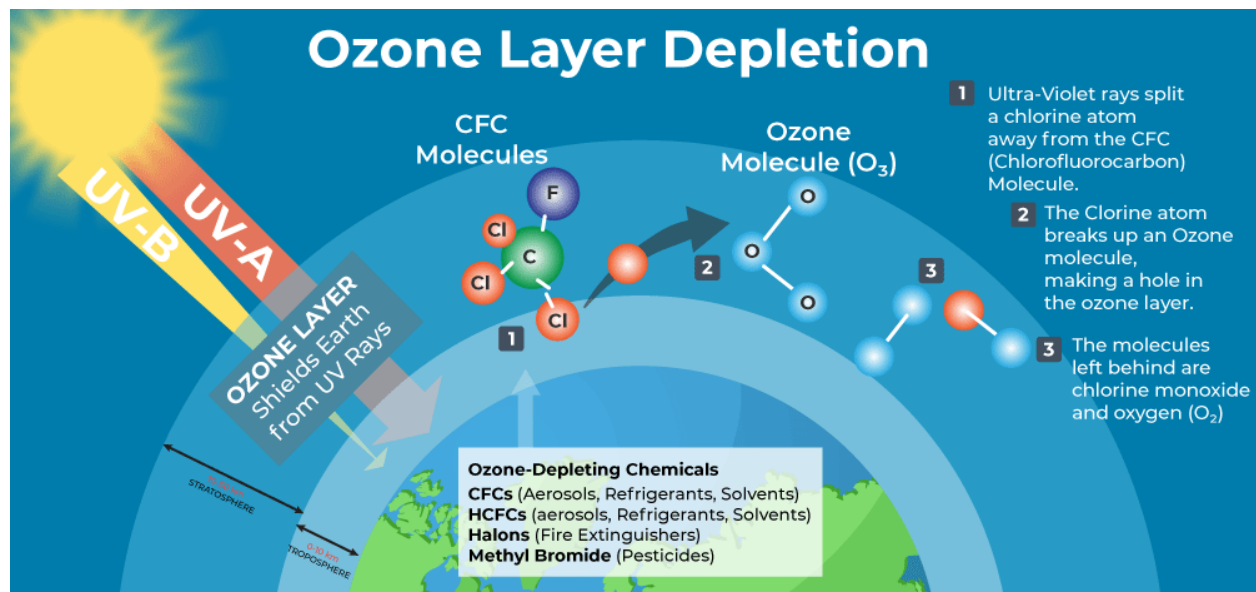
Ozone's unique physical properties allow the ozone layer to act as our planet's sunscreen, providing an invisible filter to help protect all life forms from the sun's damaging UV (ultraviolet) rays. Most incoming UV radiation is absorbed by ozone and prevented from reaching the Earth's surface. Without the protective effect of ozone, life on Earth would not have evolved the way it has.

## Ozone Depletion

Ozone depletion happens when the natural balance between the production and destruction of stratospheric ozone shifts towards destruction. While natural events can cause temporary ozone losses, chlorine and bromine from synthetic

compounds are now recognized as the primary cause of the overall decline in stratospheric ozone observed since 1980.

In 1985, Dr. Farman's article published in the esteemed journal "Nature" highlighted that, while ozone depletion was occurring globally, the most severe depletion was observed over Antarctica—known as the "Antarctic Ozone Hole." Satellite observations confirmed these findings, providing the first concrete evidence of severe ozone depletion and prompting urgent international action. This led to the Vienna Convention on March 22, 1985, and the subsequent 1987 Montreal Protocol on Substances That Deplete the Ozone Layer. The Protocol marked the beginning of a concrete effort to protect the ozone layer by committing to phase out chlorofluorocarbons (CFCs), halons, carbon tetrachloride (CTC), and methyl chloroform (MCF) according to a specified schedule.



**Source:** <https://www.geeksforgeeks.org/ozone-layer-depletion/>

## Ozone Depleting Substances (ODS)

Ozone-Depleting Substances (ODS) include materials such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), which are commonly used in refrigeration and air conditioning systems, aerosol sprays, medical devices, and foam-blowing agents for insulation and noise reduction in various applications like buildings, appliances, coolers, marine equipment, and industrial pipe insulation. CFCs and HCFCs are classified as ODS because they participate in atmospheric chemical reactions that deplete the stratospheric ozone layer.

Additionally, ODS are among the most harmful

greenhouse gases (GHGs) concerning climate change, with a Global Warming Potential (GWP) up to 10,000 times greater than that of carbon dioxide over a 100-year period. The GWP measures the global warming impact of different gases compared to an equivalent amount of carbon dioxide; CFCs have GWPs ranging from 4,750 to 10,900.

Despite the global phase-out of CFC production and the phase-out of HCFCs in most developed countries under the Montreal Protocol, these ODS are still in use. Many countries continue to recycle these substances for use in equipment originally designed for them until such equipment is retired. During production, use, and disposal, ODS refrigerants can leak into the atmosphere.



In some cases, they are vented during equipment servicing or disposal, although this practice is banned in certain countries. As equipment ages, the remaining ODS become less useful, and without mandated destruction, unused supplies can be stockpiled for extended periods, leading to further atmospheric leakage.

ODS are man-made gases that destroy ozone once they reach the ozone layer. The ozone layer sits in the upper atmosphere and reduces the amount of harmful ultra violet radiation that reaches Earth from the sun. Ultraviolet radiation can have detrimental effects on both humans and the environment. For instance, inducing skin cancer and cataracts, distorting plant growth and damaging the marine environment.

**ODS include:**

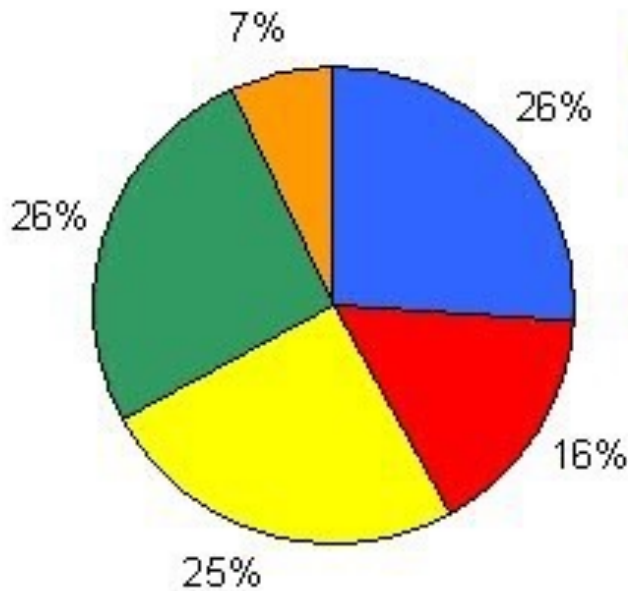
- chlorofluorocarbons (CFCs)
- hydrochlorofluorocarbons (HCFCs)
- hydrobromofluorocarbons (HBFCs)
- halons
- methyl bromide
- carbon tetrachloride
- methyl chloroform.

**They have been used as:**

- refrigerants in commercial, home and vehicle air conditioners and refrigerators
- foam blowing agents
- components in electrical equipment
- industrial solvents
- solvents for cleaning (including dry cleaning)
- aerosol spray propellants
- fumigants.

**Control of ODS**

- It is illegal to release ODS into the atmosphere for disposal. Instead, unwanted ozone-depleting substances must be collected and properly destroyed.
- The Environmental Protection Authority oversees the issuance of permits for the import or export of ODS.
- Recent research has led to the development of numerous alternative chemicals to replace chlorofluorocarbons (CFCs), Halons, carbon tetrachloride (CTC), and methyl chloroform. Since the early 1990s, hydrofluorocarbons (HFCs) have been used as substitutes for CFCs and HCFCs. While HFCs do not harm the ozone layer, they are powerful greenhouse gases.



Source: <https://www.ozone-hole.org.uk/05.php>

- Refrigeration
- Solvents
- Foams
- Aerosols
- Others

# Effects of Ozone Depletion

## Effects on Human and Animal Health

Increased exposure to solar UV-B radiation could significantly impact human health, potentially leading to eye diseases, skin cancer, and a range of infectious diseases. UV radiation is known to damage the cornea and lens of the eye, with chronic UV-B exposure potentially resulting in cataracts, including cortical and posterior subcapsular forms. UV-B radiation can also impair the immune system, increasing susceptibility to various infectious diseases. For light-skinned individuals, there is an elevated risk of developing nonmelanoma skin cancer (NMSC). Studies on animals have demonstrated that UV exposure can reduce the immune system's ability to respond to skin cancers, infections, and other antigens.

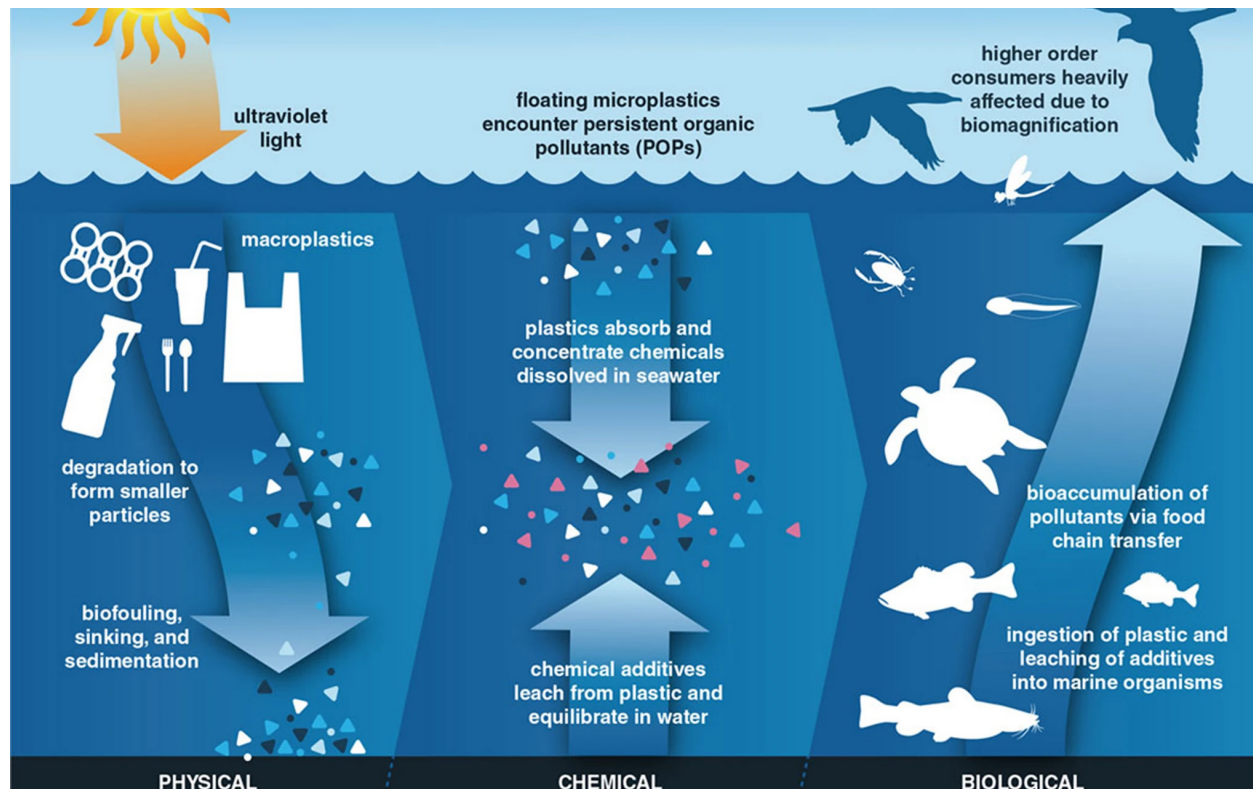
## Effects on Terrestrial Plants

It is well established that UV-B radiation impacts the physiological and developmental processes of plants. Scientists predict that rising UV-B levels will require the use of more UV-B tolerant plant varieties and the development of new, resilient cultivars in agriculture. In forests and grasslands, increased UV-B radiation may lead

to changes in species composition (mutation), thereby altering biodiversity within ecosystems. Additionally, UV-B could indirectly affect plant communities by influencing plant morphology, secondary metabolism, and other factors. These alterations could have significant consequences for plant competition, pathogen dynamics, and biogeochemical cycles.

## Effects on Aquatic Ecosystems

With over 30 percent of the world's animal protein for human consumption coming from the sea, there are concerns that increased UV exposure could negatively impact the productivity of aquatic ecosystems. Elevated UV levels in tropical and subtropical regions might disrupt the distribution of phytoplankton, which are crucial to aquatic food webs. Recent studies have reported a 6-12 percent reduction in phytoplankton production in the marginal ice zone due to increased UV-B exposure. UV-B radiation can also harm the early developmental stages of fish, shrimp, crabs, amphibians, and other marine animals, with the most severe effects being reduced reproductive capacity and impaired larval development.



Source: <https://link.springer.com/article/10.1007/s43630-020-00001-x/figures/14>

## Effects on Bio-geo-chemical Cycles

Increased solar UV radiation could disrupt terrestrial and aquatic biogeochemical cycles, altering both the sources and sinks of key greenhouse and trace gases such as carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and carbonyl sulfide (COS). These disruptions would contribute to feedback mechanisms between the biosphere and atmosphere, potentially increasing atmospheric levels of these gases. Other effects of heightened UV-B radiation include changes in the production and decomposition of plant matter, reduced primary production, and alterations in the uptake and release of crucial atmospheric gases. Additionally, UV-B radiation can decrease the growth of bacterioplankton in the upper ocean and enhance the degradation of aquatic dissolved organic matter (DOM). Aquatic nitrogen cycling may also be affected by UV-B through the inhibition of nitrifying bacteria and the photodecomposition of simple inorganic species like nitrate. The marine sulfur cycle could also experience changes, potentially impacting the sea-to-air emissions of COS and dimethyl sulfide (DMS), which are converted to sulfate aerosols in the stratosphere and troposphere, respectively.

## Effects on Air Quality

A decrease in stratospheric ozone and increased UV-B radiation lead to higher photodissociation rates

of crucial trace gases that influence the chemical reactivity of the troposphere. This can result in greater production and destruction of ozone and related oxidants, such as hydrogen peroxide, which have known adverse effects on human health, terrestrial plants, and outdoor materials. Variations in the atmospheric concentrations of hydroxyl radicals (OH) may alter the atmospheric lifetimes of significant gases like methane and substitutes for chlorofluorocarbons (CFCs). Additionally, increased tropospheric reactivity could enhance the formation of particulates, such as cloud condensation nuclei, from the oxidation and subsequent nucleation of sulfur compounds, both anthropogenic and natural (e.g., COS and DMS).

## Effects on Materials

Elevated levels of solar UV radiation have been shown to negatively impact synthetic polymers, natural biopolymers, and various other commercial materials. UV-B radiation speeds up the photodegradation of these materials, thereby shortening their lifespan. Common damages include discoloration and a loss of mechanical strength. As a result, there will likely be a growing need to replace these affected materials with more UV-resistant plastics and other durable alternatives in the future.

# Companies Manufacturing Products Without ODS

BLUE STAR LTD.



Blue Star is India's leading company in Heating, Ventilation, Air Conditioning, and Commercial Refrigeration (HVAC&R), with an impressive annual revenue of over Rs 9685.36 crores (1.16 billion USD). The company operates through 30 offices and 7 advanced manufacturing facilities, including a state-of-the-art deep freezer plant at Wada and a world-class facility at Sri City under Blue Star Climatech Limited. With a workforce of 3,500 employees and 5,500 channel partners, Blue Star manages 10,000 retail outlets offering room ACs,

packaged air conditioners, chillers, cold rooms, and refrigeration systems. Its 5,000 delivery partners serve customers across more than 900 towns in India and extend to over 20 countries from North America to East Asia.

Blue Star caters to the cooling needs of a diverse range of corporate, commercial, and residential clients. The company's R-32 refrigerant stands out in the air conditioning industry for its environmental benefits. It provides faster cooling, has zero Ozone Depletion Potential, and features the lowest Global Warming Potential, making it a highly eco-friendly choice.



Daikin Air-conditioning India Pvt. Ltd. (DAIPL) is a wholly owned subsidiary of Daikin Industries Ltd., Japan, a global leader in commercial and residential air conditioning systems. Leveraging cutting-edge technology, DAIPL provides a broad range of energy-efficient air conditioning solutions tailored to Indian customers. The company has made a significant impact by delivering premium air conditioning solutions for large-scale projects in the Indian market.

In a pioneering move for a developing country, Daikin India has become the first manufacturer to produce low Global Warming Potential (GWP) HFC-32 based room air conditioners at its advanced facility in Neemrana, Rajasthan. Since 2013, Daikin India has sold over 1.5 million of these low GWP HFC-32 based ACs in the market.

#### GODREJ & BOYCE MFG. CO. LTD.



Godrej & Boyce Mfg. Co. Ltd., part of the Godrej Group, began its journey in 1987. Today, the company operates 17 diverse divisions, manufacturing everything from locks to rocket launchers, and serving both India and global markets. Their products touch the lives of 750 million Indians daily.

A notable innovation from their appliances division, Godrej Appliances, is the use of propane (Hydrocarbon 290, HC-290, or R-290) as a refrigerant. This R-290 air conditioner exemplifies the potential for building climate-friendly AC units in India, using a refrigerant with zero Ozone Depletion Potential and the lowest Global Warming Potential.

#### BIRLA AIRCON



Birla Aircon, a division of the Pratyaksh Birla Group, is a well-established company with over four decades of expertise in air conditioning and commercial

refrigeration. The company operates a state-of-the-art plant in Northern India and is renowned for its custom-made refrigeration solutions. Birla Aircon's ISO9001:2015 certified quality management system has garnered widespread recognition.

The company has successfully provided a diverse range of products, including water coolers, water chillers, deep freezers, mortuary cabinets, ice cream freezers on wheels, and mobile lassi coolers.

#### VOLTAS



Voltas is India's largest air conditioning company and one of the world's leading engineering solutions providers and project specialists. Established in 1954, Voltas offers a wide range of products including room air conditioners, commercial refrigeration items, air coolers, water dispensers, and water coolers. The company also provides solutions across various industries such as heating, ventilation, refrigeration, electro-mechanical services, textile machinery, mining and construction equipment, water management, treatment, and cold chain solutions. Known for its strong reputation and market leadership in the room AC segment, Voltas is a prominent member of the Tata Group.

#### Green Refrigerant Products:

##### 1. Inverter Air Conditioner:

- Utilizes Green Refrigerant: Solstice R-444B
- Features: Zero Ozone Depletion Potential (ODP) & Global Warming Potential (GWP) of 295
- Provides a 10% improvement in cooling performance in tropical climates.

##### 2. Inverter Chest Freezer:

- Utilizes Green Refrigerant: R600a (isobutene)
- Features: Zero ODP & GWP of 3
- Offers faster pull-down and 30% higher energy efficiency compared to R134a.

#### References

<https://ozonecell.nic.in/home-page/science-of-ozone/science-of-ozone-depletion/>

[https://acrcarbon.org/resources/ozone-depleting-substances/#\\_edn1](https://acrcarbon.org/resources/ozone-depleting-substances/#_edn1)

<https://environment.govt.nz/acts-and-regulations/acts/ozonelayerprotectionact1996/ozonedepletingsubstances/#what-ozonedepleting-substances-are>



## Events (July – September 2024)

1. CERC-EIACP and Environment Conservation Youth Club (ECYC) organized a plantation drive to celebrate Van Mahotsav and the monsoon in Bhavnagar. On June 30th, 2024, they planted 14 saplings. Karan Thakkar, Information officer, CERC-EIACP, spoke to the 23 participants about the importance of planting native plants over exotic ones and about Mission LIFE. There will be more tree plantation drives in Bhavnagar city on the 6th and 15th of July.



2. CERC-EIACP PC RP organized a plantation drive at BAPS Swaminarayan Gurukul, Kherva, Mehsana on 4th July 2024 as a celebration of Van Mahotsav. 200 saplings of various plant species were planted by 100 students of the school and CERC EIACP Team.





3. Students from Gujarat University and Gujarat Biotechnology University completed their 1.5 months internship at the Food & EAICP dept at CERC.



4. Dr. Kartik Andharia, Programme Officer, CERC-EIACP PC RP held a session on the activities of EICAP project and Mission LiFE to the members of Maitry NGO, Wadhwan, Gujarat on 7th August 2024.



5. CERC-EIACP PC RP celebrated eco-friendly Rakshabandhan at Shwas NGO on 10th August 2024, during this event, Ms. Mayuri Tank, IT Officer, led a workshop on creating eco-rakhis using materials such as cotton thread, soil, seeds, woolen thread, and paper. She educated students (standard 6 to 9) and staff members on how to prepare an eco-friendly Rakhi. MissionLiFE pledge is also taken



6. Anindita Mehta COO CERC, EIACP Coordinator, was the Chief Guest and Keynote speaker at BIS Regional workshop 'Manak Samvad' where her talk was on "Addressing Sustainability in Indian Standards"







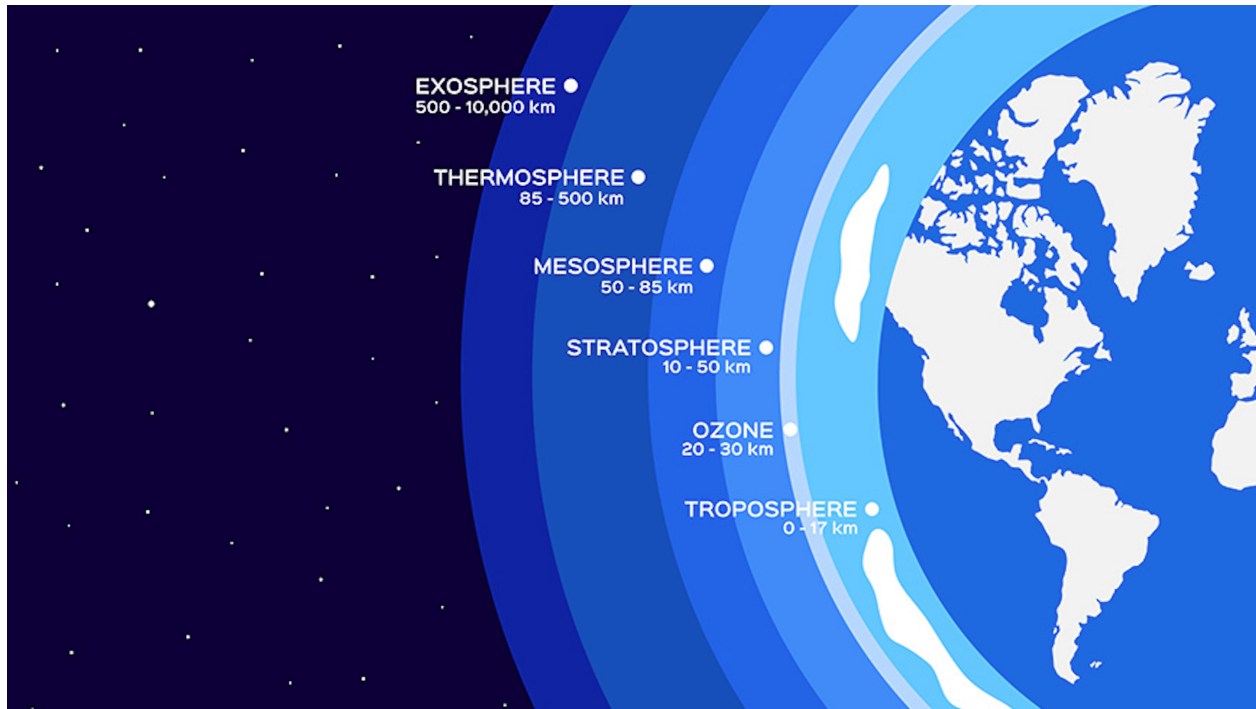
8. As part of the “Ek Ped Maa Ke Naam Campaign,” CERC-EIACP PC RP organized a plantation drive and a LiFE awareness program for the students of Kailash Vidyalaya in Ahmedabad on August 31, 2024. During the event, the significance of planting trees and the objectives of the LiFE Mission were explained. 10 saplings of various plant species were planted. School students, along with the principal and EIACP staff members, actively participated in the event.

9. Dr. Kartik Andharia, Programme Officer and Ms. Mayuri Tank, IT Officer from CEC-EIACP team were attended the Coordinator’s Meet held at India Habitat Centre, New Delhi on 7th September 2024.



7. Workshop on the occasion of inauguration of a new Division of BIS for Standardization on issues concerning Environment and Ecology. CERC will be an important stakeholder in this Division given our association with MoEF&CC as Resource Partner, EIACP program. Dr. Anindita Mehta and Dr. Kartik Andharia attended the workshop on 12th August at New Delhi, and took part in the group discussion on the need for standardization for Sustainable Agriculture and Food Systems.






Source: [https://jharenvis.nic.in/KidsCentre/20QUESTIONSABOUTOZONE\\_1644.aspx](https://jharenvis.nic.in/KidsCentre/20QUESTIONSABOUTOZONE_1644.aspx)

Environmental Information, Awareness, Capacity Building and Livelihood Programme acronymed as EIACP erstwhile Environmental Information System (ENVIS) was implemented by the Ministry of Environment, Forest & Climate Change by end of 6th Five Year Plan as a Plan Scheme for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders. MoEF&CC has identified Consumer Education and Research Centre (CERC), Ahmedabad, as one of the Resource Partner to collect and disseminate information on “Environment Literacy - Eco-labelling and Eco-friendly Products”. The main objective of EIACP Programme centre- Resource Partner is to disseminate information on Environment literacy, Eco-products, International and National Eco-labelling programmes.

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### Disclaimer

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