

# UNIT TWO

## CLIMATE CHANGE

### Introduction to Climate Change

In previous grades, you explored climatic classification, the factors influencing world climates, and the indigenous climate classification of Ethiopia. Now, you'll delve deeper into one of the most pressing environmental challenges of our time: climate change.

### What is Climate Change?

Climate refers to the average atmospheric conditions in a particular place over many years. For example, Gondar has a cold climate in winter, while Gambella is warm and humid year-round. Climate differs from weather, which is the day-to-day atmospheric conditions.

**Global climate** refers to the average climate around the world. Scientists studying global climate change observe long-term patterns and trends, such as rising global temperatures, also known as global warming. This increase in Earth's average temperature leads to various environmental changes, like stronger hurricanes, melting glaciers, and the loss of wildlife habitats. These changes occur because the Earth's air, water, and land are interconnected; a change in one can trigger changes elsewhere.

### Evidence of Climate Change

Scientific evidence, particularly from the Intergovernmental Panel on Climate Change (IPCC), shows that climate change is real and largely driven by human activities. The most compelling evidence includes rising global temperatures, increased greenhouse gas emissions (like carbon dioxide and methane), and changes in weather patterns.

### Causes of Climate Change

Climate change can be driven by both natural events and human activities.

## Natural Causes:

1. **Solar Radiation:** Changes in the amount of solar energy reaching the Earth can alter the climate. The Milankovitch cycles, which include variations in the Earth's orbit and axis, influence long-term climate changes, such as ice ages.
2. **Volcanic Eruptions:** Volcanoes can release large amounts of particles and gases into the atmosphere, which can cool the Earth's surface by blocking sunlight.

## Human-Induced Causes:

1. **Greenhouse Gas Emissions:** The burning of fossil fuels, deforestation, and industrial activities release greenhouse gases into the atmosphere. These gases trap heat, leading to global warming.
2. **Land Use Changes:** Deforestation and urbanization change the Earth's surface, affecting local climates. For instance, cutting down rainforests can reduce the cooling effect of evaporation, leading to higher temperatures.

## Consequences of Climate Change

The effects of climate change are already visible:

- **Rising Sea Levels:** Melting ice caps and glaciers contribute to rising sea levels, which can lead to flooding in coastal areas.
- **Extreme Weather Events:** Climate change increases the frequency and intensity of extreme weather events, such as hurricanes, droughts, and heatwaves.
- **Ecosystem Disruption:** Changes in temperature and precipitation patterns disrupt ecosystems, affecting plant and animal species.

## Conclusion

Understanding climate change and its impact is crucial for developing strategies to adapt to and mitigate these changes. Geography plays a vital role in analyzing the spatial dimensions of climate change, helping us to understand where and how these impacts will be felt most strongly.

## 2.4. Consequences of Climate Change

Climate change is causing significant impacts on the planet, affecting both human life and the natural environment. Below, we explore the key consequences of climate change and how they influence different aspects of life on Earth.

### *Warming Patterns*

- **Land Warming:** Climate models predict that land areas will warm more rapidly than the global average. This is especially true for regions in the northern high latitudes, such as Canada and Russia, during winter. As these areas warm, they could trigger further warming by altering the landscape. For instance, the expansion of dark green boreal forests into the snow-covered tundra could accelerate warming because these forests absorb more solar energy.
- **Health Impacts:** As temperatures rise, heat waves are expected to become more frequent and intense, leading to an increase in heat-related illnesses and deaths. However, there may also be a reduction in cold-related illnesses in some regions.

### *Changes in Precipitation*

- **Uneven Distribution:** Climate change is expected to cause changes in precipitation patterns. Some areas will experience more rainfall, while others will see a decrease. Since the mid-20th century, precipitation has generally increased in the middle and high latitudes of the Northern Hemisphere, while it has decreased in some subtropical regions.
- **Agricultural Stress:** Changes in precipitation can place additional stress on agriculture. Even if the total annual rainfall remains the same, it may come in more intense but less frequent storms, leading to longer dry periods in between.

### *Sea Level Rise*

- **Rising Oceans:** One of the most significant consequences of climate change is the rise in sea levels, caused by the melting of ice sheets and glaciers and the thermal expansion of seawater as it warms. Sea levels rose by about 17 cm during the 20th century, and the rate of rise has increased since the 1990s.
- **Coastal Threats:** Rising sea levels threaten millions of people living in coastal areas, increasing the risk of storm surges and contaminating freshwater supplies with saltwater.

### *Effects on Polar Regions*

- **Polar Changes:** The polar regions are experiencing complex interactions between temperature, precipitation, and wind patterns. In Antarctica, warmer air could lead to increased snowfall, but this might be offset by greater melting

along the coast. Greenland is also seeing rapid melting of ice, which is likely to continue despite any increase in snowfall.

- **Arctic Sea Ice:** The Arctic Ocean has seen significant reductions in sea ice, particularly during summer. If the current rate of warming continues, summer sea ice could shrink to cover less than 10% of the Arctic Ocean by the middle of this century.

### **Effects on Ecosystems**

- **CO2 Fertilization:** Higher levels of CO2 in the atmosphere may act as a fertilizer for some plants, accelerating their growth. However, this effect may diminish over time if essential nutrients like water and nitrogen are not available in sufficient quantities.
- **Agricultural Impact:** In tropical areas, climate change could decrease crop yields, while higher latitudes might benefit from longer growing seasons. However, these benefits could be offset by more frequent wildfires in forested areas.

Overall, the impacts of climate change are expected to become increasingly negative, particularly for agriculture and ecosystems, as the century progresses. These changes will affect not only the natural environment but also human well-being, highlighting the urgency of addressing climate change on a global scale.

## **Pillars of Climate Resilient Green Economy of Ethiopia**

Ethiopia aims to achieve sustainable development by following a green growth path, focusing on economic growth while minimizing greenhouse gas (GHG) emissions. The Climate Resilient Green Economy (CRGE) strategy outlines this vision, centering on four main pillars:

### **1. Improving Crop and Livestock Production Practices**

- **Goal:** Increase farmer income and food security while reducing emissions.
- **Explanation:** Agriculture is vital for Ethiopia's economy, but traditional methods lead to high emissions and environmental degradation. The CRGE strategy promotes practices that reduce soil-based emissions, limit the expansion of farmland, and enhance livestock productivity. These initiatives not only support economic growth by boosting farmer and pastoralist incomes but also minimize the environmental impact.

## 2. Protecting and Re-establishing Forests

- **Goal:** Enhance economic and ecosystem services, including carbon storage.
- **Explanation:** Forests provide essential services like carbon sequestration, which helps mitigate climate change. The CRGE strategy emphasizes reversing deforestation and forest degradation through afforestation (planting new forests), reforestation (restoring degraded forests), and improved forest management. These efforts aim to reduce the demand for fuelwood and increase carbon storage, contributing to both economic growth and environmental sustainability.

## 3. Expanding Renewable Energy Generation

- **Goal:** Increase electricity supply from renewable sources for domestic and regional use.
- **Explanation:** Electricity is crucial for modern development, powering industries, cities, and agriculture. Ethiopia has significant potential in renewable energy sources like hydro, geothermal, solar, and wind power. The CRGE strategy focuses on harnessing these resources to meet growing energy demands with minimal GHG emissions. By generating clean energy, Ethiopia not only supports its own green development but also has the potential to export electricity to neighboring countries.

## 4. Leapfrogging to Modern and Energy-Efficient Technologies

- **Goal:** Advance the development of key sectors using energy-efficient technologies.
- **Explanation:** The CRGE strategy encourages the adoption of modern technologies in sectors like transport, industry, and construction. For instance, in transportation, the strategy promotes stricter fuel efficiency standards and the development of an electric rail network powered by renewable energy. In industry, it supports energy-efficient practices and the use of alternative fuels. These measures are designed to ensure that as Ethiopia develops, it does so in a sustainable and environmentally friendly way.

## Conclusion

Ethiopia's Climate Resilient Green Economy (CRGE) strategy integrates climate change objectives into the broader national development plan. By focusing on these four pillars, Ethiopia aims to protect itself from the adverse effects of climate change while building a sustainable economy. This strategy supports the country's goal of becoming a middle-income country by 2025, aligning with the broader homegrown economic reform agenda.