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COMPARISON BETWEEN THE CHARACTERISTIC OF PURE AND MIXED STANDS OF *PINUS BRUITA* TEN. AND *QERCUS* SPP. GROWN IN DOHUK REGION

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Abstract:

Forests are a biological system that continuously moves spatially and temporally and the influence of biological processes is manifested in the form of the spatial pattern of trees.a comprehensive analysis of the structure of the arboretum is a basis in the scientific management of the forest and knowledge of the competition between trees at different growth stages and gives an insight into the processes and mechanisms that underlie the development of the forest over time, different sites have determined the densities of pure and mixed, uneven-aged quarries of protean Pines (Pinus brutia Ten.) In the Dohuk Forest on (10/9/2023), and from each of the samples, field measurements are taken, which are the geographical coordinates using the Global Positioning System (GPS) (Global Positioning System), the total height and diameter at chest height (dbh), the crown width and the crown center height of all sample trees with a diameter of (17.9) M and an area of (1006) m2, and through the survey it became clear that there is a discrepancy in the densities of growing trees depending on the area of Crown coverage in the arboretum, the Botanical characteristics of and mixed by Chi-square test, except the size for trees growing in pure and mixed quarries.

Keywords: Pure and mixed stands, uneven-aged stands, Calabrian pine, oak species

INTRODUCTION:

Therefore, their management requires a general description of the sites of these melees as well as modeling of their constituent species (Bieng, et al., 2005). knowledge of the environmental specificity of sites in the formation of different melees is the first and necessary condition for achieving stable melees capable of performing multiple functions continuously, as the suitability of forest sites for a certain group of species is a fundamental feature of sites, which is necessary for the management of these forests (Cicşa, et al., the 2021). The continued decrease in species diversity will lead to an accelerated decrease in the productivity of global forests and in general mixed forests give higher productivity, as well as show a stronger ability to resist environmental conditions than pure forests due to high biodiversity, it was noted that the increase in the productivity of different quarrels by (7-53) % over pure quarrels (Pretzsch, et al. 2021), in general competition arises where mixed species occupy the same agestam, 2003), a decrease in competition occurs when mixed species use existing natural resources The relationship between species diversity and productivity is relevant for forests due to the increased importance of mixed forests due to their potential benefits, and the decrease in competition between forest species growing in mixed areas can lead to the productivity of mixed forests and the coexistence of species often leads to an increase in the production of mixed forests and is higher than the average for each the life history of the tree expresses the productive potential of the site, so that any changes in Natural environmental factors are reflected on the characteristics of the tree and its growth on the site, so this study came to achieve the estimation of the characteristics of mixed and pure quarries of different ages .

MATERIALS AND METHODS

This study was conducted on the natural forests in northern Iraq (Duhok Governorate), which is characterized by a site with a diverse topography, as it is characterized by high mountainous areas and deep valleys, and these sites are spread mainly by prutian pine trees (Pinus brutia Ten.) And oak or oak (Quercus spp. In addition, these forests contain a variety of small shrubs that grow overlapping with trees, as these natural forests extend to include many natural sites where forests grow in pure and mixed forms, and these forests are located at an altitude of (396 – 1713) meters, and this shows the balance between human activity and the preservation of natural resources developing at

this site (Khwarahm 2020), a preliminary survey of mixed mixed uneven-aged forest forests developing in the Dohuk forest was conducted on (10/9/2023), which is a fundamental step in Natural Resources Management in order to identify the structural characteristics of the forests, their spatial distribution, growth and vitality of trees growing in these forests and thus supports decisions on various services and products provided by these forests, and through the survey it became clear that there is a discrepancy in trees growing at the study site, of which there are high densities, for which the Crown coverage is high and covers most of the Earth , While other sites have medium to low densities and the trees are spaced or scattered, and through the survey, different sites have determined the densities of pure and mixed quarries of Proteus pine trees (Pinus brutia Ten.) And mixed with oak of all kinds (Quercus spp.) Randomly, from which (10) samples were taken for pure high-intensity brawls and (10) pure medium brawls of different ages, as well as (10) low brawls for protean pine trees (Pinus brutia Ten.), As well as (9) samples for mixed quarrels of unequal ages of Oak (Quercus spp.) And the prutian Pine (Pinus brutia Ten.) And for (3) High, (3) medium and (3) low densities and randomly, depending In determining the density of quarries on the coverage area of the crowns in the Arbor, quarries with a higher coverage area (70 > X) have high densities, while when the coverage area is between (70 < X < 40) have medium densities, while low densities when the density is between (15< X < 40) . From each of the samples, field measurements are taken and installed in special tables prepared in advance before determining the samples, which include geographical coordinates using the Global Positioning System (GPS), the total height and diameter at the level of chest height (dbh), crown width and Crown center height of all sample trees with a diameter of (17.9) M and an area of (1006) M2, the field data has been organized and tabulated using various mathematical equations and software to prepare them for analysis, including these measures estimate the basal area, size, height of the Crown Point, average height of the Arbor, number of trees per hectare, diagonal growth, distances between trees , Age, average diameter as well as average square diameter and also we used CH-Square test .

RESULTS AND DISCUSSION

Forests of uneven age provide pure biological diversity, although they contain one type of trees, because the differences in the ages of these trees serve to provide environments within the ecosystem at the stages of growth and development of these trees, and this promotes the coexistence of various plants and other biota, in addition to being mentioned, they are of great importance in the conservation of Threatened Species of trees that need special environmental conditions to preserve them as indicated by (Smith, et al. 1997) and (Pretzsch 2009), and to know the composition of brawls of pure uneven-aged Proteus pine forests growing in the province of Duhok took (30) selected samples of different densities and took The Botanical characteristics of these brawlers are as in Table (1). Table (1) Botanical characteristics of uneven-aged Proteus pine trees growing in the Dohuk governorate .provide biological diversity despite containing only one tree species. The variation in tree ages creates microenvironments within the ecosystem during different growth and development stages. This diversity supports the coexistence of various plants and organisms and is critical for conserving threatened tree species requiring specific environmental conditions, as highlighted by Smith et al. (1997) and Pretzsch (2009).

To study the structure of uneven-aged pure Calabrian pine (*Pinus brutia Ten.*) stands in Duhok Governorate, 30 samples of varying densities were selected. The vegetative characteristics of these stands were recorded and are presented in **Table 1**.

Table 1. Vegetative characteristics of uneven-aged pure Calabrian pine stands in Duhok Governorate.

No.	Ho (m)	Da (cm)	Dq (cm)	G^2 (m^2. ha	N (ha)	Sp (m^2)	V (m^3 . ha)
1	11.21	8.68	15.63	17.7338	924	3.29	96.6012
2	8.89	12.69	13.14	9.5691	706	3.76	39.2559
3	8.63	12.12	12.41	9.1406	755	3.64	37.5656
4	10.17	18.10	18.82	19.9185	716	3.74	89.4252
5	10.35	18.38	19.56	21.1974	706	3.76	97.4410
6	9.60	14.35	14.93	12.5309	716	3.74	51.2931
7	10.64	16.09	16.53	16.2166	755	3.64	77.8868
8	12.33	17.62	18.28	19.0491	726	3.71	95.5676
9	12.46	16.12	17.64	17.4815	716	3.74	87.1840
10	15.22	11.82	16.30	16.8074	805	3.52	112.9377
11	16.03	25.53	26.34	24.9125	457	4.68	151.9169

12	10.59	16.68	17.18	12.2150	527	4.36	56.4461
13	11.09	15.16	19.95	12.4325	398	5.01	67.3920
14	8.55	14.83	15.19	9.3691	517	4.40	33.7020
15	7.25	14.49	14.77	8.8567	517	4.40	33.4748
16	9.86	17.01	17.51	11.2497	467	4.63	45.8049
17	7.94	15.27	15.78	9.9166	507	4.44	37.2484
18	7.61	13.02	13.96	7.2997	477	4.58	26.4682
19	8.38	15.27	15.66	9.9576	517	4.40	34.0355
20	11.46	11.33	13.07	6.4043	477	4.58	33.2645
21	9.64	21.76	22.47	12.6188	318	5.61	52.2637
22	14.56	18.03	22.04	10.2369	268	6.10	70.6606
23	8.81	14.23	2.30	6.5419	318	5.61	3.6748
24	5.89	11.67	12.00	3.2604	288	5.89	10.9102
25	9.81	18.68	19.88	7.0935	229	6.61	32.2121
26	12.34	24.43	24.61	11.8248	249	6.34	62.5157
27	14.82	22.53	23.21	12.6152	298	5.79	73.3938
28	10.51	20.50	21.21	9.4792	268	6.10	45.9438
29	9.72	19.72	20.01	8.4389	268	6.10	37.2318
30	9.62	18.60	21.89	11.2182	298	5.79	40.6492
Min	5.89	8.68	2.30	3.2604	229	3.29	3.67
Max	16.03	25.53	26.34	24.9125	924	6.61	151.92
Average	10.46	16.49	17.41	12.1862	506	4.73	57.81
S.D	2.37	3.89	4.60	4.8791	199	0.99	31.91

Table 1 indicates that the average height of pine trees was in the range of (16.03-5.89) m with an average of (10.46) M and a standard deviation of (2.37), it becomes clear to us that there is a wide variation in the height of quarrels and this is due to the difference in the densities of quarrels, high-density and medium-density quarrels have growth in height at the expense of their diagonal growth, while in low densities and as a result of the presence of large spaces between the trees, which causes a decrease in longitudinal growth and an increase in, this is due to the fact that there is competition between trees at high densities, thus affecting the productivity of wood and the quality of the wood product (Oliver and Larson 1996) as well as we observe in The knowledge of the diameter indicators, whether it is the average diameter or the average square diameter of the tree, is considered the most important indicators for analyzing and evaluating the composition of forest trees, because of its role in determining the growth, development and vitality of the trees forming that tree and therefore affects the various developmental processes that the administrator conducts in that forest (Curtis and Marshall, 2000), the base area of a unit of area is usually used for to measure the density of trees, which helps to understand the vitality of trees, when we note in Table (1) that the area The basicity of the study samples ranged in the range (24.9125-3.2604) M2 . Ha and with a standard deviation (4.8791) M2. As for the average diameter of the trees of the arboretum as well as the average square diameter, these variables mean that the growth of the size of pine trees in the Arboretum also reflects the age(McElhinny et al., 2005), Whenever the average square diameter is large, we infer from it that the trees have large ages, in addition to considering it as one of the variables that determine the specifications of the wood produced in addition to using it to know the annual growth, reference should be made to the average square diameter helps the forestry administrator to understand the distribution of sizes in the so we note from Table (1) that the mean diameter and the mean squared diameter were in the range of (8.68-25.53) and (2.30-26.34), respectively, as well as their standard deviation (3.89-4.60), respectively, through these data, we see that there is a significant variation in the samples and their composition is different from each other, including at the stage of emergence, another at the stage of juveniles and

another at the stage of maturity (Day et al., 2017), as for the number of trees per unit area (Stocking density) is a direct measure of the density of the area and the importance of determining lies in the fact that it is used to determine the extent of competition between trees for the natural resources available at the site, and therefore it indicates the growth, development and vitality of growing trees and changes in the composition of the quarries, as well as the number of trees The distance between trees is one of the variables used as an indicator of density (Gilman et al., 2016), which is included in the preparation of growth and production models for quarries, so Table (1) indicates that the distances between trees and their numbers per unit area in the study samples were in the range of (3.29-6.61) m (229-924) trees.This reflects the characteristics of the structure of these quarrels, which indicates a difference in the emergence of these quarrels in terms of natural regeneration, which depends on the biotic and abiotic factors affecting the site, which can be the elements (Hédl et al., 2009), i.e. favorable conditions for growth and development, the variation of distances from which we infer different forms of growth of these quarrels, the quarrels are uneven-aged for Pine, we find large trees (mothers) occupying large areas and narrow ones with limited requirements, we also see different stages leading to a different composition in the study samples, which provides it can be said that the wide variation and deviation indicated in the numbers and distances between for the study samples reflects the complexity and diversity of the stages of formation of these brawlers and this 2011), and also the volume produced per unit area is one of the very important indicators in guessing the productivity of forests, as well as we can determine the balance in the composition of forests, their vitality and productivity, that is, through this indicator we can determine the amount of production per unit area, in addition to developmental processes, so we can conduct it to raise the efficiency of the the pine trees growing at the study site ranged from (3.67-151.92) m2.Hectares and standard deviation (31.91), from It is clear to us that these quarrels are of very different sizes, there are quarrels in advanced stages and others in the nascent stage, and that they need a lot of developmental and administrative processes to manage these quarrels for significant differences in structure, and this is what Pastur et al.pointed out (Pastur et al., 2008).

Mixed Uneven-Aged Stand Composition:

The installation of stands of different types of trees plays a very important role in production and the environment. increasing diversity leads to enhancing the biological diversity of the site, in addition to increasing the ability of the ecosystem to stabilize, balance and cope with mixed environment disturbances, as well as increasing multiple production stands and reduces competition between species trees, as well as its ability to increase the total production per unit area, and also these stands were able to provide mixed economic, recreational and tourist activities (Mason and Connolly, 1955) . Therefore, (9) measurements were taken of random samples from the Duhok forest for various quarries in which protean pine and oak are the two most common species, of which Table (2) was prepared .

Table (2): Vegetative Characteristics of Mixed Uneven-Aged Stands of *Pinus brutia* and *Quercus spp.* in Duhok Governorate

No.	Ho (m)	Da (cm)	Dq (cm)	G (m^2 . ha)	N (ha)	Sp (m^2)	V (m^3 . ha)
31	8.48	12.15	14.24	11.2359	706	3.76	51.1684
32	11.83	17.94	20.43	24.1078	736	3.69	127.3635
33	9.30	8.42	11.83	7.6493	696	3.79	33.0703
34	8.78	14.11	16.89	9.1345	408	4.95	43.9633
35	11.09	12.72	17.48	12.6434	527	4.36	75.2092
36	9.64	16.74	18.78	13.2232	477	4.58	60.8020
37	10.89	18.14	22.58	8.7562	219	6.76	48.7722
38	10.67	17.18	22.61	8.7785	219	6.76	48.1242
39	12.89	23.65	32.52	17.3402	209	6.92	111.6552
Min	8.48	8.42	11.83	7.65	209	3.69	33.07
Max	12.89	23.65	32.52	24.11	736	6.92	127.36
Average	10.40	15.67	19.71	12.54	466	5.06	66.68
S.D	1.38	4.14	5.65	4.98	205	1.30	30.48

It can be seen from Table (2), that the average height of the trees in the samples and their variation within the range (8.48-12.89) and the standard deviation (1.38), but the different environmental conditions represented by soil and

climate factors may be one of the reasons that led to differences in height for different study samples, and Bielak et al., 2014 pointed out that the diversity of trees within the arboretum and the age differences between them lead to differences in averages for different sites, and this corresponds to different in the forest of Dohuk, which includes melees, there are two main species, pine and Oak, both of different ages. Also, the samples represented high, medium and low densities. trees at high densities give higher elevations than medium and low due to the competition between trees for Natural Resources, which is reflected in longitudinal growth at the expense of Country growth, as well as medium densities are characterized by tree heights higher than low densities for the same reason, but the competition is somewhat lower than high density, while we observe in low-density quarrels, the country growth is higher than high and medium densities due to the development of tree crowns and the decrease in the center of the crown, here the height is lower, and this is what Ginrich (1967) mentions is that the average height of quarrels It is influenced by the density of that Arboretum and the competition for nutrients and moisture .

The indicators of the average diameter, the average square diameter, the basal area per unit area and the differences estimated by the range are (8.42-23.65), (11.83-32.52) and (7.65-24.11) respectively and the standard deviation (4.14, 5.65, 4.98) respectively, where a high value indicates the presence of trees with large diameters and are the most widespread in these quarrels, and that the differences in these mixed quarrels show that there are large trees and that the distribution of diameters in these quarries is heterogeneous and contains wide diagonal categories, and therefore different stages in which these samples pass, as for the divergent base area and deviations between the samples means the presence of In general, the significant differences in these indicators reflect the variation in the sizes of trees and their distribution in the mixed forests of the Duhok forest, and this is observed in the size range of the study samples (Dhôte and Hervé, 2000) and a standard deviation (30.48), and this confirms that there are samples with high densities and sizes, while others are lower and at other stages of the emergence and formation of these this is what we have observed from the density indicators represented by the number of trees per unit area and the distances between the trees, which also indicate significant differences For the range (209-736), (3.69-6.92) and standard deviation (205) and (1.30), respectively, the distances between the trees and their numbers per unit area give evidence of the movement of trees, their structure and environmental condition, the many distances and few numbers of trees, indicate a low growing stock, as well as differences in these indicators and within a wide range may be caused by various environmental effects that led to an increase or decrease in the number of trees, and also when we observe the number of trees high and short distances, it indicates quarrels in the early stages of installation, whether it is the stage of seedlings or juveniles, while the distribution of trees in large distances and low numbers means that the systems of this forest are stable The site is dominated by large trees and there is a balance of species for mixed quarrels (Linden and agestem, 2003).

Comparison of Structural Characteristics of Pure and Mixed Uneven-Aged Stands:

Determining which of the two communities has significantly different characteristics from the other depends on the use of a specialized scale for this purpose, and one of the tools used to compare two communities uses The Chi-Square statistical scale, which can be applied to the components of these brawls, and from it we can check whether there are differences between pure and mixed unequal-age brawls, such as whether any of them is more productive and competitive in terms of density distribution and providing better growth and development conditions than others Reddy (2023), if the characteristics of the structure the size and number of trees per unit area, the prevailing height, as well as the base area per unit area does not indicate any significant differences, it This means that the discontinued effects of differences in age or species in the two trees did not make significant differences in the studied compositional characteristics, and vice versa, if there are differences, there are effects on the composition, which is represented by the density and volume produced per unit area (Pretzsch et al.2014), so the sample data were taken for uneven-aged and mixed quarries, represented by (30) samples of pure Pine quarries of unequal age scattered in the Dohuk forest and (9) other samples of mixed quarries, and estimated for these quarries the properties of the composition in Tables (3) and (4).**Tables (3) and (4)**.

Table (3): Structural Characteristics of Pure Uneven-Aged Stands Across Different Densities.

Pure	V (m^3 . ha)	N (ha)	H_0 (m)	G (m^2 . ha)
High	78.5158	752	10.9494	15.9645
Middle	51.9753	486	9.8743	11.2614
Low	42.9456	280	10.5697	9.3328

Table (4): Structural Characteristics of Mixed Uneven-Aged Stands Across Different Densities.

Mixed	V (m^3 . ha)	N (ha)	H_0 (m)	G (m^2 . ha)
High	70.5341	712	9.8687	14.3310
Middle	59.9915	471	9.8337	11.6671
Low	69.5172	215	11.4837	11.6250

Structural Characteristics of Uneven-Aged Pure and Mixed Stands: A Comparison

From Tables (3) and (4) that the volume of the unit area in pure and mixed trees has different densities, but to know if there is a significant difference between them, we used the Chi-Square measure and applied the data collected in the field, and from that the value of X2Cal. (calculated) was estimated, which was (2.2359), and when it was compared with the value of X2Tab. (tabular), it turned out to be less than it, and this indicates that there is no difference between the two communities, meaning that we accept the null hypothesis that indicates that the volume of the unit area is equal between the two communities:

V0iG12=G22V0i G12 = G22V0iG12=G22

- V1=V2V1 = V2V1=V2

  The sizes per unit area produced for both trees were fairly close, whether for high, medium or low density, that is, the differences in ages and species did not have a significant impact on the overall production of the tree, and from this we understand that both systems are equal in production efficiency, and that there is a balance in growth between trees at different stages of growth in the installation of these trees, from this we can conclude that the adoption of any of the strategies that serve administrative goals, whether different types or different ages, without having a negative impact on production (Del Rio and Sterba, 2009) . The number of trees is of great importance and management in assessing the growing stock in Forest quarrels, where we can estimate the amount of biomass per unit area, in addition to determining the distribution of trees by diameters and heights and determine the species and stages of their growth, knowing the number of trees helps the forest administrator in determining the level of competition between trees for natural chi-square to guess variance in a pure age unequal society When comparing it with The Chi-Square Tabular value, it was noted that it is lower than it, and this indicates that there are no significant differences, and then we accept the hypothesis of nothingness and reject the hypothesis of the alternative, that is, that : the alternative hypothesis:
- N0i=G12=G22N0i = G12 = G22N0i=G12=G22
- N1=N2N1 = N2N1=N2

  At a moral level of 0.05, so the results indicate that the difference in the number of trees for different densities and for the two species in the quarrels on the one hand are factors other than the number of trees, and that the number of trees does not give evidence that there are real differences between both trees in terms of the number of trees per unit area Pastur (et al .2008) and Amiri 2019). Tables (3) and (4) also show us that the heights in these quarries at different densities are different, but is this variation significant at the level of 0.05 or not, And this is because his knowledge is of great importance, the height of the Arbor is a key measure and indicator of the suitability of the environment, location, vitality and development of the trees growing in that Arbor, and he also participates in the formation of the structure of the Arbor and the number of layers, in addition, the difference in height varies with the degree of the site Between these two trees, we can estimate a value .X2Cal (calculated) for the height of the Arbor was (0.57104), which is less than the tabular value of X2 –Square , and this indicates that there are no significant differences , and that the two communities are equal when compared in terms of height, that is, accepting the hypothesis of nothingness and rejecting the hypothesis of the alternative :
- H0iG12=G22H0i G12 = G22H0iG12=G22
- H1=H2H1 = H2H1=H2

That is, the data for the rise do not provide evidence of significant differences between both communities under study . The base area of a unit of area for quarries is considered one of the indicators in assessing the composition of the forest and its density, and its importance lies in the fact that the base area gives a picture of the size of the wood stock present in the unit of area, from which we can guess the degree of competition or spaces not exploited by trees, in addition to assessing the size of wood production that can be invested, the more it has a base area plus the expected wooden or financial return, and that is an indicator of the vitality of trees or environmental effects that are not positive on growth, so the data of quarries according to the chi-square test, depending on the base area per unit area, it was a value .X2Cal The (calculated) amount of (11.0552) was compared with the tabular X2 – Square value , and it was found that there are significant differences because the calculated value is higher than the tabular value, that is, we reject the null hypothesis and accept the alternative hypothesis, which depends in comparison on the base area

G0iG12≠G2G0i G12 \neq G2G0iG12· =G2

G1≠G2G1 \neq G2G1· =G2

This shows that there are significant differences in basal area between the two stands, indicating that one stand contains larger trees than the other. The difference in basal area likely reflects environmental effects, such as soil and climate factors, as well as management practices, including stand maintenance. This also suggests that there are differences in size and structure between the stands, which may be due to either management or environmental factors (Lee et al., 2023).

CONCLUSIONS:

This study found that the compositions of mixed and uneven-aged forest trees growing in the Duhok forest after analyzing the field data, the Botanical characteristics in the province of Duhok, as well as the comparison of the

composition characteristics of the trees showed that there are no significant differences between pure and mixed trees through The Chi-Square test, except for the basal area per unit area, and this showed that there are in the distribution of trees per unit area.

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