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IMPACT OF CLIMATE CHANGE ON THE DENDROFLORA OF OKHCHUCHAY AREA OF ZANGILAN DISTRICT

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ВЛИЯНИЕ ИЗМЕНЕНИЯ КЛИМАТА НА ДЕНДРОФЛОРУ ОХЧУЧАЙСКОГО БАСЕЙНА ЗАНГЕЛАНСКОГО РАЙОНА

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Abstract. Monitoring was carried out in Okhchuchay area of Zangilan district, and scientific research works were carried out in the surrounding areas of Agali village, Beshdeli village, Kechikli, Mammadbeyli, and Dagustu park. The aim was to study the impact of climate variability on biodiversity, to investigate the taxonomic composition of natural and cultivated dendroflora, bioecological characteristics. The natural dendroflora in Okhchuchay area of Zangilan district was studied, notes were made on the study of the modern state of plant species and analyzes were made in the direction of studying the role of biodiversity in ensuring the natural regeneration of rare species. Distribution areas of relict, endemic rare and endangered plants, economically important plants in Okhchuchay area of Zangilan district have been determined. Soil water samples were taken from the research area and its composition was investigated.

Аннотация. Мониторинг проводился в бассейне р. Охчучай на территории Зангеланского района, а научно-исследовательские работы проводились в окрестностях сел Агали, Бешдели, Кечикли, Мамедбейли и парка Дагустю. Целью работы было изучение влияния изменчивости климата на биоразнообразие, таксономического состава естественной и культивируемой дендрофлоры, биоэкологические характеристики. Изучена естественная дендрофлора Охчучайского бассейна Зангеланского района, сделаны замечания по изучению современного состояния видов растений, проведены анализы в направлении изучения роли

биоразнообразия в обеспечении естественного возобновления редких видов. Уточнены ареалы распространения реликтовых, эндемичных, редких и находящихся под угрозой исчезновения растений, хозяйственно важных растений в Охчучайском бассейне Зангеланского района. С территории исследований были взяты пробы почвенной воды и исследован ее состав.

Keywords: indicators, Lesser Caucasus, biodiversity.

Ключевые слова: индикаторы, Малый Кавказ, биоразнообразие.

An expedition to Zangilan district was organized by the working group of the Dendrology Institute of the Ministry of Science and Education of the Republic of Azerbaijan, monitoring was carried out and scientific research works have been carried out in the territory of Okhchuchay [9].



Figure 1. Water samples were taken from Okhchuchay and Goturbulak of the Zangilan district

The left tributary of Araz flows through the territories of Okhchuchay, Zangilan of Azerbaijan and Gafan district of Armenia for a length of 85 km, the area of its basin is 1140 km². It takes its beginning from the Gapichig mountain of Zangezur ridge at an altitude of 285 m. The flow is formed from snow (46%), rain (10%) and underground waters (44%), water consumption is 8.90 cubic m/sec. 40% of its annual flow is spring, 43% is summer, 10% is autumn. 7% is spent in winter [2-4].



Figure 2. Comprehensive study of water, soil and vegetation in Okhchuchay surrounding areas

To provide sustainable energy to the village of Agali, Zangilan district, the natural, and cultural vegetation of the surrounding areas of the Archimedes turbine-type Hydroelectric Power Station, manufactured by the German company Rehart GmbH and consisting of 3 hydraulic turbines of 212 kilowatts each and relevant parts, were analyzed [8].



Figure 3. Hekari River Hydroelectric Power Station in Agali village, Zangilan district



Figure 4. Comprehensive study of natural and cultivated vegetation in Agaly village and surrounding areas

Observations were made by the working group of the AR ETN Dendrology Institute for studying the biological characteristics of natural and cultivated plant species. The purpose of the expedition was to study the impact of climate change on biodiversity in specially protected natural areas, and to conduct a comprehensive study of soil vegetation indicators in the surrounding areas of Okhchuchay. The research was conducted in Zangilan district, Agali village, Okhchuchay surrounding area, Beshdeli village, Kechikli, Mammadbeyli, and Dagustu Park surrounding areas [12].



Figure 5. Cultivated dendroflora of Agali village, Zangilan district

The taxonomic composition of cultivated dendroflora in Okhchuchay area of Zangilan region was investigated, and some compositions studied in regular, landscape and picturesque style were noted. The taxonomic composition and origin of the cultured dendroflora of Agaly village, Zangilan district, studied in 23 families, 36 genera, and 40 species of trees and shrubs are well adapted to soil and climate conditions and are promising species [7].

Table 1

TAXONOMIC COMPOSITION AND ORIGIN
 OF THE CULTURAL DENDROFLORA OF AGALI VILLAGE OF ZANGILAN DISTRICT

Family	Genus	Species	Homeland	
1. Pinaceae	1. Pine - <i>Pinus</i> L.	1. <i>P. eldarica</i> Medw.	Iran, Afghanistan	
	2. Cedar - <i>Cedrus</i> Mill.	2. Himalayan cedar - <i>C. deodara</i> Laws.	The northern and western part of the Himalayas	
	3. Fir - <i>Picea</i> Dietz. _____	3. Common fir - to <i>P. excel.</i> 4. Thorny fir - <i>P. pungens</i> Engelm.	Northern Hemisphere North America	
2. Cupressaceae	4. Juniper - <i>Juniperus</i> L.	5. Virginia juniper - <i>J. virginiana</i> L.	North America	
		6. Chinese juniper - <i>J. chinensis</i> L.	China, Korea	
	5. Cypress - <i>Cupressus</i> L.	7. Evergreen cypress - <i>C. sempervirens</i> L.	Asia Minor, Mediterranean countries	
3. Magnoliaceae	6. Magnolia – <i>Magnolia</i> L.	8. Lily magnolia - <i>M. liliiflora</i> Desr.	Central and Western China	
4. Oleaceae	7. <i>Ligustrum</i> L. _____	9. Japanese one-eyed - <i>L. japonicum</i> Thunb. 10. Chinese one-eyed - <i>L. chinensis</i> L.	Japan, Korea China	
	8. <i>Fraxinus</i> L.	11. Ordinary bruise - <i>F. excelsior</i> L.	Europe, Transcaucasia	
	9. Olive - <i>Olea</i> L.	12. European olive - <i>O. europaea</i> L.	Mediterranean countries	
	5. Platanaceae	10. Sycamore - <i>Platanus</i> L.	13. Eastern sycamore - <i>P. orientalis</i> L.	Balkan Peninsula, Asia Minor
6. Rosaceae	11. <i>Pyracantha</i> Roem.	14. Scarlet immortal – <i>P. coccinea</i> Roem.	Italy, Caucasus	
	_____	12. Photinia - <i>Photinia Lindl.</i>	15. Saw-leaf photinia - <i>P. serratifolia</i> Kalkman	South and East Asia
	_____	13. Plum - <i>Prunus</i> Mill.	16. Common cherry - <i>P. divaricata</i> Ledeb.	Caucasus, Central Asia
	_____	14. Eriobothria - <i>Eriobotrya</i> Lindl.	147 Japanese sweet - <i>E. japonica</i> Lindl.	Asia, Himalayas
7. Celastraceae	15. Garmashov - <i>Euonymus</i> L.	18. Japanese game show - <i>E. japonica</i> L.	Japan	
8. Lamiaceae	16. Rosemary- <i>Rosmarinus</i> L.	19. Medicinal rosemary - <i>R. officinalis</i> L.	Mediterranean countries	
9. Myrtaceae	17. Callistemon - <i>Callistemon</i> R.Br.	20. Callistemon lanceolate - <i>C. lanceolatus</i> DC.	Australia, Tasmania	
10. Buxaceae	18. Shamshad - <i>Buxus</i> L.	21. Shamshad in Colchis - <i>B. colchica</i> Pojark.	Asia Minor, North Caucasus	
11. Caprifoliaceae	19. Abelia - <i>Abelia</i> R. Br.	22. Large-flowered abelia - <i>A. ×grandiflora</i> (Rovelli ex André) Rehder	China, Himalayas	
	_____	20. Nineteen- <i>Lonicera</i> L.	23. <i>L. caucasica</i> Pall.	Caucasus, Asia Minor
	_____	_____	24. Fragrant nine - <i>L. fragrantissima</i> Lindl. et Paxton	China

_____	21. Basinagaci - <i>Viburnum</i> L.	25. Common head tree - <i>V. opulus</i> Roseum.	Europe, North Africa
12. Elaeagnaceae	22. <i>Elaeagnus</i> L.	26. Thorny smell - <i>E. pungens</i> Thunb.	Japan
13. Fabaceae	23. Gladysia - <i>Gleditsia</i> L.	27. Three-thorn gladioli - <i>G. triacanthos</i> L.	North America
	24. Arghavan- <i>Cercis</i> L.	28 European hornet - <i>C. siliquastrum</i> L.	Mediterranean countries,
14. Laurels - Lauraceae	25. Laurel - <i>Laurus</i> L.	29. Noble laurel - <i>L. nobilis</i> L.	Asia Minor
15. Aglarotukimi - Lythraceae	26. Indian jasmine - <i>Lagerstroemia</i> L.	30. Common Indian jasmine - <i>L. indica</i> L.	China, Japan
16. Obsessions - Moraceae	27. Mulberry - <i>Morus</i> L.	31. White mulberry - <i>M. alba</i> L.	China, Japan
	28. Fig - <i>Ficus</i> L.	32. Common fig- <i>F. carica</i> L.	Kopetdag, Pamir-Alay
17. Blackberry Taxaceae	29. Blacks - <i>Taxus</i> L.	33. Blackberry with berries - <i>T. baccata</i> L.	Europe, Africa, Far East
18. Pittosporums - Pittosporaceae	30. Pittosporum - <i>Pittosporum</i> Gaertn.	34. Tobira pittosporum - <i>P. tobira</i> (Murray) Aiton fil.	Japan
19. Palm trees - Arecaceae	31. Washington - <i>Washingtonia</i> H. Wendl.	35. Washington's leaf - <i>W.</i> <i>filifera</i> (Rafarin) H. Wendl. ex de Bary	America
20. Elms - Ulmaceae	32. <i>Ulmus</i> L.	36. Small elm - <i>U. minor</i> Mill.	Western Europe, Asia Minor
_____	33. <i>Celtis</i> L.	37. Western Mountain range- <i>C. occidentalis</i> L.	North America
21. Zirinckimilar - Berberidaceae	34. Nandina – <i>Nandina</i> Thunb.	38. House nandina – <i>N. domestica</i> Thunb.	China, Japan
22. Maple trees - Aceraceae	35. Birch- <i>Acer</i> L.	39. Gray-leaved birch- <i>A. negundo</i> L.	North America, New Mexico
23. Apocynaceae - Apocynaceae	36. Oleander - <i>Nerium</i> L.	40. Common oleander - <i>Nerium</i> <i>oleander</i>	Morocco, Portugal, China

Total: 23 families, 36 genera, 40 species

The bioecological characteristics of natural dendroflora in the Okhchuchay area of Zangilan district were investigated, notes were made on the study of the modern state of plant species and analyzes were conducted in the direction of studying the role of biodiversity in ensuring the natural regeneration of rare species.



Figure 6. Dendroflora of Beshdeli village of Zangilan district

Analysis of the taxonomic composition of the vegetation, introduction and reintroduction of plant species, and research in the direction of gene pool restoration is planned. The population status of biodiversity under natural conditions, the influence of climate variability on the processes occurring in the populations of rare species of natural flora were analyzed and investigated by experts, records were made, some economically important plants were studied, and samples were taken in order to systematically analyze the vegetation.

Distribution areas of medicinal plants in Okhchuchay surrounding area of Zangilan district were determined and inventory was carried out. In terms of flora biodiversity, the area where we conducted the study is very rich in economically important plants, and according to its relief structure, it is concentrated in different types of vegetation.



Figure 7. Dendroflora of Dagustu park, Zangilan district

Complex research of the soil-vegetation cover of the research area, application of plants in the landscape style in that area in the direction of restoration and health of the ecological environment in those areas by using decorative and ornamental tree-shrub plants, grouping of plants according to their biological and decorative properties in compositions for urban greening, arrangement of compositions in regular (geometric shape) and landscape or natural (original shape) styles, rules of using small architectural forms (fountain, lantern, seat, flower basket, figure, etc.) around the compositions, mainly landscape or natural (original shaped) styles is to be envisaged to prepare the project [8].



Figure 8. Dendroflora of Mammadbeyli, Kechikli village, Zangilan district

During the research, scientific-research works were carried out on the study of the influence of climate change on the taxonomic composition of Zangilan dendroflora, the investigation of medicinal plants, and visual observations were made to study the bioecological characteristics of plant species. In accordance with the plan and program, monitoring was carried out, videos and photographs of the distribution areas of tree and shrub plants were taken, the taxonomy of forest

plants was investigated, the vegetation was analyzed, the distribution areas, formations and associations of plants were determined, and the impact of anthropogenic and adverse climatic factors on the forest stock was investigated.

The analysis of natural plant species around Okhchuchay, the population status of plants in the areas, and the taxonomic composition of trees, shrubs and herbs were studied. The presence of several species belonging to the oak genus in the same area, a small area of the jasmine bush, the presence of two species of bitter gourd in the same area, and the area of several species belonging to the birch genus were observed. In the center of Zangilan district, cultivated plants planted in people's backyards have turned into a wild forest [9].

Material and methodology

The analysis of the plant taxa of the Basitchay State Nature Reserve and Okhchuchay surroundings, the population status of plants in the areas, the taxonomic composition of trees, shrubs and herbs was analyzed based on S. Cherepanov (1995), Engler and APG systems. The Diva-Gis system was used to obtain ecological parameters in the study area. Hypsometric height and areal coordinates were measured with Garmin eTex 20 model GPS. Using GPS coordinates during monitoring, scientific studies are carried out on investigating the natural range of plants, assessing the ecological condition of the area and determining the level of exposure to anthropogenic influence.

Caucasian palm (*Diospyros lotus* L.), Araz oak (*Quercus araxina*), Caucasian dogwood (*Celtis caucasica* Willd.), Oriental hornbeam (*Carpinus orientalis*), *P. mutica*, Iberian maple (*Acer iberica*), Araz elm (*Ulmus araxina*), willow pear (*Pyrus salicifolia*), sparse forests with multi-fruited juniper (*Juniperus polycarpus*) were observed. In the surrounding areas of the mountainous park, there are xerophytic bushes, thorny camellia (*Atraphaxis spinosa*), Iberian horsetail (*Lonicera iberica*), small-fruited cherry (*Cerasus microcarpa*), medium-sized bittersweet (*Ephedra intermedia* Schrenk. et. C. A. May.), bush jasmine (*Jasminum fruticans*), Pallas's thorn (*Rhamnus pallasii*) and blackthorn (*Paliurus spina-christi*) were observed to spread naturally. As a result of monitoring, Iberian oak (*Quercus iberica*) and Caucasian hornbeam (*Carpinus caucasica*), common pomegranate (*Punica granatum*), two types of junipers — low in the forest cover of Beshdeli and Kechikli villages of the area juniper (*Juniperus depressa* Stev.), heavy juniper (*J. foetidissima*), and prickly gum (*Pistacia mutica*) were observed. Walnut, willow, ash, birch, dogwood, mulberry, poplar, herbaceous shrubs were the main components of the forest in the mixed plane trees in the Goturbulag area. In the Mammadbeyli village area, hawthorn, rose, buckthorns, mountain xerophilous plants, bushes, blackthorn, common medlar, cotoneaster, ephedra, bitter horsetail, etc. plants were noted, samples were taken from three species belonging to the oak genus. Mountain almond (*Amygdalus fenzliana*), Nairi almond (*Amygdalus nairica*), *P. mutica*, Iberian maple (*A. iberica*), heavy juniper (*J. foetidissima*) and multi-fruited juniper (*J. polycarpus*) mixed trees are spread naturally. *Spiraea* sp. dominates the understory in many places. Blackthorn (*Paliurus spina-christi*), full-leaved cotoneaster (*Cotoneaster integerrimus*), Black-fruited cotoneaster (*Cotoneaster melanocarpus*), Pallas buckthorn (*Rhamnus pallasii*), heavy-leaved juniper (*J. foetidissima*), *Berberis densiflora*, rose (*Rosa* sp.) there are many species belonging to the genus. It was noted that grass cover of the forest is mainly distributed naturally by the species belonging to the genera wormwood (*Artemisia* sp.), stonewort (*Andropogon* sp.), germanders (*Teucrium* sp.), thyme (*Thymus* sp.), *Xeranthemum* sp., *Stellaria media*, wormwood (*Poa annua*), geranium (*Geranium molle*), nettle (*Urtica dioica*), sage (*Sambucus ebulus*), dandelion (*Taraxacum vulgare*), etc. Common pomegranate (*Punica granatum*) was observed in almost all the research area. Oriental sycamore, common walnut, and mixed trees form in Zangilan district. These tree species occupy the

first layer of the forest. In the second layer by the river, mountain ash and pistachio, silverberry, poplar, willow elm, and long-stemmed oak species are common. Sometimes, as an undergrowth, gorse, bush jasmine, argyle, alder, blackthorn, cotoneaster, Pallas's thorn, juniper, bramble, rose, etc. bushes were noted by the working group. Considering the season and climate of the grass cover, it is rare to find wormwood (*Artemisia sp.*), *Andropogon sp.*, St. John's wort (*Teucrium sp.*), nettle (*Urtica dioica*), ball-shaped sedge (*Sambucus ebulus*), dandelion (*Taraxacum vulgare*), thyme (*Thymus sp.*) and single marigold (*Xeranthemum sp.*), violet (*Viola sp.*) etc. has been noted by researchers. Soil, water and plant samples were taken from Agaly village, Okhchuchay surrounding area, Beshdeli village, Kechikli, Mammadbeyli, Dagustu park surrounding areas, Goturbulag, Agalyk, and submitted to laboratories.

In Agaly village, Okhchuchay surrounding area, Beshdeli village, Kechikli, Mammadbeyli, Dagustu park surrounding areas, the degree of sustainability of trees and shrubs as a result of climate changes was analyzed depending on the degree of their biological adaptation. Biometric measurements of annual shoots of plants, CO₂ absorbed in the leaf organ (of carbon dioxide) and water molecules, chloroplast temperature, transpiration related to photosynthesis rate, relative humidity and other parameters were determined using Plant Photosynthesis Metr-2021 year LI-6400XT system RC-P60 equipment.

Analysis of natural plant species of Agaly village, Okhchuchay surrounding area, Beshdeli village, Kechikli, Mammadbeyli, Dagustu park surrounding areas of Zangilan region, population status of plants in the areas, taxonomic composition of tree and shrub plants was analyzed based on S. Cherepanov (1995), Engler and APG systems. The Diva-Gis system was used to obtain ecological parameters in the study area. Hypsometric height and areal coordinates were measured with Garmin eTex 20 model GPS. Various data and GPS coordinates were used during monitoring.

The main purpose of the research work is to study the surrounding areas of Agaly village, Okhchuchay surrounding area, Beshdeli village, Kechikli, Mammadbeyli, Dagustu park, Zangilan region, investigate the natural area of plant taxa, evaluation of the ecological situation, determination of the level of exposure to anthropogenic influence of the area.

For this purpose, Zangilan district Agaly village, Okhchuchay surrounding area, Beshdeli village, Kechikli, Mammadbeyli, Dagustu park surrounding areas vegetation monitoring and the results of anthropogenic effects in the area during the occupation period were investigated.

There is a forest massif consisting of species: *Platanus orientalis* L. at a distance of 12-15 km along Okhchuchay; in the north, *Pistacia vera*, *Mespilus germanica*, *Celtis caucasica* Willd., *Rhamnus pallasii*, *Paliurus spina-christi*, *Crataegus monogyna*, *Pistacia vera*, etc., xerophytic forest cover consisting of *Quercus orientalis*, *Carpinus orientalis* in the south direction, it is observed that the sycamore tree (*Juglans regia*) occupying the first layer of the forest in the area creates a mixed forest. In the second layer, mountain ash (*Celtis caucasica*), and poplar (*Populus sp.*), elm (*Ulmus sp.*), long-stemmed oak (*Quercus longipes*) species were found. The taxonomic composition of trees, shrubs, grasses of the area is grouped and reflected in Tables 1, 2.

Table 2

TAXONOMIC COMPOSITION OF THE VEGETATION COVER OF AGALI VILLAGE,
 BESHDELI VILLAGE, KECHIKLI, MAMMADBeyLI, DAGUSTU PARK,
 OKHCHUCHAY SURROUNDING AREA OF ZANGILAN DISTRICT

<i>In the forest cover of the mountainous part</i>	<i>On dry stony slopes</i>	<i>At altitudes from 800 m to 1400 m</i>
1. Eastern sycamore (<i>Platanus orientalis</i>)	1. Araz oak (<i>Quercus araxina</i>)	1. White almond (<i>Amygdalus fenzliana</i>)
2. Georgian oak	2. Caucasus Mountain range	2. Nairi almond

<i>In the forest cover of the mountainous part</i>	<i>On dry stony slopes</i>	<i>At altitudes from 800 m to 1400 m</i>
(<i>Quercus iberica</i>)	(<i>Celtis caucasica</i>)	(<i>Amygdalus nairica</i> Fed. et Takht.)
3. Common walnut (<i>Juglans regia</i>)	3. East and West (<i>Carpinus orientalis</i>)	3. <i>Diospyros lotus</i> L.
4. Caucasian hackberry (<i>Celtis caucasica</i>)	4. Boassye pear (<i>Pyrus boissieriana</i> Boiss. et Buhse)	4. Heavy-smelly juniper (<i>Juniperus foetidissima</i>)
4. Black mulberry (<i>Morus nigra</i>)	5. Georgian birch (<i>Acer iberica</i>)	5. Arrowroot juniper (<i>Juniperus polycarpus</i>)
7. Willow (<i>Salix</i>)	7. Weeping pear (<i>Pyrus salicifolia</i>)	7. <i>Corylus colurna</i>
8. Short-height juniper (<i>Juniperus depressa</i>)	8. Heavy-smelly juniper (<i>Juniperus foetidissima</i>)	8. Long-stemmed oak (<i>Quercus longipes</i> Steven)
9. <i>Pistacia mutica</i>	9. <i>Elaeagnus orientalis</i>	9. Blackthorn (<i>Paliurus spina-christi</i>)
10. Poplar (<i>Populus</i>)	11. <i>Rhamnus pallasii</i>	10. <i>Crataegus monogyna</i>

As a result of monitoring, along with rare and endangered relic species such as Oriental sycamore, berry-bearing blackberry, bear nut, Araz oak, Caucasian mountain ash, Boissye pear, willow-leaf pear, gum tree, Caucasian palm, common pomegranate, forest grape, mulberry, silverberry, tamarisk types are common.

Relict, endemic rare and endangered plants in Zangilan district Agaly village, Okhchuchay surrounding area, Beshdeli village, Kechikli, Mammadbeyli, Dagustu park surrounding areas were also investigated, grouped and tabulated. 17 rare and endangered trees, 6 shrubs and herbs of the reserve were observed. Agaly village, Beshdeli village, Kechikli, Mammadbeyli, Dagustu park, Okhchuchay surrounding area of Zangilan district rare and endangered trees, shrubs and herbs in the territory of the reserve, 5 species included in the Red Book: *Platanus orientalis* L., *Pyracantha coccinea* M. Roem. *Iris paradoxa* Steven. *Crocus adami* J. Gay., *Ophrys caucasica* Woronow was observed.

Table 3

A RARE AND ENDANGERED SPECIES OF OKHCHUCHAY AREA
 OF ZANGILAN DISTRICT PLANTS

<i>Rare and endangered woody plants</i>	<i>Rare and endangered herbs and shrubs</i>
1. Common walnut (<i>Juglans regia</i> L.)	1. <i>Pyracantha coccinea</i> M. Roem
2. Georgian oak (<i>Quercus iberica</i>)	2. <i>Rosa sachokiana</i> P. Jarosch.
3. <i>Celtis caucasica</i> Willd.	3. <i>Atraphaxis spinosa</i> L.
4. <i>Corylus colurna</i> L.	4. <i>Ophrys caucasica</i> Woronow
5. Caucasian willow (<i>Salix caucasica</i> Andersson)	5. Adam saffron (<i>Crocus adami</i> J. Gay)
6. Blackberry with berries (<i>Taxus baccata</i> L.)	6. Paradoxical iris (<i>Iris paradoxa</i> Steven)
7. <i>Pistacia mutica</i>	
8. Black poplar (<i>Populus nigra</i> L.)	
9. Boissye pear (<i>Pyrus boissieriana</i> Buhse)	
10. Araz oak (<i>Quercus araxina</i> (Trautv.) Grossh.)	
11. Willow pear (<i>Pyrus salicifolia</i> Pal.)	
12. Nairi almond (<i>Amygdalus nairica</i> Fed. & Takht.)	
13. Georgian maple (<i>Acer ibericum</i> M. Bieb.)	
14. Heavy juniper (<i>Juniperus foetidissima</i> Willd.)	
15. Mountain almond (<i>Amygdalus fenzliana</i> Lipsky)	
16. Blackberry with berries (<i>Taxus baccata</i> L.)	
17. Long-leaved oak (<i>Quercus longipes</i> Steven)	

The test results of the water samples taken from the Okhchuchay and Basitchay rivers revealed the presence of heavy metals, especially iron, copper, manganese, molybdenum, zinc, chromium, nickel and others, in the water on the river surface. the level of pollution of the river was found to be critical. In the laboratory of the Institute of Dendrology, the soil sample brought from Okhchuchay and Basitchay surrounding areas of Zangilan district was analyzed by means of Palintest Soil equipment and studied with 14 parameters according to mineral composition. The obtained results are reflected in Table 4.



Figure 9. Analysis of a soil sample brought from the surrounding area of Zangilan district in the laboratory using Palintest Soil equipment in the Plant ecology laboratory of the institute



Figure 10. Analyzes with 14 parameters according to mineral content with Palintest soil kits 400 equipment

Table 4
 THE RESULT OF THE ANALYSIS OF THE SOIL SAMPLE BROUGHT FROM OKHCHUCHAY SURROUNDING AREA OF ZANGILAN DISTRICT (mg/l)

Examples	Depth (cm)	pH	Electricity conductivity cm/ms	NO ₃ ²⁻	K ⁺	NH ₄ ⁺	Cu ²⁺	Mg ²⁺	SO ₄ ²⁻	P ₂ O ₅ ³⁻	Ca ²⁺	Cl ⁻	Al ³⁺	Fe ²⁺	Mn ²⁺
Roadside	10-25	7.8	520	>>	350	<<	7.0	120	65	49	4250	2375	0.8	4.2	<<
Riverside	10-25	7.1	920	27.0	360	0.5	18.4	370	65	0	3750	2250	<<	21.8	0.0

As a result of monitoring, Iberian oak (*Quercus iberica*) and Caucasian hornbeam (*Carpinus caucasica*), 2 types of junipers — heavy juniper (*J. foetidissima*), short juniper (*Juniperus depressa* Stev.) and short-leaved gum tree (*Pistacia mutica*), mixed walnut, mountain ash, mulberry, willow, poplar, hawthorn, dogwood, sedum, mountain xerophilous plants, bushes, blackthorn, etc. encountered.

Araz oak (*Q. araxina*), Caucasus Mountain ash (*Celtis caucasica* Willd.), *C. orientalis*, Kutyardpak gum (*Pistacia mutica*), Iberian maple (*Acer iberica*), Araz elm (*Ulmus araxina*), on dry stony slopes. Willow pear (*Pyrus salicifolia*) forms sparse woodlands with juniper. Among the xerophytic shrubs in these forests: thorny camellia (*Atraphaxis spinosa*), Iberian horsetail (*Lonicera iberica*), small-fruited cherry (*Cerasus microcarpa*), *Ephedra intermedia* Schrenk et C. A. Mey., jasmine bush (*Jasminum fruticans*), *Rhamnus pallasii* and blackthorn (*Paliurus spina-christi*) are spread naturally.

The soil sample brought from Basitchay surrounding area of Zangilan region, the pH index is weakly alkaline (7.8), the electrical conductivity is 520 cm/mS, and there are metal ions. There is a lot of nitrate nitrogen (NO_3^{2-}), which indicates that nitrogen bacteria are active in the soil. Potassium ions in the area (K^+) were 350 mg/g, confirming that the soil has a low water holding capacity. If we look at the ammonium ion (NH_4^{4+}) in the soil, it can be said that no organic fertilizers were applied to the area. In the sample, copper ions (Cu^{2+}) are about 3 times more than the standard indicator, the area belongs to the pasture area. On the contrary, magnesium ions (Mg^{2+}) are 2 times lower than the standard, sulfur ion (SO_4^{2-}), phosphorus ($\text{P}_2\text{O}_5^{3-}$) ion is 3 times lower than the standard. These indicators show that mineral fertilizers have not been applied to the soil for a long time. In this sample, Ca salts are 2 times, chloride salts are 3 times higher than the standard, confirming that the area is medium saline soil. Aluminum ion is only 0.8 mg/g, iron ion (Fe^{2+}) is very little, manganese ion (Mn^{2+}) is completely absent. According to the indicators of the analytical analyzes we have mentioned, giving organic and mineral fertilizers to such soil can allow to increase productivity.

Results

27 types of trees, 18 shrubs and 11 types of grass plants were recorded in Okhchuchay area of Zangilan district. Of these, 17 trees, 3 shrubs, 3 grass species are rare and endangered plants, and 6 trees and 2 shrubs are relic and endemic plants.

Due to the effect of environmental factors on tree and shrub plants in areas liberated from occupation and against the background of climate changes and anthropogenic influence, noticeable quantitative changes in the pigment apparatus of plant leaves occur, and the synthesis of chlorophyll increases with increasing illumination and temperature, on the contrary, climate (high temperature, drought) and anthropogenic factors due to its negative effect, the weakening of the synthesis of pigments in evergreen species has been determined, it is intended to analyze the degree of durability of tree and shrub plants and their dependence on the degree of biological adaptation. It is intended to study the connection of CO_2 (carbon dioxide) to the process of photosynthesis in young leaves and the intensive implementation of synthesis of organic substances.

Ecological monitoring of soil and water samples of Okhchuchay and Basitchay surrounding areas were analyzed in the laboratory. Nutrient elements that can be assimilated by plants in the soil samples: very weak with absorbed ammonia form of nitrogen, moderate, high and severe depending on the samples with active phosphorus, and weak with exchangeable potassium. soil environment (pH) is weakly alkaline, strong salinization was not observed [10-12].

Zangilan district Basitchay and Okhchuchay water mineral extraction analyzes were carried out by means of Palintest Photometer 7100 device, made in England, and it was determined that the

water sample (pH) is weakly acidic. While the indicators of Basitchay are close to the standards, the mineral trace of Okhchuchay water has a high level of Magnesium — Mg^{2+} and Magnesium carbonate — $MgCO_3$ ions.

According to the analysis, more than 800 economically important plants have formed in the rich and colorful vegetation of Azerbaijan [1]. Most of them are useful and widely used plants in various fields of the national economy. Generally speaking, the flora of Azerbaijan can be considered as a source of medicinal plants, essential oil, rich in biologically active substances. These plants are being studied by scientists from time to time, and so far, new fields of application of biologically active substances and essential oils obtained from many plants have been clarified [6].

The introduction of useful plants and the study of the biological bases of agrotechnical methods in the zones of the country where the soil and climate conditions are suitable are in the spotlight with their relevance. Cultivation of wild useful, including economically important essential oil and aromatic-spicy plants has great economic importance [5].

Rhus coriaria L., *Capparis spinosa* L. belongs to Capparaceae family, one of the most important representatives of essential oil plants in the flora of Azerbaijan. Its leaves contain tannin, methyl ether and citric acid. People use the leaves or fruits for rheumatism and rheumatism. Yellow dyes are obtained from the bark of juniper, brown dyes are obtained from the bark of cypress trees, black dyes are obtained from the leaves, and red dyes are obtained from the fruits.

Dried fruits of the edible *Lepidium sativum* in addition to its medicinal value are used as a natural ingredient in fish and meat stews.

Botanical Description

It was first described as part of the world flora from southern Europe. In nature, it is common in Crimea, Caucasus and Turkmenistan.

Most of these species are found in tropical and subtropical countries. *Rhus coriaria* L. species is very common in Lankaran-Talysh areas in Azerbaijan. The side of the tree has circular veins, yellow brown-green leaves are dense and open flowing. Most of the leaves are light-brushed, white in color and very dry. The leaves are large, set, oblong-ovate or narrow-ovate, sharp, toothed on the edge, the type consists of 4-8 double lobes, the top is dark green, and the bottom is gray green. The flowers are white, 5-lobed, collected in bunches. The fruit is small, square-shaped, with resin spots, the fruit is very dense, light red in color. It blooms and fruits ripen in June-July.

Rhus coriaria L. is common on stony slopes, rocks and sparse forests. It produces abundant crops on fertile lands and riverbanks. It is a valuable economic raw material such as medicine, food, spices. The fact that the biochemical composition in natural conditions is not sufficiently studied, it is of great importance for the Azerbaijan to conduct research in the direction of the introduction of aromatic-spicy plants and their use in various fields of national economy.

A complex study dedicated to its study and introduction was conducted on botanical analysis, bioecological characteristics, distribution, etc. of *Rhus coriaria* L. species in flora biodiversity of Azerbaijan. It should be noted that *Rhus coriaria* L. species is a very valuable medicinal plant, used in folk medicine. Taking into account all the above, we consider the ways of formation, distribution, taxonomic composition of *Rhus coriaria* L. species in the flora biodiversity of Azerbaijan relevant, determination of essential oils and cultivation.

Aims and objectives of the research

The aim of the research on the Talish Mountains assessment of the population of the *Rhus coriaria* L. species, which spreads in the main phenomenological complexes of natural vegetation

in the flora of the border area, and the study of its reserve. At this time, a number of phytochromes were determined, phylogenetic complexes were named, the number dynamics of plants in localities were determined, and age limits and efficiency levels were determined.

Material and methodology

Geobotanical records were made in 10×10 m vegetation areas. In order to find out the reserve and density of plants, first each 1 m², then 4 and 10 m² then 3 experimental plots were selected in the researched vegetation types. In a word, the structure, composition, number of species, edificers and dominants of the vegetation, floristic-geobotanical indicators of the areas were studied, and the richness of the flora was recorded using Drude's 5-point scale.

Phenological observations in stationary conditions are based on the methods of I. N. Beydeman and I. P. Lapina [6]. For the description and separation of the phases of morphogenesis, the approaches previously applied to other living plants were used [1, 5].

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