



An analytical study of the climatic elements in Bazian region - Sulaymaniyah for the period from 1985 - 2022 and its impact on the planting dates of some crops

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Abstract

During a field study in Bazian Plain which is one of the most important agricultural areas in Sulaymaniyah it became clear that current scenario is linked to rapid climate change directly. Arid and semi-arid ecosystems are likely to be particularly affected by changes in wind speed and vapour pressure regimes, changes in those regimes may show from climate data that vapour pressure has clearly increased during these years. For instance, in January and February of 2017 wind speed reached 8 and 9 (m. sec.⁻¹). Sulaymaniyah Meteorology Department reported a lesser speed of 0.1 (m. sec.⁻¹) in the months 4, 5, 6 and 9, on average the greatest rates of 3.1 and 2.2 (m. sec.⁻¹) in 1985 and 1992. on the other hand, in 1991 recorded the lowest rate of (1 m. sec.⁻¹) amounts and times of precipitation during the study years, floods occurred in some seasons the dry seasons less than 300 (ml) were very few, while the remaining seasons were more than 450 (ml) rainfall amounts in the seasons 2006-2007, 2007-2008 and 2008-2009 were among the driest seasons during the years of the study Which was straight (66000, 87000, 86000) dunam. as the agricultural areas were reduced to their lowest levels, although the levels of precipitation were acceptable. The data gathered found that the average annual temperature rate has increased by over 1.3(°C) with the warmest year for this time being recorded in 2010 at 21.55(°C). Sunshine was the lowest in terms of the number of daylight hours in December with total annual averages for the period 1985-2022 for December being 184.4 (hours) 1996 was the lowest with 2.3 (hr.) and 2018 was also the second lowest with a value of 3.3 (hr.) During the decades of the study period, wheat growing seasons advanced mostly to November, and in recent decades (2011-2020) (2010-2009) 20 farmers plant in December to ensure rainfall.

Key words: climate change, precipitation, temperature, wind, vapour pressure

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Introduction

The earth has not uniformly experienced warming but the rising trend in the global average temperature indicates that more places are warming than cooling the combined land and ocean temperature has risen at an average rate of 0.08 (°C) per decade since 1880, according to [1] Annual Climate Report; the average rate of increase since 1981 has been more than twice as fast 0.18 (°C) per decade. The quantity of carbon dioxide and other greenhouse gases release over the next several decades will determine how much warming Earth will experience in the future. Today the combustion of fossil fuels and the removal of forests contribute more than 11 billion metric tons of carbon annually to the atmosphere, which is roughly comparable to about 40 billion metric tons of carbon dioxide. The amount of carbon in the atmosphere exceeds what can be eliminated by natural processes causing an annual rise in carbon dioxide, although many climate models are expecting future global warming there is less scientific agreement over how to forecast how these changes would affect weather and consequently precipitation. Heavy precipitation is predicted to increase in warmer climates leading to fewer but more severe events. Longer droughts and an increased risk of flooding might arise from this Any effects of climate change on regional precipitation have so far proven unable to differentiate from normal variations. However, in some particular circumstances, a signal started to emerge [2].

In a study by [3] for 79 seasons they showed that the amounts of precipitation that exceeded the risk of drought which ranged between 400 and 650 mm, were for 70 seasons, and only 9 seasons in which the amounts of precipitation reached less than 400 mm.

The results showed that the proportion of different rainfall events, as well as associated annual and annual rainfall, are spatially and regionally diverse in the Kurdistan Region/Iraq, with the northeast seeing the most rainfall and the south experiencing the lowest rainfall. Unsurprisingly, it was shown via seasonal study that there was a positive correlation between

regional rainfall and agricultural productivity. This link demonstrates the prevalence of rain-fed agriculture in the area [5].

[4] reported, primary method through which carbon is taken from an ecosystem is through ecosystem respiration (Re), one of the key fluxes in terrestrial ecosystems and the atmospheric carbon cycle Re has thus attracted a lot of interest since it has a significant impact on the carbon matter and energy balance of ecosystems. Re is a better indicator of the variation in carbon sink flow observation points than Gross Ecosystem Production. [5] In light of this, Re's dynamic patterns and its reaction to external influences have been as a result, extensive study has been done in recent years on Re's dynamic patterns and how it reacts to external influences. The monthly total change of Re and seasonal dynamics are influenced by factors such as air temperature, relative air humidity, soil temperature, soil moisture content, plant aboveground biomass, aboveground respiration, and groundwater level, according to numerous studies However, different regions respond differently to these factors.

[6] reported, it will be appropriate and helpful for researchers who are interested in reducing the impact of climate change on any ecosystem and in gathering the data necessary to achieve such a goal. For all forms of plants in ecosystems, wind is essential for the transportation of precipitation. Arid and semi-arid ecosystems are anticipated to be most strongly impacted by changes in wind speed and vapour pressure systems, which may represent past regime changes since, according to climatology data, the vapour pressure increased noticeably over these years. Climate change statistics from the past ten years show that winds and vapour pressure are seasonal. Future climates may change the timing, variability, and severity of these effects. Sunstroke occurs when a region of the earth's surface is exposed to direct sunlight in a way that causes the things around to cast shadows. The sun's sunlight must then exceed 120 watts per square meter of surface, which establishes a

threshold. The primary climatic parameters that have the greatest impact on agricultural productivity, according to this rule are solar radiation, temperature and water. From this degree of sunshine there is sunshine, solar radiation, temperature and water. To ensure that planting harvesting, and all other plant-related activities are carried out as efficiently as possible, the length of sunshine must be measured and taken into consideration. The light is a crucial component of what plants require to flourish. Although not every one of them need sunshine exposure, the great majority cannot thrive without it. [7] reported Although the Sun can have an impact on Earth's climate, it is not to blame for the recent warming trend. The Sun helps maintain the globe warm enough so that we may exist. It is a source of life. We are aware that the occurrence and disappearance of the ice ages are caused by minute variations in Earth's orbit around the Sun. However, the warming we've observed in recent years is too quick to be explained by variations in Earth's orbit, and it's also too significant to be the result of solar activity. Looking at the quantity of solar radiation that strikes the top of the atmosphere is one of the "smoking guns" that proves the Sun is not the cause of global warming. The quantity of solar energy reaching our globe has not increased, according to data collected since 1978 by scientists using sensors aboard satellites. The fact that we would anticipate to observe warming in all levels of the atmosphere, from the surface to the high atmosphere (stratosphere), if the Sun were the cause of global warming is a second smoking gun. In reality, however, we observe cooling in the stratosphere and warming at the Earth. This is consistent with the idea that the warming is brought on by an accumulation of gases that trap heat close to the Earth's surface rather than by the Sun becoming "hotter" [8].

Location study

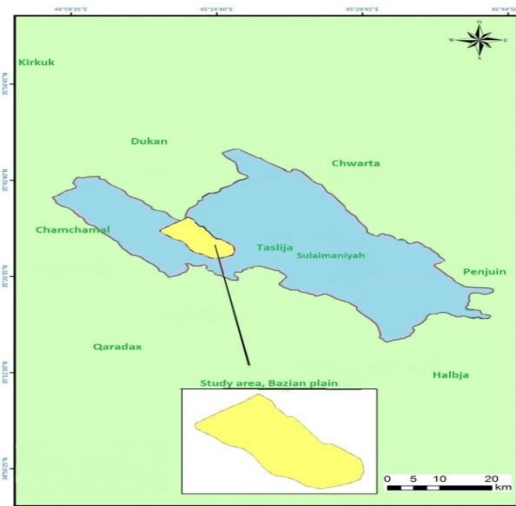


Figure (1) location study in Sulaymaniyah

Northern Iraq contains the province of Sulaymaniyah. It stands apart due of the general its surface's look. It is steep, surrounded by little plains and valleys. The city is located 850 meters above sea level at $35^{\circ}33'26''N$ $45^{\circ}26'08''E$. level Many hills that go from north to south around Sulaymaniyah. The ground in Sulaymaniyah slopes about 3.5%. The northern end of the city rises to 800 meters above sea level., and the southern end reaches 885 meters. The city's climate may be categorized as temperate or as having a Mediterranean climate. a mountain. based on studies on climatic classifications and specialists in this area. Its most significant climatic characteristics included the typical 18.74 ($^{\circ}C$) on a yearly basis The rainy season is mostly in spring and winter and the major winds are northeast and typically fairly rapid. 2018 had an increase in yearly rainfall, totaling 1273.80 mm. The Sulaymaniyah station receives an average of 989.4 kcal/cm² of solar radiation every day. It is possible to say that sun radiation is regulated in the northern area in general and in Sulaymaniyah in particular due to the dense clouds and relative humidity. In the northern region, there is a daily vertical radiation rate of $5-6$ kWh/m², while in the center and southern areas, it is $6-6.5$ kWh/m². Since it occupies more than half of the land area in the research

area, wheat is by far the most important crop there. [9].

Data and methodology

In this paper, the research materials used are the source of the data coming from the Directorate of Meteorology and Seismic Monitoring and the Directorate of Agricultural Research in Sulaymaniyah Governorate. The obtained results were used for comparison. The statistical tests conducted on the series of rainfall amounts, temperatures, wind speed and Water vapor pressure in the atmospheric air and the duration of sunshine, the totals for the time period 1985-2022 were analyzed and their variables analyzed. [10]

Results and Discussion

1- Influence of Rainfall on Bazian Ecosystem

The results may be surprising: when rainfall increases in the long term, the soil transforms and one of the most obvious results is that it absorbs less water, as the increase in precipitation transforms the structure of the soil: the more water, the thicker the roots of plants, and the more they become the “pores” that allow the soil to absorb water are blocked and water passes through the surface. No

serious changes were observed in the amounts of precipitation in the province of Sulaymaniyah and the Bazian region in particular, but it seems that the dates of rainfall are the ones in which clear changes occurred, as the farmers who were planting in the ninth month in the years 1950, but in the years after 2003, the farmers began to plant in the month of November. It is noted in Table (1) showed first decade of research or the decade of the forties (1941-1950) the amounts of rain were less than the rest of the years and decades. However, in this decade, farmers were planting wheat in the ninth month due to the appropriate amounts of rain for cultivation in some seasons of this decade until Some seasons of the fifties were suitable for agriculture in the ninth month, but after that it was necessary for the farmers to plant the wheat crop in the tenth month because of the change in the timing of rainfall in the appropriate amounts for planting the wheat crop. And the sixth, in addition to the seventh, the average amounts of precipitation increased to similar levels. As for the eighth decade (2011-2020) the average amounts of precipitation increased to higher levels, reaching 850 (mm) [11].

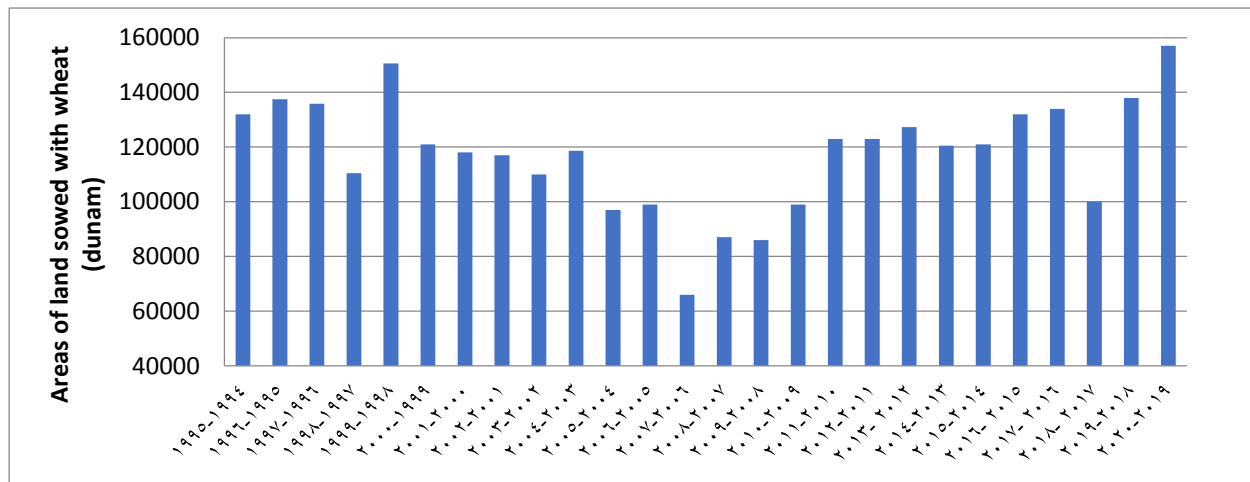


Figure (2) The impact of climate change on the areas of cultivated wheat for the years 1995 to 2020 (Source, Sulaymaniyah Meteorology Department).

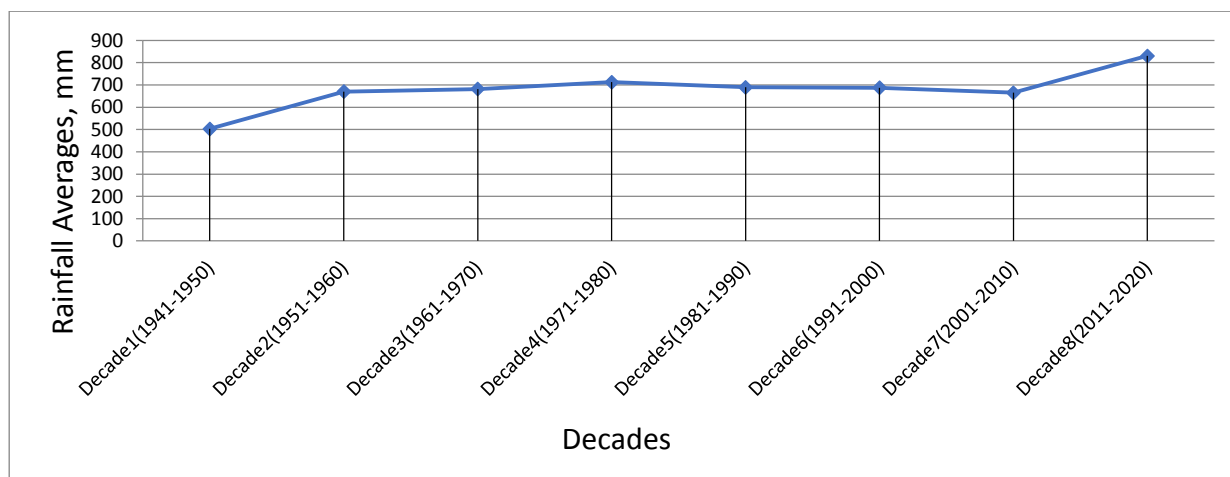


Figure (3) Precipitation averages (mm) for each decade of the year (Source, Sulaymaniyah Meteorology Department).

Soils are directly affected by emergency climatic changes in the amount of precipitation and their periods as they are directly related to the atmosphere. Soil changes resulting from climate change take a long time. but they greatly affected on the areas that sowed with wheat, Figure (2)

Threat to food security:

As a result of the effects of climate change on soils and agricultural crops, food security could be threatened. There may be a shortage of food supplies and an increase in food prices, which affects the ability of individuals to obtain a healthy and balanced diet [12].

Through its effects on the physical, chemical, and biological aspects of the soil climate

change has an impact. Climate change is the shift in the statistical characteristics of the climate system as seen throughout time periods, and it is either directly or indirectly related to human activities. In Figure (3) it is noted from the third decade (1961-1970) that the seasons of wheat cultivation began to move towards the month of November, as most of the planting seasons in the decade were in this month, and a smaller percentage of farmers were planting wheat in the month of October, and it was observed in the seventh decade (2001-2010) and the eighth decade (2011-2020) that some farmers started sowing in the month of December to ensure the rain necessary for wheat germination. [13]

Table (1) Effect of long term of rainfall on changing sowing wheat date.

Decades (1941-2020)	Sowing in September	Sowing in October	Sowing in November	Sowing in December
Decade 1 (1941-1950)	2 Seasons	2 Season	5 Seasons	Non
Decade 2 (1951-1960)	1 Seasons	2 Season	6 Seasons	Non
Decade 3 (1961-1970)	Non	3 Season	6 Seasons	Non
Decade 4 (1971-1980)	Non	2 Season	7 Seasons	Non
Decade 5 (1981-1990)	Non	2 Season	6 Seasons	1 Seasons
Decade 6 (1991-2000)	Non	3 Season	6 Seasons	Non
Decade 7 (2001-2010)	Non	3 Season	4 Seasons	2 Seasons
Decade 8 (2011-2020)	Non	4 Season	4 Seasons	1 Seasons

Increasing concentrations of greenhouse gases in the atmosphere of the Earth Figure (3) mean surface temperatures are rising and are expected

to continue to rise [14]. It is axiomatic that higher temperatures lead to increased evaporation, which in turn generally increases

precipitation. Therefore, it is expected that climate warming will lead to increased precipitation in some of our regions. since climate change causes shifts in wind patterns and currents that drive the climate system Towards a change in its state, so temperatures sometimes rise and sometimes decrease the amount of water available for drinking, More severe precipitation episodes may also result from increased evaporation for instance, in 2018 heavy rains in Sulaymaniyah governorate damaged crops and property and recently the risk of flooding has increased even if the total amount of precipitation in the region has not increased. [15].

2- Influence of Temperatures on Bazian Ecosystem

When the temperature rises, the rate of plant loss of water through transpiration increases, and the plant begins to wither when its water balance becomes negative, as in this if the amount of water absorbed by the roots is greater than the amount of water lost through transpiration, and this process often ends with the death of the plant due to the cessation of vital processes, which dependent on water. [16].

- When the flowers are formed and as a result of the high temperature, they fall off
- The quality of the fruits is affected at high temperatures, as they are less sweet due to the lack of sugars, which are used in the respiration process.

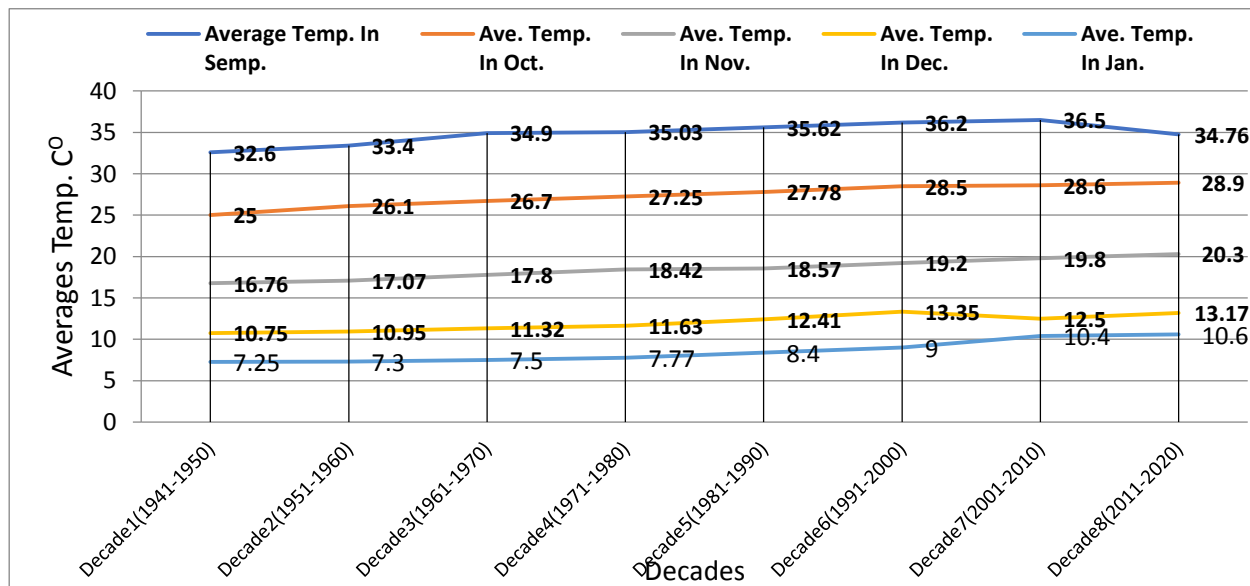


Figure (4) Influence of Changing in Air Temperatures degree on Soil Hearth and Bazian Ecosystem (Source, Sulaymaniyah Meteorology Department).

From this, it is clear that the months of October and November are the most important for wheat cultivation in the region. Therefore, it is noted from Figure (4) that the average temperature in September was 34.87(°C) and October was 27.35 (°C), and this month is the most variable as the average temperature changed Ascendingly as for the month of November it was around 18.49 (°C) while the month of December changed but alternately between high and low but in a way to the limits of 12.01 (°C).

most extreme year on record for this time period was 2010 with a mean temperature of 21.5 (°C). There is significant evidence that climate change is currently changing in Bazian plain. In 2016 temperature degree increased like globally the average temperature hit a peak of 20.3 (°C) in this time frame, the coolest temperature was 16.2 (°C) which was recorded in 1992. The average annual temperature has been rising by about 1.5 (°C) since 1980. [17].

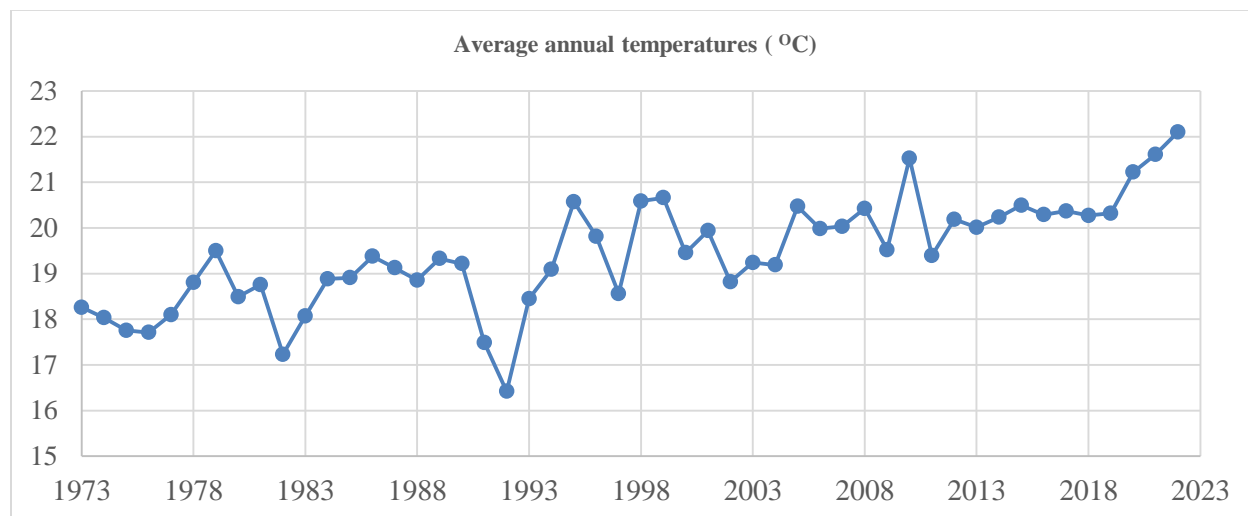


Figure (5) Average annual temperatures ($^{\circ}\text{C}$) for the period 1970- 2023 in Bazian ecosystem (Source, Sulaymaniyah Meteorology Department).

The data in Figure (4) were distributed into 4 stages according to the rise in average temperatures which were as follows period from 1973 to 1985 mean temperature degree was $18.39 (^{\circ}\text{C})$; from 1986 to 1998 temperature average increased to $18.79 (^{\circ}\text{C})$; period from 1999 to 2010 temperature degree increased to $19.93 (^{\circ}\text{C})$; and from 2011 to 2018 increased to $20.09 (^{\circ}\text{C})$; last period from 2019- 2022 increased to $20.33 (^{\circ}\text{C})$ [18].

3- Influence of Changing in Speed Wind on Sulaymaniyah Ecosystem.

Changing in Wind speed have a unique force impact on dry and semi-arid environments, which may also reflect previous systemic changes the climatology data in Figure (6) clearly show that the wind speed has decreased over the past few years. [19]. It is noted from

the figure that a sudden rise in wind speed occurs approximately every 10 years, as the wind speed rates decreased during the years of study starting from the period 1985-1991 There was a gradual decrease until it reached a speed of $1 (\text{m}\cdot\text{sec}^{-1})$ Then it rose to $3.17 (\text{m}\cdot\text{sec}^{-1})$ in the year 1993 and after this period from 1993-2002 it decreased to $1 (\text{m}\cdot\text{sec}^{-1})$ again and rose again in the year 2004 to $2.18 (\text{m}\cdot\text{sec}^{-1})$ and in the period 2005-2013 the wind speed decreased until it reached $0.6 (\text{m}\cdot\text{sec}^{-1})$ in year 2013 and in the year 2017 it increased until it reached $0.73 (\text{m}\cdot\text{sec}^{-1})$ then in the period 2018-2022 it decreased until it reached $0.87 (\text{m}\cdot\text{sec}^{-1})$. This may be due to the climatic changes taking place in the region, in addition to construction of giant housing projects in the vicinity of the city [20].

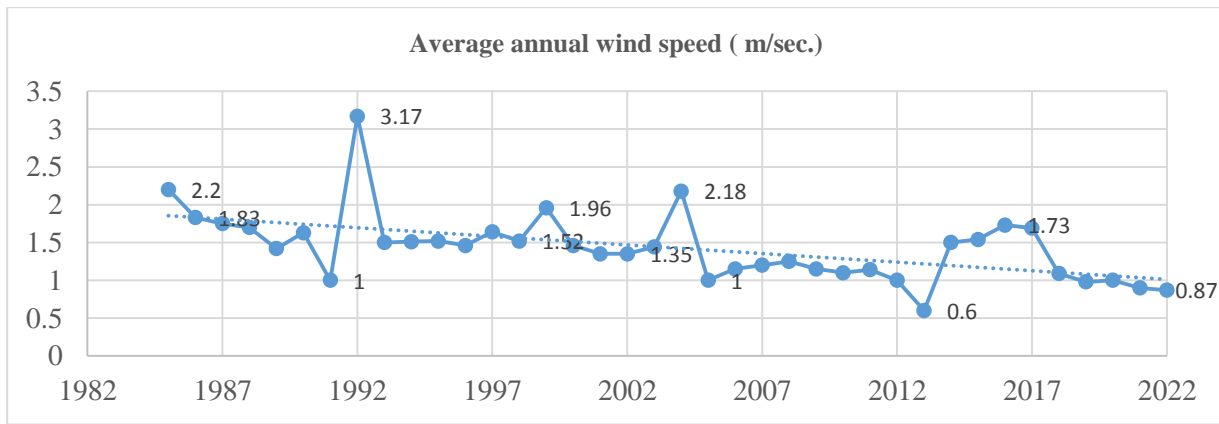


Figure (6) Averages Annual of Wind Speeds (m/sec.) throw period 1985- 2022 (Source, Sulaymaniyah Meteorology Department).

Reducing wind speed: Dense vegetation and trees can act as a barrier in the path of the wind and reduce its speed. This can be helpful in reducing evaporation and wind erosion and minimizing damage from strong winds. [21].

4- How is vapor pressure affected by climate change? (mbar) in Sulaymaniyah Ecosystem.

It is noted from Figure (7) that the highest annual mean of vapour pressure was recorded in Sulaymaniyah during the study years (11.45mbar) in 2022, while the lowest was (7.5 mbar) in 1985. Also, the wide changes in the barometric pressure recorded by the Department of Meteorology and Seismic Monitoring in the Sulaymaniyah Governorate began in 2014, as its values increased in most months of the year (March, April, May, May, June, July, August, September, October), where it is noted that in these months the values of the vapour pressure increased until the end of the year 2022. [22].

In August 2004, the highest value of vapour pressure was recorded reaching 15.5 (mbar). In the same year, the second highest value was recorded, which was 14.9 (mbar). As for the lowest value of vapour pressure that was recorded in the year 2008 and reached 5.3 (mbar), it was in January, and the second lowest value that was recorded was in the same month

in the year 1993 and amounted to 5.5 (mbar) [23].

From following up the daily data in the Department of Meteorology and Seismic Monitoring, it was found that in our region high vapour pressure represents clear weather whereas, low vapour pressure represents humid weather, Weather of a place depends more on the vapour pressure of adjacent areas than the vapour pressure of its own. [24].

climate change's increased effects on vapour pressure are linked to threats interrelated with the rest of the climate elements, especially temperatures that can affect the health of forests in our mountainous regions, especially where trees and various other plants need a specific quantity of moisture to develop and flourish. Vapour pressure increases, as we can see from Figure (7) how Water vapor pressure has risen over the years, especially in recent years. The shows have led to an increase in forest dryness and tree death in many areas. Rising vapour also raises the risk of forest fires since dry air and dry plants foster the optimum circumstances for the spread of flames. Because some plants, like crops, will need more water to thrive and produce fruit, it might also decrease agricultural yields or increase water demand. [25].

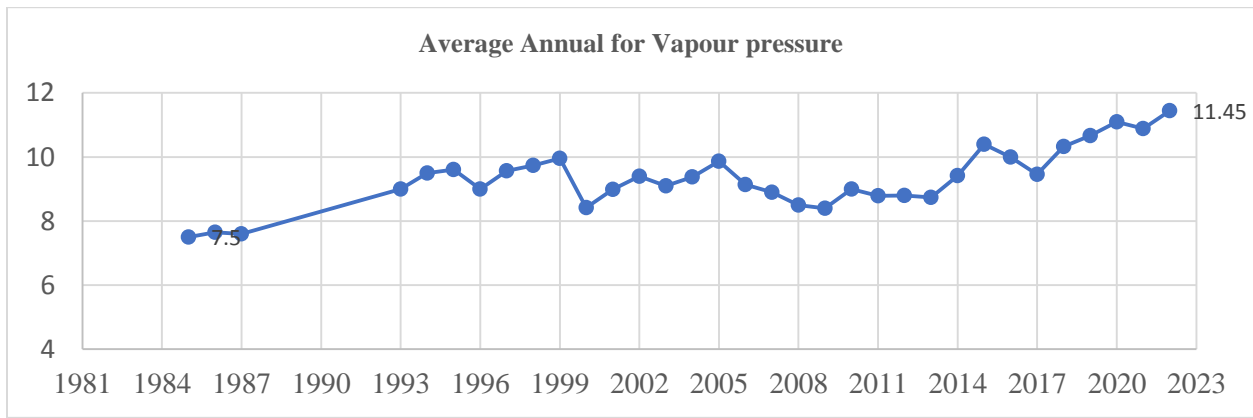


Figure (7) Annual averages of vapour pressure (mbar) degree in Sulaymaniyah Ecosystem for the period 1985 until 2022(Source, Sulaymaniyah Meteorology Department).

It is impossible to overlook the impact that rising vapour on our region worsen. It is critical to recognize that the increase in vapour pressure is tied to a variety of interconnected issues, and that the problem's effects will only get worse with time. However, there are steps we can take to solve the problem, such as lowering greenhouse gas emissions, funding forest management, and boosting funding for fire risk reduction. [26].

We do know that high temperatures raise the risk of heat-related disorders since they make it difficult for the body to heat up, even though there isn't enough study on the direct consequences of high vapour pressure in individuals (perhaps because there are so many other factors impacting the body). to sweat out heat in an effort to cool down. Dehydration and harmful rises in body temperature result from this, particularly in susceptible populations like the elderly, small children, and those who are more exposed to heat than usual. [27].

5- Influence of Changing climate in Sunshine (houre) on Sulaimaniyah Ecosystem.

The Sun has a major impact on our daily lives. in study area measureing the level of sunlight or sunshine every day by houre unite as noted in figure (8) Every location is exposed to sunlight for at least some of the year. Any given point on the surface of the Earth receives varying amounts of solar energy, vapour pressure

is the most important climate element that has an impact on sunshine hours in addition to Clouds, dust, pollutants, water vapour, air molecules, and forest fires. [28] there were days when the surface irrigation ranges of the climatic station fell between 1-5 km Because of very small particles of dust, these particles remain suspended in the air for several days. Until it is deposited in it when it rains or dissipates in the wind , There is a relationship between the amount of annual precipitation and the number of local dust storms, because many dust storms are not local, so it is not excluded that some dust storms reach these areas even in rainy years, and these storms travel long distances (thousands of miles) if conditions are available for them in terms of continued speed air required Soil and low vegetation cover in the regions are all factors conducive to the emergence Dust and poor plowing of the land and retreat Its productivity and overgrazing are factors that increase the number of these storms. [29].

The month of December is the lowest in the number of hours of daylight, as the total annual averages for the period 1985-2022 for the month of December were 184.4 (hr.) and the year 1996 is the least, reaching 2.3 (hr.) and the year 2018 was also the lowest second, with a value of 3.3 (hr.) As for the highest value of the number of daylight hours, it was in the

month of June 2001, and the year 2002 was the second highest with a value of 12.7 (hr.) The total annual averages for the study period were 413.2 (hr.) and the month of July was also high in the total annual averages for the study period 415.8 (hr.) The month of August is the

sun's rays were high Duration values which were 420.6 (hr.) During the study years there was an irregular increase in the duration of the annual sunshine which was clearly seen especially in the period 2017-2022 and beyond first decade of the twenty-first century. [30]

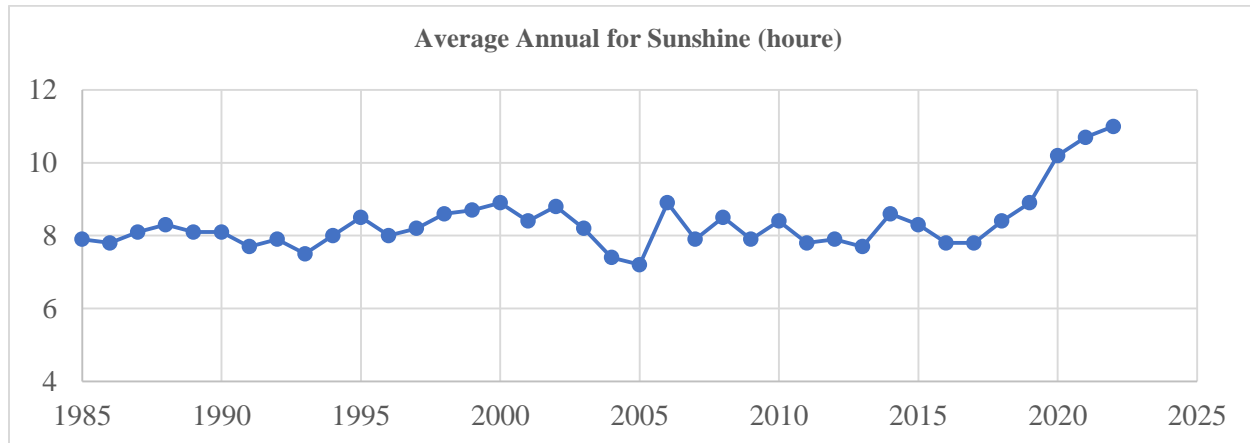


Figure (8) Annual averages Sunshine (hour) in Sulaymaniyah Ecosystem for the period 1985 until 2022 (Source, Sulaymaniyah Meteorology Department).

6- Influences of Hummin activities in Sulaymaniyah City on Climate change

If we want to describe soil health, we can say that it a key component of the idea of sustainable agriculture, the rise in temperatures during the study years can be explained by the gradual decline in natural diversity, the effects of atmospheric warming resulting from cement factories and power stations, and the increase in the number of greenhouses in this region. the use of fossil fuels for heating and vehicle fuels contributed to the rise in temperature this warming trend has accelerated as we have increased our use of fossil fuels to include gasoline, diesel, kerosene and natural gas, as well as the petrochemicals (plastics, pharmaceuticals, fertilizers) we now make from oil., which led to an increase in greenhouse gases. The total area of the province of Sulaymaniyah is only 106,000,000 square meters, and from 2010 to 2018, approximately 2,538,595 square meters were built, equivalent to 2.3%, and this is within a very narrow range, which reduced the vegetation cover because all

these lands were agricultural Which contributed in various ways to global warming. In Bazian plain only the number of agricultural greenhouse projects exceeded 10,000 projects, and according to the data collected from the farmers of the region, every 10 agricultural greenhouses need to dig an artesian well. This means that nearly 1,000 artesian wells were drilled to irrigate these projects. [31].

Over the last century, burning of fossil fuels like coal and oil has increased the concentration of atmospheric carbon dioxide (CO₂). This increase happens because the coal or oil burning process combines carbon with oxygen in the air to make CO₂. To a lesser extent, clearing of land for agriculture, industry, and other human activities has increased concentrations of greenhouse gases. In a field study conducted by the researcher in 2020 in 10 regions in the Bazian Plain, it was noted that carbon dioxide rates were 1000ppm as a general average for the ten regions, which is a significant increase compared to natural

concentrations of 400ppm in a vast agricultural area. [32].

Soil acts as a reservoir for pesticides whether applied directly or indirectly Earthworms improve soil aeration and digest organic matter as well as increase the nutrient content of the soil and work as a biological indicator in the state of soil fertility Earthworms help protect human health. Some pesticides kill earthworms and may reduce Indirectly from its preparation by killing the vegetation on which the worms feed. Show imidacloprid, chlorpyrifos, and Negative effect on earthworm in rice and maize cropping system, Impact on soil microorganisms: Microorganisms are important for soil fertility. The activity and enzyme of soil microflora will negatively affect soil fertility and thus soil health. [33].

On the other hand, enhancement of pesticides degrading microbial population has practical implication in retaining soil health by allowing degradation and consequential removal of the pesticides and toxic residues but the purpose for which the pesticide is applied may not solve. [34].

Conclusion

For years Sulaymaniyah climate and the Bazian Plain have seen rising temperatures, with surface air temperatures approaching the world average. Agriculture ecosystems and human health. Reasoning for historical changes provides a scientific foundation for national and international climate regulation. In this paper, we examine recent advances in attributing climatic trends seen over the last few decades. Human impacts, mostly greenhouse gas emissions, are the primary causes of observed increases in mean and high temperatures. Human impacts on precipitation are beginning to emerge as evidence. Human activity has raised the risk of high heat events and has most certainly changed the probability of some heavy precipitation occurrences. So, soil is closely related to the climate system through nutrient cycles and hydrology, and from the results of our research, climate change will have an influence on soil fertility caused by the soil's

physical, chemical, and biological characteristics as a result of higher temperatures, changing precipitation patterns, and increasing The levels of greenhouse gases in the atmosphere, etc. and It is worth noting that these negative consequences of climate change can be mitigated in our regions by using adaptation and mitigation strategies. In our modest work, we tried to study the impact of climate change on processes that affect soil fertility, such as rising temperatures, changes in precipitation patterns, and an increase in carbon dioxide in the atmosphere When describing soil health in regard to climate change, it is essential to take into account how various anticipated global change drivers, such as increased temperatures, lowered precipitation, and atmospheric nitrogen deposition, will affect the physical, chemical, and biological functions of soil.

References

- [1] - Moberg, A. & Jones, P.D. (2005). Trends in indices for extremes in daily temperature and precipitation in Central and Western Europe, 1901-99. *Int. J. Climatol.*, 25(9): 1149-1171. DOI:10.1002/joc.1163.
- [2] - Misson, L.; Rocheteau, A.; Rambal, S.; Ourcival, J. M.; Limousin, J. M. and Rodriguez R. (2010). Functional changes in the control of carbon fluxes after 3 years of increased drought in a Mediterranean evergreen forest? *Glob Chang Biol.* (16) 2461–2475. doi: 10.1111/j.1365-2486.2009.02121.x
- [3] - Akram, M., Abdulrahman and Jawhar, H., Khalid. (2019). Influence of climate changes (Winds, vapour pressure) on Sulaimaniyah Governorate stricture and sustainable Agroecosystem, *Kufa Journal for Agricultural Sciences*, No. 11, Vol. 2, pp. 43-53
- [4] - Stanhill, G. and Cohen, S. (2001). Global dimming: A review of the evidence for a widespread and significant reduction in global radiation with discussion of its probable causes and possible agricultural consequences. *Agric. For. Meteorol.* (107)255–278 [https://doi.org/10.1016/S0168-1923\(00\)00241-](https://doi.org/10.1016/S0168-1923(00)00241-)
- [5] - Aggarwal, P.K. (2008). Global climate change and Indian agriculture: Impacts, adaptation and mitigation. *Indian J. Agric. Sci.*, 78(10): 911-919
- [6] - Dell, M.; Jones, B., F. and Olken, B., A. (2014). What do We Learn from the weather? The new climate ecosystem literatures. *J. Econ. Lit.*, 52(3): 740-798. DOI: 10.1257/jel.52.3.740.
- [7] - Brayshaw, D. J.; Troccoli, A., Fordham R. and Methven J. (2011). The Impact of Large-scale

- atmospheric circulation patterns on wind power generation & potential predictability: case study over UK Renew. Energy 36 2087–96, <https://doi.org/10.1016/j.renene.2011.01.025>
- [8] - Schuur, E., A., G.; McGuire, A., D.; Schädel, C.; Grosse, G.; Harden, J. W.; Hayes, D., J. (2015). Climate change and the permafrost carbon feedback. *Nature* (520) 171–179. doi: 10.1038/nature14338
- [9] - Akram, M., Abdulrahman.; Jawhar H., Khalid; Zana, M., Majeed; and Aso, K., Taieb. (2021). Influence of temperature rice over 48-year on Sulaimaniyah agroecosystem structure and nematodes distribution GIS application, *Zagazig J.Agric. Res.*, No. 48 Vol. 1, pp.111- 122, DOI.10.21608/zjar.2021.165676
- [10] - Chiacchio, M. and Wild, M. (2010). Influence of NAO and clouds on long-term seasonal variations of surface solar radiation in Europe. *J. Geophys. Res.* 115: D00D22, doi: 10.1029/2009JD012182.
- [11] - Chen, W.; Zheng, X.; Chen, Q.; Wolf, B.; Butterbach-Bahl, K. and Brüggemann, N. (2013). Effects of increasing precipitation and nitrogen deposition on CH₄ and N₂O fluxes and ecosystem respiration in a degraded steppe in Inner Mongolia, China. *Geoderma.* (192) 335-340. doi: 10.1016/j.geoderma.2012.08.018
- [12] - IPCC (Intergovernmental Panel on Climate Change). (2013). *Climate change 2013: The physical science basis. Working Group, I contribution to the IPCC Fifth Assessment Report.* Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/report/ar5/wg1.
- [13] - Fischer, G.; Shah, M. and Tubiello, F., V., H. (2005). Socio-economic and climate change impacts on agriculture: An integrated assessment, 1990–2080. *Philos. Trans. R. Soc. Lond.* (360) 2067–2083.
- [15] - He, L.; Asseng, S.; Zhao, G.; Wu, D.; Yang, X.; Zhuang, W.; Jin, N. and Yu, Q. (2015). Impacts of recent climate warming, cultivar changes, and crop management on winter wheat phenology across the Loess Plateau of China. *Agric. For. Meteorol.* (200)135–143. <https://doi.org/10.1016/j.agrformet.2014.09.01>
- [16] - Huang, L.; Wang, Z., Wei, Y., and Zhang, X. (2009). Ecosystem respiration and its controlling factors in the riparian wetland of Yangtze River. *Acta Ecol. Sin.* (29) 3621–3628. doi: 10.3321/j.issn:1000-0933.2009.07.021
- [17] - Zhang, B.; Li, W.; Chen, S.; Tan, X.; Wang, S.; Chen, M. (2019). Changing precipitation exerts greater influence on soil heterotrophic than autotrophic respiration in a semiarid steppe. *Agric. For. Meteorol.* (271) 413–421. doi: 10.1016/j.agrformet.2019.03.019
- [18] - Akram, M., Abdulrahman; Jawhar, H., Khalid and Zana, M., Majeed. (2022). A Study on Precipitation Change and its Impact on Wheat Cultivation in Sulaimaniyah Region, Iraq. *Biological and Applied Environment Research.* Vol. 6(2): 178-191. DOI: <https://doi.org/10.51304/baer>
- [19] - Al-Quraishi, A.M.F.; Gaznayee, H., A., A., and Messina, J.P. (2021). Drought severity trend analysis based on the landsat time-series dataset of 1998-2017 in the Iraqi Kurdistan Region. In: *IOP Conf. Ser.: Earth Environ. Sci.*, 779(1): 012083. IOP Publishing.
- [20] - Kitsara, G.; Papaioannou, G.; Papathanasiou, A. and Retalis A. (2012). Dimming/ brightening in Athens: trends in sunshine duration. Cloud cover and reference evapotranspiration. *Water Resour. Manage.* 27(6): 1623–1633.
- [21] - Bett, P., E.; H. E. Thornton and R. T. Clark. (2017). Using the Twentieth Century Reanalysis to assess climate variability for the European wind industry. *Theor. Appl. Climatol.* (127). 61–80, <https://doi.org/10.1007/s00704-015-1591-y>.
- [22] - USGCRP. (U.S. Global Change Research Program). (2017). *Climate science special report: Fourth National Climate Assessment, volume I.* Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K.Maycock(eds.). <https://science2017.globalchange.gov>. doi:10.7930/J0J964J6
- [23] - Rustad, L. E.; Huntington, T. G. and Boone, R., D. (2000). Controls on soil respiration: implications for climate change. *Biogeochemistry* (48) 1–6. doi: 10.1023/A:1006255431298
- [24] - Rötter, R., P. and Geijn, S., C. van de. (1999). Climate Change Effects on Plant Growth, Crop Yield and Livestock. *Clim. Chang.* (43) 651–68.
- [25] - Akram, M. Abdulrahman; Farhad, M., T.; Hassen, R., H.; Awara, A., A.; Bakhtiar, A., K. (2020). Influence of heavy rainfall in 2018-2019 and submerging on some soil properties greenhouse's in Bazian plain, Sulaymaniyah Governorate, Kufa *Journal for Agricultural Sciences.*12(1) PP.1-10
- [26] - Lobell, D.B.; Schlenker, W. and Costa-Roberts, J. (2011). Climate trends and global crop production since 1980. *Science*, 333(6042): 616-620. DOI:10.1126/ science.1204531
- [27] - Gang, F.; Zhen, S. and Zhang, X. (2018). Increased precipitation has stronger effects on plant production of an alpine meadow than does experimental warming in the Northern Tibetan Plateau. *Agric. For. Meteorol.* 249, 11–21. doi: 10.1016/j.agrformet.2017.11.0
- [28] - Deng, Q.; Aras, S.; Yu, C., L.; Dzantor, E., K.; Fay, P., A. and Luo, Y. (2017). Effects of precipitation changes on aboveground net primary production and soil respiration in a switchgrass field. *Agric. Ecosyst. Environ.*(248) 29–37. doi: 10.1016/j.agee.2017.07.023
- [29] -Borken, W.; Savage, K.; Davidson, E. and Trumbore, S. (2006). Effects of experimental drought on soil respiration and radiocarbon efflux from a temperate fo[30] - Johnston, A. S. A.; Meade, A., Ardö, J.; Arriga, N.; Black, A. and Blanken, P. D.

- (2021). Temperature thresholds of ecosystem respiration at a global scale. *Nat. Ecol. Evol.* (5) 487–494. doi: 10.1038/s41559-021-01398-z
- [31] -NOAA. National Centers for Environmental Information. (2023). State of the Climate: Global Climate Report for 2022. Accessed January 18,
- [32] - Fan, W.; Liu, Y.; Chappell, A.; Dong, L.; Xu, R.; Ekström, M., Fu, T. and Zeng, Z. (2021). Evaluation of global reanalysis land surface wind speed trends to support wind energy development using in situ observations *J. Appl. Meteorol. Climatol.*(60),33–50, <https://doi.org/10.1175/JAMC-D-20-0037.1>rest soil. *Glob. Change Biol.* (12) 177–193. doi: 10.1111/j.1365-2486.2005.001058.x
- [33] - Zhao, J.; Luo, T.; Li, R.; Li, X. and Tian, L. (2016). Grazing effect on growing season ecosystem respiration and its temperature sensitivity in alpine grasslands along a large altitudinal gradient on the central Tibetan Plateau. *Agric. For. Meteorol.* 114–121. doi: 10.1016/j.agrformet.2015.12.005
- [34] - Zhang, P., Ren, C., Sun, H. and Min, L. (2018). Sorption, desorption and degradation of neonicotinoids in four agricultural soils and their effects on soil microorganism. *Sci. Total Environ.*, 615:59-69



دراسة تحليلية للعناصر المناخية في منطقة بزيان - السليمانية للفترة من 1985 - 2022 واثار ذلك في مواعيد زراعة بعض المحاصيل

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المخلص

التغيرات في سرعة الرياح وأنظمة ضغط البخار لها تأثير على النظم البيئية القاحلة وشبه القاحلة لبزيان، زاد ضغط البخار في شهري يناير وفبراير 2017 وبلغت سرعة الرياح 8 و 9 (م. ثانية⁻¹). ولكن في الأشهر 4،5،6،9 تم تسجيل سرعة أقل في السليمانية 0.1 (م. ثانية⁻¹). متوسط عامي 1985 و 1992 حصل على أعلى معدل 3.1 و 2.2 (م. ثانية⁻¹). في عام 1991 سجلت أدنى معدل 1 (م. ثانية⁻¹). لم تكن كميات وأوقات هطول الأمطار خلال سنوات الدراسة ثابتة وحدثت الفيضانات في بعض المواسم، وكانت مواسم الجفاف أقل من 300 (مل) قليلة جدًا، بينما كانت المواسم المتبقية أكثر من 450 (مل). كانت كميات هطول الأمطار في مواسم 2006-2007 و 2007-2008 و 2008-2009 من بين الفصول الأكثر جفافاً والتي كانت على التوالي (66000، 87000، 86000) دونم حيث انخفضت المساحات الزراعية إلى أدنى مستوياتها، على الرغم من أن مستويات هطول الأمطار كانت مقبولة. وجدت البيانات التي تم جمعها أن متوسط معدل درجة الحرارة السنوي قد زاد بأكثر من 1.3 (درجة مئوية) مع تسجيل أحر عام لهذا الوقت في عام 2010 عند 21.55 (درجة مئوية). كانت الشمس الساطعة هي الأدنى من حيث عدد ساعات النهار في ديسمبر حيث بلغ إجمالي المتوسطات السنوية للفترة 1985-2022 لشهر ديسمبر 184.4 (ساعة) وكان عام 1996 هو الأدنى مع 2.3 (ساعة) و 2018 كان أيضًا ثاني أدنى متوسط مع قيمة 3.3 (ساعة).

الكلمات المفتاحية: التغير المناخي، هطول الامطار، درجات الحرارة .