CLIMATE CHANGE
GLOSSARY-GUIDE FOR TAJIKISTAN: KEY CONCEPTS, SECTORAL IMPACTS, AND LOCAL SOLUTIONS

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INTRODUCTION

Tajikistan is one of the most climate-vulnerable countries in Central Asia. Rising temperatures, unpredictable rainfall, droughts, floods, landslides, and the rapid melting of glaciers are already affecting people's lives, livelihoods, and the environment.

These changes are especially concerning because Tajikistan depends heavily on glacier-fed rivers, agriculture, hydropower, and natural ecosystems. Climate change threatens water security, food production, energy systems, health, infrastructure, biodiversity, and economic growth across the country.

This glossary explains key climate-related terms in simple and accessible language. It includes real-life examples from Tajikistan to help people understand what climate change means in their daily lives. The glossary is intended for use by community members, local government officials, teachers, and professionals working in the six climate-sensitive sectors identified as national priorities: **water resources, agriculture, energy, forestry/ biodiversity, transport/infrastructure, and industry/ construction**.

By improving awareness of climate change, its causes and consequences, and the actions that can reduce risks or slow the damage, this glossary supports better decisions, stronger communities, and a more climate-resilient Tajikistan.

SECTION 1: UNDERSTANDING CLIMATE CHANGE

1.1 What is Climate?

Definition: Climate is the average weather conditions—such as temperature, rainfall, wind, and humidity—recorded in a specific region over a long period, usually 30 years or more.

Tajikistan example:

- Tajikistan has a continental climate with hot, dry summers and cold winters.
- In mountain regions, the climate is colder and snow lasts longer than in the valleys.

1.2 What is Weather?

Definition: Weather refers to short-term atmospheric conditions in a specific place at a specific time, such as whether it's hot or cold, raining or sunny today.

Tajikistan example:

- Rain in Dushanbe today is weather.
- A hot day in July is also weather.

1.3 Climate vs. Weather – What's the Difference?

Explanation:

- Weather changes day to day.
- Climate describes the average of those weather patterns over many years.

Tajikistan example:

- One unusually hot summer day in Khujand is weather.
- If summers in Khujand are getting hotter year after year, that's a change in climate.

1.4 What is Climate Change?

Definition: Climate change is the long-term change in Earth's climate, including shifts in temperature, rainfall, snowfall, and extreme weather. Today's climate change is happening faster than normal because of human activities like burning fossil fuels.

Tajikistan example:

- Glaciers are melting earlier each year, reducing water flow to rivers.
- Droughts are becoming more common in farming areas like Khatlon.

1.5 Global Warming vs. Climate Change – Are They the Same?

Explanation:

- **Global warming** refers specifically to the increase in Earth's average temperature.
- **Climate change** includes global warming plus related impacts, like glacier melt, droughts, and stronger storms.

Tajikistan example:

- Tajikistan's average temperature has risen by about 1°C since the 1950s.
- Melting glaciers and increased floods are part of climate change.

1.6 The Greenhouse Effect – Why is the Earth Getting Warmer?

Definition: The greenhouse effect is the process by which certain gases in the atmosphere trap heat from the sun, keeping Earth warm. Without it, Earth would be too cold.

Note: The term "greenhouse gases" may sound like it refers to gases from farming greenhouses. In fact, it comes from the way these gases trap heat in the atmosphere, just like a real greenhouse keeps heat inside to help plants grow.

But now, too many greenhouse gases are making the planet too warm.

Simple analogy: Earth is like a parked car in the sun. The windows trap heat inside, just like greenhouse gases trap heat in Earth's atmosphere.

Tajikistan example:

- Extra CO_2 from cars and factories adds to the greenhouse effect.
- Warmer temperatures in the Pamirs lead to earlier snowmelt and more flooding.

1.7 Key Greenhouse Gases (GHGs) and Their Role

Main greenhouse gases:

- **Carbon dioxide (CO_2):** from burning coal, oil, gas, and wood.
- **Methane (CH_4):** from livestock, landfills, and rice farming.
- **Nitrous oxide (N_2O):** from fertilizers and industrial activities.

Tajikistan example:

- CO_2 is released by coal-fired power plants, diesel generators, vehicles, and household stoves.
- Livestock in rural areas release methane into the atmosphere.

1.8 Why is Climate Change a Problem?

Explanation:

Climate change affects food, water, health, infrastructure, and ecosystems. It increases the risk of natural disasters and damages the economy.

Tajikistan example:

- Farmers face water shortages and unpredictable seasons.
- Floods and landslides damage roads and buildings in mountain areas.

1.9 How Do We Know Climate Change is Happening?

Scientific evidence:

- Long-term temperature records
- Satellite and glacier monitoring
- More frequent and intense droughts and floods

Tajikistan example:

- Glaciers in the Pamirs are shrinking rapidly.
- In 2015, a major mudflow in the Bartang Valley was linked to glacier melt.
- In 2022, floods in Khatlon damaged homes, crops, and infrastructure.

SECTION 2: CAUSES OF CLIMATE CHANGE

2.1 What Causes Climate Change?

Climate change is caused by both natural processes and human activities. While natural changes in climate have occurred over thousands of years, the rapid warming we are seeing today is mainly the result of human activities—especially burning fossil fuels, cutting down forests, and pollution from farming, transport, and industry.

2.2 Natural Causes of Climate Change

These natural factors influence the climate over long periods but cannot explain the fast changes happening today.

Volcanic Eruptions

Volcanoes release gases and dust into the air. Some volcanic particles block sunlight and cool the planet temporarily, while others contribute small amounts of greenhouse gases.

Tajikistan context:

- Tajikistan does not have active volcanoes, but eruptions elsewhere may affect its weather for a short time.

Solar Activity

The Sun's energy output changes slightly over time, which can influence Earth's temperature.

Note:

- These changes are small and do not explain the strong warming seen since the 20th century.

Ocean Currents and Natural Climate Cycles

Oceans store and move heat around the world. Climate cycles such as El Niño (Spanish term for a warming event in the Pacific Ocean) and La Niña (Spanish term for a cooling event in the Pacific Ocean) are natural phenomena that can influence global weather, including rainfall and temperature patterns in Central Asia.

Tajikistan context:

- These cycles may occasionally cause unusual weather in Central Asia, but they are not the main reason for long-term warming in Tajikistan.

Changes in the Earth's Orbit

Earth's orbit and tilt change very slowly over tens of thousands of years. These changes affect how much sunlight different parts of the Earth receive.

Note:

- These natural shifts explain ice ages in the past, but not today's rapid climate change.

2.3 Human Causes of Climate Change

Most scientists agree that the main cause of modern climate change is human activity. Since the Industrial Revolution, people have been burning fossil fuels and changing land use, which has greatly increased greenhouse gas emissions.

Burning Fossil Fuels

Coal, oil, and gas are burned for energy in homes, cars, factories, and power plants. This releases large amounts of **carbon dioxide (CO_2)** into the atmosphere.

Tajikistan context:

- In cities like Dushanbe, CO_2 is released from cars, trucks, buses, and power plants.
- Diesel engines also release **black carbon**, which makes glaciers melt faster.

Deforestation

Trees naturally absorb CO_2. When forests are cut down, less CO_2 is removed from the air, and more ends up in the atmosphere.

Tajikistan context:

- Cutting trees in mountain areas increases the risk of landslides and reduces the land's ability to store carbon.
- Forest protection and reforestation help slow climate change.

Agriculture and Livestock

Farming releases **methane (CH_4)** from animals and **nitrous oxide (N_2O)** from fertilizers. Both are powerful greenhouse gases.

Tajikistan context:

- Cows, goats, and sheep in Khatlon and Sughd release methane.

- Chemical fertilizers used in crop farming release nitrous oxide.

Industrial Pollution and Waste

Factories and landfills release greenhouse gases into the atmosphere.

Tajikistan context:

- Waste sites near Dushanbe and other cities produce methane as trash decomposes.
- Some industries use outdated technology that pollutes the air and increases CO_2 emissions.

Transportation

Cars, trucks, and planes burn fuel and release CO_2 and other pollutants.

Tajikistan context:

- Many vehicles in Tajikistan are old and lack emission controls.
- Growing traffic in cities adds to both climate change and local air pollution.

SECTION 3: CONSEQUENCES OF CLIMATE CHANGE

3.1 What Happens When the Climate Changes?

Climate change affects much more than just temperature. It influences rainfall patterns, increases natural disasters, and puts stress on water, food, health, infrastructure, ecosystems, and the economy. For Tajikistan, which depends on glacier-fed rivers, agriculture, and hydropower, the risks are especially serious.

3.2 Global and Local Impacts of Climate Change

The following impacts are observed worldwide and are already happening in Tajikistan:

Rising Temperatures

Earth's average temperature is increasing.

Tajikistan context:

- The national average temperature has risen by about 1°C since the 1950s.
- Hotter summers in Khatlon and Sughd are harming crops and increasing heat-related health problems.

More Extreme Weather Events

Climate change increases the frequency and intensity of floods, droughts, heatwaves, and landslides.

Tajikistan context:

- In 2022, heavy rains caused destructive floods in Khatlon province.
- Unpredictable rainfall makes it difficult for farmers to plan their harvests.

Water Scarcity

Melting glaciers and shifting rainfall reduce the availability of water for people, farming, and electricity.

Tajikistan context:

- River flows from glacier melt are declining.
- Low water levels in the Norak Dam affect hydropower generation and irrigation.

Disruptions to Food and Agriculture

Crops are sensitive to temperature and water changes.

Tajikistan context:

- Farmers in Sughd face reduced wheat and fruit yields due to erratic seasons.

- In Khatlon, droughts are damaging cotton and vegetable production.

Public Health Challenges

Hotter temperatures and water stress increase disease risks.

Tajikistan context:

- Waterborne illnesses like diarrhea are rising in rural areas.
- Dust storms and heatwaves affect respiratory and heart health, especially in children and the elderly.

Loss of Forests and Biodiversity

Forests and wildlife are at risk from changing temperatures and land use.

Tajikistan context:

- Deforestation in mountain areas worsens erosion and landslide risks.
- Habitat loss threatens species like the snow leopard and Marco Polo sheep.

Infrastructure and Transport Risks

Climate change weakens infrastructure and increases repair costs.

Tajikistan context:

- Roads and bridges in mountain regions are damaged by floods and mudslides.
- Melting permafrost affects buildings and roads in high-altitude areas.

Impacts on Industry and Economy

Changes in weather, water, and energy supply slow down industry and reduce income.

Tajikistan context:

- Hydropower shortages reduce electricity for industrial use.
- Heat and drought affect cement production and construction timelines.

3.3 Glaciers and Their Importance

Glaciers are slow-moving masses of ice that store freshwater and feed rivers. In Tajikistan, over 12,000 glaciers provide water for drinking, farming, and energy.

Tajikistan context:

- Glacier-fed rivers such as the Vakhsh and Panj supply most of the country's water.
- As glaciers melt earlier and faster, there's more water in spring—but less in summer when it's most needed.

3.4 Vanjyakh Glacier (Fedchenko)

Vanjyakh Glacier, formerly known as Fedchenko Glacier, is the largest glacier in Central Asia and one of Tajikistan's most important water sources.

Tajikistan context:

- Its melting increases the risk of glacial lake outburst floods (GLOFs), which can destroy villages and farmland.
- Continued melting reduces water for irrigation and hydropower during summer months.
- Vanjyakh's retreat is one of the clearest signs of climate change in the country.
- According to 2024 studies, Vanjyakh Glacier has retreated by 230 meters since 2000, lost 0.69 km² of surface ice, and formed a new glacial lake (0.2 km²) due to meltwater accumulation—indicating accelerating ice loss.

SECTION 4: ADAPTATION AND MEASURES

4.1 What is Climate Adaptation?

Definition:
Adaptation means taking actions to reduce the negative effects of climate change and adjust to new conditions. It includes planning ahead, protecting people and resources, and making systems stronger so they can cope with climate impacts.

Tajikistan context:

- Farmers planting drought-resistant crops
- Villages reinforcing bridges and riverbanks to prevent flood damage

4.2 Why is Adaptation Important for Tajikistan?

Tajikistan is especially vulnerable to climate change because of:

- Its reliance on glacier-fed rivers for water and electricity
- A large rural population depending on farming
- Steep mountain terrain prone to floods and landslides
- Limited infrastructure and financial resources to recover from disasters

Without strong adaptation measures, the country faces increasing risks to food security, public health, energy systems, and economic stability.

4.3 Adaptation Strategies for Tajikistan

Water Management and Conservation

Melting glaciers and unpredictable rainfall make water use more challenging.

Solutions:

- Rainwater harvesting systems

- Drip irrigation for farming
- Small dams and water reservoirs
- Repairing leaks in pipes and canals
- Promoting safe drinking water in rural areas

Example:

- Farmers in Khatlon are using drip irrigation to save water during dry seasons.

Climate-Resilient Agriculture

Farming needs to adapt to changing seasons, pests, and water shortages.

Solutions:

- Growing drought-tolerant crops
- Rotating crops to maintain soil health
- Supporting seed banks for local climate conditions
- Using early warning systems for weather events

Example:

- In Sughd, farmers are switching from water-intensive crops to almonds and apricots.

Disaster Preparedness and Infrastructure Protection

Adapting roads, buildings, and public services can reduce damage and save lives.

Solutions:

- Building flood barriers and drainage channels
- Reinforcing roads and bridges in landslide zones
- Improving healthcare systems to handle climate-related emergencies

- Installing community early warning systems

Example:

- Villages in Rasht and GBAO are reinforcing infrastructure to withstand floods and landslides.

Sustainable Land and Forest Management

Mountain ecosystems are vulnerable and must be protected to reduce erosion and natural disasters.

Solutions:

- Preventing deforestation and replanting trees
- Reducing overgrazing and restoring degraded land
- Building terraces on slopes to prevent erosion

Example:

- Reforestation projects in GBAO are helping prevent avalanches and improve water retention.

Energy and Electricity Adaptation

As water flow becomes less predictable, Tajikistan needs more reliable energy sources.

Solutions:

- Installing solar and wind energy systems
- Making homes and buildings more energy-efficient
- Diversifying energy sources beyond hydropower

Example:

- Rural households in mountain areas are using solar panels to meet energy needs in winter.

4.4 Community-Based Adaptation: What Can Local People Do?

Adaptation is not only the responsibility of government. Families, farmers, and communities can also take action.

Examples of community-level adaptation:

- Using traditional knowledge to manage land and water
- Participating in tree-planting campaigns
- Fixing water leaks and improving storage at home
- Joining local climate education and training sessions

Example:

- In Khatlon, community groups are working together to install rainwater collection tanks.

4.5 Integration of Six Priority Sectors

Tajikistan's national adaptation strategies focus on six key sectors. Each one needs specific actions to increase resilience:

- **Water:** Efficient irrigation, safe drinking water, small-scale storage
- **Agriculture:** Drought-tolerant crops, soil management, farmer training
- **Energy:** Solar, wind, and improved hydropower systems
- **Forestry and Biodiversity:** Tree planting, forest protection, reducing overgrazing
- **Transport and Infrastructure:** Stronger roads and bridges, early warning systems
- **Industry and Construction:** Climate-resilient building materials and energy-efficient processes

These sector-specific actions help reduce risks, protect livelihoods, and support long-term development.

4.6 Glacier Preservation Measures

Tajikistan's glaciers are critical for the country's water, food, and energy security. As they melt, new risks emerge.

Glacier preservation is considered a form of climate adaptation, though some activities also support mitigation by reducing emissions.

Key measures include:

- Monitoring glacier health using satellites and field research
- Reducing black carbon emissions from vehicles and stoves
- Reforesting mountain slopes to regulate temperature and reduce runoff
- Raising public awareness on the value of glaciers
- Supporting regional cooperation to manage shared water resources

Tajikistan context:

- Vanjyakh Glacier continues to shrink due to rising temperatures.
- In 2025, Tajikistan will host a global glacier conference in Dushanbe to promote awareness and solutions.

SECTION 5: MITIGATION AND MEASURES

5.1 What is Climate Mitigation?

Definition:
Mitigation means taking actions to reduce or prevent the release of greenhouse gases into the atmosphere. While adaptation helps people adjust to the effects of climate change, mitigation focuses on stopping it from getting worse.

Tajikistan context:

- Using solar and hydropower instead of coal
- Planting trees to absorb carbon dioxide
- Improving fuel efficiency and reducing waste

5.2 Why is Mitigation Important for Tajikistan?

Although Tajikistan produces very low greenhouse gas emissions compared to most countries, it is highly affected by climate change. Taking mitigation actions brings several local benefits:

- Cleaner air and water
- More reliable energy
- Stronger food systems
- A healthier and more sustainable economy
- Fulfillment of global commitments like the Paris Agreement

5.3 Key Climate Mitigation Strategies for Tajikistan

1. Expanding Renewable Energy

Tajikistan already relies on hydropower but can reduce risks by adding more diverse energy sources.

Solutions:

- Improve efficiency of existing hydroelectric plants
- Install solar panels and wind turbines
- Develop better energy storage systems

Example:

- Remote villages are using solar panels for heating and lighting during power outages.

2. Improving Energy Efficiency

Using less energy means fewer emissions and lower costs.

Solutions:

- Insulate homes and buildings
- Promote LED lights and energy-saving appliances

- Upgrade outdated machinery in factories

Example:

- Rural families are switching to energy-efficient stoves that use less wood and coal.

3. Reforestation and Ecosystem Protection

Forests absorb CO_2 and protect land from erosion and desertification.

Solutions:

- Plant more trees in urban and rural areas
- Prevent illegal logging
- Restore degraded lands

Example:

- Reforestation projects in GBAO and Rasht are helping to stabilize mountain slopes and absorb carbon.

4. Sustainable Agriculture and Livestock Management

Better farming practices can reduce emissions and improve food security.

Solutions:

- Use organic fertilizers instead of chemical ones
- Improve animal feed to reduce methane emissions
- Promote crop rotation and soil conservation

Example:

- Farmers in Sughd are experimenting with low-emission crop and livestock systems supported by local NGOs.

5. Waste Management and Pollution Reduction

Improved waste systems reduce methane and other emissions.

Solutions:

- Set up recycling and composting programs
- Use organic waste to create biogas
- Reduce open waste burning

Example:

- Some villages are building biogas digesters to convert animal waste into clean cooking fuel.

6. Cleaner Transport Options

Transportation is a growing source of emissions in Tajikistan.

Solutions:

- Promote electric and hybrid vehicles
- Improve public transport
- Design cities that support walking and cycling

Example:

- Dushanbe is exploring the use of electric buses to reduce traffic emissions.

5.4 Government Policies and International Commitments

Tajikistan is taking steps to reduce emissions and join global climate efforts.

Key commitments include:

- The **Paris Agreement** on climate change
- The **Nationally Determined Contributions (NDCs)** submitted to the UN
- The **National Climate Change Adaptation Strategy (2022–2030)**
- Participation in **regional cooperation on water and energy**

Example:

- Tajikistan is working with international partners to install renewable energy systems and improve forest management.

5.5 What Can Individuals and Communities Do?

Everyone has a role to play in reducing emissions and promoting greener lifestyles.

Actions include:

- Use energy-saving lights and appliances
- Walk, cycle, or use public transport when possible
- Reduce, reuse, and recycle materials
- Join local tree-planting campaigns
- Talk to others about climate-friendly choices

Example:

- Schools and community groups across the country are planting trees and promoting waste separation.

5.6 Summary of Mitigation Strategies for Tajikistan

- **Renewable energy:** Hydropower, solar, and wind
- **Energy efficiency:** Better insulation, lighting, and machinery
- **Reforestation:** Tree planting and land restoration
- **Sustainable agriculture:** Organic inputs and methane reduction
- **Waste management:** Recycling, composting, and biogas
- **Clean transport:** Public transit and electric vehicles
- **Community action:** Education, green choices, and local leadership

SECTION 6: ADDITIONAL KEY CLIMATE TERMS

This section includes important terms that help deepen understanding of climate change, especially in areas like disaster planning, governance, equity, and nature-based solutions. These terms are particularly useful for decision-makers, community leaders, and practitioners working in climate-sensitive sectors.

Disaster Risk Reduction (DRR)

Definition: Actions taken before, during, and after a hazard to reduce the potential damage caused by disasters such as floods, landslides, or droughts. DRR includes prevention, early warning, preparedness, and response planning.

Tajikistan example:

- In flood-prone districts, DRR includes building embankments and installing early warning systems for mudflows.

Carbon Footprint

Definition: The total amount of greenhouse gases (mainly CO_2) emitted by a person, organization, product, or activity. It is usually measured in tons of CO_2 equivalent.

Tajikistan example:

- Driving long distances in an old diesel vehicle or heating with coal in winter increases your household's carbon footprint.

Nationally Determined Contributions (NDCs)

Definition: The official national climate goals submitted by each country under the Paris Agreement. These outline how a country will reduce emissions and adapt to climate change.

Tajikistan example:

- Tajikistan's NDC includes plans for clean energy, reforestation, and improving resilience in water, agriculture, and health sectors.

Glacial Lake Outburst Flood (GLOF)

Definition: A sudden and powerful flood that occurs when a lake formed by melting glaciers bursts through its natural dam, often made of ice or rock.

Tajikistan example:

- Communities near the Pamirs are vulnerable to GLOFs due to the melting of high-altitude glaciers like Vanjyakh.

Climate-Smart Agriculture

Definition: Farming practices that increase productivity, help farmers adapt to climate impacts, and reduce greenhouse gas emissions.

Tajikistan example:

- Using drip irrigation, planting drought-tolerant crops, and rotating crops to maintain soil fertility are examples of climate-smart practices.

Ecosystem Services

Definition: The benefits people get from nature, such as clean air, water, fertile soil, pollination, and climate regulation.

Tajikistan example:

- Forests help store water, prevent erosion, and protect mountain communities from avalanches and floods.

Gender and Climate Change

Definition: Climate change affects women and men differently, often making existing inequalities worse. Supporting women's involvement in planning and response increases community resilience.

Tajikistan example:

- In rural areas, women often manage household water and food supplies and must adapt daily routines during droughts or floods.

Climate Migration

Definition: The movement of people caused by climate-related factors like drought, flood, or land degradation. This can be temporary or permanent.

Tajikistan example:

- Some families relocate during long droughts or after repeated floods in vulnerable valleys, especially in southern and eastern regions.