

UNIT TWO

CLIMATE CHANGE

2.1. Basic concepts of climate change

- Weather refers to the condition of the atmosphere at a particular place over a short period of time. Weather includes daily changes in precipitation, air pressure, temperature, wind, etc. While Climate refers to the condition of the atmosphere in a certain place over a long period of time or many years.
- Climate change also refers to the long-term alteration in the Earth's climate patterns, including changes in temperature and weather conditions, occurring globally over many years.

- The climate in a particular area, like Gondar or Gambella, is called **a regional climate**, while the overall climate patterns across the world are referred to as the **global climate**(the average climate around the world).
- **Global warming** is a significant aspect of climate change, characterized by **the gradual increase in the average temperature of the Earth over an extended period**.
- Rising global temperatures have various consequences, such as more powerful hurricanes, melting glaciers, and the loss of habitats for wildlife. This is because the Earth's air, water, and land are all **interdependent** and prone to the climate change. This means a change in one place can lead to other changes somewhere else.

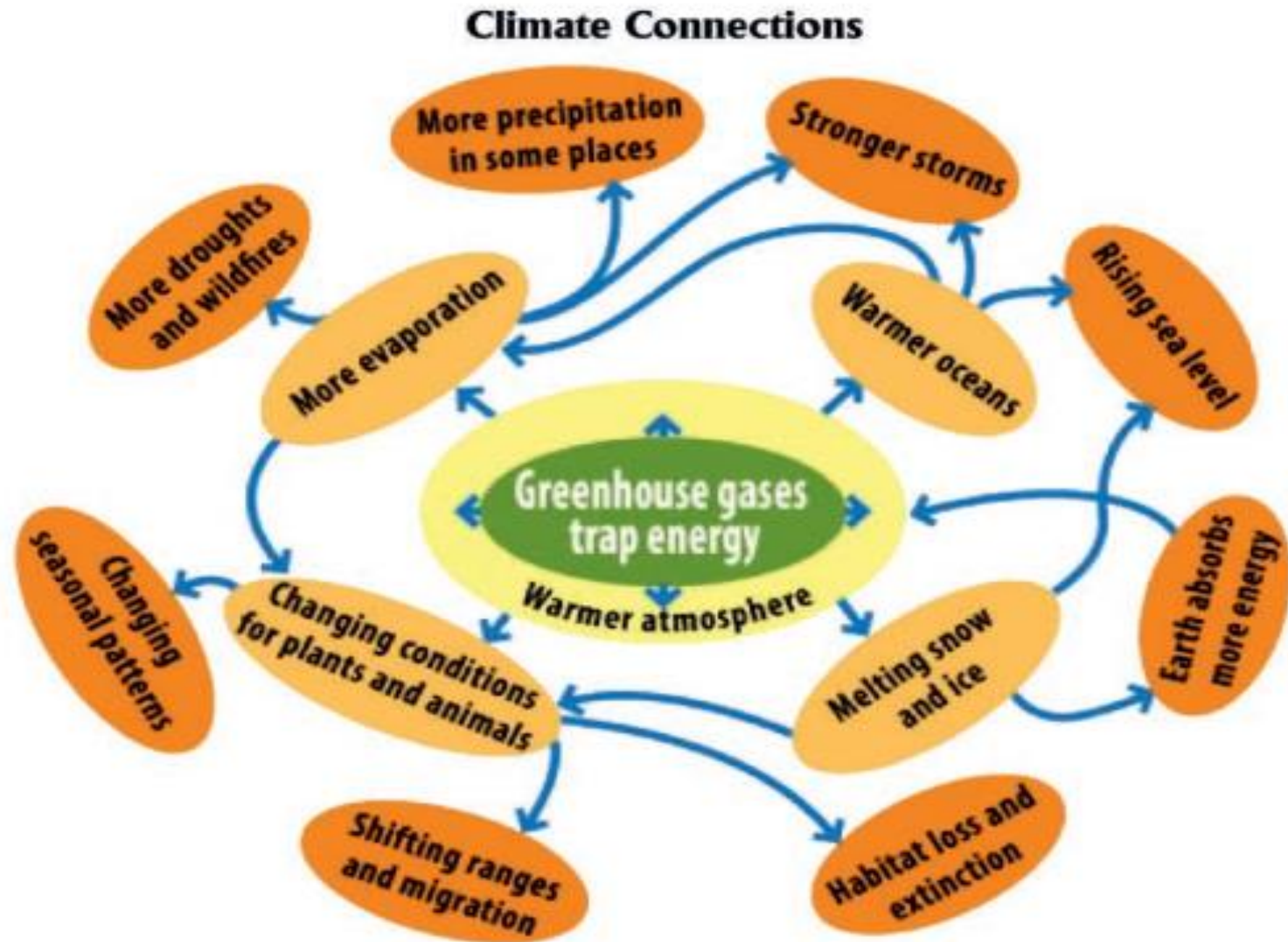


Figure 2:1 Global warming leading to a variety of changes.

- According to the Intergovernmental Panel on Climate Change (IPCC),
 - ❖ Climate change refers to a change in the state of the climate that persists for an extended period, typically decades or longer.
 - ❖ It refers to **any change in climate overtime**, due to either natural variability or human activities.
- It's important to recognize that climate change is not just about increasing temperatures; it has far-reaching and profound effects that should be taken seriously.
- According to IPCC, climate is changing across our planet, largely as a result of **human activities.**

- Multiple lines of evidences, indicated that the **climate is changing across our planet**, largely as a result of **human activities**.
- The most convincing evidence of climate change derives from observations of the atmosphere, land and oceans.
- In-situ observations and ice core records provide clear evidence of **increasing concentrations of greenhouse gases** like **carbon dioxide** (CO₂), **methane** (CH₄), and **nitrous oxide** (N₂O) over the past few centuries.. These greenhouse gases contribute to **the warming of the Earth's climate system** and are principally influenced by **human activities**.

2.2. Trends in Global Climate Change

- The earth's climate is dynamic. It is always changing due to natural and human causes.
- **The human activities** such as **deforestation, atmospheric emissions from industry and transport**, which resulted in **the storage of gases and aerosols** in the atmosphere. They are known as **greenhouse gases** (GHGs).
- **GHGs** trap heat and raise air temperatures near the ground, acting like a greenhouse on the surface of the planet.

- **The Intergovernmental Panel on Climate Change (IPCC) stated in 2001 Third Assessment Reported that:**
 - ❖ **the world is experiencing warming and other climate system change.**
 - ❖ **the 1990s were the warmest decade on record, and 1998 was the warmest year.**
 - ❖ **the 20thC was also likely the warmest century in the past 1000 years.**
- **These changes are primarily caused human activities and its trend continue throughout 21stC.**
- **Global warming is impacting sea level, snow cover, ice sheets and rainfall pattern.**

- The average global surface temperature has increased by **0.8⁰c over the past century** and **0.6⁰c over the past three decades**.
- If greenhouse gases emission continue to rise, the IPCC projects that **global temperatures could increase by 1.4⁰c to 5.8⁰c by the end of 21st century**.

2.3. Natural and Human Induced Climate Change

Climate Change Caused by Natural Events

- There are three **“external”** causes of climate change. These are:
 - ❖ **1. Change in incoming solar radiation**

- ❖ 2. Change in the composition of the atmosphere; and
- ❖ 3. Change in the Earth's surface.

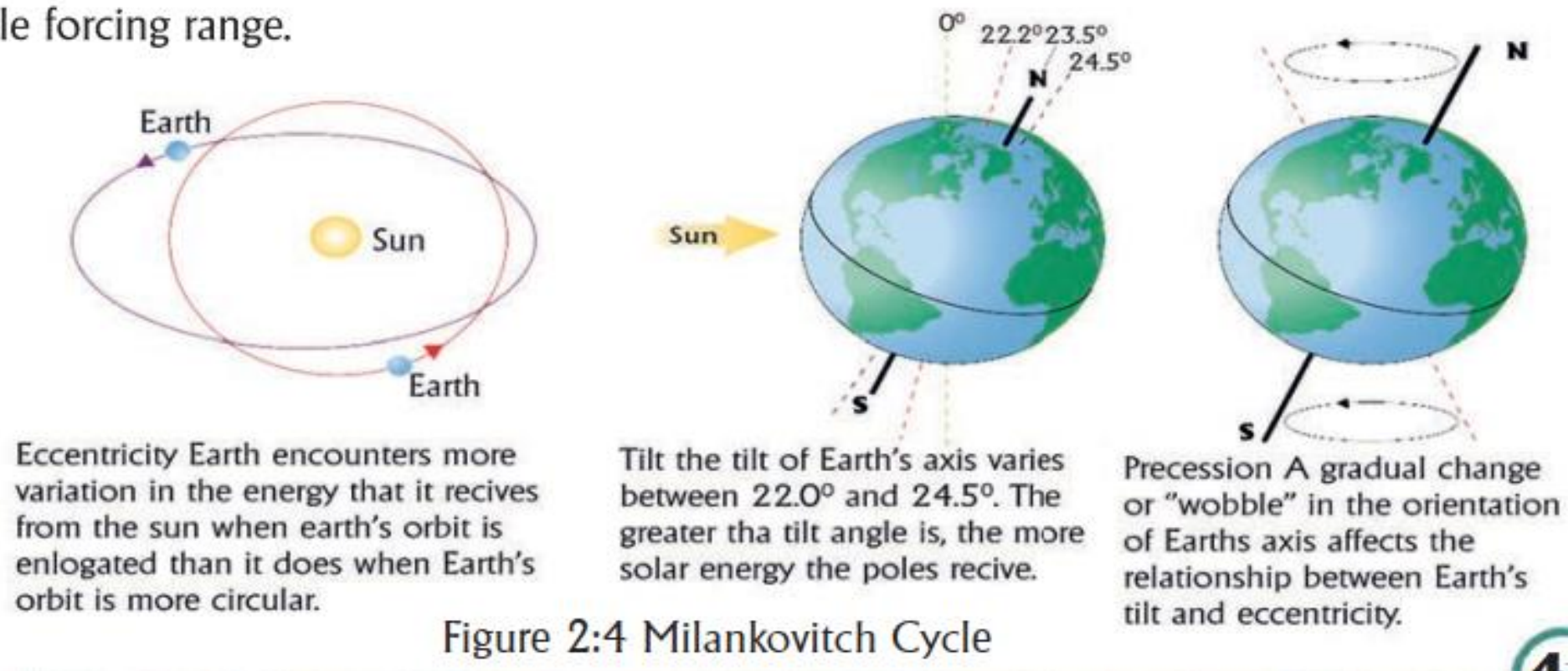
- Natural phenomena can cause climate to change by **all the three mechanisms**, whereas human activities primarily affect climate through change in the **atmosphere** and **the earth's surface**.
- On the other hand, “**internal**” causes of climate change, manifested in terms of **circulation patterns of the ocean and atmosphere**, which redistribute energy within the climate system.
- understanding climate change is **complex** due to complicated interrelationship among various elements, such as the atmosphere, oceans and ice.

Variations in the Earth's Orbit

- A theory attributing climatic changes to variations in the Earth's orbit is the Milankovitch theory, named after the name of astronomer Milutin Milankovitch, who first proposed the idea in the 1930s.
- The basic idea of this theory is that, as the Earth travels through space, three separate cyclic movements combine to produce variations in the amount of solar energy that reaches the Earth. These cycle include:
 - ❖ Changes in the shape (eccentricity) of the Earth's orbit about the sun.
 - ❖ Precession of the Earth's axis of rotation, or wobbling.
 - ❖ Changes in the tilt (obliquity) of the Earth's axis.

- These **orbital** and **axial variations** influence the initiation of climate change in long-term natural cycles of ‘ice ages’ and ‘warm periods’ known as ‘glacial’ and ‘interglacial’ periods.

ycle forcing range.



Variations in Solar Output

- Solar output variations also influence climate change. Measurements show that the sun's energy output varies slightly with sunspot activity, with periods of maximum sunspots emitting more energy.

Atmospheric particles

- Atmospheric particles, including aerosols from natural and human sources, can also affect climate by cooling the Earth's surface by preventing sunlight from reaching it.

Volcanic eruption

- Additionally, volcanic eruptions can have a significant impact on climate by releasing ash, dust, and sulfur gases into the atmosphere, forming a haze(cloud) that reflects sunlight and cools the air at the Earth's surface.

- Overall, climate change is a complex phenomenon influenced by a range of natural events and human activities, and understanding these factors is crucial to knowing the changing climate.

Human (Anthropogenic) Induced Climate Change

- Human-induced climate change is caused by various factors. These include:
- **Aerosols injected into the lower atmosphere:** primarily from human activities such as emissions from factories, vehicles, and power plants, contribute to the formation of particles that can reflect or absorb sunlight and tend to cause a net cooling of the surface air during the day.

- **Land use changes:** such as deforestation and overgrazing, can also impact climate by altering the amount of evaporation and changing the reflectivity of the Earth's surface, leading to warming or desertification.
- **Increasing greenhouse gas emissions:** Naturally, atmospheric GHGs are important **to maintain life on earth.** The role of water vapor, CO₂ and other GHGs play keeping the earth's mean surface temperature higher than it otherwise would be.
- If the GHGs were absent earth's average atmospheric temperature would be 33°C less.

- **Carbon dioxide** is one of a greenhouse gas that strongly absorbs infrared radiation and plays a major role in the warming of the lower atmosphere.
- Carbon dioxide has been increasing steadily in the atmosphere, primarily due to human activities, such as the burning of fossil and deforestation.
- **Nitrous oxide** (N_2O) and **methane** (CH_4) are other greenhouse gases that also contribute to warming. These gases differ in **how they absorb energy and how long they stay in the atmosphere, with CO_2 having a longer lifespan.**
- **Global warming:** The Earth's atmosphere has been experiencing a warming trend since the late 19th century, with the average global surface air temperature rising by **about 1°C .**

- Each decade since the **1980s** has been warmer than the preceding(previous)one.
- Other indications of global warming include:
 - ❖ the decrease in water stored in glaciers and ice sheets,
 - ❖ rising sea levels,
 - ❖ increasing ocean heat content, and
 - ❖ increase temperature over land
 - ❖ increase humidity in the atmosphere
 - ❖ increase sea surface temperature
 - ❖ declining snow and glacier cover, etc.

2.4. Consequences of Climate Change

- The consequence of climate change is varied and widespread. One of the major consequence is the warming of the land areas, particularly in the northern high latitude during winter.
- The greatest surface warming for the period **2001 to 2006** tended to occur over landmasses in the high latitudes of the Northern Hemisphere, as experienced in Canada and Russia.
- As high-latitude regions of the Northern Hemisphere continue to warm, modification of the land may actually enhance the warming, such as **expansion of boreal forest into tundra region.**

Precipitation

- change in precipitation and drought just as important as change in temperature.
- some areas will experience increased precipitation. **Example**, the middle and higher latitude areas of Northern hemisphere. While other experience less. **Example**, sub-tropical land areas.

Sea Level Rise

- Climate change causes the sea level to rise due to melting of ice sheet and glaciers. This can have damaging effects on coastal ecosystem and contaminate coastal ground water supplies with salt water.

Effects on Polar Regions

- In Polar Regions, areas of the world, rising temperatures produce complex interactions among temperature, precipitation, and wind patterns.
- Antarctica, Greenland and Arctic ocean are experiencing rapid melting of ice , causing the ice sheet to shrink and increase precipitation.

Effects on ecosystems

- climate change has significant effects on ecosystems as it alter temperatures, ppt patterns and other environmental condition. Some of the effect of climate change on ecosystem: **habitat loss, species extinction, altered species distributions, increase forest fire, ocean acidification, loss of biodiversity, etc.**

- Climate change also has significant impacts on ecosystems. **Increased carbon dioxide levels can act as a fertilizer for some plants, accelerating their growth.** However, this can lead to certain dominant plant species outcompeting others, resulting in changes to ecosystems.
- The effects of climate change on agriculture vary by region, with **tropical areas experiencing potential decreases in crop yields, while higher latitudes could benefit from longer growing seasons.**
- Climate-driven changes in species distributions affect **human well-being both directly** (for example, through emerging diseases and changes in food supply) and **indirectly** (by degrading ecosystem health).

2.5. Adaptation and Mitigation Strategies to Climate Change

- To prevent the causes and possible impact of climate change, human beings applies two types of measures:
 - ❖ Adaptation measure and
 - ❖ Mitigation measure

Climate Change Adaptation

- Adaptation is defined by IPCC 2014 as” the process of adjustment to actual or expected climate and its impact”.
- This term refers to changes in process, practice and structure to moderate potential damages or to benefit from opportunities associated with climate change.
- Adaptation measures are based on reducing vulnerability to the effects of climate change. Adaptation, therefore, address its impacts.

- The most commonly identified adaptation strategies in Ethiopia include **soil conservation, terracing, water harvesting, crop diversification, changing crop planting date, planting trees and irrigation.**

Types of Adaptation

- Depending on its timing, goal and motive of its implementation, adaptation can either be **reactive or anticipatory, private or public, planned or autonomous.** Adaptations can also be **short/long term, localized or widespread** (IPCC 2001).

1. Reactive or Anticipatory Adaptation

- **Reactive adaptation:** is adaptation that takes place after initial impact of climate change have occurred.
- **Anticipatory adaptation:** is adaptation that takes place before the impact of climate change are observed. **In natural system, there is no anticipatory adaptation.**

2. Private or Public Adaptation

- **Private adaptation:** is adaptation taken by private (individual) households. **Example**, installing water tanks to ensure availability of water during dry spell.
- **Public adaptation:** adaptation undertaken by public (gov.t) entity to benefit the broader community.

3. Planned or Autonomous Adaptation

- **Planned adaptation:** is a deliberate policy decision or action taken in response to climate change impact.
- **Autonomous adaptation:** refers to spontaneous response to climate change impact without any policy plan decision.

		Anticipatory	Reactive
Natural System	Private		Changing in length of growing season Changes in ecosystem composition Wetland migration
		Purchase of insurance Construction of house on stilts Redesign of oil-rigs	Changing in farm practices Change in insurance premiums Purchase of air-building
Human System	Public	Early- Warning system New building codes, design standards Incentive for relocation	Compensatory payments, subsidies Enforcement of building codes Beach nourishment

Climate Change Mitigation

- It refers avoiding and reducing emission of heat trapping greenhouse gases in to the atmosphere to prevent the planet from warming to more extreme temperatures.
- **For example**, reducing source of heat trapping GHGs the burning of fossil fuels for electricity, heat or transport and enhancing the sinks that accumulate and store these gases (such as the oceans, forests and soil).
- Mitigation measures are those actions that are taken to reduced and limit GHG emission. Mitigation, therefore, **attends the cause of the climate change**.

➤ some of the mitigation measures that can be taken to avoid the increase emission of GHGs are:

- ✓ Practicing energy efficiency
- ✓ Greater use of renewable energy
- ✓ Electrification of industrial process
- ✓ Efficient means of transpiration implementation:
electric public transport, bicycle, etc.
- ✓ Carbon tax and emission market

2.6. International Conventions and Agreements on Climate Change

- The international conventions and agreements on climate change have played **a crucial role in addressing the urgent problem of climate change.**
- The First World Climate Conference held in 1979, which recognized **climate change as a global concern and called for practical measures to safeguard against potential climate hazards.**
- Subsequent **conferences and agreements** further advanced the discussions on climate change.

- The Toronto Conference on the Changing Atmosphere in 1988, recommended the development of a comprehensive global framework convention to protect the atmosphere. This led to the adoption of Resolution 43/53 by the United Nations General Assembly, acknowledging climate change as a common concern and emphasizing the need for global action.
- To assess the magnitude and impacts of climate change, the IPCC was published the First Assessment Report in 1990. This report became a basis for negotiations under the United Nations General Assembly on a climate change convention.
- The IPCC Second Assessment Report, published in 1996, highlighted the distinct human influence on global climate and presented strategies for addressing climate-related risks.

- **The Conference of Parties (COP) is a key component of the international framework for addressing climate change.** It is the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC) and consists of all the countries that are party to the convention.
- **COP meetings are held annually,** providing a platform for countries to come together and discuss the progress, implementation, and future actions related to climate change. These meetings serve as **a forum for negotiations, policy development, and the adoption of decisions and measures to address climate change at the global level.**

- The COP meetings have resulted in significant milestones and agreements in the international response to climate change.
- COP 6 in 2001 reached the Bonn Agreements, which included an emissions trading system and financial support for developing countries.
- COP 7 in 2001 adopted the Marrakesh Accords, providing detailed legal texts for implementation.
- COP 8 in 2002 focused on implementing the Marrakesh Accords and adopted the Delhi Ministerial Declaration on Climate Change and Sustainable Development.

- **COP 9** in 2003 addressed afforestation and reforestation activities, while **COP 10** in 2004 emphasized adaptation to climate change.
- **The Kyoto Protocol**, adopted in 1997 and in force since 2005, set mandatory targets for greenhouse gas emissions reduction in developed countries. However, **the United States**, did not ratify the protocol, and **developing countries** were exempted from emission reductions.
- **The Paris Agreement**, introduced in 2015, marked a significant milestone with **almost all nations committing to voluntary targets for emission reductions**. Under this agreement, countries regularly report their progress. While the **United States** initially announced its intention to withdraw from the Paris Agreement, there is ongoing reconsideration.

- In addition to international agreements, **individual countries and cities have taken independent initiatives to address climate change.** Some countries, including **Costa Rica, Iceland, and Norway,** have promised to become **carbon neutral, offsetting their emissions through activities like tree planting.**
- To effectively combat climate change, it is essential to reduce greenhouse gas emissions. This involves:
 - ❖ **Transitioning to renewable energy sources** like solar, wind, hydro, and geothermal energy.
 - ❖ **Sustainable development practices,**
 - ❖ **Circular economy principles, and**
 - ❖ **Responsible consumer choices**

➤ **The cutting down on the emissions of greenhouse gases and pollutants has several potentially positive benefits. These are, it:**

- ❖ **Could slow down the enhancement of Earth's greenhouse effect,**
- ❖ **Reduce global warming,**
- ❖ **Reduce acid rain, Diminish haze,**
- ❖ **Slow the production of photochemical smog, and**
- ❖ **Produce significant health benefits**

2.7. Pillars of Climate Resilient Green Economy of Ethiopia

- Ethiopia has developed a Climate Resilient Green Economy (CRGE) strategy, which focuses on four pillars to foster development and sustainability.

Pillar I: improve crop and livestock production practices.

- This pillar recognizes that agriculture will remain a core sector of the economy that provides employment to the majority of the Ethiopian population.
- The strategy prioritizes initiatives that **limit soil-based emissions from agriculture and avoid expanding land under cultivation.**
- It also focuses on **increasing resource efficiency and productivity in the livestock sector**, providing economic growth and limiting emissions.

- The prioritized initiatives in the livestock sector have offered the combined benefit of economic growth support, by increasing pastoralists' income and limiting emissions.

Pillar II: protecting and re-establishing forests for their economic and ecosystem services, including carbon stocks.

- The strategy aims to reverse deforestation and forest degradation by reducing fuel wood demand, promoting afforestation and reforestation, and implementing forest management practices.
- These measures increase carbon sequestration and storage in Ethiopian forests.

Pillar III: Expanding electricity generation from renewable sources of energy for domestic and regional markets:

- The third pillar focuses on **expanding electricity generation from renewable sources to meet domestic and regional markets' needs.**
- Ethiopia plans to leverage(force) its vast potential for hydro, geothermal, solar, and wind power to provide electricity with virtually zero greenhouse gas emissions.
- This clean energy **will not only enable economic development but also offers the possibility of exporting energy to neighboring countries.**

Pillar IV: Leapfrogging to modern and energy-efficient technologies in transport, industrial sectors and building:

- The strategy promotes energy efficiency and alternative fuels in sub-sectors such as cement, textile, leather, and fertilizer industries.
- For transportation, initiatives include **stricter fuel efficiency standards, construction of an electric rail network powered by renewable energy, and modern transport improvements.**
- The CRGE strategy **intends to protect the country from the adverse effects of climate change while striving to achieve middle-income status by 2025.** . By embracing a green economy, Ethiopia aims to achieve sustainable development and prepare for future challenges posed by climate change.

Choose the Best Answer from the given Alternatives

1. When was the First World Climate Conference held? **Q1**

- A. 1988 B. 1990 C. 1979 D. 2001

1. Which organization was responsible for directing the World Climate **Programme**? **Q2**

- A. United Nations General Assembly
- B. Intergovernmental Panel on Climate Change (IPCC)
- C. World Meteorological Organization (WMO)
- D. International Council of Scientific Unions (ICSU)

1. What was the main outcome of the Toronto Conference on the Changing Atmosphere? Q3

A. Adoption of the Paris Agreement

B. Establishment of the Intergovernmental Negotiating Committee

C. Recommendation for a comprehensive global framework convention

D. Recognition of climate change as a common concern

2. When did the Kyoto Protocol come into force? Q4

A. 1988

C. 2005

B. 1990

D. 1997

1. Which assessment report by the IPCC had a significant impact on policy makers and public opinion? Q5

- A. First Assessment Report C. Second Assessment Report**
B. Third Assessment Report D. Fourth Assessment Report

1. Which COP meeting reached the Bonn Agreements? Q6

- A. COP 6 B. COP 7 C. COP 8 D. COP 9**

1. Which country initially announced its intention to withdraw from the Paris Agreement? Q7

- A. China C. United States**
B. Costa Rica D. Norway

1. What is the objective of the Paris Agreement? Q8

A. Mandatory greenhouse gas emissions reduction targets

B. Voluntary greenhouse gas emissions reduction targets

C. Implementation of the Kyoto Protocol

D. Creation of a global climate change convention

2. Which one of the following country did not ratify the Kyoto protocol? Q9

A. Japan

B. France

C. USA

D. Germany

1. What does it mean for a country to become carbon neutral?

Q10

- A. No greenhouse gas emissions reduction targets**
- B. Offsetting all emissions with tree planting**
- C. Completely eliminating all greenhouse gas emissions**
- D. No commitment to reducing emissions**

2. What is one essential step in combating climate change? Q11

- A. Increasing the use of fossil fuels**
- B. Reducing reliance on renewable energy sources**
- C. Transitioning to renewable energy sources**
- D. Ignoring sustainable development practices**

1. What is climate change? Q12

- A. A change in weather patterns over a short period of time.**
- B. A change in the state of the climate that persists for a long duration, typically decades or longer.**
- C. A change in the average temperature of the Earth's surface.**
- D. A change in the regional climate due to human activities.**

1. Which of the following is an example of the global climate?

Q13

A. The climate in Gondar during the winter.

B. The climate in Gambella, which is warm and humid all year long.

C. The average climate patterns observed worldwide.

D. The climate in the Horn of Africa, which is referred to as a regional climate.

2. Which one of the ff. is the consequence of rising global temperatures? Q14

A. Decreased hurricanes

C. Expansion of glaciers

B. Loss of wildlife habitats

D. Reduction in sea levels

- 1. What is global warming? Q16**
 - A. The increase in the average temperature of the Earth over many years.**
 - B. The increase in the strength of hurricanes and tropical storms.**
 - C. The melting of glaciers and polar ice caps.**
 - D. The loss of wildlife habitats due to changes in climate.**
- 2. How are the Earth's air, water, and land interdependent? Q17**
 - A. They have separate and isolated effects on climate change.**
 - B. Changes in one can lead to changes in the others.**
 - C. They are not influenced by climate change.**
 - D. Only the air and water are affected by global warming.**

1. According to the IPCC, climate change can be caused by:

Q18

- A. Only natural variability such as volcanic activity or solar radiation.**
- B. Human activities and their impact on the environment.**
- C. Changes in the variability of weather patterns over a short period of time.**
- D. The average temperature of the Earth remaining constant over centuries.**

1. Which of the following is NOT a consequence of rising global temperatures? Q19

A) Melting glaciers

C) Decrease in sea level

B) Stronger hurricanes

D) Loss of wildlife habitats

1. What is the name of the theory that explains how variation in the earth's orbit affect climate change? Q20

A) Milankovitch theory

C) Newton's theory

B) Kepler's theory

D) Einstein's theory

1. What are the three "external" causes of climate change?

Q21

- A. Changes in solar radiation, ocean currents, and volcanic eruptions**
- B. Changes in the composition of the atmosphere, land use patterns, and solar output**
- C. Changes in solar radiation, the composition of the atmosphere, and the Earth's surface**
- D. Changes in greenhouse gas emissions, deforestation, and land use changes**

- 1. According to the IPCC, what is the primary cause of climate changes over the last few decades? Q22**
- A. Variations in the Earth's orbit**
 - B. Changes in solar output**
 - C. Human (anthropogenic) activity, mainly the burning of fossil fuels**
 - D. Natural phenomena such as volcanic eruptions**
- 2. Which one of the ff. is the main greenhouse gas responsible for the warming of the lower atmosphere? Q23**
- A. Nitrous oxide (N_2O)**
 - B. Methane (CH_4)**
 - C. Carbon dioxide (CO_2)**
 - D. Aerosols**

1. Which of the following is NOT an indicator of global warming? Q24

A. Decrease in sea ice

B. Increase in humidity

C. Decrease in temperature over land

D. Increase in sea level

1. According to the IPCC's Third Assessment Report, which decade was the warmest worldwide? Q25

A) 1980s

C) 2000s

B) 1990s

D) 2010s

- 1. Which of the following is the main effects of volcanic eruptions on climate change? Q26**
- A. They increase the GHG effect by releasing carbon dioxide and methane.**
 - B. They decrease GHG effect by releasing oxygen and nitrogen**
 - C. They cool the surface of the earth by blocking sunlight with ash and dust.**
 - D. They warm the surface of the earth by reflecting sunlight with ash and dust.**

1. Which one of the ff. is the primary source of the increased atmospheric concentration of carbon dioxide? Q27

A. Deforestation and burning of fossil fuel.

B. Natural processes and Volcanic activity

C. Ocean current and variation of solar output.

D. Volcanic eruption and continental drift.

1. By how much has the average global surface temperature warmed in the past century? Q28

A) 0.8°C

B) 0.6°C

C) 1.4°C

D) 5.8°C

1. Which factor contributes to the rising sea levels? Q29

A. Expansion of oceans as they warm

B. Decrease in the amount of rainfall

C. Melting of glaciers and ice sheets

D. Increase in average global temperature

1. Which activity is NOT categorized as a human cause of climate change? Q30

A) Deforestation

C) Transportation emissions

B) Industrial emissions

D) Volcanic eruptions

- 1. How do climate-driven changes in species distributions affect human well-being? Q31**
- A. They lead to the extinction of certain species**
 - B. They have no direct impact on humans**
 - C. They improve human food supply**
 - D. They can cause emerging diseases and degrade ecosystem health**
- 2. The Milankovitch cycles refer to variations in: Q32**
- A) Incoming solar radiation C) The Earth's surface**
 - D) Atmospheric composition D) The Earth's orbit**

1. What did the IPCC project regarding mean global temperatures by the end of the 21st century? Q33

A) No significant change in temperatures

B) A decrease of 2°C

C) An increase of 0.5°C

D) An increase of 1.4°C to 5.8°C

1. Which one of the ff. conference of the parties(COP) emphasised afforestation and reforestation activities?

Q34

A. COP 7 B. COP 6 C. COP 9 D. COP 10

1. One of the following is describe the role of greenhouse gases (GHGs)? **Q35**
 - A. Gases that cool the Earth's atmosphere
 - B. Gases that absorb heat and raise air temperatures near the ground
 - C. Gases that reduce air pollution
 - D. Gases that deplete the ozone layer
2. The type of adaptation that takes place after the initial impacts of climate change has occurred is: **Q36**
 - A. Anticipatory
 - B. Planned
 - C. Reactive
 - D. Autonomous

1. What is a feasible method to reduce the release of the greenhouse gases without decreasing the production of these gases? Q37

A. Mitigation

C. Adaptation

B. Resilience

D. Exposure

1. Which renewable energy sources does Ethiopia plan to leverage for electricity generation? Q38

A. Hydro, geothermal, solar, and wind power

B. Coal and natural gas

C. Oil and nuclear power

D. Biomass and bioenergy

1. Which one of the ff. is the major consequence of climate change in the northern high latitude during winter? **Q39**
 - A. Increased heat related death
 - B. Expansion of boreal forest into Tundra region
 - C. Coastal ecosystem damage
 - D. Increased precipitation
2. One of the ff. is NOT the impact of the rise of sea level? **Q40**
 - A. Coastal ecosystem damage
 - B. Contamination of ground water supplies with salt water
 - C. Enhance ground water supplies
 - D. Exposed storm surges and increased baseline water level

- 1. Which of the following accurately describes sunspot? Q41**
- A. Dark areas caused by intense magnetic activity on the surface of the earth.**
 - B. Bright areas caused by intense nuclear reactions on the sun's surface.**
 - C. Dark area caused by variation in earth's orbit**
 - D. Bright areas caused by variation in solar radiation on the earth's surface**

- 1. Which of the following is an example of a mitigation measure to combat climate change? Q42**
 - A. Research and development on possible catastrophes.**
 - B. Landscape restoration and reforestation.**
 - C. Carbon tax and emission market**
 - D. More secure locations and infrastructure**
- 2. Which sector does the first pillar of the Climate Resilient Green Economy of Ethiopia focus on? Q43**
 - A) Agriculture**
 - B) Electricity generation**
 - C) Forestry**
 - D) Transport and industrial sectors**

- 1. Which is the focus of adaptation measure relation to climate change? Q44**
- A. Reducing vulnerability to climate change impact.**
 - B. Reducing greenhouse gas emission.**
 - C. Increasing energy efficiency**
 - D. Implementing renewable energy sources.**

- 1. What is the purpose of a carbon tax and emission market as mitigation measure? Q45**
 - A. Reducing vulnerability to climate change impact.**
 - B. To promote landscape restoration and reforestation**
 - C. To encourage the use of efficient means of transportation.**
 - D. To reduced greenhouse gas emission.**
- 2. What is the main source of carbon dioxide (CO₂) emissions contributing to climate change? Q46**

A) Deforestation	C) Volcanic activity
B) Natural gas combustion	D) Oceanic processes

1. Which of the following is NOT one of the pillars of Ethiopia's Climate Resilient Green Economy (CRGE) strategy? Q47

- A. Improving crop and livestock production practices**
- B. Protecting and re-establishing forests**
- C. Expanding electricity generation from fossil fuels**
- D. Leapfrogging to modern and energy-efficient technologies in various sectors**

1. Which renewable energy sources does the third pillar of the Climate Resilient Green Economy of Ethiopia prioritize? Q48

- A) Hydro, geothermal, and solar power**
- B) Geothermal, wind, and nuclear power**
- C) Solar, wind, and bioenergy**
- D) Hydro, solar, and wind power**

1. Among the greenhouse gases, which gas has the longest lifespan in the atmosphere? Q49

- | | |
|---|---|
| A) Carbon dioxide (CO₂) | C) Nitrous oxide (N₂O) |
| B) Methane (CH₄) | D) Sulfur dioxide (SO₂) |

1. The fourth pillar of the Climate Resilient Green Economy of Ethiopia aims to promote energy efficiency and the use of alternative fuels in which sectors? Q50

A) Agriculture and forestry

B) Transport and industrial sectors

C) Electricity generation and buildings

D) Health and education sectors

1. Which of the following is NOT a human-induced source of aerosols in the lower atmosphere? Q51

A) Emissions from factories

C) Volcanic eruptions

B) Power plants

D) Autos and trucks

- 1. What is the overall trend observed in global temperatures since the 1980s? Q52**
- A. Each decade has been cooler than the preceding one**
 - B. Each decade has been warmer than the preceding one**
 - C. Temperature has remained constant since the 1980s**
 - D. There is no consistent trend in global temperatures since the 1980s**

1. Which type of measures focuses on reducing greenhouse gas emissions? Q53

A) Adaptation measures

B) Both adaptation and mitigation measures

C) Mitigation measures

D) None of the above