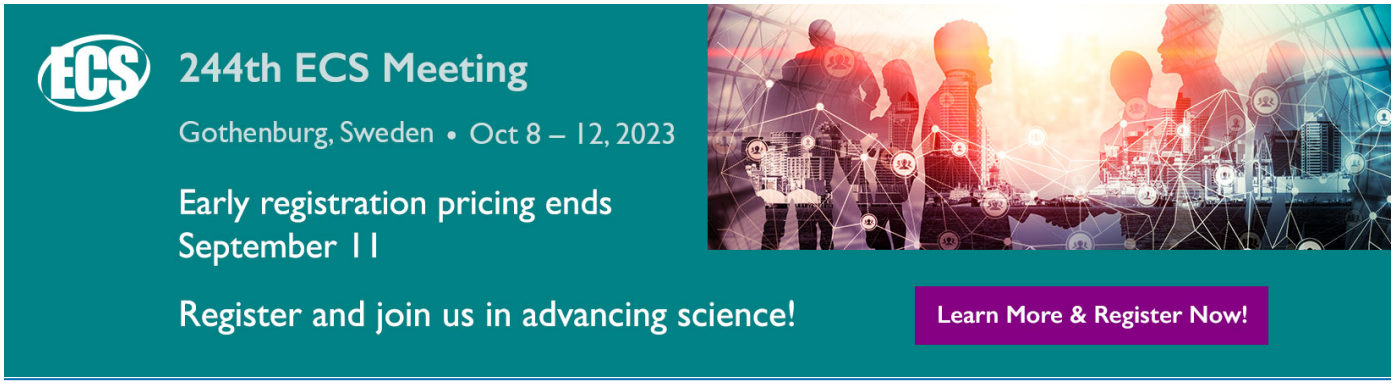
A Statistical Analysis of the Effects of Afforestation on the Environment in Iraq (Northern Iraq)



A Statistical Analysis of the Effects of Afforestation on the Environment in Iraq (Northern Iraq)

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Abstract. The significance of the research conducted in northern Iraq comes despite the expansion of afforestation projects; yet, the suffering of the forests has increased due to their lack of scientific study, unpredictability of the climate, and adverse effects on the spread and growth of plant species Therefore, the goal of the study is to understand the effects of afforestation through a statistical analysis of plant diversity in northern Iraq and its distinctivenessThe analysis revealed that natural groupings had improved qualitatively more than other groups, particularly some dwindling species that are able to compete and occupy new areas. drought-prone vegetation, vegetation, and climate change. Restoring natural land vegetation is beneficial for sustaining and enhancing biodiversity, and it is important at environmentally endangered sites of degradation or erosion

Keywords. Time series, Variety of plants, Multivariate analysis, Probability.

1. Introduction

One of the most crucial issues in Iraq is reforestation, which has a significant impact on the ecology and the availability of water. In order to understand the [1], condition of the forests after Mosul was subjected to numerous terrorist attacks, how they were restored to a state through natural and artificial afforestation, and how it became the nature of the environment, we attempted to conduct a statistical analysis of the forests in Mosul for forests [2].

1.1. Climate Information

Due to the region's complicated topography, each location needs its own climate station to accurately represent the climate of the area. However, because these stations aren't present, the closest climate station with complete climatic data for the two temperature elements' annual and seasonal data was used instead. Additionally, there was rain, which is a station, and the information came from the Baghdad Meteorological Authority (2021). In order to reflect how the climate is changing, the station analysed how the two elements of heat and rain vary. The period was further divided into two time periods, each lasting for the duration of the region(2011-2015). The second, meanwhile, stretches between the Regarding the second, it spans the years (2015-2021) in order to compare the two periods' climate variations in the area.

2. The Study of Climate Change

Calculating statistical climate change indicators included:

2.1. Coefficient of Difference CV%

It measures how far the standard deviation deviates from the mean It is determined using the next equation [3].

$$CV = sd/\bar{X} *100$$

2.2. Standard Deviation DV

When divided by the number of years, it is the square root of the sum of the squares of the items' departures from their arithmetic means[3]:

$$DV = \sqrt{((\sum(X-\bar{X}))/(n-1))}$$

2.3. The Arithmetic Mean X

Calculate by dividing the climatic component values by the total number of years as follows [3]:

$$X= (\sum x)/n \ \bar{X}$$

3. Analyzing Climatic Time Series Graphically

The goal of this analysis is to identify the pattern and behaviour of a time series of an element through time in terms of a general trend for it, as well as to quantify the amount of change that occurred in this series from the start of the investigated period to the end of it. This was done so that the first order straight line equation, using the simple trend line, would reveal the rate of diminishing trend. Alternatively, the overtime growth in the examined climatic component The following is how the first-order regression line equation is expressed:

$$Y= b + cx$$

Where Y is Precipitation value or temperature and c,b is constant and x is time.
Therefore, the investigated climatic component's positive values show a growth through time, whilst its negative values show a fall.in the historical climate component.

4. Measurements and Field Research were Done

Each of the study's sites had three different types of groups [4]:

- A naturally occurring population that is uncontaminated.
- Collections that naturally regenerated.
- Groups that have planted trees artificially.

Five lists were then located in each forest group, bringing the total number of listings per site to 15 botanical lists The following measurements and conclusions were made because the ambient conditions for each detection were distinguished by several characteristics:

- Using a gadget, height above sea level by GPS.
- Using a compass, determine the exposition's slope direction.
- Observational descriptions of the soil surface's organic litter type were used to describe it.

Throughout the three-year academic period, numerous field trips were taken (2018, 2019, 2020) This distribution of tours over the months of the year meant that x represented all of the inspection spots in the two locations, which were (15) We guarantee that most species will be registered, particularly yearly and seasonal ones, and they will be done so within the following months [5], October , 2019 December, 2020 March 2018. The analysis was put together on a table whose rows represent the species that were recorded in all locations, and whose columns contain all the lists that were studied at the site, and whose total number is (15). (112) If the type in question is on the list, add a value of 1, and if not, add a value of 0. species that were wiped out Adding it to all lists despite the fact that it included no useful information [2]. The program performed the factorial analysis (SPSS).

5. Statistical Study

The information indicates where the Bashiqa station is High altitude moderate temperatures, and concentrated precipitation characterize the local climate, which also somewhat affects the seasons of fall and spring.

Table 1. The monthly average temperature and precipitation amounts in the station Bashiqa(2011-2021)

The counter monthly	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov	Dec.	annual rate
Temperatures	6.73	8.07	10.94	14.6	18.4	21.6	23.26	23.94	22.38	19	13.3	8.55	15.89
precipitation/ mm	227	173	142.9	89.01	53.76	12.77	1.32	8.66	19.94	94.79	129	197	1149.3

Table 2. Seasonal average temperatures and precipitation amounts at a station Bashiqa(2011-2021).

The counter monthly	Winter	The spring	Summer	Autumn
Temperatures	7.78	14.6	22.95	18.2
precipitation/mm	597.2	285.7	22.752	243.7

According to the table, Bashiqa station experienced above-average precipitation for the years 2011 through 2021, with a total of 1149 mm, and above-average temperatures of 15.89 We observe that the region's rainfall regime follows the following cycle: winter, spring, autumn, and summer. It is the distinctive seasonal precipitation system for the Mediterranean basin's eastern region

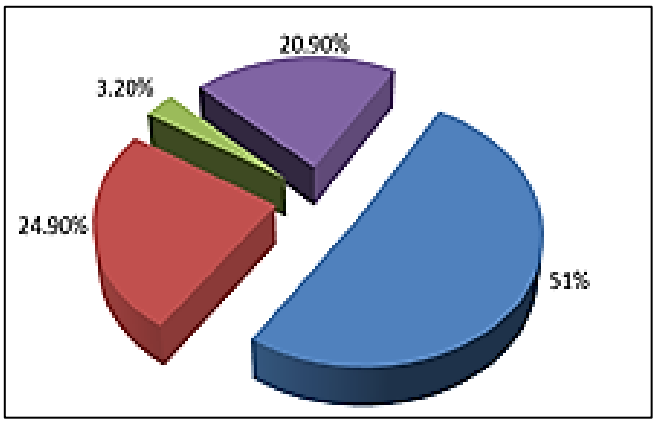

Figure 1. Seasonal distribution of rain in the study area.

5.1. Quotient Pluviothermique (Q)

The quotient pluviothermique be write as :

$$Q = 1000p/((M+n)/2(M-n)) \text{ or } Q = 1000p/((M^2-m^2))$$

The average temperature is 1149 mm, and the average annual temperature is 15.89 when the formulae are applied to the station data (P) The average lowest temperature for the coldest month of the year is 28.6 (m) Equals the maximum temperature for the hottest month of the year, and the average annual quantity of precipitation (m) = 5.9.

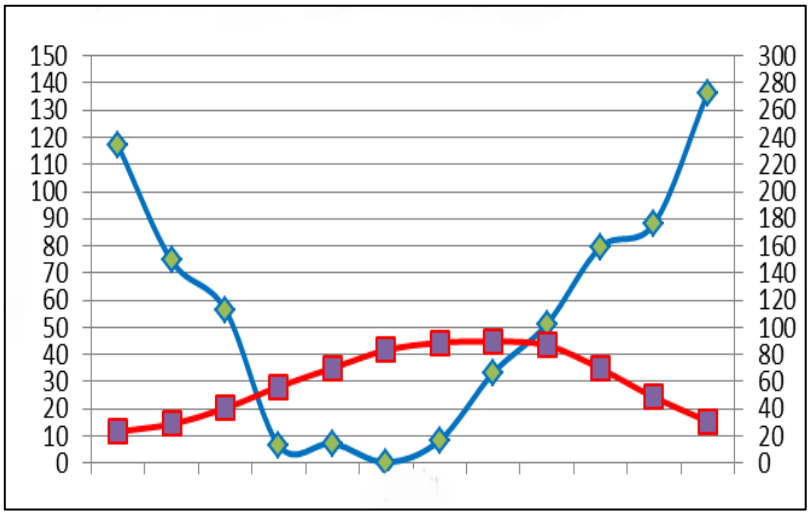

Figure 2. Thermal rain diagram in the study area.

5.2. Defining Statistical Indicators

The seasonal and annual statistical indicators for the two variables temperature and precipitation were established. A station Bashiqa in the study area provides a clear image of the climate of the area, and the results are displayed in the table 3.

Table 3. Statistical indicators of the two elements of heat and amounts of precipitation at the station Bashiqa(2011-2021).

Climatic component	Pointer statistic	Winter	Spring	Summer	Autumn	Annual
Temperature	X	7,7	14,6	23	18,1	15,8
	Sd	1,7	1,5	1,6	1,7	1,3
	Cv%	22,4	10,4	7	9,3	8,1
	Max value	12,2	18,17	27,21	21,91	18,31
	Min value	4	12,37	20,7	16,1	13,34
amount of precipitation	X	199,7	95	7	82,5	1155
	Sd	95	44	12,3	42	412,1
	Cv%	48	46,1	154	51	35,7
	Max value	423,77	203,1	65,67	215,9	2127,2
	Min value	62,13	31,67	0	1,5	529,77

During the time period, we observe a decline in the amount of precipitation (2011-2021) It rains all year round there (976.96 mm on average), but winter has the biggest amounts (169.45 mm), followed by spring (82.45 mm), and autumn (82.45 mm) (68.89 mm) although in the summer it got up to (4.87 mm).

The relationship between the values of the climatic factors and the coefficient of variation reveals that there is an inverse relationship between the two. This suggests that the effect of seasonal and annual changes in them grows in the lower seasons.

Rain falls more frequently in seasons with lower temperatures and in less wet years than in others, which supports the idea that In terms of declining precipitation totals, these changes are more severe.

When examining the trend of temperature change using the simple regression line method, it was discovered that there is an increasing trend For temperatures over time at the annual and seasonal rate as well, with a strongly increasing linear regression variation. From the equation of the simple regression line, which takes the formula (b, c), the value of the change in it was calculated based on the values of the constants $Y = b+cX$.

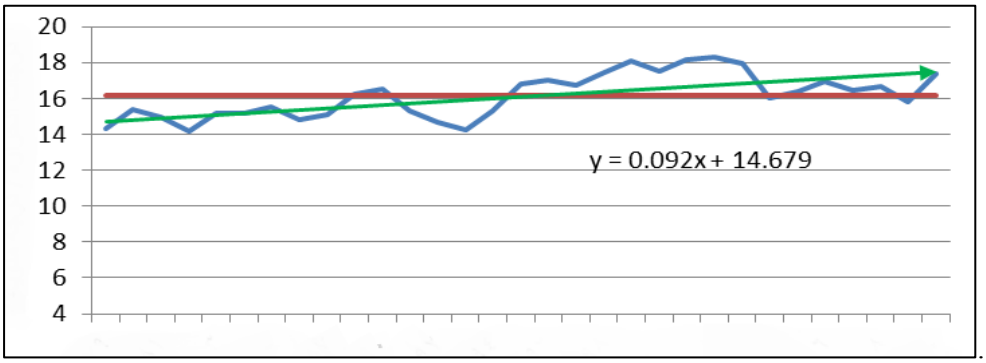

Figure 3. Deviation from mean and trend of temperature change at station Bashiqa(2011-2021).

Table 4. The amount of change in average temperatures at a station Bashiqa(2011-2021).

Climatic factor		B	C	Initial value	Final value	The amount of change
average temperatures	annual rate	14,68	0,09	14,77	17,62	2,85
	winter season	6,48	0.09	6,57	9,55	2,98
	spring season	13,34	0.09	13,43	16,21	2,79
	summer season	21,65	0,1	21,75	24,99	3,24
	autumn season	17,25	0.08	17,33	19,75	2,42

The Amount of Precipitation Has changed.

Using a simple regression line, precipitation levels and the direction of their change fluctuate across the analyzed time period.

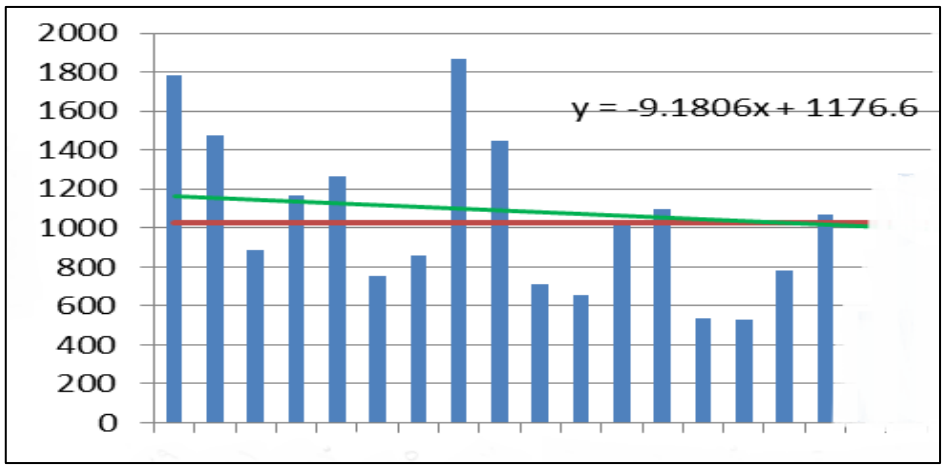

Figure 4. The direction of change in the annual rainfall and its deviation from its average in Bashiqa (2011-2021).

It is verified to us that there is a risk because the coefficient of change is inversely related to the values of the analyzed climatic factors. The variations in precipitation levels, particularly in the winter season followed by the spring season because the lower the amounts of precipitation Its impact on plant biodiversity will grow as a result of its increasing coefficient of change

6. Result and Discussion

Some of the discovery sites had organic litter on the soil's surface made of forest remnants. The thickness of this litter ranged from 5 to 7 cm in the lists of the burned forest group to 15 cm in the lists of the natural forest group, and between 1 and naturally renewable. The lists of the burned and wooded

forest group had almost no plant litter. From these insights, it is feasible to move on to emphasize the importance of pre-afforestation activity, whether it is beneficial or harmful. Litter may have been removed from afforestation sites by being buried beneath the soil surface, which is advantageous because it raises the proportion of organic matter in the soil.
It can withstand the heat of the fire less, so it begins immediately to contribute to the growth of the new vegetation cover, utilizing it.
conditions that are favorable for crowding and controlling naturally recovering areas following burning, particularly when planting is weak. Trees that are grown for human use and their vulnerability to environmental stresses including shade and competition for moisture and food ،10 . %10.3in the lists of the forest group, forested, burned and wooded group, and 40 27%, respectively, while the study revealed that the average grass cover in the lists of the natural forest group was 15%.
The large-scale and successful terrorist attacks that occurred in the area can be blamed for the disparity in tree coverage ratios. The majority of trees are woody and naturally renewable, and it was discovered that the natural group's percentage of tree coverage is higher due its older trees.more than the age of the trees, i.e., the natural forest's old trees are old enough to overpower them.
the absence of Her lordship caused the dominant bushes and grasses covering the forest floor to take control, replacing the lordship's function The lack of trees, the accompanying shadowing, and the new plantings on the soil surface all hindered the growth of those plantings. and restrain its expansion

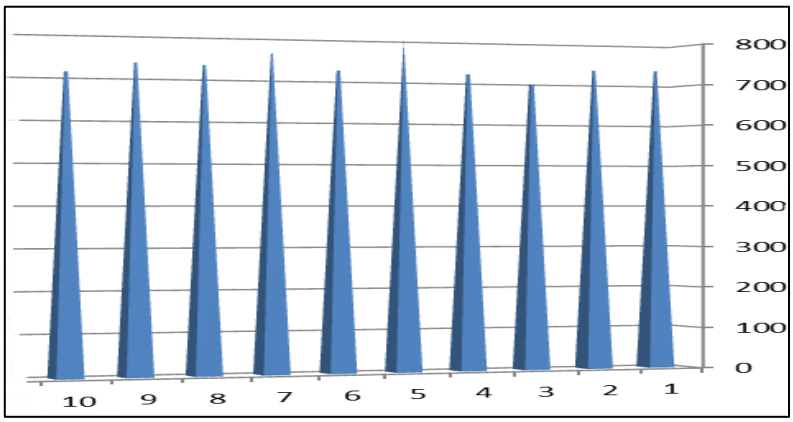

Figure 5. The height above sea level of the studied botanical lists study region.

Conclusion

According to the meteorological analysis, the advent of an increased temperature trend indicates that the area is on the verge of drought. The amount of precipitation is trending downward, while the length and severity of the dry season are trending upward .The failure to reforest lands cleared of trees in a region prone to drought and when there is a reliance on The degradation of the vegetation cover and the predominance of drought-resistant species are both caused by its natural regeneration.
The vegetation of the examined groups varied in terms of species, frequency, and degree of coverage in each of the naturally wooded and naturally regenerating locations.Despite the fact that afforestation had a negligible impact on biodiversity Clearly superior than naturally renewable groupings in terms of species coverage and frequency Reduce vegetation loss and manage species affected by drought . The movement of plant groupings reveals a "evolutionary" pattern that progresses in the direction of the initial vegetation's natural condition. the appearance of arid plants, which is consistent with the trend of drought-causing climate change

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