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Effects and Consequences of Climate Change on the Natural Conditions of Mirzachol District

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Abstract

This article examines the effects and consequences of climate change on the natural conditions of Mirzachol district. Through an in-depth analysis of climate data, ecological studies and socio-economic impacts, the study highlights significant changes in temperature, precipitation and extreme weather events in recent decades. These changes have led to changes in local ecosystems, agricultural productivity, and water resources, challenging the county's predominantly agricultural economy. The paper also discusses existing adaptation strategies and mitigation efforts and recommends additional measures to increase resilience to future climate change.

Keywords

Climate change, mirzachol district, natural conditions, temperature changes, precipitation regimes, ecosystem changes, agricultural productivity, water resources, adaptation strategies, mitigation efforts actions, global warming.

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Introduction

Global climate change refers to the continuous increase in average temperature and its impact on the Earth’s climate system. In a broader sense, climate change includes previous long-term changes in the Earth's climate. The current increase in global average temperature is primarily due to human burning of fossil fuels since the Industrial Revolution. The use of fossil fuels, deforestation, and some agricultural and industrial activities increase greenhouse gases (Abduljaleel et al., 2024). These gases absorb part of the heat emitted by the Sun’s rays after impacting the Earth’s atmosphere and warm the lower part of the atmosphere. The main “greenhouse gas” that causes global warming is carbon dioxide (CO), which has increased by about 50% during the Earth’s development.

Deserts are expanding, heat waves and forest fires are spreading as a result of climate change's increasing impact on the environment. Increased Arctic warming has led to melting permafrost, retreating glaciers, and declining sea ice. Higher temperatures are also causing more severe storms, droughts and other extreme weather changes. Climate change in mountains, coral reefs, and the Arctic is forcing many organic species to relocate or become extinct (Allen et al., 2018).

Climate change threatens people with floods, extremely hot temperatures, increased food and water shortages, more diseases and economic losses. Human migration and conflicts can also be its result (Sredić et al., 2024). The World Health Organization (WHO) declared climate change to be the greatest threat to global health in the 20th century. Adapting to climate change through efforts such as flood mitigation or drought-tolerant crops can partially reduce the risk of climate change.

Many of the impacts of climate change have been felt in recent years, with 2023 being the warmest year on record by +1.48°C (2.66°F) since regular monitoring began in 1850.

Literature Review

Climate change is a global phenomenon and has been increasingly recognized, scientifically, as one of the most important environmental challenges of the 21st century. This scientific community has documented impacts on various ecosystems due to climate change through the changes in temperature and precipitation patterns, and events of extreme weather (Allen et al., 2018). These climatic changes have wide ramifications, especially in economies depending totally on agriculture and natural resources, like that of the Mirzachol district.

Global warming, contributed mainly by the anthropogenic increase of greenhouse gases, more so carbon dioxide and methane, has been implicated in a number of environmental changes. The Intergovernmental Panel on Climate Change has continued to report on global rising temperatures, shrinking ice caps, and increasing sea levels, all of which further degrade natural habitats and agricultural productivity (Angin et al., 2020). Taking into the context of Central Asia, the changing climate manifests as the extremes of temperature and changing precipitation regimes in the district of Mirzachol.

As a district of the continental climate, Mirzachol has suffered quite dramatic changes in weather patterns during the last few decades (Dilorom et al., 2024). With the increase in frequency and intensity of heatwaves, droughts, and other extreme events, this influences water shortages and lowered agricultural yields (Nabeesab Mamdapur et al., 2019). The implication of these processes is that the threat to the regional food supply and economic stability becomes more real, with urgent adaptation and mitigation strategies being very much called for.

Although the bulk of studies have focused on the broader impacts on ecosystems and agriculture, such changes have received much attention with respect to food production and water resources (Bobir et al., 2024). With this, there is now an increasing need for local-level studies on the particular impacts of climate change on areas similar to Mirzachol (Khaydarova & Khujamova, 2024).

Adaptation strategies are mentioned in the literature to be related to a number of strategies, including drought-resistant crop variety development and efficient water management practices that will be able to handle and reduce the adverse impacts of climate change. At the same time, application of such strategies would require deep and profound awareness with regard to local climate dynamics and socio-economic factors causing vulnerability of the region to a changing climate.

Global Climate Change and Its Impacts

While the impact of climatic change is currently supported by a broad spectrum of evidence on a global basis, for the most part there is a need for regional studies such as that undertaken here for Mirzachol. This study is important in the development of focused ways of improving the resilience of local communities and ecosystems against sustained climatic variations.

Climate change is a long-term change in average weather patterns that determine Earth’s local, regional, and global climate. The observed changes in the Earth’s climate since the middle of the 20th century are associated with human activity, in particular, the burning of fossil fuels, which increased the level of greenhouse gases that trap heat in the Earth’s atmosphere and the average temperature of the Earth’s surface. Natural processes related to human activity can also contribute to climate change. These include internal variability (eg, cyclical ocean movements such as El Niño, La Niña, and the Pacific Decadal Oscillation) and external influences (eg, volcanic activity, solar energy changes, changes in the Earth’s orbit).

Climate data records key indicators of climate change, such as global land and ocean warming; sea level rise; Loss of ice at the Earth’s poles and mountain glaciers; changes in the frequency of extreme weather such as hurricanes, heat waves, wildfires, droughts, floods and precipitation; including changes in cloud and vegetation cover (Masson-Delmotte et al., 2021).

“Climate change” and “global warming” are often used interchangeably, but have separate meanings.

Global warming is the long-term warming of the Earth’s surface observed in the pre-industrial era (between 1850 and 1900) due to human activity, primarily the burning of fossil fuels, which increases the level of heat-trapping greenhouse gases in the Earth’s atmosphere. This term is not interchangeable with the term “climate change”.

Global warming is caused by the greenhouse effect, which occurs when infrared radiation passes through the Earth’s atmosphere to the Earth’s surface, and is then returned to the Earth’s surface by greenhouse gases collected in the troposphere 10-15 km above the Earth. Increased infrared radiation increases the temperature of the earth’s surface. The annual average global temperature has increased from 14.5°C in 1886, when records began, to 15.4°C in 2005. The hottest year on record was 2006, and 11 of the last 12 years have broken global average temperature records. In addition, warming around the Earth’s poles has exceeded the average increase (Ritchie, 2020).

Anthropogenic Contributions to Climate Change

Greenhouse gases are mainly CO_2 and methane. CO_2 is the main greenhouse gas that accumulates in the troposphere and has a lifetime of about 400 years. Real-time measurements of CO_2 atop Hawaii's Mauna Loa show a rise from 315 ppm in 1959 to 383 ppm in 2007. In contrast, Antarctic ice cores show that CO_2 levels have ranged from 200 to 280 ppm over the past 400,000 years. Although methane is a smaller component of the greenhouse gas than CO_2, it has 20 times the greenhouse warming effect of CO_2. Methane measurements now exceed 1,700 ppb, while ice core measurements indicate methane was around 400 to 700 ppb.

In its fourth report, the International Panel on Climate Change concluded that global warming is indisputable and that human activity is the main driving force behind the rise in temperatures since 1950. Every year more than 27 billion tons of CO_2 are released into the atmosphere as a result of fuel combustion for electricity generation (coal) and transportation (gasoline and diesel fuel). That's about the same amount of CO_2 as other air pollutants, including $PM_{2.5}$ and ozone (Sh et al., 2020).

In 1827, the French physicist Jean-Baptiste Joseph Fourier proposed the theory of the greenhouse effect. He called "greenhouse gases" the fact that water vapor, carbon dioxide, methane, and ozone trap heat from the sun in the atmosphere.

In 1859, the English physicist John Tyndell confirmed the existence of the greenhouse effect using laboratory experiments and put forward the idea that changes in the concentration of gases in the atmosphere can change the climate.

In 1896, the Swedish scientist, Nobel laureate Svante Arrhenius, proposed that the accumulation of CO_2 in the atmosphere contributes to the increase in average temperature, and calculated that if it doubles, the average temperature on the Earth's surface will rise by 5 degrees Celsius. came out In addition, Arrhenius found that the decrease in the concentration of CO_2 in the atmosphere was one of the causes of the Ice Age (Mukhamajanovich et al., 2020).

However, all these theories were not supported. Most of the scientists of that time believed that climate change is happening very slowly and humans cannot influence it.

In 1938, British meteorologist Guy Callendar analyzed data from 147 weather stations since the mid-19th century and found that the global temperature had increased by 0.3 degrees in the past 50 years. He proved that one of the main causes of climate warming is human activity, in particular, the increase in the release of gases into the atmosphere that cause the greenhouse effect.

In 1950, after the American physicist Gilbert Plass published a series of articles on the relationship between warming and human activity, many scientists became interested in the problem of climate change. In 1958, American meteorologist Charles Killing began measuring atmospheric CO_2 at the Mauna Loa Observatory in Hawaii. During his experiments, he proved that the concentration of CO_2 is increasing at the same time as the average annual temperature. These data were the first scientific confirmation of the contribution of anthropogenic influence to modern climate change. Measurements collected by the observatory show a steady increase in the average concentration of CO_2 in the atmosphere from 0.0315% in 1958 to 0.0403% in May 2015. However, scientists assumed that this result was due to seasonal changes, and Killing's findings did not attract much attention.

In the 1960s, the existence of the problem of climate change and the possibility of human influence on it were recognized by several scientific organizations of the United States (National Science Foundation

(1963), the Committee of Scientific Advisers of the President of the United States (1965) and the National Academy of Sciences (1966)). In 1967, the first scientific model for calculating the "greenhouse effect" was created. At the same time, the first alarming forecasts about the prospects of global warming appeared. In 1968, for the first time, it was predicted that the Antarctic ice could melt and have catastrophic consequences. In the 1970s, the environmental movement began to develop actively. Nature protection organizations began to seriously influence the formation of public opinion under their pressure in North America and Western Europe, and the authorities began to pay more attention to environmental problems, including the problem of climate change.

In 1972, an international conference on environmental protection was held in Stockholm. It includes environmental issues. climate change was discussed at the global level for the first time. At the same time, the first document in the field of environmental protection was adopted.

In 1975, American scientist Wallace Brocker published an article in the journal Science in which the term “global warming” was used for the first time. This term gradually replaced the phrase “climate change” and entered scientific circulation. It became a scientific term in July 1988 after a widely publicized speech by NASA climatologist James Hansen before the US Senate.

In 1988, the Intergovernmental Panel on Climate Change (IPCC; established jointly with the World Meteorological Organization and the United Nations Environment Program) to discuss the problem of warming at the international level and to discuss the scientific, technical and social climate was created to evaluate economic data. In 1990, this organization published the first report on the state of the environment. In it, the release of greenhouse gases into the atmosphere will cause the earth’s surface to overheat, and if the current rate of warming continues, the planet will experience temperatures never known to mankind within half a century.

In 1989, British Prime Minister Margaret Thatcher said in her speech at the UN: “...we are witnessing the release of so much CO_2 into the atmosphere that the changes that await us in the future will be far more fundamental and far greater than we have ever imagined. has a broader character” [https://www.margaretthatcher.org/document/107817]

By the early 1990s. The scientific community has generally formed the opinion that global warming on Earth is associated with an increase in the concentration of “greenhouse” gases in the atmosphere, primarily carbon dioxide, as well as methane, water vapor, nitrogen oxides, freons, etc.

The objections of the opponents of this theory are explained by the fact that periods of climate warming have occurred several times in the history of the Earth. In addition, the past 30 years have seen global warming in some regions and global cooling in others. According to some scientists, the main environmental problem of our planet may be caused by the reduction of forest area and irreversible climate change, not more greenhouse gases, but the disruption of the global moisture and heat transfer mechanism. Geographical theories explain the long-term changes in climate by the movement of the earth’s crust, changes in the location of continents and oceans (Yusubov et al., 2021).

In 2014, greenhouse gas emissions reached record levels. Between January and September 2015, according to the UK Met Office, the Earth's average temperature was 1.02 degrees Celsius above the annual average from 1850 to 1900.

According to the expert community, an increase in the average global temperature of two degrees above pre-industrial levels will have irreversible consequences for people and ecosystems. In general, the

global climate is expected to become wetter. In the 21st century, the sea level will rise up to 1 m (in the 20th century - 0.1-0.2 m). There are predictions of 30-40% loss of plant and animal species. Because their habitats are changing faster than they can adapt to these changes. The species composition of forests also changes, and intensive melting of glaciers begins. Desalination of the ocean due to melting ice causes changes in the Gulf Stream. In addition, the frequency and intensity of abnormal events such as extreme winds and heat waves, tsunamis and floods will increase. Thus, global warming will cause changes with serious negative consequences for all mankind and accelerate climate change (Khaydarova & Khujamova, 2024).

On May 27, 2021, the World Meteorological Organization (WMO), citing the Global Climate Bulletin prepared by the UK Met Office, stated that there is a 90% chance of at least one year being the warmest on record in the next 5 years (2021-2025) and 2016 has published a press release that is reported to be out of the number one spot.

It is estimated that the average annual global temperature could be 0.9-1.8°C higher than pre-industrial levels in each of the next five years.

In fact, recent assessments by international experts in the field of climate change show that the long-term trend towards climate change is increasing.

In the report of the World Meteorological Organization entitled “State of the Global Climate in 2020”, the ten years from 2011 to 2020 and the six years from 2015 to 2020 were named as the warmest periods in the history of observation.

2020 was one of the hottest three years on average for the planet in the history of meteorological observation. It tied for the top spot with 2016 and 2019 for the world’s average warmest year.

So, for the territory of Uzbekistan in 2020, the record of temperature indicators, like in other countries of the world, was not set. A large part of the territory of the republic was not even included in the ten warmest years. Compared to the norm for an average year, the hottest region of Uzbekistan was the north-western districts - the Republic of Karakalpakstan. In the ordered series of observations (from the warmest to the coldest year), the agricultural zone of Karakalpakstan was the Top-10 year 2020, the Ustyurt plateau was the Top-5 warmest year, and the Aral Sea was the warmest year for the entire observation series in 2020.

The UK Met Office estimate is likely to differ slightly from the global estimate at a regional level, but this does not distort the long-term warming trend.

“The period of global warming is over, the period of global boiling has entered,” UN Secretary General Antonio Guterres said. As a result of meteorological observations, July 2023 was the hottest month in the history of observations. Three warmest weeks and three warmest days were recorded this month.

According to the VMO and Copernicus, July recorded the hottest three-week period and three hottest days on record, July 5, 6 and 7.

In the first 23 days of July, the average temperature on the planet was 16.95 degrees Celsius. This is well above the 16.63 degrees Celsius recorded in July 2019, the hottest month on record to date.

Carlo Buontempo, director of Copernicus, said that this year's July temperatures were a sharp contrast to weather records since the 1940s and were "unprecedented in our history over the last thousand years and even in the last hundred thousand years".

These temperatures will cause extreme heat waves in North America, Europe and Asia, as well as wildfires in Canada and Greece, the statement said.

"Record temperatures are part of a global warming trend. Anthropogenic emissions are the main reason for the rise in temperature," says Carlo Buontempo, director of the Copernicus Climate Change Organization.

Earlier, the World Weather Attribution (WWA) team of scientists also concluded that anthropogenic climate change played a major role in the extreme heat that swept North America, Europe and Asia in July.

"If there were no human influence on the climate, the conditions for such a rise in global temperature would be very small," the study says.

According to the analysis of WWA (World Weather Information), greenhouse gas emissions caused an increase in air temperature in Europe by 2.5 degrees, in North America by 2 degrees, and in China by 1 degree.

Another factor causing the increase in temperature is the onset of the El Nino natural phenomenon, characterized by an abnormal increase in temperature in the eastern part of the Pacific Ocean.

Anthropogenic and natural factors combine to make the next five years the warmest on record with a 98 percent chance.

"Humanity is at risk," Guterres said at a July 28 press conference. "It's been a brutal summer for North America, Asia, Africa and large parts of Europe. This is a disaster for the entire planet. It is clear that people are to blame for scientists."

"What is happening is fully consistent with the predictions and repeated warnings. Only the speed of change was surprising... The era of global warming is over; the period of global boiling has entered," he added. The beginning of the summer of 2023 was very hot even for the climate of Central Asia, the Uzgidromet Service Agency reports.

The heat began at the beginning of the month and lasted almost until the end of the second ten days. During this period, the average air temperature on the territory of Mirzachol district was 3-5 degrees higher than the average long-term values.

On the hottest days of the first and second ten days, the air warms from $+39^0$ to $+42^0$ degrees C, and in the far south of the republic from $+43^0$ degrees to $+45^0$ degrees.

Forecasters say that such temperature values in June are not rare. For all years of meteorological observations, the absolute maximum temperature in June is $+42^0$C to $+44^0$C, in desert areas and in the south $+45^0$C to $+48^0$C.

But in Mirzachol district, the beginning of the summer month, which is observed with a temperature higher than the norm, is almost rarely observed, reports Uzgidromet.

In the third ten days of June, a series of cool air inflows from the Caucasus was observed in the Mirzachol district, which lowered the temperature background. In most of the region, the average temperature of the third ten days was 1-2^0 degrees below the norm, in some places it was around the norm.

During this period, daytime air temperature decreased from +33^0C to +38^0C, and in the middle of ten days from +28^0C to +30^0C. Even in the most extreme southern regions, the temperature drops from +35^0 C to +37^0 C.

In general, June was 2-3^0 C above normal, and in the north it was around normal. The average temperature in June 2023 was 0.4 degrees higher than in June 2021.

The Syrdarya region, located in the Mirzachol district, is open on all sides, and only the southern parts are surrounded by the Turkestan and Nurota mountain ranges. Because of this, the climatic conditions of the region have their own characteristics. In winter, cold air masses from the north enter the plain without any obstacles, and in summer, thermal depression prevails. The average annual temperature is +12.5°C in the north (Syrdarya city), +15.1°C in the south (Ursatevsky station - Khovos town). The average July temperature is +26 - +27°C in the north and +30°C in the south. The average temperature in January is−3 - 4°C in the north, and 0.8–1.1°C in the south. Atmospheric precipitation averages 252-363 mm in the country, less than 200 mm in the north-west, 200-300 mm in the central part, and more than 300 mm in the southern foothills. Precipitation falls mostly in spring (40%) and winter (25-35%). The wind movement in Syrdarya is different: northerly winds prevail in the northern part (45%, average speed 1.8-2.9 m/sec), southeast winds prevail in the southeast (average speed 20 m/sec, maximum 46 m/sec). But in the GIS technology analysis of Syrdarya region, the main wind direction comes from the southeast part of the local winds. Their annual speed is from 4.55 m/sec to 2.55 m/sec in the southeastern part, from 2.33 m/sec to 3.57 m/sec in the central part, in the south-west and west 2, From 52 m/s to 3.3 m/s, in the north-east and north it varies from 2.04 to 2.24 m/s to 2.16 to 2.54 m/s.

According to its climate, Syrdarya region is located in the extra-continental climate region of the northern temperate climate region. Therefore, its climate is hot and dry in summer and cold and relatively dry in winter. Despite the fact that the area of Syrdarya region is relatively small and there are few changes in the relief, there are differences in climatic characteristics. In order to highlight the main differences in the atmosphere, according to the laws of geographical latitude, the complete data of last 5 years of the hydrometeorological station of Sirdarya in the north, the hydrometeorological station of Gulistan in the center, and the meteorological station of Yangiyer in the south, as well as the main data from 1938 to 2023, statistical analysis, cosmographic, studied using cartographic, GIS, interpolation methods.

The City of Syrdarya is located in the northern part of the Syrdarya region at 40.81°N, 68.68°E on an alluvial plain at an altitude of 264 m above sea level. The climate is temperate - extracontinental. Summers are hot and dry, winters are cold and relatively dry. Therefore, the 4 seasons of the year are clearly shown. The annual amount of atmospheric precipitation is 300-330 mm. Most of the precipitation falls in spring (38%) and winter (40%). The least amount of rain falls in summer (4%). The most annual rainfall in the Syrdarya region was 688 mm in 1969, and 206 mm in March in 2022. The minimum annual precipitation is 84 mm in 1982, and the minimum monthly precipitation is 0 mm in July 1938-1939.

The average annual air temperature is +14.1 - +15.7 °C. The highest annual temperature in Syrdarya region was +15.8 °C in 2016, while the lowest annual temperature was +11 °C in 1972. Differences in average air temperature are also large between months. Since 2015, the average air temperature of July, the hottest month, has increased from +28.7 °C to +30.2 °C in 2019 and +29.1 °C in 2022. During the periods, there are a few years when these months exceeded +28 °C (1944, 1983, 1997, 1998, 2000, 2005, 2007-2009, 2011-2013, 2015-2022). The coldest temperature is observed in January, the average monthly air temperature is 0 - + 5 °C. But in some years, as a result of the influence of cold air masses from the north through the Voyeykov axis, the air temperature covers the region at a negative level for several days. For example, in January 1957 - 6.9 °C, in 1969 - 10.0 °C, in 1971-1972 -6.6 - -6.8 °C, in 1977 -8.0 °C, -10.2 °C in 2008 and -6.6 °C in 2023 were observed. There are also big differences in the temperature of the summer air within months, which also determines the unique climate of the Syrdarya region. The highest daily air temperature was +43.9 °C in July in 2005, but +44.6 °C in June in 1988. The coldest daily air temperature was -23.5°C in January 1984, -27.2°C in January 2023, and -29°C in February 1974 (see Figure 1).

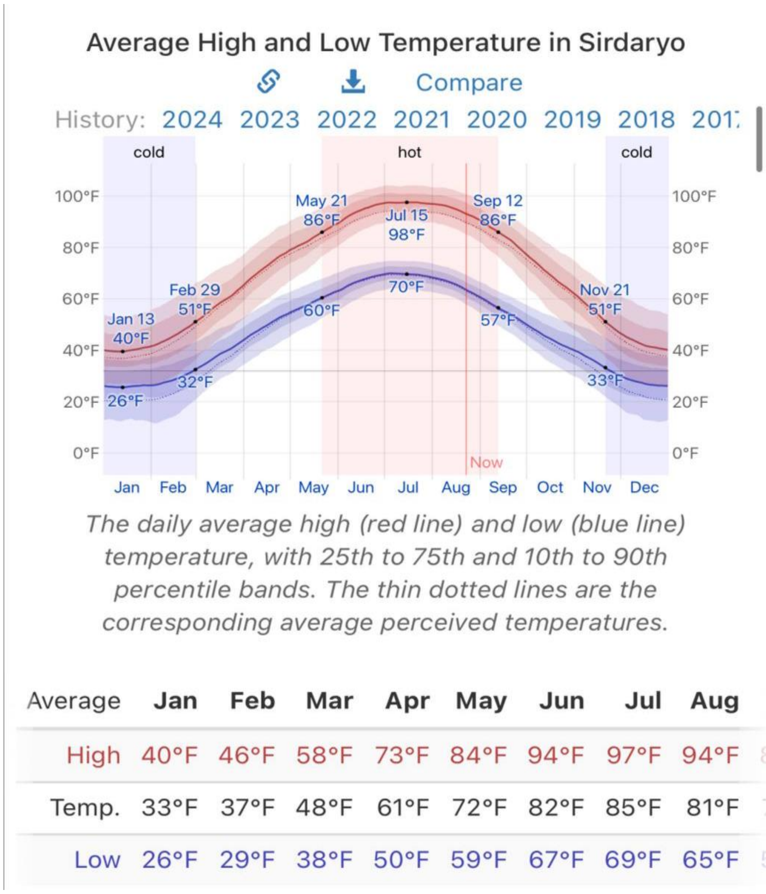


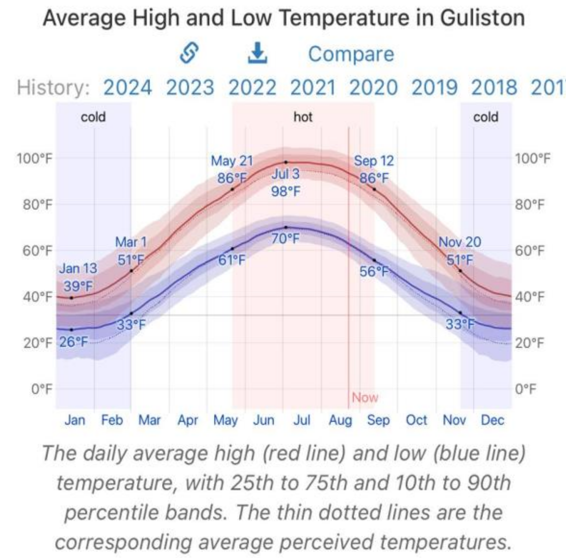
Figure 1. Linear climate (temperature) diagram of the city of Syrdarya in 2015-2022.

https://ru.weatherspark.com/ - taken from the international climate website in its original form.

The city of Gulistan is located in the central part of Syrdarya region at 40.49°N, 68.78°E on a plain at an altitude of 273 m above sea level. The climate is temperate continental. The climate of Gulistan is hotter and drier than the rest of the region. The main reason for this is the relief, the proximity of the groundwater level to the earth's surface and the salinity, as well as the anthropogenic factor, which means that the demographic capacity has doubled in a short period of time. Summers in Gulistan are hot, dry and clear, and winters are very cold, snowy, and sometimes cloudy.

Temperatures typically range from -4 °C to +37 °C throughout the year and rarely fall below -11 °C or above +40 °C. The hot season lasts 3.7 months, from May 22 to September 13, with a maximum average daily temperature above +30°C. July is the hottest month of the year in Gulistan, with an average temperature of +37°C and a minimum of +21°C. The cold season lasts 3.4 months, from November 21 to

March 2, the minimum average daily temperature is below +11°C. The coldest month of the year in Gulistan is January, with average cold temperatures of maximum -3 °C and minimum +4 °C (see Figure 2).



Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
High	40°F	45°F	58°F	73°F	85°F	95°F	98°F	95°F
Temp.	33°F	37°F	48°F	61°F	72°F	82°F	85°F	81°F
Low	26°F	29°F	38°F	50°F	59°F	67°F	69°F	65°F

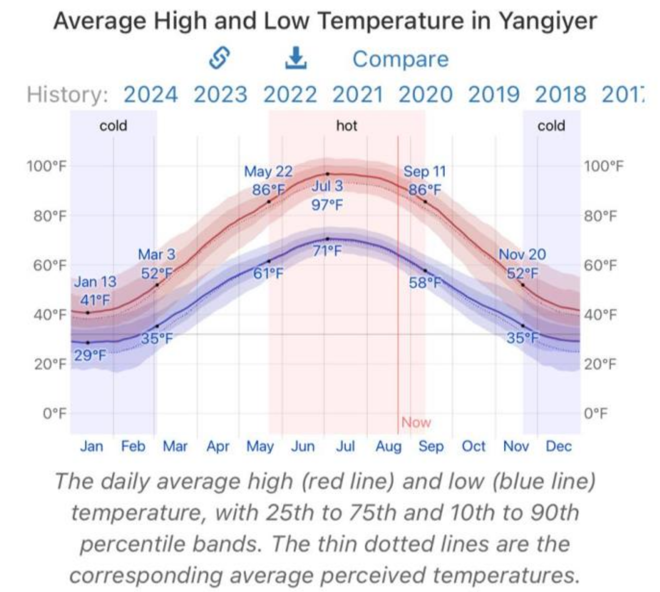
Figure 2. Linear climate (temperature) diagram of Gulistan city in 2015-2022.
https://ru.weatherspark.com/ - taken from the international climate website in its original form

The annual amount of atmospheric precipitation is 162.5 - 220 mm. The main part of precipitation falls in spring (46%) and winter (26%). The rainy season lasts 7 months from October 28 to May 27, and the daily humidity during this period is more than 11%. The drier season lasts 5.0 months, from May 27 to October 28. The least amount of rain falls in summer (7%). The open and clear part of the year in Gulistan lasts 5.0 months from May 18 to October 17. The clearest month of the year in Gulistan is August, during which the sky is moderately clear, 97% of the time is clear or partly cloudy. The cloudy part of the year is observed for 7.0 months from October 17 to May 18. The cloudiest month of the year in Gulistan is January, with an average of 62% or more (Odilov & Madraimov, 2024).

The city of Yangiyer is located in the alluvial plain at 40.22°N, 68.83°E in the southern part of the Syrdarya region at an altitude of 317 m above sea level. The climate is temperate-extracontinental**.** Summers in New York are hot, dry, and clear, and winters are very cold, snowy, and sometimes cloudy. Temperatures typically range from -2°C to +36°C throughout the year and rarely fall below -9°C or above +40°C. Therefore, the 4 seasons of the year are clearly shown. The hot season lasts 3.7 months, from May 23 to September 12, with a maximum average daily temperature above +30°C. The hottest month of the year in New York is July, with an average temperature of +36 °C and a minimum of +21 °C (see Figure 3).

The cold season lasts 3.5 months from November 21 to March 4, with minimum average daily temperatures below +11 °C. The coldest month of the year in New York is January, the average cold temperature is maximum -2°C, minimum +5°C.

The annual amount of atmospheric precipitation is 336.4-350 mm. The main part of precipitation falls on spring (26%) and winter (53.2%). The least amount of rain falls in summer (3%). The open and clear part of the year in New York lasts 5.0 months from May 18 to October 18. The clearest month of the year in New York is August, when the sky is mostly clear or 98% clear. The cloudy part of the year lasts for 7.0 months from October 18 to May 18. The cloudiest month of the year in New York is February, when the sky is moderately cloudy (59%) (Sh et al., 2020).



Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
High	41°F	46°F	58°F	72°F	84°F	94°F	97°F	93°F
Temp.	35°F	38°F	49°F	62°F	72°F	82°F	84°F	81°F
Low	29°F	31°F	40°F	51°F	60°F	68°F	70°F	66°F

Figure 3. Linear climate (temperature) diagram of the city of Yangi, 2015-2022.
https://ru.weatherspark.com/ – taken from the international climate website in its original form.

The Need for Localized Climate Studies

Taking into account the fact that the terrain of Syrdarya region lies on a relatively flat alluvial and proluvial plain and slopes from the south to the foothills to the north, its climate (air temperature and precipitation) was analyzed in the geographical latitude factor of 68° meridian, based on the data of 3 observational meteorological stations. According to the results of this analysis, in the northernmost city of Syrdaryo region, the average annual air temperature is +14.1 - +15.7 °C, the amount of precipitation and its distribution by season is 300-330 mm, the majority of the main precipitation is in winter (53.2 %) and spring (26 %) seasons. In the central part of the Syrdarya region, in the city of Gulistan, located 40 km south of the city of Syrdarya, the average annual air temperature is +14.8 - +21 °C, the amount of precipitation and its distribution by seasons is 162.5 - 220 mm, the majority of the main precipitation is on the contrary, it rained in spring (46%) and winter (26%) seasons. In the southernmost part of Syrdarya region, 24 km south of the city of Gulistan, Yangiyer has an average annual air temperature of +15.3-+20.9 °C, the amount of precipitation and its distribution by season is 336.4-350 mm, the most of the main precipitation. part of it rained in winter (53.2%) and spring (26%). As a result of the analysis of the data obtained as a result of long-term monitoring of the weather at hydrometeorological stations in 3 spheres of Syrdaryo region, the distances of which do not differ much (Syrdarya - Guliston 40 km, Guliston - Yangiyern 24 km) In the case of New York cities, the influence of annual air temperature dominance) is increasing. As a result, local human-induced geoecological problems in cities contribute to global geoecological problems such as global climate change.

Conclusion

The presented study on the effects and consequences of climate change in the Mirzachol district underlines the critical challenges due to the rise in temperature, changes in precipitation patterns, and escalation in extreme events. It has influenced, and continues to influence, local ecosystems, agricultural productivity, and water resources at the heart of the regional economy, comprised mostly of agriculture.

The findings have underlined, with a great deal of effectiveness, an urgent requirement of adaptation and mitigation strategies considering special climatic and socio-economic conditions of Mirzachol. In this respect, drought-resistant crops should be elaborated, water management should be optimized, taking into account sustainable agricultural practices that may contribute to enhancing the resilience against climate change in this region.

Moreover, the research emphasizes the importance of localized studies in understanding and addressing the specific impacts of climate change. While global trends provide a broad framework, regional studies like this are important in order to come up with specific solutions which could protect livelihoods of communities directly affected by climate variability.

Mirzachol exhibits high vulnerability to ongoing climate changes, yet such processes may be adapted, considering respective strategies and actions with the purpose of preserving a sustainable future.

Author Contributions

All Authors contributed equally.

Conflict of Interest

The authors declared that no conflict of interest.

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