Determination the Impact of some Abiotic Factors on growth *Quercus aegilops* and *Quercus infectoria* in Mergasour Forest – Erbil – Iraq

ABSTRACT

This study was create out in the natural forest of Mergasour region. The highest mean height of autumn, winter, spring, and summer obtained were; (6.20, 6.30, 6.37 and 6.86m), of *Q. infectoria* trees in the East site. Based on the results of the correlation analysis between the diameter for both species and aspects there was significant correlation identify, which the largest value of diameter autumn, winter, spring and summer obtained were; (11.23, 11.52, 11.80 and 12.06cm) found in *Q. infectoria* stems at East site. And the maximum branches number obtained was; (7.0), of *Q. aegilops* branches in the East aspect. The maximum tree number in the area (20×20) m was (32.67) recorded by *Q. aegilops* in west. There were differences in microclimate among the both aspects. Although the average soil moisture content during the autumn, winter, spring and summer on the east aspect were (0.18, 0.47, 0.32 and 0.14), compare to the west aspects were (0.11, 0.35, 0.25 and 0.12). On the other hand, soil nutrients only showed minor differences with concentrations being higher on the east aspect expect for potassium, which was higher on the west aspect that the present of the nutritional elements in the soils of the east and west, and the average phosphorus concentrations were (23, 19.5) ppm, nitrogen (0.10, 0.12)%, potassium (86, 202) ppm, the organic matter (2.13, 2.86)%, the electric conductivity (0.2, 0.3), the hydrogen ion concentration (7.86, 7.53). The soil type of the both aspects in the study area it was clay.

KEY WORDS: *Quercus sp.*, tree growth, abiotic factors, aspects-elevation, soil nutrients, soil moisture.

1. INTRODUTION:

Oak plants, a deciduous tree, belong to family Fagaceae. It has a long history in Kurdistan (about 6000 BC) and distributed on many geographical areas (Tahir and Mezori, 2020). Oaks (*Quercus sp*.) are dominant trees in most Asian forests, North African, European and American forests, from cool temperate to tropical environments, on which thousands of other species depend on (Douaihy *et al.*, 2020). They are an important source of timber and coppice wood, but also are used to produce fuel wood, charcoal, medicinal products, animal fodder, dyes, cork and bark used in tanning (Khwarahm, 2020). The oak tree prefers partial shade or partial sun to full sun, and requires moist soil. The flowers are monoecious and are pollinated by wind (Shrestha *et al*., 2014). Forests of Iraq are confined almost entirely to the northeast region of the country, which extends from the Zakho region near the Turkish border to the Hurin Sheren region on the Iranian border, within the longitudes of 42° 40' - 45° 30' and two latitudes 34° 40' – 37° 08', it constitutes 4% of the total area of Iraq (Younis and Hassan, 2019). Kurdistan forests are mainly composed of broad-leaved forests mostly oak (*Quercus*) species 90 % and coniferous forests pine (*Pinus spp*.). Oak trees form the main species of the mountain forests includes *Quercus aegilops* (balut) with *Q. infectoria*, and *Q. libani* (dindar) (Shahbaz *et al*., 2015). Forest ecosystem is under impact of abiotic factors; the effect of inanimate nature factors has increased (Ruba *et al*., 2013). The main abiotic factors are classified into three broad categories such as weather (temperature, precipitation, light, and wind), soil (minerals and moisture), human activity, animals and birds (wildfire, air pollution, mechanical damage, herbicides, cutting) (Teshome *et al*. 2020). While

Comment [r1]: Change the title into one of the followings.

1.The role of aspects in shaping of oak trees (***Quercus aegilops* and *Quercus infectoria*)** features in **Mergasour** landscape ecosystem (Northern Iraq)

2.Effect of aspects on growth of (***Quercus aegilops* and *Quercus infectori)*** in **Erbil Governorate.**

3.The impact of aspect on growth of (*Quercus aegilops* and *Quercus infectori* in a Mergasour Forest (Erbil-Iraq)

Comment [r2]: 1- The present study was carried out in the **Mergasour forest** landscape ecosystem (Northern Iraq) and the aim is

2- Mention parameters that were measured

3- Start with the main finding of the data
4- this value (32.67) was is not the manuscript

5- write the results as mentioned in the methodology and results because need to be the same order.

6- it is recommend to conduct a study on tree volume and above ground biomass for both aspects to present a higher productivity of studied species

Comment [r3]: There was not correlation analysis in the manuscript.

Comment [r4]: Write them in alphabetic order

Comment [r5]: Belongs to fagaceae family

Comment [r6]: Put this section in study location

these factors may have a good and bad effect on tree species such as (*Quercus aegilops* and *Quercus infectoria)* trees in the natural forest areas surrounding Mergasour-Erbil are important places inhabited by man from ancient times to the present. The geographical location of Mergasor district is located on the administrative border of Erbil province.

Non-living chemical and physical factors in the air are mentioned to as abiotic impacts (Ceccon *et al*., 2006). The impact of abiotic factors on forest trees and shrubs is called abiotic disease, wherever forests are found. The major abiotic factors that cause disease in the environment such as temperature extremes, drought, wind, light, precipitation, as the effects of these factors on forests occur directly or indirectly are also related to human activity (Teshome *et al*., 2020). Temperature is one of the most important elements of climates, and plays a key role in plant growth and development, because it affects metabolic rates of every physiological processes such as photosynthesis, respiration, erosion that supply it with energy, solar energy is the main source of heat needed by trees (Bloor *et al*., 2010, Butler *et al*., 2012, Melillo *et al*., 2011, Reich *et al*., 2018). Among the abiotic factors, light is the most significant factor that affects plant growth directly in controlling physiological traits of plants in terms of photosynthesis, respiration, stomatal conductance, chlorophyll synthesis. In addition, many researchers showed that light are the most limiting factor for plant growth and survival in the forest understory (Kenzo *et al*., 2011). The precipitations in various forms such as rain, snow, hail, dew, mist, fog and rime ice have a close relationship with forests because they are essential elements in nature (Goldsmith *et al*., 2013). Soil is a natural medium for growth of tree roots and associated forest vegetation, soil can describe as a complex natural material derived from disintegrated and decomposed rock and organic materials, which provides nutrient, and moisture for a plants (Osman, 2013). Aspect, a topographic variable, influences the microclimate, particularly air temperature, humidity, and soil moisture, as well as the quantity and daily cycle of solar radiation received at various times of the year. Because the peak of the solar disk is perpendicular to south-facing slopes, it is commonly accepted that a southwest slope is brighter, hotter, and drier than a northeast slope (Desta *et al*., 2004). Plant growth of some oak species under environmental change and habitat factors such as elevation change or altitudinal gradients show different morphological and physiological forms (Douaihy *et al*., 2020; Taleshi and Babarabi, 2013), but the use of these characteristics alone is not sufficient because of the influence of environmental conditions (Gamfeldt and Kallstrom, 2007; Crutsinger *et al*., 2008).

Comment [r7]: Not found in the reference list

The main objective of this study was:

The specific aim of this study was to examine the spatial variability in aspect-elevation, soil nutrients, and microclimate on growth *Quercus aegilops* and *Quercus infectoria*, to prevent the plant from being exposed to all abiotic harmful causes leading to forest degradation in the Mergasour-Erbil forest area on both sides of mount Bradost, to reduce their numbers under the economic injury level, and also to use this study in the field of the protection of natural forests and the preservation of this natural priceless resource because of its economic, ecological and beauty benefits.

2. MATERIAL AND METHODS

2.1 Description of the study area and species selection

2.1.1 Study area

The study was conducted in the areas around Bradost Mountain, especially the eastern and western sites of the mountain in Mergasour; Mergasour is a district in northern Erbil Governorate in the Northern Iraqi Kurdistan Region. It is situated in the northern part of the Erbil Governorate, not far from the Turkish and Iranian borders, which is about (1400 km^2) and (130 km) from the center of Erbil province. The eastern front of the mountain is located (latitude 36.832 N and longitude 44.306 E), and with an elevation of 1171 meters above sea level (m.a.s.l.). As for the western front of mountain Bradost is located (latitude 36.833 N and longitude 44.312 E), and elevation of 1146 meters above sea level (m.a.s.l.). The topography of the area is fairly rugged and in East site the average slope inclination is 15%, and 35% to the West site. The study area's climate is characterised by cold temperatures and early winter snowfalls on the high mountains. Maximum temperature in summer is 42 ℃ and low temperature at minimum (-11 ℃) during winter season with the mean annual rainfall in the study area was more than 1000mm.

Comment [r8]: According to table 1 the minmum and maximum temperatures are not the same.

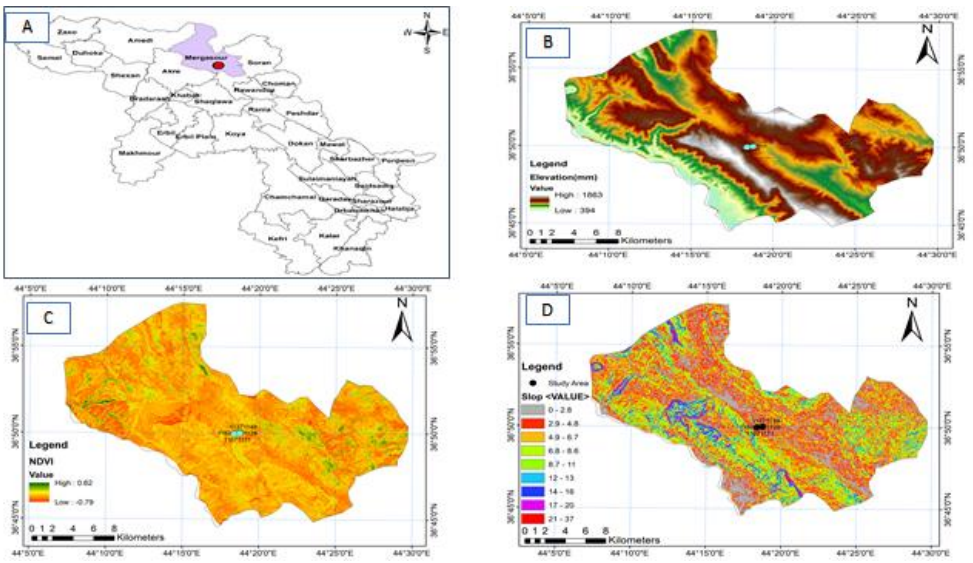

Figure1. (A) the District map of Mergasour; (B) The Digital Elevation Model (DEM) of the study area; (C) The normalized difference vegetation index (NDVI) Map of study area;(D) The slope map of the study area.

Comment [r9]: Remove figure C and D because you did not studied the relationship between INDVI and slope with parameters and forest type classification.

Table (1): **Coordinates of the study areas in Mergasoor region.**

Comment [r10]: Write information about an elevation of the area.

area	Coordinate	Altitude (m.a.s.l.)

Table (2)(1) Meteorological data in Mergasour region (October 2021) to (September 2022).

Months	Temperature (C)			Relative Humidity (%)	Precipitation (mm)	Sunshine Dura. hours	Wind speed
	Min.	Max.	Av.				
Oct	15.5	24.6	**19.8**	34.1	30.2	18.4	2.0
Nov	8.8	17.6	**13.2**	49.1	18.4	15.4	1.8
Dec	3.0	9.7	**6.3**	70.8	351.2	10	1.9
Jan	-1.7	5.1	**1.6**	82.6	168	7.9	1.6
Feb	2.9	11.0	**7.0**	65.0	261.4	14.1	1.9
Mar	2.5	8.8	**5.6**	72.9	229.0	7.3	2.2
Apr	10.0	20.5	**15.2**	68.8	46.0	15	2.3
May	12.5	23.2	**17.8**	73.8	30.0	20	2.5
Jun	20.0	30.1	**25.0**	57.6	0.0	22.6	2.4
Jul	25.6	37.2	**31.4**	20.6	0.0	25.1	2.6
Aug	25.0	36.2	**30.6**	18.6	0.0	26.5	2.4
Sep	20.3	30.7	**25.5**	23.5	0.0	24.6	2.4

Comment [r11]: This will be table 2 for the rest of manuscript

2.1.2 Vegetative sampling

At each aspects, tree data (species, height, diameter, branches number and tree number) were collected from the study area for all trees larger than 4m height and 6 cm diameter at breast height (dbh) because homologous we used to selected trees in each repeater. In order to compare species dominance across the two aspects, it was assumed that the dominating species for each had the highest significance value.

Comment [r12]: It is replication or plot number

Comment [r13]: Rewrite this section again simply.

Comment [r14]: Delete it

2.1.2.1 Measurement of tree height

Tree height was determined using Haga altimeter. The height was measured by taking two types of *Quercus* tree in each repeater of each aspect randomly and then taking the rate of height of this tree to express the height of both species in each repeater, and so on for both types of *Quercus* tree and for both aspects (Larjavaara and Muller-Landau, 2013).

Comment [r15]: The comment no. 8

2.1.2.2 Measurement of tree diameter outside bark

The caliper is the most used tool for measuring stem. To accommodate tree stems of varied diameters, calipers are available in a variety of sizes. Calipers can be used to measuring small and large diameter. However, utilizing calipers is frequently faster than using diameter tapes. The diameter of trees was measured using caliper, dedicated to measuring the diameter of forest trees and has three sizes 50cm, 100cm, 130cm. The diameter rate of the five random trees was calculated in each repeater and for each aspect (West, 2015).

Comment [r16]: 1- Delete this section no need to mention the function of using these tools, jus simply mention how did you measure tree diameter at breast by using caliper tool.
2- which caliper size did you used?

2.1.2.3 Number of branches per tree

The number of branches consisting of each tree in the forest area where the research was conducted for two oak tree species and each repeater was calculated by taking five trees and taking the rate of branches for each type.

2.1.2.4 Number of trees per hectare

Calculating the number of trees for both aspects in each of the three replications of the both studied areas by making rep (20*20) m, calculating the number of trees and then calculates the rate of each tree species for each aspect.

2.2 Soil sampling

I took soil samples at the lowest and highest sea level in the study place and collected them at the base of the trees we studied on each aspect by using augers and shovels. The removal of the layer of falling leaves after soil was collected from the organic layer to a depth of 50cm and placed in nylon bags with cards and clarifications and closed tightly to prevent moisture leakage, the samples were mille in a steel-made soil mill, and then passed through a 2mm sieve for measuring its texture and physical and chemical properties table (3). Soil texture was identified according to the book (Ryan *et al*., 2001). After measuring and knowing the proportions of sand, silt, and clay, the strength of the soil is determined based on the triangle of strengths USDA texture triangle. Through the triangle of texture, the types of soils, varied based on the proportions of earthen granules, can be identified. The pH was measured on a 1:1 ratio soil: distilled water suspension. Using the EC-meter (Model Conductivity meter laboratory/portable), the soil's EC value was calculated according to (Rhoades, 1996). Total nitrogen % was determined by the Kjeldahl digestion-distillation method. Estimate of organic matter ratio (OM): Most laboratories perform an analysis of organic matter in the soil. The most common method is those that include the return of potassium dioxide by organic carbon compounds. Available phosphorous (ppm) was determined by using Olsen procedure. Available potassium (ppm) was extracted by using flame photometer (Ryan *et al*., 2001).

2.2.1 Calculating the percentage of soil moisture

Soil samples were brought into the laboratory, 10 grams of soil were weighed and dried metal box (at 105c temperature) and previously balanced (soil weight with can before drying), after that dried the samples in the oven at 105c, and in the next day, samples were removed from an oven, closed the box directly, then cooled the samples with the dryer for at least 30 minutes, and then weighed the samples again (weight the soil with the can after drying).

2.3 Statistical analyses

The analyzed as a factorial combination of a two factors (AS); two Aspects (A) East (A1), West (A2) of Oak forest Mergasour in Kurdistan region, with the two abundant oak species (S) in these aspects; *Quercus aegilops* (S1) and *Quercus infectoria* (S2). Analysis of variance (ANOVA) of the data computed using the Statistical package for the Social Sciences (SPSS) model 18. The Duncan's

Comment [r17]: The number of stems per hectares was calculated in (2021-2022). A total of (how many sample plots you measured) sample plots of 20 x 20 m were set up and covers an area of (number) hectare. Within these measured sampled plots (mention number of trees measured in total) were randomly chosen for analyzing collected data.

Comment [r18]: 2.2 Measurement of Soil aspects.
2.2.1 soil sample collection
2.2.2. soil physical properties
2.2.3. soil chemical properties

It is important to rewrite this section as mentioned above because in many papers physical properties should be mentioned before chemical properties

Comment [r19]: Soil moisture content (S.M%)

Comment [r20]: 1-This section should be mention in chemical properties section
2- based on which way did measure smc% either dry weight or fresh weight
3- write an equation of soil Moisture content % with a reference

Comment [r21]: Write the correct symbol

Comment [r22]: Write the correct symbol

Comment [r23]: By using

multiple range test (DMRT) used to check the variations among the mean values of studied parameters, 5 % level of possibility for the height, diameter, number of trees and branches growth characters

Comment [r24]: Delete it

Comment [r25]: and 1% for the libratory measurements.

3. RESULTS

3.1 Tree height

Height is an important parameter in the morphological state of the tree. In forestry, tree height is a crucial factor since it is necessary for estimating tree volume and biomass (Younis and Hassan, 2019). The analysis of variance the effect of different aspects on the height of *Quercus aegilops* and *Quercus infectoria* demonstrated that height ratio significantly impacted by both aspects of four season's year as shown in table (2). The highest mean of tree heights were obtained in autumn, winter, spring, and summer saesons (6.20 ± 0.15, 6.30 ± 0.09, 6.37 ± 0.06 and 6.86 ± 0.11) for *Q. infectoria* in the (S2A1). However, the lowest height of autumn, winter, spring, and summer recorded by *Q. aegilops*; (4.83 ± 0.14, 5.07 ± 0.32, 5.00 ± 0.15, and 5.33 ± 0.20) in the west site (S1A2).

Comment [r26]: Height of sampled tree were

Comment [r27]: The lowest values of tree heights were found during the same period in (S1A2) by *Q. aegilops* (4.83 ± 0.14, 5.07 ± 0.32, 5.00 ± 0.15, and 5.33 ± 0.20) respectively.

3.2 Tree diameter

The result of the statistical analysis shows that there are significant differences for the difference in the diameters of *Q. aegilops* and *Q. infectoria* trees at each season in the studied areas at the level of change in the aspect factor. The largest value of diameter autumn, winter, spring and summer obtained were; (11.23 ± 0.69, 11.52 ± 0.65, 11.80 ± 0.45, 12.06 ± 0.63) found in *Q. infectoria* stems at East (S2A1), while the lowest value of diameter autumn, winter, spring and summer were obtained from *Q. aegilops* stems (8.77 ± 0.28, 9.02 ± 0.20, 9.09 ± 0.25, 9.58 ± 0.12) in the West (S1A2)

Comment [r28]: Showed

Comment [r29]: Were a

Comment [r30]: Tree diameter changes of both species

Comment [r31]: In addition, in all seasons the highest values of stem diameter were recorded in (S2A1), (11.23 ± 0.69, 11.52 ± 0.65, 11.80 ± 0.45, 12.06 ± 0.63), while a significant decrease in this measurement were observed in (S1A2) (8.77 ± 0.28, 9.02 ± 0.20, 9.09 ± 0.25, 9.58 ± 0.12) table 2.

Table (2) Variation in trees height (m) and stem diameter (cm) during the four year seasons of 2021- 2022 growing period

Treatment combination	Plant height (m)	Stem diameter (cm)
	Autumn	
S1A1	5.53 ± 0.11 b	10.94 ± 0.57 a
S1A2	4.83 ± 0.14 c	8.77 ± 0.28 b
S2A1	6.20 ± 0.15 a	11.23 ± 0.69 a
S2A2	5.43 ± 0.14 b	10.30 ± 0.51 ab
	Winter	
S1A1	5.60 ± 0.09 b	11.33 ± 0.68 a
S1A2	5.07 ± 0.32 c	9.02 ± 0.20 b

S2A1	6.30 ± 0.09 a	11.52 ± 0.65 a
S2A2	5.47 ± 0.17 bc	10.48 ± 0.53 ab
	Spring	
S1A1	5.66 ± 0.08 b	11.50 ± 0.51 a
S1A2	5.00 ± 0.15 c	9.09 ± 0.25 b
S2A1	6.37 ± 0.06 a	11.80 ± 0.45 a
S2A2	5.65 ± 0.15 b	10.67 ± 0.43 a
	Summer	
S1A1	5.96 ± 0.18 b	11.92 ± 0.63 a
S1A2	5.33 ± 0.20 c	9.58 ± 0.12 b
S2A1	6.86 ± 0.11 a	12.06 ± 0.63 a
S2A2	5.91 ± 0.12 b	10.8 ± 0.5 ab

Comment [r32]: Under the table mention below sentence.

Different letters showed a significant differences across two studied species under the same aspects according to DMRT test ($P < 0.05$).

3.3 The number of branches

One of the indications of the state of oaks is the degree of branches transparency (Jurc *et al*., 2009). The branches number of *Q. aegilops* and *Q. infectoria* significantly variable at the study area as shown in figure (2). The maximum branches number obtained was; (7.0 ± 0.28), of *Q. aegilops* branches in the East aspect (S1A1). Similarity, in west *Q. infectoria* had the minimum number of branches; (5.3 ± 0.40) (S2A2).

Comment [r33]: Branch numbers per stem

Comment [r34]: Move this sentence into discussion section

Comment [r35]: Of both species were significantly variable at the study area as shown in figure (2).

Comment [r36]: A Higher values of branch umbers per stem were obtained for *Q. aegilops* (7.0 ± 0.28) in (S1A1), but in West aspect *Q. infectoria* showed the lowest data for the same parameter.

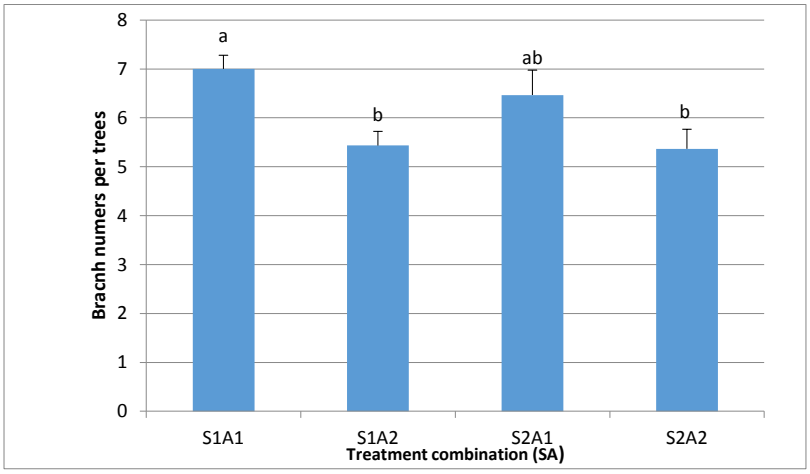

Figure2.Effect of aspects on the branches number for both tree species.

3.4 Number of trees in the area

There were significant differences between mean effects of tree number of five tree species that present in the study area includes (*Quercus aegilops* L., *Quercus infectoria* Oliv, *Crataegus azarolus* var., *Prunus microcarpa* C.A.Mey, *Pyrus syriaca* var), as exhibited in figure (3). The maximum tree number was (32.67 ± 6.73) recorded by *Q. aegilops* in west (S1A2). However, the minimum tree number was; (1.67 ± 0.33) recorded by *C. azarolus* and *P. syriaca* in the west (S3A2) and (S4A2).

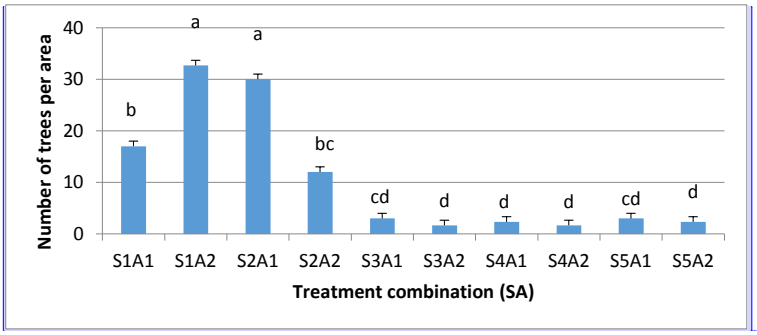

Figure3. Influences of aspects on the tree number for several tree species.

3.5 Relationship of soil characteristics with Aspects on tree growth

Table (3) shows the results of the chemical and physical properties for the soils samples at the studied area for both aspects. The pH of soil is considered to be one of the most important properties of soil. In this study the pH value for the soil saturation extract had generally a slight alkaline reaction such as 7.86 for east aspect as compared to 7.53 for west aspect, for an electrical conductivity (Ec) in the soil

Comment [r37]: Effect of aspects on number of branches of the studied species.
Different letters showed a significant differences across two studied species under the same aspects according to DMRT test ($P < 0.05$).

Comment [r38]:

Comment [r39]: This section need to be rewrite it again because in methodology you focused only on two types of oak species so it is essential to mention number of trees per area for both studied species.

Comment [r40]: From s3a1 until s5a2 delete them.

Comment [r41]: Effect of aspects on number of tree per area of the studied species.
Different letters showed a significant differences across two studied species under the same aspects according to DMRT test ($P < 0.05$).

Comment [r42]: Effect of aspects on Physical and chemical properties

Comment [r43]: Physical analysis of the soil of both aspects was carried out to find out the type of soil, that it's found the soil of both the studied area is similar in terms of texture, namely clay soils due to the increase in the percentage of clay on sand and silt

Comment [r44]: The soil pH value

Comment [r45]: was

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of the east aspect it was 0.2 ds/m, compared to 0.3 ds/m for the west aspect. The total nitrogen (N) for the east aspect it was 0.10% as for the west aspect it was 0.12%. The concentration of phosphorus (P) element in the east aspect was found (23ppm) greater than the west aspect with a concentration of (19.5ppm). While, the potassium (K) element increased its concentration in the west aspect its concentration was (202ppm), compared to 86ppm for the east aspect. As for organic matter content (OM) in the soil of east aspect it was 2.13%, compared to 2.86% for the west aspect.

Physical analysis of the soil of both aspects was carried out to find out the type of soil, that it's found the soil of both the studied area is similar in terms of texture, namely clay soils due to the increase in the percentage of clay on sand and silt.

Table (3) Analysis some chemical and physical properties for the soil samples of the studied location

Chemical properties						
Location	Nitrogen %	Phosphor (ppm)	Potassium (ppm)	pH	Ec ds/m	OM %
East	0.10	23	86	7.86	0.2	2.13
West	0.12	19.5	202	7.53	0.3	2.86

Physical properties				
Location	Particle Size Distribution (PSD) %			Soil texture class
	Sand	Silt	Clay	
East	18.3	17.5	64.2	Clay
West	23.3	22.5	54.2	Clay

3.6 Relationship Moisture content in the soil with Aspects

Over the entire duration of the study, from October to June, there was obvious variability in the readings obtained at the 50 cm depths on both sites of the mountain. We noted that in all four seasons of the year autumn, winter, spring and summer the rate of soil moisture in the east aspect was higher than the west aspect .

Table (4) Moisture content in the soil of the Mergasour region during the four seasons is measured on the basis of the dry weight of the soil.

Location	Soil moisture content %			
	Autumn 15.10.2021	Winter 15.1.2022	Spring 15.4.2022	Summer 15.7.2022
East	18.76	47.05	32.10	14.67

Comment [r48]: Delete

Comment [r49]: Delete

Comment [r50]: In addition

Comment [r51]: while, , the potassium (K) element increased was significantly greater for the west aspect its concentration was (202ppm) than the east aspect 86ppm

Comment [r52]: During the experiment, organic matter content (OM) in the soil was decreased in east aspect (2.13%), whereas it increased the west aspect (2.86%).

Comment [r53]: Delete due to has moved to the first section of discussion

Comment [r54]: Change the order of this table because physical properties should be first chemical properties just exchange the table order.

Comment [r55]: Effect of aspects on soil moisture content (S.M.C %)

Comment [r56]: an

Comment [r57]: data were

Comment [r58]: it is

Comment [r59]: from table (4)

Comment [r60]: delete it

Comment [r61]: the percentage of soil moisture

Comment [r62]: (18.76%, 47.05%, 32.10%, and 32.10%)

Comment [r63]: (11.35%, 35.13%, 25.31% and 12.35%) respectively.

West	11.35	35.13	25.31	12.35

4. DISCUSSION

4.1 Relationship vegetation growth with Micro climate and Aspects

The rate of tree growth is an integrated response to both past and current stresses (Kozlowski *et al.*, 1991). Uribe-Salas *et al.* (2008) identified a strong relationship between morphological features and environmental factors (mainly temperature and soil moisture). Since evaporative demand rises with temperature in many systems, temperature increases have indirect implications on water availability in addition to direct effects on plant physiology. (Bloor *et al*., 2010, Butler *et al*., 2012, Melillo *et al*., 2011, Reich *et al*., 2018). Due to the difference in the amounts of precipitation of the eastern and western aspects, because rain is the main climatic factor limiting the growth of oak forests in the KRI, as well as the high temperatures have been linked to reduced rate of growth because of high rates of leaf transpiration and soil water evaporation, which together produce premature stomata closure related to water stress and this is due to the fall of sunlight for longer hours on the west aspect and the lack of fall in the east aspect and this is identical to what them said (Rentch *et al*., 2002). Temperature has a greater impact on growth in height than in diameter (Way and Oren, 2010). Chen and Sumida, (2018) they showed that the effects of light intensity on branch growth and survival have been studied extensively. Typically, the number of current-year shoots produced on a branch increases with increasing light intensity. Shiran *et al.*, (2011) showed that, at the morphological level, macro morphological traits significantly differentiate between populations. For oak trees, while temperature rise starting between the ends of April and the middle of May as this conditions are very necessary for the oak trees that make up the forests of the region mainly, because it mainly affects the growth, as oak trees have their growth limited to only two seasons, such as summer and spring.

4.2 Relationship of soil characteristics with Aspects on tree growth

It is clear to us that there are differences in the proportion of nutrients in the soils of both aspects as in the table (3). While the main factor influencing the process of forest tree growth is the element nitrogen, although it represents the state of availability of nitrogen in forest soils. Oaks, as a genus, appear to be more susceptible to the stresses associated with nitrogen saturation (Wallace *et al*., 2007). When a forest is opened, nitrogenous substances are lost because they decompose more quickly. As for phosphorus and pH levels are typically not seasonally affected in most soils in Illinois (Fernández and Hoeft, 2009). Through the chemical analysis of the soil of the studied area which was found that the soil of the forest of this area suffers from a lake of organic matter content, because the both of the aspects excite small percentages of organic matter. This is because the aspect of west has a good density of trees, but in the east aspect with low density and open forests, thus reducing the amount of leaves and stems falling on the surface of the soil and therefore the thickness of the liter layer is thin, because the primary source of organic matter is the collection of plant residues from leaves, fruits and twigs falling on the surface of the soil, and decomposed by microbiology that present in the soil. Increasing vegetative organs of plant might be attributed with increasing macro elements of plant such as N, P, K (Luo *et al.*, 2020; Salehi *et al.*, 2020). The type of soil in the area and the spread of forest cover have the strongest relationships, because soil type affects the spread of forest cover. Additionally, tree growth is usually greater in fine-textured soils, resulting in larger return residues to the soil (Jackson and Meetei, 2018).

Comment [r64]: Effect of microclimate and aspects on vegetative growth

Comment [r65]: Stated that there is a

Comment [r66]: Rewrite this section and compare your results with other published papers.

Comment [r67]: compare your significant data results with other published papers.

Comment [r68]: Delete this because the paper did not studied the effect of light on tree growth

Comment [r69]: From finding of the present study there were a

Comment [r70]: ,

Comment [r71]: Present of soil

Comment [r72]: Do you think this is in accordance with your finding results

Comment [r73]: What is this term can you explained more?

Comment [r74]: May exciste higher tree density

Comment [r75]: It is too long make it clear.
Provide some references then compare them with your results such as effect of aspects on o.m

4.3 Relationship Moisture content in the soil with Aspects on tree growth

In general, that amount of soil moisture of the east aspect was more than of the west aspect in different seasons of the year because the amount of drops is more proportional in the east aspect as well as the western aspect is exposed to the sun for longer hours than the west aspect so evaporation increases in it as well as the processes of transpiration and breathing of plants due to heat and thus increase water consumption by the roots of trees. Soil moisture is one of the most important abiotic factors determining vegetation growth, variability and regeneration. Soil moisture dynamics are the central component of the hydrological cycle (Legates *et al*., 2011). Soil moisture availability could be one of the main factors, affecting habitat associations of the trees, shrubs and herbs. The distribution, diversity and primary productivity of plant communities have been reported to be highly associated with rainfall gradients and the availability of soil moisture (Chaturvedi and Raghubanshi, 2018). Topography one of the factors affected on soil moisture content such as slope and elevation of the study area, because slope in study area of the west façade more than of the east façade, so with decrease of slope, increases the retention of soil water and increased the rate of growth.

5. CONCLUSION

Concerning the relationship between topographic factors and microclimate response, the study comes to the conclusion that while the difference between the more exploitative species' microclimate response in the East and West sites was moderate or negligible for the more dominate species, it was significant. The severity, site environments, essential characters (abiotic tolerance and competitive strategy) of the species, as well as other factors, can all have an impact on the outcome of such investigations. Although this study evidently indicates the high sensitivity of *Quercus sp*., to both the changes in climate and topographic aspect, for climate reconstruction studies. Should be considered so, that the species has a high potential for such studies.

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Comment [r76]: The orientation of the slope with regard to the sun's position, such as it is east aspects air temperature are cooler during morning sun rises and this is vice versa with West aspect during afternoon sun shines. As a general role East facing slopes are exposed to direst sun light in the early morning are considered to be higher in moisture content than west-facing slopes, being nearly 15% more productive than the north and west aspects (Barnes et al., 1997).

Barnes, B.V., Zak, D.R., Denton, S.R. and Spurr, S.H., 1997. *Forest ecology* (No. Ed. 4). John Wiley and Sons.

Comment [r77]: West-facing more than of the east facing

Comment [r78]:
Below are listed some papers for your discussion need to been mentioned at least see their abstracts in order to compare with your data

Effect of aspect, tree age and tree diameter on bark thickness of *Picea orientalis*

Scholten, T., Goebes, P., Kühn, P., Seitz, S., Assmann, T., Bauhus, J., Bruelheide, H., Buscot, F., Erfmeier, A., Fischer, M. and Härdtle, W., 2017. On the combined effect of soil fertility and topography on tree growth in subtropical forest ecosystems—a study from SE China. *Journal of Plant Ecology*, *10*(1), pp.111-127.

Effects of slope aspect and topographic position on environmental variables, disturbance regime and tree community attributes in a seasonal tropical dry forest

Interactions of Elevation, Aspect, and Slope in Models of Forest Species Composition and Productivity

Comment [r79]: Interms of listed citation need to be in accordance to journal style
1- this an example of reference style GLISZCZYNSKASWIGLO, A. 2006. Antioxidant activity of water soluble vitamins in the TEAC (trolox equivalent antioxidant capacity) and the FRAP (ferric reducing antioxidant power) assays. *Food Chemistry,* 96, 131-136.
2- make sure to write scientific name of trees and plants in a correct way.

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