

UNIT SIX

Issues in Sustainable Development IV:

Solutions to Environmental and Sustainability Problems

6.1. Environmental Problems

- Global environmental problems are now worldwide and have significant effects on human societies.
- **Wealthy nations and individuals** contribute to much higher ecological or environmental problem than **poor nations**.
- Global environmental concerns have gain importance recently (since UNCED in Rio de Janeiro in 1992). Because **National environmental policies efforts alone are not enough to address environmental challenges.**

- **Population growth, consumption (affluence) patterns, and technology** are key drivers of environmental damage.

Global Env.tal impact = $f(P,A,T)$

Where, P is population growth

A is affluence/consumption of goods & service

T is env.tally unsound technology

- Some of the major global environmental problems include **climate change, ozone layer depletion, biodiversity loss, air and water pollution and land degradation.**

6.1.1. Climate change

- Climate change is currently the most discussed environmental problem. It has already caused noticeable effects on ecology and society.

- Potential consequences include significant **changes in temperature, sea level, precipitation(weather)patterns, and ecosystems.**
- Greenhouse gases, which contribute climate change, disrupt Earth's natural thermal(heat)balance by blocking thermal radiation from escaping into outer space.
- To avoid severe impacts of climate change, governments are proposing mitigation and adaptation strategies.

6.1.2. Ozone layer depletion

- The ozone layer, located in the **stratospheric layer** of the Earth's atmosphere.

- The ozone layer shield (barrier) us from harmful Ultraviolet (UV) rays from the sun. However, the ozone layer has been depleted by substances such as chlorofluorocarbons (CFCs).
- The depletion of ozone allows more UV rays to reach the Earth's surface, leading to health hazards like skin cancer and cataracts.
- Ozone layer is being depleted globally except over tropical areas and the rate of depletion is higher in highest latitudes regions.

- To address this problem, the **Montreal Protocol** was established **to reduce emissions of ozone-depleting substances**.
- The Montreal protocol has successfully safeguard both the ozone layer and the climate by replacing ozone depletion substances(ODS) with **fluorinated gases** known as **F-gases**, like **hydrofluorocarbons (HFCs)**, **perfluorocarbons (PFCs)**, and **sulfur-hexafluoride (SF6)**.
- Although **these F-gases are not ozone-depleting substances**, they are still classified as **greenhouse gases** that contribute to climate change.
- While F-gases have smaller impact than CO₂, their presence in the atmosphere is increasing steadily.

6.1.3. Biodiversity loss

- The UN Convention on Biological Diversity, adopted in Rio de Janeiro in 1992, reflects **international recognition of the need to environmental protection and biodiversity.**
- **Biodiversity** refers to the variety of plant and animal species, including microorganism, genes, and ecosystems they inhabit.
- Despite international agreements on biodiversity conservation, **biodiversity loss and ecosystem degradation continue at a rapid pace.** This is due to **the ineffectiveness of past approaches, as well as the lack of political will and financial commitments** needed to address ongoing problem.

6.1.4. Air and Water Pollution

- **Air Pollution:** Air pollution refers to the presence of harmful chemicals, particles, or biological elements in the atmosphere. These pollutants can cause **health problems, damage ecosystems, & harm natural or human environment.**
- Pollutants are divided into two main types:
- **Primary pollutants:** Directly emitted from sources like volcanoes or car exhaust. Examples,
 - ✓ **Sulphur dioxide (SO₂)** is produced by volcanoes and industrial processes, and the interaction of Sulphur with oxygen produces **acid rain**, which can causing significant **environmental harm.**

- ✓ **Nitrogen dioxide (NO₂)** is expelled from high-temperature combustion and is also produced during thunderstorms. It is a reddish-brown toxic gas and a prominent pollutant.
- ✓ **Carbon monoxide (CO)** is a colorless and odorless, but **very poisonous gas** that is produced by incomplete combustion of fuel. **Vehicular exhaust** is a major source of carbon monoxide pollution.
- ✓ **Volatile organic compounds (VOCs)** refers to a group of chemical compounds that are easily vaporize at room temperature.
- ✓ **VOCs** are outdoor air pollutants, divided into **methane (CH₄)** and **non-methane (NMVOCs)**.

- While **methane** and **other hydrocarbon VOCs** contribute to **greenhouse gas formation** which contributes to **enhance global warming and influence in creating ozone**.
- Among NMVOCs, certain **perfume compounds** like **benzene**, **toluene** and **xylene** are suspected chemicals to pose health risks, potentially leading to **leukemia** with prolonged exposure.
- **Secondary pollutants**: pollutants that are formed through **chemical reactions between primary pollutants in the atmosphere** (e.g., **ground-level ozone** resulting from the reaction of nitrogen oxides (NO_x) and VOCs).
- **Smog** is a kind of air pollution; the word "smog" is a combination of smoke and fog.
- **Classic smog** results from large amounts of **coal burning in an area** caused by a mixture of smoke and Sulphur dioxide. **Modern smog** comes from **vehicular and industrial emission**.

- **Particulate matter** (PM) refers to tiny solid or liquid particles suspended in the air, which can come from natural sources like volcanoes and human activities like burning fossil fuels.
- **Water pollution** occurs when harmful substances, such as chemicals or microorganisms, contaminate water bodies and making them toxic to humans and the environment.
- **Point source pollution** refers to contamination originating from a specific source, while **non point source pollution** comes from diffused sources.
- **Industrial waste**, chemicals, fertilizers, and plastic debris are all major pollutants of water. These pollutants led to the formation of “**dead zones**” in the ocean.

- **Ocean dead zones:** are areas where oxygen levels are severely depleted, making it difficult for life to survive due to a combination of factors including **climate change and nutrient pollution**.
- The depletion oxygen in the ocean has increased over the past 50 years, leading to significant impacts for marine life.

6.1.5. Land Degradation and Soil Contamination

- **Land degradation** is the long-term decline in land quality due to human activities and climate change. It reduces the land's productivity, ecological health, and value.
- Land deterioration has been associated with mankind since the widespread **introduction of agriculture during the Neolithic period**, around 10,000 to 7,500 years ago.

- Land degradation is one of the world's most pressing environmental problems and it will **worsen/degraded without rapid remedial action.**
- When land is degraded, soil carbon and nitrous oxide is released into the atmosphere, making **land degradation one of the most important contributors to climate change.**
- Scientists recently warned that 24 billion tons of fertile soil was being lost per year, largely due to **unsustainable agriculture practices.**
- If this trend continues, 95 percent of the Earth's land areas could become degraded by 2050.

- This issues affects 3.2 billion people globally, particularly rural communities and smallholders farmers, putting pressure on food security for billions of people.
- The increasing global population and demands for agriculture products further intensify the pressure on land resources.
- Factors such as unsustainable agricultural practices, climate variability, and extreme weather events contribute to land degradation.
- Soil contamination/pollution is the presence of harmful substances in soil that endanger human health and ecosystems.

- Soil contamination can happen **directly (leaks)** from improper treatment of raw materials or **indirectly through (water/air pollution)** from commercial activities.
- Contaminated soil can have long-term effects on plants, animals, and humans, especially children.
- **The Global Environmental Facility (GEF)** works to address issues related to land degradation and deforestation. The GEF support:
 - ✓ Countries implement sustainable land management practices through its impact programs, which focusing on food security, sustainable forest management, and integrating land degradation neutrality into urban planning.

6.2. Sustainability Challenge

- Sustainability involves making decisions that do not have negative consequences for current or future generations.
- It encompasses ecological and human issues, including the preservation of natural resources and the wellbeing of society.
- However, current development practices are not enough to achieve sustainable development. Some challenges that need to be addressed are:
 - ✓ **Climate change:** The impact of climate change needs to be addressed through integrated and sustainable management of natural resources, mitigation, and adaptation actions.

- ✓ **Hunger and malnourishment:** While progress has been made in reducing hunger in some developing countries, it remains a persistent issue in others. Food and nutrition security is still a challenge.
- ✓ **Income inequality:** Income inequality within and among countries is increasing, which can lead to social tension and conflict.
- ✓ **Rapid urbanization:** Developing countries are experiencing rapid urbanization. This requiring changes in urban development in designed and increased investments in urban infrastructure and services.
- ✓ **Energy access:** Many households still lack access to modern energy services, and efforts are needed to ensure universal access.

- ✓ **Financial system:** Recurrence of financial crises needs to be prevented, and the financial system should focus on promoting long-term financing for sustainable development investments.

6.2.1. The challenges of sustainable Development

- The challenges of sustainable development include **population growth, urbanization, energy use and global warming, water scarcity, and waste management.**

Population growth:

- The world population is rapidly increasing with an annual growth rate of 1.1%. This rapid population growth **putting pressure on limited resources.**

- currently, there are approximately 1.8 hectares of productive land per person, but we are already using 2.2 hectares per person. This means that the current population has already exceeding the sustainable limit by over 20%.

Urbanization:

- In 1950, only New York city had a population of over 10 million, but by 2015, there were 21 cities with populations exceeding 10 million.
- The world's urban population reached 2.9 billion in 2000 and is expected to increase by 2.1 billion by 2030. This making up approximately 60% of the world's population.

➤ **However, population growth coupled with urbanization has led to significant environmental impacts and challenges such as**

- ✓ **increased temperature,**
- ✓ **decreased air quality,**
- ✓ **increase water run-off,**
- ✓ **decreased quality of run-off,**
- ✓ **loss of natural beauty,**
- ✓ **reduction in farmlands leading to food shortage,**
- ✓ **altered weather patterns, and**
- ✓ **deforestation.**

Energy use and Global warming:

- Energy consumption is closely related to wealth.
- India's energy consumption **tripled** between 1980 and 2001. This making India one of the top consumers alongside the US, Germany, Japan and China.
- According to international energy outlook projections for 2030 of the US department of energy, **China and India** account for nearly one-half of the total increase in residential energy use in **Non-OECD** countries.
- The **Organization Economic Co-operation and Dev.t(OECD)** brings together 38 member countries and collaborates on key global issues related to energy consumption.
- **The consumption of energy, particularly from fossil fuels, contributes to global warming and climate change.** Countries like China and India are major contributors to the increase in energy consumption.

Water scarcity:

- Access to safe drinking water and adequate sanitation is a challenge for many people. The demand for water is increasing, but the supply is limited, leading to water scarcity in many regions.
- Only approximately 2.5% of the earth's water is **freshwater**.
- A country is considered water-scarce when **its annual supply of renewable freshwater is less than 1000m³ cube per capita**.

Waste management:

- Waste management is the collection, transportation, processing, recycling or disposal of waste materials.
- The generation of waste, particularly **municipal solid waste**, is a significant issue. A large portion of waste is not managed in an environmentally sustainable manner, leading to pollution and resource depletion.

6.2.2. Sustainable Solutions

- There are several solutions that have been suggested and successfully implemented in some countries. Some of these solutions are the following:

Combating Climate Change:

- One solution is combating climate change and reducing the impacts of global warming.
- **Microbes** have great potential in this area. **For example,** **ocean**(the largest carbon reservoir on the earth) **microbes** like **cyanobacteria**(blue-green algae) can fix carbon dioxide through photosynthesis and convert it into carbon-rich lipids, which can be used for biofuel production.

- Additionally, preserving ecologically significant regions, developing environmentally friendly energy and waste management systems, and using biofuels can help mitigate global warming(combating climate change).

Sustainable Agriculture:

- Microbes also play a role in sustainable agriculture. Soil microorganisms are essential for maintaining soil fertility and crop productivity.
- However, the use of chemical fertilizers and pesticides has depleted beneficial microbes. It is important to introduce these microbes back into agro-ecosystems to increase yields in an environmentally friendly way.

Renewable Energy:

- Renewable energy, particularly **solar power**, is another sustainable solution.
- **Solar chimneys**, which use convection to generate electricity, are an example of a renewable energy power plant.
- Other renewable energy sources like wind, hydropower, and geothermal, as well as waste recycling energy processes offer sustainable alternatives to traditional energy sources.

Green buildings

- These buildings are designed to minimize environmental impact throughout their lifecycle by:

- ✓ Minimizing natural resource consumption,
- ✓ Reducing emissions,
- ✓ Minimizing waste discharge, and
- ✓ Minimizing negative impacts on site ecosystems.



Figure 6.9: Examples of green buildings

6.3. Environmental Education

- **Environmental education aims to develop a knowledgeable and motivated population that takes action to address environmental challenges.**
- **It involves engaging students, community members, policymakers, and people of all ages.**

6.3.1. The Essence of Environmental Education

- **The essence of environmental education can be summarized in three main goals:**
 - ✓ **To raise awareness of the interdependence of economic, social, political, and ecological factors**

- ✓ To provide knowledge and skills to protect and improve the environment
 - ✓ To promote behavioral changes in individuals, groups, and society as a whole towards the environment.
- Environmental education can take place in various settings, including **schools, museums, and community centers**, and can be **formal** (education that occurs in a traditional school setting) **or informal** (education in a broader public setting/learning outside of classroom). **Tacit knowledge:** Learning from everyday experiences and interactions with others or living together.
- Environmental education utilizes different strategies and teaching techniques, such as
- ✓ **information activities:** Raising awareness and understanding of environmental issues.

- ✓ **Communication activities:** Fostering dialogue between people and environmental organizations.
 - ✓ **Education activities:** Promoting knowledge, concern, motivation, and collaboration towards solutions.
 - ✓ **Capacity building activities:** Empowering civil society to support environmental preservation.
- Environmental education is **interdisciplinary**, integrating natural and social sciences, arts, and mathematics to address complex environmental issues.

6.3.2. Fundamental Characteristics of Environmental Education

- Environmental education encompasses the following main characteristics:

Environmental education is lifelong learning:

- Environmental education is a lifelong strategy that involves everyone, encouraging them to connect with the natural environment and take action to safeguard it (**Everyone can learn and act to protect the environment throughout their lives**).
- **Environmental education is not limited to schools** but also includes informal settings such as zoos, aquariums, museums, community centers, parks, and media outlets.

Environmental education is interdisciplinary nature

- **While scientific discipline like geography and ecology provides vital foundations for understanding environmental issues, environmental education goes beyond science.**
- **It inherently social, focusing on human behavior and interaction with the environment.**
- **Environmental education aims to alter thinking setup by shaping attitudes, values and perspectives.**
- **Within schools, environmental education encompasses various subjects such as social studies, government studies, history, geography, biology, chemistry, and physics in addressing today's complex environmental problem.**

- The origin of environmental education trace back to the **18 century**.
- **Jean-Jacques Rousseau** emphasized the need for environment- focused education.
- During the **Great Depression** (sever worldwide economic crises) and **Dust Bowl** (a period of sever dust storm) in the 1920s and 1930s, conservation education emerged as a new form of environmental education.

Environmental education is a proven strategy

- Environmental education is an effective strategy in addressing complex environmental issues that regulation and market incentives alone cannot solve.

- **While education may not always directly change behavior, it empowers people with knowledge, critical thinking, and motivation to take action for environmental solutions.**
- **Investing in environmental education initiatives is important for the future, as they can lead long to long-term impact on environmental attitudes, knowledge, skills, and action related to environmental issues.**

Environmental education is about critical thinking and citizen participation:

- **Environmental education aims to teaches people how to analyze environmental issues, not just what to think. It fosters citizen involvement in solving problems.**

6.4. Environmental Movements

6.4.1. The concept of Environmental Movement

- The environmental movement is **a broad social movement that works to protect the environment.**
- It includes a wide variety of **people and groups, from the very organized to informal local groups.**
- They can be focused on **a single issue or a wide range of environmental concerns.**
- The movement can be started by anyone, anywhere, like **Greta Thunberg**, a young climate activist.

6.4.2. Types of Environmental Movements

- There are different types of environmental movements.

1. Free market environmentalism

- This approach believes that **free market, property rights and tort law are effective tools for preserving the environment.**
- It advocates for individual and class action to expel polluters and protect the environment, rather than relying on government regulation.

2. Preservation and conservation

- Preservation focuses on **stopping any human activity that could damage natural resources** such as logging, mining, hunting, and fishing.

- Conservation allows for some industrial growth within sustainable limits.
- Regulations and laws may be enacted to preserve natural resources.

3. Popular Environmentalism

- is a recent trend among educated middle and upper class **where people choose sustainable consumption patterns**, such as choosing local and organic products.
- However, there is criticism about this **"green consumerism"** being seen as **elitist(exclusive) and not aligned with the true ideals of environmentalism**. Because organic and sustainable items are sometimes more expensive , purchasing them may perceived a sign of affluence.

4. Light Greens, Dark Greens and Bright Greens

- Contemporary environmentalists can be categorized into these three groups.
- **Light Greens** prioritize environmental protection as a personal responsibility and often view environmentalism as a lifestyle choice.
- **Dark Greens** believe that environmental problems are inherent in industrialized capitalism and seek radical political change.
- **Bright Greens** advocate for radical changes in economic and political systems to achieve sustainability, focusing on better designs, new technologies, and social innovations.

6.4.3. Environmental Movements in Ethiopia

- Environmental movements in Ethiopia are **not well-organized**, but there are some initiatives and organizations that are focused on environmental issues.
- **Lem Ethiopia** (Environment and Development Society of Ethiopia) is an example of a well-known organization in this field.
- **Lem Ethiopia**: Founded in 1992 by 29 Ethiopian professionals working in the fields of environment and development.
- Its mission is to promote sustainable development by addressing various environmental issues.

- The organization works on areas such as **natural resource management, urban waste management, livelihood security, Climate Change Advocacy and capacity building.**
- Lem Ethiopia collaborates with **donors, government institutions, local and international NGOs, and communities** to manage natural environment effectively.
- **Individual Efforts**, For instance:
 - ✓ **Sileshi Demise** (Gash Abera Molla), an artist, played a crucial role in **municipal solid waste management** in Addis Ababa. His work had a significant impact on the local community.
 - ✓ **The late Prime Minister Meles Zenawi**, as a movement leader, represented the continent in **global climate change negotiations.**

- ✓ His influence contributed to Ethiopia's prominence in the 'green economy' movement in Africa, both ideologically and practically.
 - ✓ **Prime Minister Abiy Ahmed's Green Legacy:** His ambitious initiative involved **planting over four billion seedlings** during the First Green Legacy Campaign in 2019. This number increased to five billion seedlings in 2020.
 - ✓ Such efforts can inspire a broader environmental and climate change movement, especially among the young population.
- **Despite challenges, these initiatives contribute to Ethiopia's environmental awareness and sustainable development**

6.5. Environmentally Friendly Indigenous Practices

6.5.1. Indigenous Knowledge for Environmental Issues

- **Indigenous Knowledge** refers to the unique, traditional, local knowledge developed by indigenous people in specific geographic areas.
- It is **holistic**, **dynamic**, and **community-based**, generated through trial and error in social practice.
- Some of the most **key qualities of indigenous knowledge** include:
 - ✓ **Local and experience-based**: Developed by people living in a specific environment over generations.
 - ✓ **Orally transmitted**: indigenous knowledge is often transmitted orally or through imitation and demonstration.

- ✓ **Practical Engagement:** Integrates cultural traditions with practical solutions for everyday life.
- ✓ **Tradition and Negotiation:** tradition could be considered as a fluid and transforming agent with no real end. Negotiation is key when applying this knowledge.
- ✓ **Shared wisdom:** Indigenous knowledge is often referred to as "people's science" because it is shared to a greater extent than other forms of knowledge.
- ✓ **Fragmentary distribution:** Indigenous knowledge can be very specific to a particular person or community. Its distribution is fragmented, and it is situated within broader cultural traditions.
- ✓ **Functional organization:** The organization of indigenous knowledge is functional, focusing on practical applications rather than abstract classifications.

- ✓ **Cultural traditions:** it exist within broader cultural traditions, distinguishing between technical and non-technical aspects.

➤ **The application of indigenous knowledge in areas such as**

- ✓ **Ecosystem and landscape management,**
- ✓ **Water management,**
- ✓ **Soil conservation,**
- ✓ **Biological control of pests and diseases,**
- ✓ **Ecological agriculture and livestock practices, and**
- ✓ **Plant and animal breeding** can enhance food security, alleviate poverty, and contribute to sustainable development.

6.5.2. Practices of Environmentally Friendly Indigenous Knowledge in Ethiopia

- In Ethiopia, there are various practices of environmentally friendly indigenous knowledge among different ethnic groups.
- These practices contribute to the protection and preservation of the natural environment. Here are some examples:

1. Wet Highland Landscape of the west

- **The Illuababora, Maccaa Oromo** community utilize indigenous knowledge to protect the natural environment.

- They have knowledge of **folk healing practices** for their livestock and families, including identifying and classifying medicine, preparing remedies and preserving medicinal plants.
- The community also takes measure to conserve and duplicate folk medicinal animals, plants and mineral-based medicines.
- Cutting trees and killing animals intentionally will be seen as **broken norms and value of the society**.

2. Dry Highland Landscape in the south

- **(A) The Konso** cultural landscape is characterized by **dry-stone terrace** that have been built over hundred of years.
- These terrace prevent soil erosion, retain soil, collect water and create suitable areas for agriculture.

- The Konso build **dry-stone walled towns(Paleta)** for strategic and defensive purposes, utilizing locally available rocks.
- **(B) The Gedeo people:** The Gedeo people have a strong cultural emphasis on respect, which extends **not only to elders and humans but also to all species and the surrounding ecosystem.**
- They have specific traditions and rules that emphasize respect for environmental resources. For example, they protect **songo sacred trees** through prohibitions and traditional rules.
- The Gedeo people consider actions such as cutting sacred trees, damaging sacred forests, injuring plants, and degrading the landscape as **disrespectful and a violation of their ancestral rules.**

3. Western Lowlands Dry lands

- **The Gumuz people** have a close relationship with their lands and the environment.
- Their indigenous knowledge is closely tied to their traditional belief systems. The Gumuz believe that natural resources are **sacred gifts from the supreme deity, Yamba**.
- Violations of these beliefs result in severe punishments and revenge from the respective spirits (**Missa**).
- Ownership of natural resources is seen as **a communal responsibility**, and the present generation acts as **trustees over these resources**.
- **Shifting cultivation** is an indigenous practice used to maintain the health of ecosystem & allows the land to recover nutrients.

Choose the Best Answer from the Given Alternative

1. Why has interest in global environmental concerns grown in recent years? **Q1**

A. Wealthy nations are demanding action from poorer nations.

B. National environmental policies haven't been effective alone.

C. The ecological footprints of poorer nations are increasing rapidly.

D. The UN has mandated stricter environmental regulations.

1. Which global environmental problem is currently the most discussed? Q2

A. Ozone depletion

C. Biodiversity loss

B. Climate change

D. Land degradation

2. Which substances are responsible for ozone layer depletion? Q3

A. Carbon dioxide (CO₂)

C. Chlorofluorocarbons (CFCs)

B. Nitrous oxide (N₂O)

D. Methane (CH₄)

3. What are the consequences of ozone layer depletion? Q4

A. Skin cancer

C. Acid rain

B. Heart disease

D. Lung cancer

- 1. What is the main cause of land degradation? Q5**
- A. Natural factors such as climate variability**
 - B. Industrial processes**
 - C. Unsustainable agriculture practices**
 - D. Soil contamination**
- 2. Which global initiative is focused on addressing land degradation and deforestation? Q6**
- A. United Nations Convention on Biological Diversity**
 - B. Global Environmental Facility (GEF)**
 - C. Montreal Protocol**
 - D. United Nations Framework Convention on Climate Change (UNFCCC)**

- 1. What is the primary function of the ozone (O₃) layer in the stratosphere? Q7**
 - A. To absorb harmful ultraviolet (UV) rays from the Sun.**
 - B. To regulate Earth's temperature.**
 - C. To provide oxygen for breathing.**
 - D. To shield against cosmic radiation.**
- 2. What health hazards can occur when the ozone layer is depleted? Q8**
 - A. Increased risk of skin cancer and cataracts.**
 - B. Respiratory diseases.**
 - C. Allergic reactions.**
 - D. Digestive disorders.**

- 1. Where is the ozone layer being depleted globally? Q9**
- A. Over tropical areas.**
 - B. In the stratosphere.**
 - C. In the mesosphere.**
 - D. In the highest latitude regions.**
- 2. Which gases are used as replacements for ozone-depleting substances (ODS) under the Montreal Protocol? Q10**
- A) Carbon monoxide (CO)**
 - B) Hydrofluorocarbons (HFCs)**
 - C) Sulfur dioxide (SO₂)**
 - D) Nitrogen oxides (NO_x)**

1. What is formed from the reaction of NO_x and VOCs and is a key constituent of the troposphere and certain regions of the stratosphere? **Q11**

A. Ground level ozone

C. Sulphur dioxides

B. Carbon monoxide

D. Particulate matter

2. What is the primary cause of modern smog? **Q12**

A. Large amounts of coal burning

B. Vehicular and industrial emissions

C. Photochemical reactions

D. Ultraviolet light from the sun

1. Which type of volatile organic compounds (VOCs) are important outdoor air pollutants? **Q13**
 - A. Methane
 - B. Perchloroethylene
 - C. Carbon monoxide
 - D. Nitrogen dioxide
2. What is a major source of carbon monoxide? **Q14**
 - A. Vehicular exhaust
 - B. Forest fires
 - C. Volcanoes
 - D. Electric discharge
3. Which chemical compound is produced by volcanoes and in various industrial processes, and can cause acid rain? **Q15**
 - A. Sulphur dioxides
 - B. Carbon monoxide
 - C. Nitrogen dioxide
 - D. Volatile organic compounds

1. Which of the following is NOT a challenge to sustainable development? Q16

A. Population growth

C. Urbanization

B. Energy use & global warming

D. Technological advancement

2. What are some impacts of population growth coupled with urbanization? Q17

A. Increased air quality and natural beauty

B. Increased farmland and food supply

C. Altered weather patterns and deforestation

D. Decreased water run-off and loss of natural beauty

1. What factors are considered in the “environment formula”
Q18

- A. Population, Consumption and technology**
- B. Climate change, ozone depletion and biodiversity loss**
- C. Water and air pollution and land degradation**
- D. Soil degradation, oceans and biodiversity**

2. Which activity contributes to over one-third of human-induced greenhouse gases? **Q20**

- A. Burning fossil fuels for electricity generation**
- B. Industrial manufacturing processes**
- C. Deforestation and land use changes**
- D. Agricultural activities**

1. The concept of biological diversity or biodiversity embraces
Q21

- A. All animal and plant species, including microorganisms.**
- B. All plants solely found on the land surface**
- C. All animals merely found in the ocean**
- D. All microorganism that only found in the soil**

2. What is land degradation? **Q22**

- A. A positive trend in land condition**
- B. A negative trend in land condition caused by human-induced processes**
- C. The introduction of agriculture during the Neolithic period**
- D. The loss of soil carbon and nitrous oxide into the atmosphere**

1. What is one of the most important contributors to climate change? **Q23**
 - A. Land degradation
 - B. Soil contamination
 - C. Sustainable agriculture practices
 - D. Climate variability and extreme weather events
2. Who is most affected by land degradation? **Q24**
 - A. Urban communities
 - B. Industrial workers
 - C. Rural communities and smallholder poor farmers
 - D. Government officials

1. Which type of pollution originates from a single identifiable source? Q25

A. Point source pollution C. Nonpoint source pollution

B. Diffused pollution D. Industrial pollution

2. What are "dead zones" in the ocean characterized by? Q26

A. High oxygen levels

B. Abundant marine life

C. Severe or complete oxygen depletion

D. Clear water

1. What is the main factor driving the alarming shift in ocean chemistry? Q27

A. Plastic pollution

C. Rising global temperatures

B. Nutrient pollution

D. Natural processes

2. Which of the following is an example of a primary air pollutant? Q28

A. Ground-level ozone (O₃)

B. Carbon monoxide (CO)

C. Photochemical smog

D. Classic smog

- 1. What is the main source of sulfur dioxide (SO₂) in the atmosphere? Q29**
- A. Combustion processes**
 - B. Volcanic activity**
 - C. Industrial emissions**
 - D. Chemical reactions in the lower atmosphere**
- 2. Which of the following pollutants is formed through chemical reactions in the lower atmosphere? Q30**
- A. Carbon monoxide (CO)**
 - B. Particulate matter (PM)**
 - C. Nitrogen dioxide (NO₂)**
 - D. Ground-level ozone (O₃)**

1. **Water pollution can occur due to contamination from: Q31**
 - A. Volcanic activity
 - B. Industrial processes
 - C. Fertilizers
 - D. All of the above
2. **Point source pollution refers to contamination that originates from: Q32**
 - A. Diffused sources
 - B. Specific sources
 - C. Chemical reactions
 - D. Industrial processes
3. **What is the main consequence of oxygen depletion in the ocean? Q33**
 - A. Increased marine biodiversity
 - B. Formation of dead zones
 - C. Reduction in water pollution
 - D. Promotion of aquatic life

1. How does land degradation contribute to climate change?

Q34

- A. By releasing soil carbon and nitrous oxide into the atmosphere**
- B. By increasing rainfall patterns**
- C. By reducing greenhouse gas emissions**
- D. By promoting reforestation efforts**

2. What is soil contamination? Q35

- A. The presence of harmful substances in water bodies**
- B. The decline in soil quality due to natural causes**
- C. The process of enriching soil with nutrients**
- D. The presence of harmful substances in soil at levels that threaten human health and ecosystems**

1. How can soil contamination occur? Q36

- A. Only through direct contamination, such as leaks**
- B. Only through indirect contamination, such as water or air pollution**
- C. Both through direct contamination, such as leaks, and indirect contamination, such as water or air pollution**
- D. Soil contamination does not occur naturally**

1. What are the focus areas of the Global Environmental Facility (GEF)? **Q37**

- A. Addressing water pollution and marine ecosystem degradation**
- B. Promoting renewable energy and reducing greenhouse gas emissions**
- C. Implementing sustainable land management practices and integrating land degradation neutrality into urban planning**
- D. Ensuring access to clean drinking water and sanitation for all**

- 1. What are the long-term effects of contaminated soil? Q38**
- A. Improved plant growth and biodiversity**
 - B. Enhanced soil fertility**
 - C. Negative impacts on plants, animals, and humans, especially children**
 - D. Increased resistance to pests and diseases**
- 2. What is the average amount of productive land per person based on the current population and available land? Q39**
- A. Approximately 1.8 hectares**
 - B. Approximately 3.0 hectares**
 - C. Approximately 2.2 hectares**
 - D. Approximately 4.0 hectares**

- 1. Which of the following elements are identified as the most serious challenges to sustainable development? Q40**
 - A. Population expansion**
 - B. Urbanization and water shortage**
 - C. Energy usage and global warming**
 - D. All of the above**
- 2. What are the impacts of population growth and urbanization on the environment? Q41**
 - A. Increased ambient temperature**
 - B. Increase air quality**
 - C. Decrease water run-off**
 - D. Reduction in farmlands and subsequent food shortage**

1. Which source of energy consumption has contributed significantly to global warming? **Q42**
 - A. Solar energy
 - B. Hydroelectric power
 - C. Wind energy
 - D. Burning of fossil fuels
2. What is the term used for the collection, transport, processing, recycling, or disposal of waste materials? **Q43**
 - A. Waste management
 - B. Environmental preservation
 - C. Sustainability
 - D. Resource recovery

1. What percentage of the Earth's water is considered fresh water? Q44

A. 0.3% B. 2.5% C. 5.0% D. 10.0%

2. Which countries is projected to contribute the most to the increase in residential energy use in non-OECD countries by 2030? Q45

A. USA and Germany C. Japan and South Korea
B. China and India D. England and France

3. What is the primary cause of water scarcity? Q46

A. Glacial melting C. Lack of rainfall
B. Excessive consumption D. Pollution

1. Which organization brings together 38 member countries and collaborates on key global issues related to energy consumption? **Q47**
 - A. US Department of Energy
 - B. UNICEF
 - C. OECD
 - D. Greenpeace
2. When is a country considered water-scarce? **Q48**
 - A. When its annual supply of renewable freshwater is less than 100m³ cube per capita
 - B. When its annual supply of renewable freshwater is less than 500m³ cube per capita
 - C. When its annual supply of renewable freshwater is less than 1,000 m³ cube per capita
 - D. When its annual supply of renewable freshwater is less than 10,000 m³ cube per capita

1. Which of the following is an example of a sustainable solution for combating climate change? Q49

- A. Increased use of fossil fuels**
- B. Preservation of ecologically significant regions**
- C. Expansion of industrial activities**
- D. Dependence on non-renewable energy sources**

2. How do oceans contribute to combating climate change? Q50

- A. By emitting greenhouse gases**
- B. By reducing carbon dioxide emissions**
- C. By consuming carbon dioxide through photosynthesis**
- D. By increasing global temperatures**

- 1. What role do soil microorganisms play in sustainable agriculture? Q51**
- A. They reduce crop productivity**
 - B. They deplete nutrients in the soil**
 - C. They maintain soil fertility and ecological balance**
 - D. They increase the use of chemical fertilizers**
- 2. Which renewable energy source is mentioned as the most appealing for meeting growing energy demands? Q52**
- A. Solar energy**
 - B. Fossil fuels**
 - C. Nuclear energy**
 - D. Coal energy**

1. What is a characteristic of green/sustainable buildings?

Q53

- A. High resource consumption**
- B. Negative impact on site ecosystem**
- C. Minimization of emissions**
- D. Discharge of solid waste and liquid**

2. What is the goal of minimizing natural resource consumption in green buildings? Q54

- A. To increase energy consumption**
- B. To reduce waste management costs**
- C. To promote sustainability and efficiency**
- D. To maximize environmental impact**

1. What are the primary goals of environmental education?

Q55

- A. To develop an ecologically educated population**
- B. To raise awareness about climate change only**
- C. To promote economic and social integrity only**
- D. To provide opportunities for action in urban areas**

2. What does environmental education aim to provide every person with? Q56

- A. Opportunities for economic development**
- B. Knowledge and skills to protect and improve the environment**
- C. Political power to influence environmental policies**
- D. Career opportunities in environmental organizations**

1. Which of the following is an example of informal environmental education? **Q57**
 - A. Education delivered in a traditional school setting
 - B. Education in museums and community centers
 - C. Education through formal communication activities
 - D. Education activities that promote knowledge and understanding
2. What does tacit knowledge refer to in the context of environmental education? **Q58**
 - A. Knowledge obtained implicitly through living together
 - B. Knowledge acquired through formal education
 - C. Knowledge gained through information activities
 - D. Knowledge shared through communication activities

- 1. How does environmental education address complex environmental issues? Q59**
 - A. By focusing on a single subject, such as geography or biology**
 - B. By promoting interdisciplinary learning and critical thinking**
 - C. By relying solely on regulation and market incentives**
 - D. By advocating for specific positions on environmental issues**
- 2. Why is environmental education considered a proven strategy? Q60**
 - A. It provides market incentives to address environmental issues**
 - B. It leads to immediate behavior change in individuals**
 - C. It increases knowledge, critical thinking skills, and motivation to take action**
 - D. It relies on legislation and policies to solve environmental problems**

- 1. What is the role of environmental education in promoting citizen participation? Q61**
- A. Advocating for specific positions on environmental issues**
 - B. Teaching people what to think about the environment**
 - C. Developing citizen-action skills and providing opportunities for action**
 - D. Maintaining the integrity of the field through professional training**

- 1. What is the environmental movement? Q62**
- A. A political party focused on environmental policies**
 - B. A type of social movement advocating for environmental protection**
 - C. A scientific research organization studying ecosystems**
 - D. A religious group promoting sustainable living**
- 2. Which type of environmental movement believes that the free market and property rights are effective tools for preserving the environment? Q63**
- A. Preservation & conservation**
 - B. Dark Greens**
 - C. Popular environmentalism**
 - D. Free market environmentalism**

1. What is the main goal of the environmental movement?

Q64

- A. Promoting economic growth and industrial development**
- B. Preserving natural resources for future generations**
- C. Advocating for technological advancements in energy production**
- D. Supporting government deregulation of environmental policies**

1. Which of the following best describes Greta Thunberg's role in the environmental movement? Q65

- A. A young climate change activist with global influence**
- B. An environmental scientist studying climate patterns**
- C. A political leader advocating for economic growth**
- D. A representative of a multinational corporation promoting green initiatives**

1. Which group of environmentalists emphasizes environmentalism as a personal responsibility and a lifestyle choice? Q66

A. Bright Greens

C. Light Greens

B. Dark Greens

D. Free market environmentalists

2. What is the main concern of dark greens? Q67

A. Sustainable industrial growth and development

B. Radical political change and opposition to capitalism

C. Reforms in economic and political operations

D. Promoting the use of new technologies for sustainability

1. Which group of environmentalists believes that fundamental changes in economic and political structures are necessary for sustainability? Q68

A. Light Greens

C. Popular environmentalists

B. Dark Greens

D. Bright Greens

2. What is the focus of bright green environmentalism? Q69

A. Criticizing consumerism and promoting sustainable consumption

B. Advocating for legislative government action to protect the environment

C. Seeking radical political change and reforming industrial capitalism

D. Emphasizing innovative designs, technologies, and social innovations for sustainability

1. Which organization in Ethiopia is known for its work in promoting sustainable development and environmental protection? Q70

A. Lem Ethiopia

B. African Green Economy Movement

C. Ethiopian Geographic Society

D. Addis Ababa Municipal Solid Waste Control Task Force

2. Who was assigned by African countries to represent the continent in global climate change negotiations? Q71

A. Sileshi Demise

C. Meles Zenawi

B. Dr. Abiy Ahmed

D. Gash Abera Molla

- 1. What are the focus areas of Lem Ethiopia's work? Q72**
- A. Climate change negotiations and policy advocacy**
 - B. Urban waste management and livelihood security**
 - C. Environmental education and awareness interventions**
 - D. All of the above**
- 2. What was the major accomplishment of Prime Minister Abiy Ahmed's Green Legacy campaign? Q73**
- A. Development of big ecotourism projects**
 - B. Planting over four billion seedlings**
 - C. Promoting sustainable development in urban areas**
 - D. Advocating for environmental protection policies**

- 1. Why is it important to include the voices of Ethiopian youth in environmental and climate change debates? Q74**
- A. They are the citizens of tomorrow who will inherit the environment.**
 - B. They have the necessary expertise and knowledge on environmental issues.**
 - C. They have the financial resources to invest in environmental projects.**
 - D. They are more likely to engage in global activism than other groups.**

- 1. How can indigenous knowledge be described? Q75**
- A. Universal and standardized**
 - B. Developed by experts in academic institutions**
 - C. Rooted in specific geographic areas and experiences**
 - D. Based on modern scientific research**
- 2. What is a distinguishing characteristic of indigenous knowledge? Q76**
- A. It is static and unchanging over time**
 - B. It is based on abstract classifications of knowledge**
 - C. It is constantly reinforced through experience and trial and error**
 - D. It is exclusive to specific individuals and not shared with others**

- 1. In which areas can indigenous knowledge be applied? Q78**
 - A. Industrial manufacturing and technology development**
 - B. Financial and economic planning**
 - C. Ecosystem and landscape**
 - D. Social media marketing and advertising strategies**
- 2. What is one example of indigenous knowledge practiced by the Illuababora, Maccaa Oromo in Ethiopia? Q79**
 - A. Dry-stone terracing**
 - B. Traditional healing practices for humans**
 - C. Protection of sacred forests and ritualistic trees**
 - D. Shifting cultivation techniques**

- 1. What is the main purpose of the dry-stone terraces in the Konso Cultural Landscape? **Q80****
- A. To prevent erosion and retain soil**
 - B. To provide shelter for wildlife**
 - C. To serve as aesthetic value for towns**
 - D. To create a scenic view for tourists**
- 2. Which group in Ethiopia believes that natural resources are a sacred gift from Yamba, the supreme deity? **Q81****
- A. Illuababora, Maccaa Oromo**
 - B. Gedeo people**
 - C. Konso community**
 - D. Gumuz tribe**