

The Research of the Radial Growth of the Flora Species which do not have Special Protection on the South Hillsides of Greater Caucasus

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ABSTRACT

The radial growth of the trunks of the following flora species which do not have special protection on the south hillsides of Greater Caucasus were studied in the article: Georgian oak- *Quercus iberica* M.Bieb Common hornbeam - *Caprinus betulus* L. Common chestnut - *Castanea sativa* Mill. Black walnut - *Juglans nigra* L., Heart leaved alder - *Alnus subcordata* C.A. Mey. During the dendrochronological analyses, the dynamics of growth over the years were analysed based on the distances between the tree rings. The impact of the climatic factors to the growth of the trees was analysed and the ages of tree species were investigated. Based on dendrochronological historical application, according to the numbers of tree rings the ages of the trees were defined in the studied species. According to the numbers of tree rings, the oldest type of the rare and scanty flora types which have no special protection was identified as *Caprinus betulus* L. in Zagatala region. The tree was taken from Zagatala district, planted in 1944, was 75 years old and had 330 cm diameter. The observation of dendrochronological researches indicates the formation of a new microclimate. It was observed that in the investigated species, radial growth was more intense during matureness, then it was weakened with age. In the comparative analysis, it was observed that the minimum radial growth was in 2010 and 2015, and the maximum growth was in 1973 and 1985 in the Zagatala region.

Keywords: Dendrochronology, radial growth, TSAP-win, monitoring, climatic factors, phenogenetics differentiation

INTRODUCTION

For the restoration of the soil and climatic conditions of the country, the protection as well as restoration works of existing forests together with the establishment of new forests is a requirement of the day. There has been an extensive research for studying biometric analysis and dendrochronology of processes occurring in populations of rare species of natural and cultural flora. The possibility to increase tree types that meet predetermined qualities will enable the wood to be used effectively. For this reason we have dedicated this research to the dendrochronology of the *Quercus iberica* M.Bieb and *Caprinus betulus* L. which grow in the forests in Zagatala region. The study of species has created conditions for the study of anthropogenic impact on the vegetation of Azerbaijan, the monitoring of the vegetation of specially protected areas, the study of the phenogenetic differentiation of the

populations and recultivation of technogen landscape.

MATERIALS AND METHODS

During the year, researchers from the laboratory "Dendrochronology" Institute of Dendrology.

ANAS organized scientific trips and expeditions to various regions of our republic, such as Zagatala and Balakan, together with the staff of the ANAS Institute of Erosion and Irrigation, the purpose of which was also to study the soil-erosion characteristics of the objects of study in the region, where field studies to determine the water-physical and agrochemical properties of soils in the region where soil sections were laid and soil samples were taken, according to which.

The study of agrochemical indicators showed that the humus content in the upper horizon of unwashed soils was 4.9%, total nitrogen 0.329%

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with a tendency to decrease down the profile. In indelible soils, the sum of absorbed cations in the upper horizon was 33.48 mEq. per 100 g of soil. In the medium-washed counterparts in the

upper 0-16 cm horizon, the humus content was 3.4%, the total nitrogen was 0.215%, the sum of exchange cations was 24.94 mEq per 100 g of soil with a tendency to decrease down the profile.

Tabl.1. Structural and aggregate composition of mountain brown steppe soils of Zakataly district

Incision	Genetic horizon	Depth in cm	Fractions							
			>7	7-5	5-3	3-1	1-0,5	0,5-0,25	<0,25	<1
un washed	A	0-31	21,23 3,40	11,45 6,79	9,54 12,34	19,56 20,44	19,89 24,15	11,37 13,45	6,96 19,43	61,78 42,97
	B	31-52	15,29 5,61	12,45 10,92	14,13 12,91	7,85 4,49	9,35 29,71	21,94 15,64	18,79 20,72	49,72 33,93
	C	52-89	6,50 3,6	7,40 4,5	9,44 6,8	11,31 8,9	31,18 12,60	25,49 14,40	8,68 49,20	34,65 23,8
medium washed	A	0-16	5,20 4,30	9,10 5,10	9,90 5,50	11,00 4,00	12,10 6,70	5,58 7,20	47,12 67,20	35,20 18,90
	B	16-30	3,18 2,90	4,20 5,30	17,60 4,40	4,02 5,00	7,66 9,19	8,22 10,00	54,22 63,21	20,07 17,60
	C	30-64	5,00 -	3,30 4,90	3,30 5,00	4,40 4,11	5,30 9,30	10,59 16,59	67,11 59,60	16,50 14,01

In the laboratory of analytical studies of the Erosion and Irrigation Institute of ANAS Velis 1 laboratory analyzes based on the results of which a corresponding cartogram of the soil-erosion hazard of the lands at the research objects in the region of Sheki-Zagatala zone (see figure 2) is compiled, which is

emonstrated. The main goal of dendrochronological analysis is to study the following facts based on scientific facts: the interaction between the tree trunk and the environment, the variability of the wood depending on the year, the impact of events occurring due to environmental factors and the age of the tree trunk.

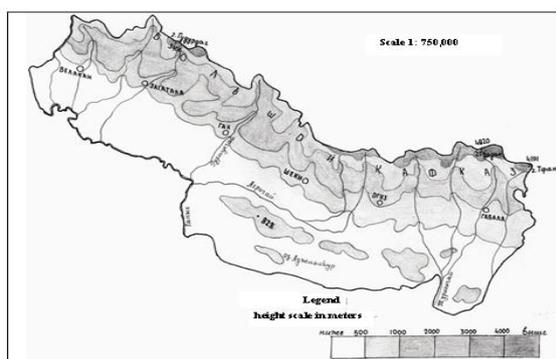


Fig.2. Soil-erosion map of Sheki-Zagatala administrative district

To do this, samples are taken from tree trunks, determine their age and establish charts showing the absolute and relative indicators of factors affecting biological growth. This, in turn, allows us to determine the criteria for the continuation of a sequential growth period by years.

In the course of the study, the taxonomic, biomorphological, and radiological features of

the species were studied on the basis of modern equipment and TSAP-win software (Rinn F., 1996). The average and annual indicators of the main climatic factors that most affect species, data from central meteorological stations and species indicators were comparatively analyzed. Then it was justified and using the alphanumeric key of the political analysis, which was compiled on the basis of the results achieved, the status of the species was confirmed and the corresponding diagrams were established (T.S. Mamedov et al., 2016; Eugene A. et al., 1978)

Phenological observations, qualitative analyzes, assessments and records in accordance with methodological guidelines were carried out during the study of rare and scant species of flora that do not have special protection status in the Zagatala region.

RESULT AND DISCUSSION

The studies were carried out in Zagatala in the north-west of the Republic of Azerbaijan, in the southern foothills of the Greater Caucasus Mountains, and in the east by the border with Gakh region and in the Balakan region in the west. According to the literature materials, about half of Zagatala's territory is occupied by forests located in the mountains and in the foothills. Zagatala region is rich in various types of trees such as Castanea Mill., Corylus L., Caprinus L etc (Mammadov T.S., 2011).

4 climate zones mainly humid subtropic and mountain tundra are typical for the area. Moderate and semi-humid subtropic climate are in plain and foothill areas and on mountainous places there are cold and humid climate. 65% of the district has a subtropical climate zone. Rich

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forest cover accounts for 5% of the country's forest reserves. *Fagus L.*, *Tilia L.*, *Fraxinus L.*, *Sorbus L.* Etc tree species grow in the forests. There is Tugay forest along with Qanix (Alazan) river.

The monitoring of the areas was conducted during the research, ecosystem was assessed, rare and extinct tree and bushes were identified, old and scant types were dendrochronologically analysed and forecasts were given for these species. Samples were taken from *Quercus iberica* M.Bieb and *Caprinus betulus L* in Zagatala region (pic. 1)

In accordance with methodological guidelines phenological observations, qualitative analyzes, assessments, records were carried out in ANAS Dendrology Institute, "Dendrochronology" laboratory and in the north-west of the Republic of Azerbaijan, in the southern foothills of the Greater Caucasus Mountains, and in Zagatala which located by the border with Gakh region in the east and in the Balakan region in the west

According to the literature materials, about half of Zagatala's territory is occupied by forests located in the mountains and in the foothills. Zagatala region is rich in various types of trees such as *Castanea Mill.*, *Corylus L.*, *Caprinus L.*, *Juglans L.*, *Corylus L.* *Ulmus L.* etc (Mammadov T.S., 2011).

4 climate zones mainly humid subtropic and mountain tundra are typical for Balaken district. Moderate and semi-humid subtropic climate are in plain and foothill areas and on mountainous places there are cold and humid climate. 65% of the district has a subtropical climate zone. Rich forest cover accounts for 5% of the country's forest reserves. *Fagus L.*, *Tilia L.*, *Fraxinus L.*, *Sorbus L.* Etc tree species grow in the forests. There is Tugay forest along with Qanix (Alazan) river.

Containers were used to transport equipment, installations and samples to carry out scientific research in the Zagatala Balakan region (Campelo F. *et al.*, 2012; Schweingru-ber F.H., 1996).

Samples were taken from the species for getting chronological information. These samples

Table 2. Area, diameter, and age of the samples

№	Species	Area	Diameter of the trunk (sm)	Sample age
1	<i>Quercus iberica</i> M.Bieb	Zaqatala.	320	62 (1957)
2	<i>Quercus castaneifolia</i> C.A.Mey	Car forest	330	75 (1944)
3	<i>Juglans nigra</i> L.	Balakan	270	44 (1975)
4	<i>Caprinus betulus</i> L.	---	210	74 (1945)
5	<i>Alnus subcordata</i> C.A.Mey.	Zaqatala.	392	85 (1934)

collected in the special containers, were dried and kept in laboratory conditions.

The surfaces of the samples which were moved to containers were hewed for clear look of the wood rings and distinguishing the cells. Lintab 6 and Resistograph devices were used for setting diagrams for getting information about global changes that happened in the past based on the tree rings after samples were ready.

The main purpose of the research done in 2018 in ANAS Dendrology Institute, "Dendrochronology" laboratory is to biometrically analyze processes occurring in populations of rare species of natural and cultural flora, their dendrochronological analysis, the monitoring of the areas and prepare plan for assessing and protection of ecosystems (T.S Mammadov *et al.*, 2016; Eugene A. *et al.*, 1978; Shiyatov S.G., 2000).

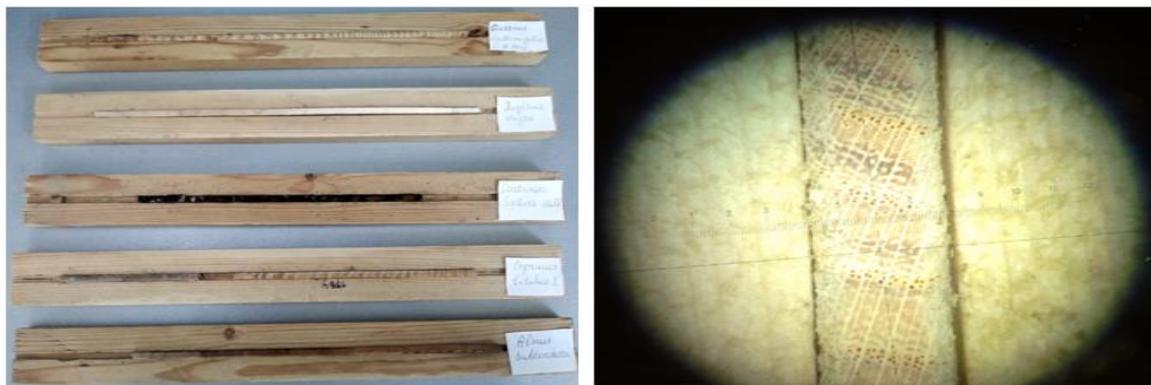
Scientific trips were organized during the research of the rare and scant flora species which do not have special protection in Zagatala Balaken region, the monitoring of the areas was conducted ecosystem was assessed, rare and extinct tree and bushes were identified, old and scant types were dendro-chronologically analysed and forecasts were given for these species.

Samples were taken from *Quercus iberica* M.Bieb, *Caprinus betulus L.* *Castanea sativa* Mill. *Juglans nigra L.* Heart leaved alder *Alnus subcordata* during scientific trips to Zagatala Balaken region (pic 1,2)

It was revealed from the research that the mineral content of the soil, humidity, rivalry etc. has positive impact on the growth of the species in different forms. Humidity, lack of nourishment and changeable temperature creates dense tree rings on the species which are grown in shallow soils.

The ring orders were subject to changes in years on the species which are grown in favorable conditions. These species in their growth period reacted sensitive and non-sensitively to the impact of the environment. The results are in figure Charts 1,2,3,4,5.

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Pic2. The view of the samples which dried, planed and put into container

Quercus iberica M.Bieb is naturally found in Europe and the Caucasus. In Azerbaijan, it is found in the Samur-Shabran lowland, Guba, the western-eastern part of the Greater Caucasus, the northern, southern and central parts of the Lesser Caucasus and Lankaran. It can reach to 32m height. Its shoots are of reddish-brown color and bare.

Reproduced with seeds, the natural reproduction is good. It requires soil fertility *Quercus iberica* M.Bieb sample which was taken Jar forest in Zagatala was planted in 1957. It was 62 years old. It was revealed that it had grown intensively until 1975 then the dynamic of the growth decreased with age.

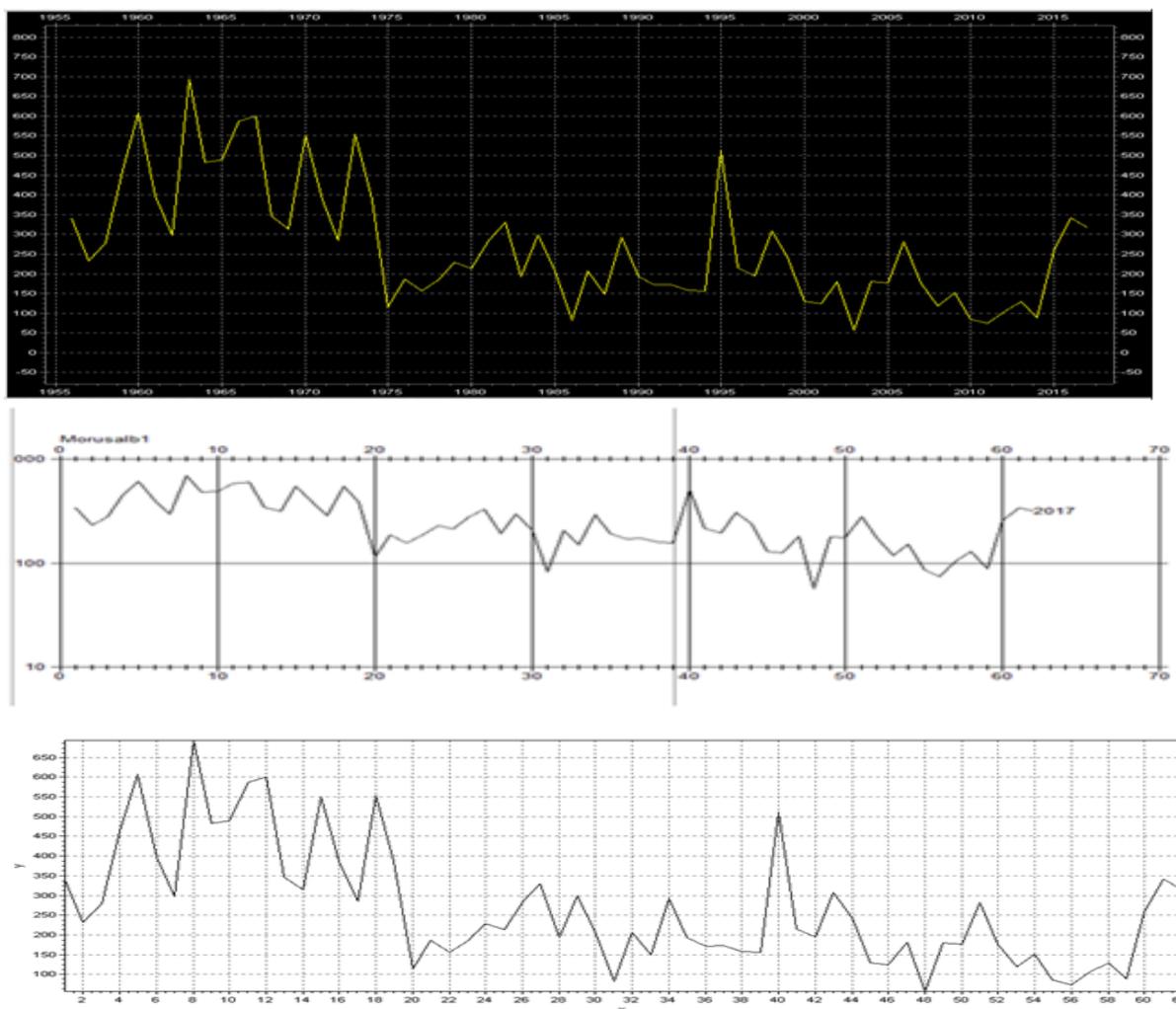


Chart1. *Quercus iberica* M.Bieb radial growth indicators

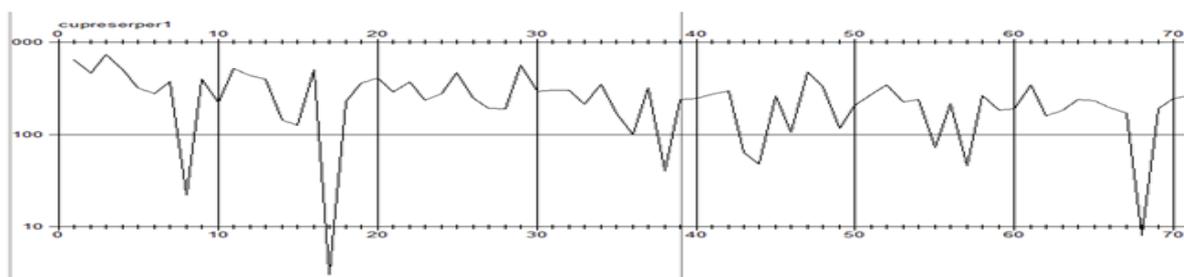
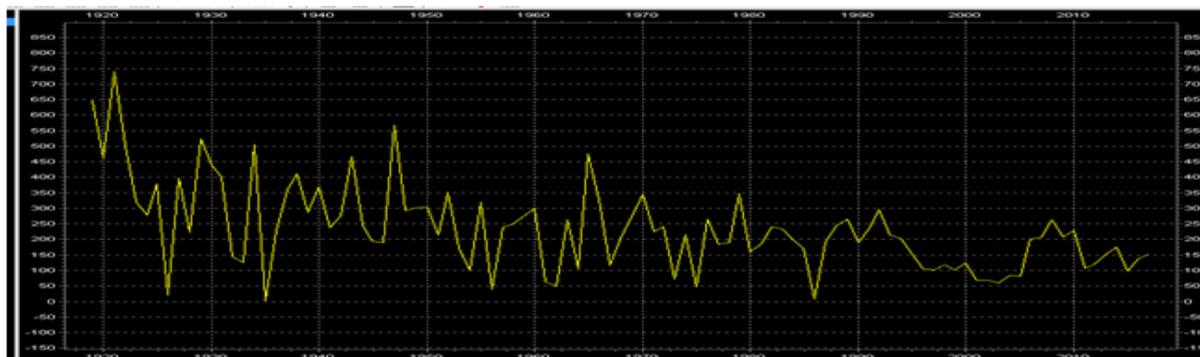
Quercus castaneifolia C.A.Mey is found in Iran. It is rare and relict type its natural habitat is not

wide. It is found in Astara, Lankaran, Lerik, Masalli, Yardimli and Ismayilli districts. Under

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favorable environmental conditions, it is a tree with a height of up to 40 m. It is one of the first tier type of trees in the forest. The young shoots are initially covered with dense and delicate hairs, and then they are shed. It blooms in

March-April, and seeds germinate in October-November. In nature, it is mainly reproduced by seeds. It is more common in mixed forests of the Middle Mountain Range (Mammadov T.S., 2010; Mammadov T.S., 2011).



Quercus castaneifolia 0 75 1944 2018

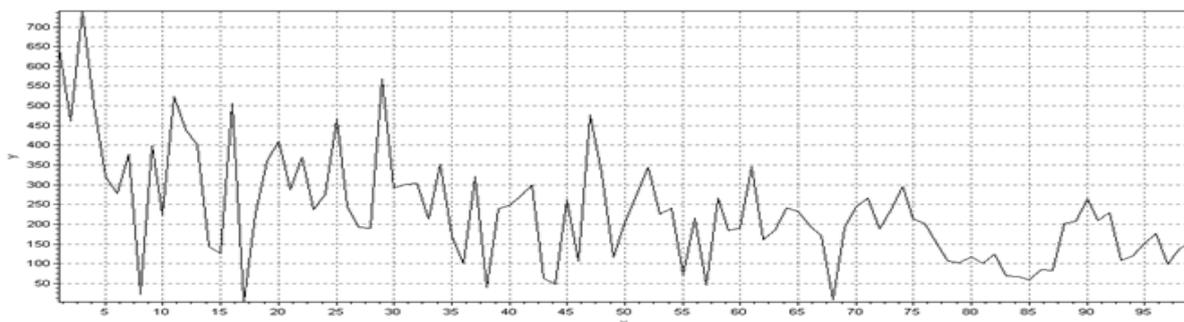
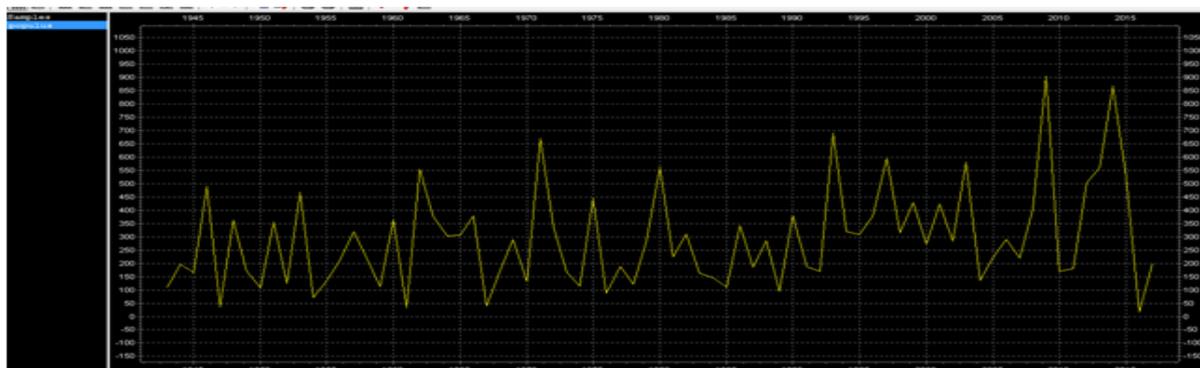


Chart2. *Quercus castaneifolia* C.A. *Mey* radial growth indicators

Caprinus betulus L. - it is naturally found in Europe. The height reaches up to 25 m. The diameter of its umbel reaches up to 7-12 meter. The annual height increase is 35 cm. The bark is dark brown, smoother.

It blossoms in May and June. The fruit ripens in September-October. It is reproduced with seeds. It is resistant to drought and frost (Mammadov T.S., 2011).



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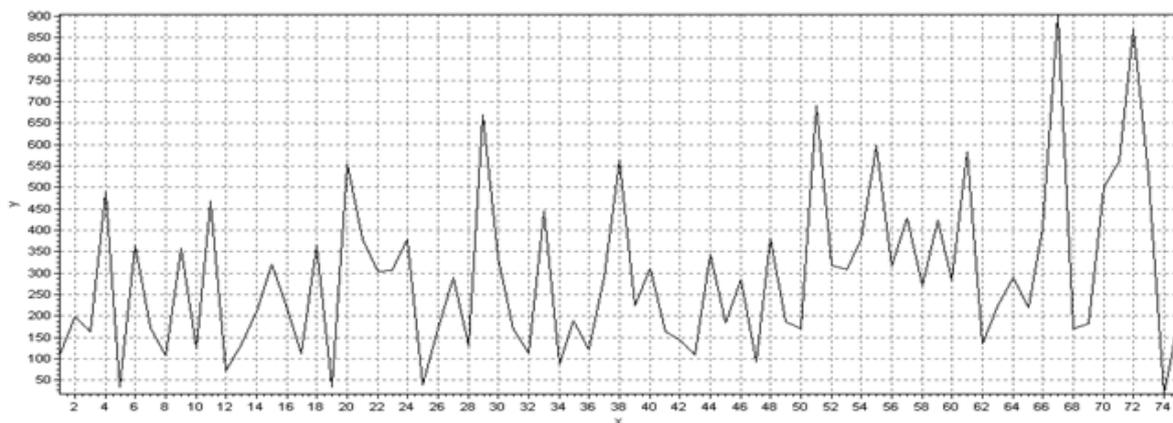
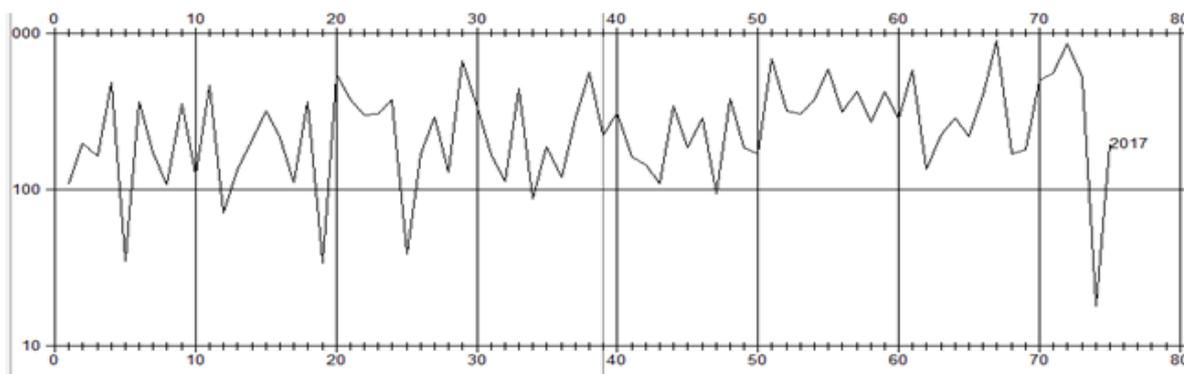
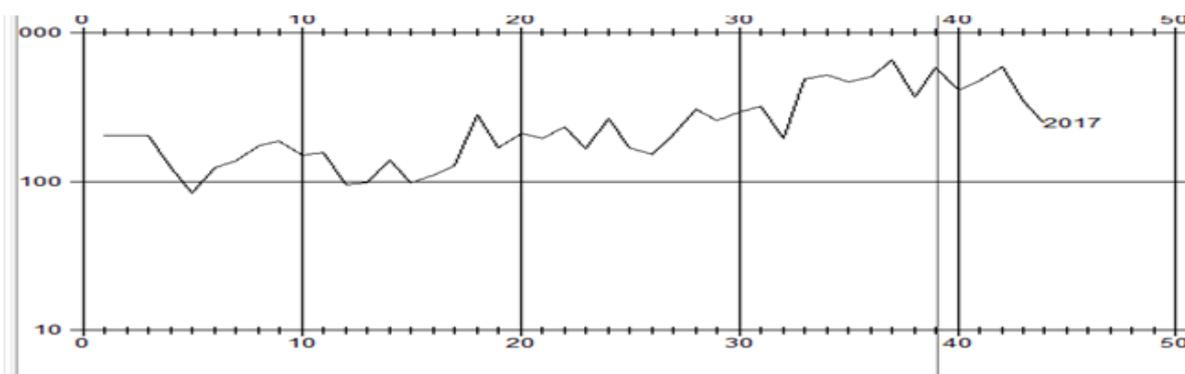
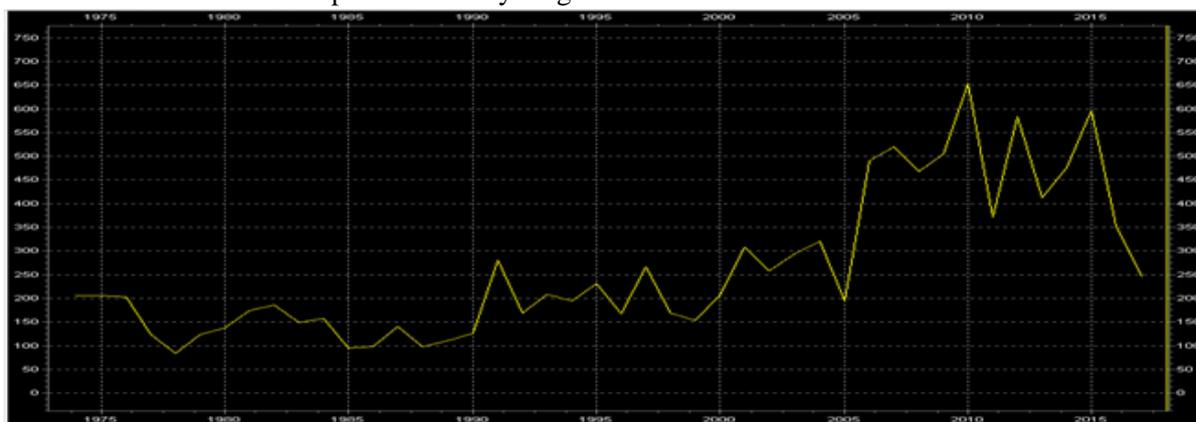


Chart3. *Caprinus betulus L.* radial growth indicators

Juglans nigra L. its homeland is North America. It is found in Ganja, Nagorno Karabakh, Zagatala, Absheron under cultural conditions. The tree is sometimes 45 m high and the diameter is 180 cm. The bark of the body is dark brown and it has uneven deep cracks. The young

shoots are sparse hairy, its bud is bare. It grows in open places and has big and tent shaped umbel. It is fast-growing, frost- and drought-resistant, heliophilous and soil needing tree (Mammadov T.S., 2011).



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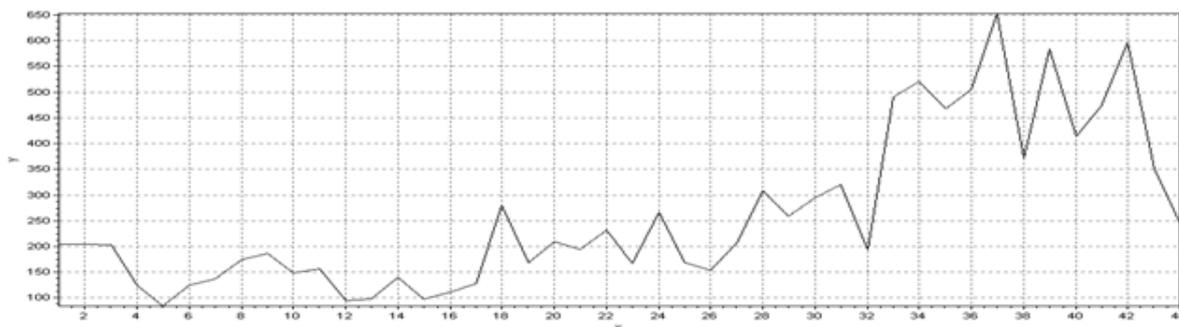


Chart4. *Juglans nigra* L. radial growth indicators

Alnus subcordata C.A.Mey has natural habitat in Iran. It is considered as rare and relict type of tree and found in Lankaran, Lerik, Yardimli, Astara districts. It is straight-boled and reaches up to 20-30 meter height. The young trees trunk is greenish grey. Then the bark of the trunk thickens, the color becomes dark and cracks

form on it. The top bud is sedentary and has no stalk. The side buds have stalks. It is reproduced by generative way. It is found in the forests, in the valleys, in humid places, on heights ranging from, low mountain ranges to moderate ranges (Mammadov T.S., 2010;Mammadov T.S., 2011).

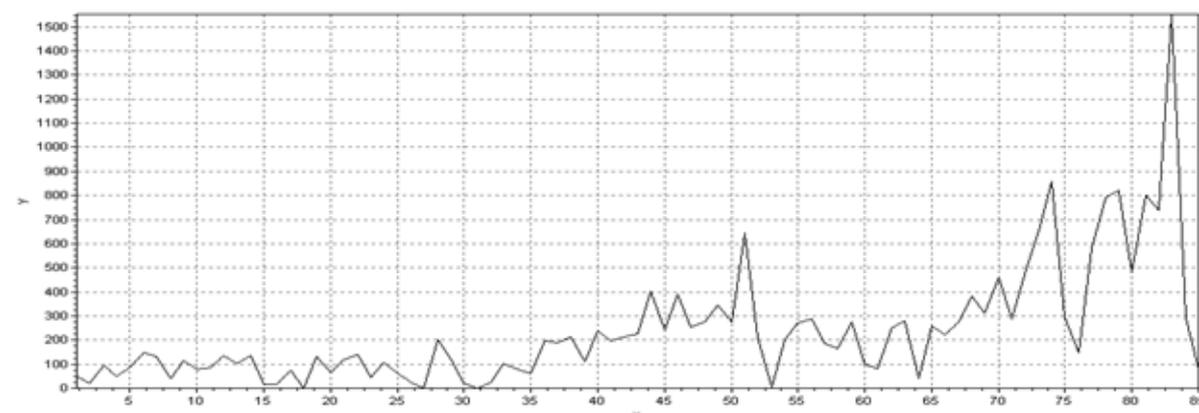
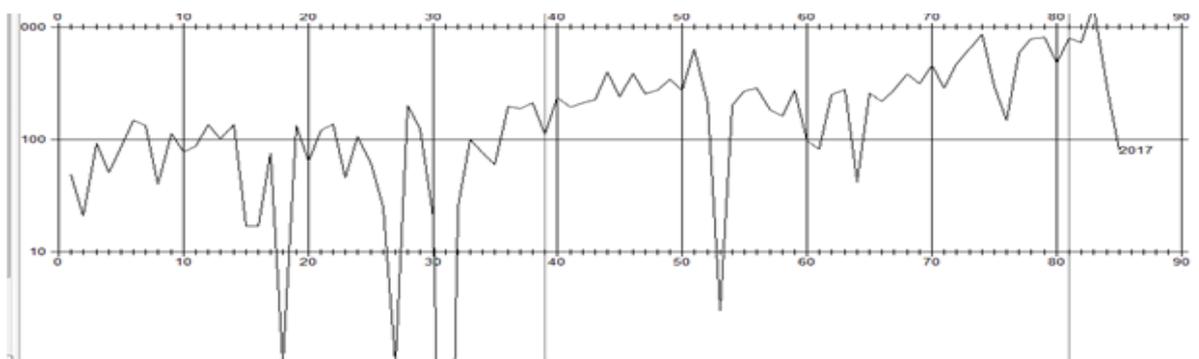
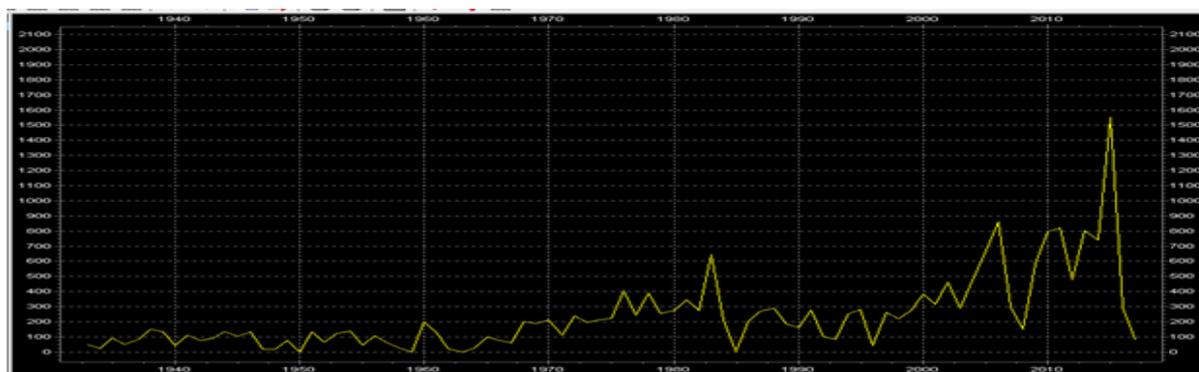


Chart5. *Alnus subcordata* C.A.Mey radial growth

RESULT

The radial growth is fast during maturity period and getting slow with age in the studied species on Zagatala Balaken region. Based on dendrochronological historical application, according to tree rings the ages of the trees were defined in the studied species. According to the numbers of tree rings, the older type of the rare and scanty flora types which have indicators no special protection was identified as *Alnus subcordata* C.A.Mey in Zagatala region. The tree was taken from Ismayilli district, planted in 1934, was 85 years old and had 392 cm diameter. In the comparative analysis, it was observed that the minimum radial growth was in 2010 and 2015, and the maximum growth was in 1973 and 1985 in the Zagatala Balaken region.

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