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Phytosociological Characteristics the Vegetation of the Caspian's Shores in Azerbaijan

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Abstract: This study was performed on the phloristic and phytosociologic features and the classification and productivity of the vegetation of Caspian shores in Azerbaijan. Between Abseron peninsula and Astara (100-150 m shore zone) on the shore, 24 families, 83 geneses and 114 species were defined. Of these species, one belonged to Pteridophyta (*Equisetum ramosissimum* Desf.), one to Gimnospermae (*Ephedra distachya* L.) and the others belonged to Angiospermae. In the region, 4 vegetation types (desert, semi-desert, swamp and forest), 9 subtypes (sandy-desert, halophytic damp desert, halophytic arid desert, subtropical semi-desert, ephimeric subtropical semi-desert, swamp, meadow-swamp, shore plain forest and shore tugay forest), consisting of 48 formations and 57 associations were identified. The productivity of the above-ground surface and underground (40 cm) phytomasses were (dried grass per 25 cm^2) 40-6400 and 50-4560 g, respectively.

Key words: Azerbaijan, Caspian Sea, productivity, vegetation

INTRODUCTION

Important successions occur in the vegetations after the changes in the ecological conditions. The vegetation of the Caspian shores undergoes important succession due to the natural (increase or decrease in the level of water, wind, or sand movement) or anthropogenic (herding, sand deportation for construction, etc.) factors. Especially the changes in the underwater surfaces causes an increase or decrease in the level of the water. Due to this change, the shore vegetation may be overloaded with water when the level of water increases or in the case when the level decreases, the land surface may increase. These changes may cause important changes in the floristic or phytosociological changes in the flora. Such changes may be seen as the growing of new species or formations or the extinction of existing ones due to the succession. Therefore, it is important to investigate and document the types of vegetations their formations and associations in the Caspian shores. In addition, identification of endangered species and conserving them is posed as important scientific questions.

In general, psammophyte plants are more common on the Caspian shores. Especially, leafless shrubs and semi-shrubs are characteristics in the area. The following taxons can be given as such examples: *Calligonum bakuense* Litv., ve *C. petunnikowii* Litv., *Ephedra distachya* L., *Eleagnus caspica* (Sosn) Grossh., *Nitraria schoberi* L. and *N. komorovii* Iljin, *Artemisia arenaria* DC., *Convolvulus persicus* L., *Glycyrrhiza glabra* L., *Astragalus bakuensiz* Bge., *Medicago coerulea* Less. and *M. littoralis* Rohde., *Elymus giganteus* Vahl., *Phragmites communis* (L.) Trin.

In addition to the above taxa, the following groups can also be seen especially in the areas of hard ground with the high underground water surface and wavy ground level: *Kochia prostrata* (L.) Schrad., *Salsola pestifera* A.Nels., *S. paulsenii* Litv., *Tournefortia sibirica* L.,*Centaurea adpressa* Ledeb., *Gypsophylla bicolor* Freyn., *Limonium meyeri* (Boiss.) Kuntze. *Alhagi pseudoalhagi* (M.Bieb.) Desv., *Melilotus caspicus* Grun., *Calamogrostis gigantea* Reshevitz, *C. glauca* (M.Bieb.) Trin., *Erianthus purpurescens* Anderss., *Cynodon dactylon* (L.) Pers., *Aeluropus littoralis* (Gouan) Parl., *C. melanostachya* M.Bieb., *Juncus littoralis* C.A.Mey. *J. acutus* L.

Evaluation of the phytomass (underground and surface) and fodder value of the plant mass is important both ecologically and economically. Therefore, we along with, the vegetation associations we also evaluated the fodder values of plants in the region.

MATERIALS AND METHODS

The study covered the area from the north of Abseron peninsula (Buzove-Bilgeh) to Kizilagac Golf in the south (~450 km). Examples have been taken from 11 different identified points. The characteristics of the

formations, the floristic and phytosociologic features were investigated. The identification of the plants were performed according to the *Flora of Azerbaijan* (Karyagin 1950, 8 volumes) and the classification was performed according to the dominant feature (Rabotnov, 1983; Yaroshenko, 1961). The plant formations on the shore up to 100-150 m in width was investigated and a vegetation map of the area was drawn. Considering the effect of the changes in the level of water and according to our geobotanic data and the literature, we draw a vegetation map of the Azerbaijan's Caspian shore (Haciyev, 1992; Grossheym, 1948; Sakhsuvarov, 1994; Prilipko and Agacanov, 1972; Prilipko, 1965, 1970; Haciyev *et al*., 1991). The map was drawn in MS-Word and the legend was made according to the Vegetation Classification of the Caspian Shores of Azerbaijan (Table 1). The abundance of the plants were classified according to a 5 scale system (Yaroshenko, 1961). The formations and associations in the study area and their underground and surface phytomasses (g/25 cm^2) and the humidity features were defined (Titlyanova *et al*., 1988).

Findings: The plant formation of the Azerbaijan's Caspian Shores belong to the sandy-desert type vegetation of the Mid Asian variant, common in hardened sandy areas. The sandy vegetation of the Caspian Shores of Azerbaijan belongs to the psamnophyte littoral according to its echological features and phytosociologically belongs to sandy desert types (Mailov, 1989). These plants can be seen either individually, in groups or mixed.

According to Mailov (1989), sandy areas in Azerbaijan is about 117650 ha. Of this, 24150 ha is mobile sandy bodies located on the Caspian Shores. These research indicate that the Caspian Shores within Azerbaijan is covered with a narrow band of sandy-desert vegetation (Grossheym, 1945, 1948; Beydeman, 1954; Aliyev, 1954, 1966; Glushko, 1989; Mailov, 1989; Haciyev, 1992; Sakhsuvarov, 1994). North part of the research area is Abseron peninsula, which covers a large part of the western shores. According to Aliyev (Aliyev, 1966) Abseron has 300 ha sandy areas and 30-35% of this is mobile.

In the Northern shores of the Abseron peninsula around (Sakhsuvarov, 1994), there are 298 plant species belonging to 17 formations, 59 associations and 56 families spread over the wet saline, moving, sandy ground with sandy-desert, swam, meadow and forest vegetation types.

The results of our vegetation and floristic studies are shown in the Table 1 and 2, respectively. The Caspian shores with the width of 100-150 m in the east and south east part of the Azerbaijan's shores, there are 4 vegetations, 9 subtypes, 48 formations and 57 associations. In Table 2, 114 species belonging to 24 families and 83 genus that are found in the same region are listed.

The results of the vegetation studies show that the vegetation of the east and south east has 48 formations and 57 associations, white Samur Deveci plain of (Sakhsuvarov, 1994) has 17 formations and 59 associations. These results indicate that the South and North vegetations are similar; but the northern flora was found to be richer (59 families and 298 taxa).

This is because the study area was limited the shores and was not extended beyond. One of the taxa found in the wite study region belonged to Pteridophyta (*Equisetum ramosissimum* Desf.), one belonged to Gymnosperm (*Ephedra distachya* L.) and the other 112 taxa belonged to Angiospermae. The families with more species in the region are as following: Poaceae (26 species), Chenopodiacae (24), Asteraceae (13), Cyperaceae (12) and Fabaceae (5). The taxa belonging to these families were 54% (75) of all. The number of taxa belonging to the other families was between 1-3. Each of the following families were represented by 3 species: Plumbaginaceae, Polygonaceae, Juncaceae and Caryophyllaceae. Each of the following families were represented by 1 species: Plantaginaceae, Apiaceae, Boroginaceae 2 species, Brassicaceae, Thyphaceae, Tamarixaceae, Convolvulaceae, Solonaceae, Rubiaceae, Zygophyllaceae, Ephedraceae, Eleagnaceae ve Ranungulaceae. In the study area 83 genus were defined. In the area, the species represented with more individuals are as following: *Salsola* (7 species), *Artemisia* (4), *Zerna* (2), *Juncus* (2), *Carex* (2), *Medicago* (2), *Lepidium* (1), *Centaurea* (1), *Aegilops* (1), *Limonium* (1), *Galium* (1), *Suaeda* (1), *Chondrilla* (1 species). The total species number in this region was 30, 3% (37 species). One of the most characteristic species on the shore was *Turneforsia sibirica* L. This species was sometimes covering much of the ground. Other than this, 10-12 seeded plants were present. Of these 3-4 species were permanent. These are *Turneforsia sibirica* L., *Calamogrostis gigantea* Roshev., *Artemisia arenaria* DC., *Convolvulus persicus* L., *Juncus littoralis* C.A. Mey. and *J. acutus* L. were forming monodominant associations. Other than these associations about 15-20 psammophyte species were found.

The floristic composition and the phytosociological structures of the associations depended on the salinity and the humidity levels of the sandy soil. In these

Table 1: The classification of caspian shores vegetation of Azerbaijan

Taksonomic categories		
Types	Formation	Association
Desert		
Coastal sandy desert	Artemisietum	*Artemisietum arenariae, Artemisietum szovitsiae*
	Astragaletum	*Astragaletum hyrcanusae*
	Collugonetum	*Gollugonetum petunnikoviae*
	Ephedreto-Artemisietum	*Ephedro distachyae-Artemisietum scopariae*
	Salsoleto-Artemisietum	*Artemiso szovitsiani-Ephedretum-distachyaea*
	Artemisieto-Convolvuletum	*Artemiso arenaria-Convolvuletum persicae*
Halophytic owet desert	Salicornietum	*Salicornietum europeae*
	Halocnemumetum	*Halocnemumetum strobilaseumae*
	Glycyrrhizeto-Alhagetum	Glycirrhizo glabrae-Alhagetum pseudoalhagae
	Kalidieto-Halocnemumetum	*Kalidio caspica-Halacnemumetum strobilaseae*
	Halocnemumeto-Halostachusetum	*Halocnemo strobilasea-Halostachusetum caspicusae*
	Tamarixeto- Kalidietum	*Tamarixo ramassisima-Kalidietum caspicae*
	Tamarixeto-Halostachusetum	*Tamarixo ramassisima-Halostachysetum caspicusae*
	Salicornieto-Kalidietum	*Salicornio europea-Kalidietum caspicae*
Halophytic arid desert	Salsoletum	*Salsoletum dendroidesae, Salsoletum crassae, Salsoletum sodae, Suaedetum microphyllae, Suaedetum dendroidesae*
	Suaedetum	
	Petrosimonietum	*Petrosimonietum brachiatae*
	Kalidietum	*Kalidietum caspicae*
	Halostachusetum	*Halostachs caspicusae*
	Salsoleto-Artemisietum	*Salsolo ericoides-Artemisietum szovitsianae*
	Petrosimonieto-Kalidietum	*Petrosimonio brachiata-Kalidietum caspicae*
	Petrosimonieto-Salicornietum	*Petrosimonio brachiata-Salicornietum europae*
Semi-desert		
Subtropic semi-desert	Ephemereto-Artemisietum	*Aegilopo biunsialis-Artemisietum fragransae Aveno pilosa-Artemisietum fragransae*
	Ephemereto-Astragaletum	*Eremopyro triticea-Astragaletum hyrcanae*
	Kochieto-Artemisietum	*Kochio prostrata-Artemisetum fragransae*
Efemerous subtropic	Ephemeretum	*Tournefortio sibiricae-Brometum japonicae*
semi-desert	Convolvuleto-Ephemeretum	*Convolvulo persica- Eremopyretum triticeae*
	Artemisieto-Ephemeretum	*Artemiso fragrans-Brometum japonicusae*
	Astragaleto-Ephemeretum	*Astragalo hyrcanus-Hordetum leporiniae*
Wet-swamp		
Wet swamp	Phragmetum	*Phragmetum communisae*
	Calamagrostisetum	*Calamagrostisetm giganteae*
	Juncusetum	*Juncusetum acutusae, Juncusetum littoralae*
	Thyphetum	*Thyphaetum angustifoliae*
	Bolboschoetum	*Bolboschoetum maritimuae*
	Calamagrostiso-Phragmetum	*Calamagrostiso giganteae-Phragmetum communisae*
Meadow swamp	Carexetum	*Carexetum divisae, Carexetum compactae*
	Juncuseto-Glycyrrhizetum	*Junco littoralis-Glycyrrizetum glabrae*
	Glycyrrhizeto-Alhagetum	*Alhago pseudoalhagi-Glycyrrhizetum glabrae*
	Tamarixeto-Phragmetum	*Tamarixo ramassisima-Phragmetum communisae*
Forest		
Coastal plain forest	Quercuseto-Carpinetum	*Querco iberica-Carpinetum caucasicae*
	Carpineto-Quecusetum	*Carpino caucasica-Quercusetum ibericae*
	Carpinetum	*Carpinetum caucasicae*
	Quecusetum	*Quercusetum ibericae*
Coastal (Tugay) forest	Populetum	*Populetum hybridae, Populetum nigraeae*
	Salexeto-Tamarixetum	*Salexo alba-Tamarixetm ramassisimusae*
	Populeto-Salexetum	*Populo nigrae-Salexetum albae*
	Tamarixetum	*Tamarixetum ramassisimusae*

The vegetation classification was performed according to the dominant principles (Leningrad ecol)

formations, ephemers were characteristic and formed a special sinusia. Even though *Centaurea arenaria* Bieb. was not so much wide-spread, it formed associations with Astragalus *hyrcanus* Pall. and *Artemisia arenaria* DC.

One of the characteristic formations in this whole Azerbaijan's Caspian shore (850 km) is ephemerism. Some of the characteristic taxa in this region are *Bromus japonicus* Thumb., *Plantago indica* L., *Zerna sterilis* (L.) Panzer., *Eremopyrum triticeum* (Gaertn.) Nevski. *Bromus variegatus* Bieb., *Hordeum leporinium* Link., *Avena eriantha* Durieu, *Trachynia distachyua* (L.) Link, *Lolium rigidum* Gaud., *Medicago minima* Grufb., *Alyssum desertorum* Staph. More taxa (80-85) were detected in the lime regions. The species that liked the lime soil are: *Artemisia fragrans* Willd, *Astragalus hyrcanus* Pall., *Gypsophylla paniculata* L., *Astragalus caspius* Hohen., *Centaurea iberica* Trev., *Salsola nodulosa* (Mog.) Jijin., *Stipa szovitsiana* Trin., *Gypsophylla bicolor* Freyn., *Eryngium campestre* L. These species were located on the small hills found mostly around Elet, Buzovna and Sihow regions in the Abseron Peninsula.

Table 2: Common associations and floristic composition of Caspian Shores of Azerbaijan (Numbers indicate the abundance of the species; numbers in parenthesis indicate aggregated abundance of the species)

		Associations																		
No.	Species	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	*Aegilops biuncialis* Vis.	1			1	1			1		1								1		
2	*Aeluropus littoralis* (Gouan) Parl.			1			1			1		1(2)				1	1	1			
3	*Agropyrum elongatum* (Host) P.B.	1							1		1								1		
4	*Alhagi pseudoalhagi* (M.B.) Desv.					1		1	1	(2)	1		1(2)								
5	*Alyssum desertorum* Stapf.	1			1	1	1	1	1		1		1	1					1		
6	*Arenaria serpyllifolia* L.				1												1	1			
7	*Artemisia arenaria* DC.				1	1(2)		1	2		1		1					1	2		
8	*Astragalus hyrcanus* Pall.							3	1										2		
9	*Atropis gigantea* Grossh.				1	1			1		1		1	1	1					1	
10	*Calamagrostis gigantea* Reshevitz		1(2)	1												1(2)	1				3(4)
11	*Centaurea arenaria* Bieb.	1			1			1	1		1								1		
12	*Cynodon dactylon* (L.) Pers.	1(2)				1		1		1	1						1		1	1	
13	*Elymus giganteus* Vahl										1					1	1				
14	*Eremopyrum triticeum* (Gaertn.) Nevski	1			1		1	1	1		1		1(2)	1	1				1	1	
15	*Gypsophylla paniculata* L.	1						1					1	1					1	1	
16	*Heliotropium europaeum* L.					1	1			1							1	1	1		
17	*Kohlrauschia prolifera* (L.) Kunth								1						1						
18	*Limonium meyeri* (Boiss.) Kuntze			1						1											
19	*Lolium rigidum* Gaud.	1			1	1		1	1				1	1					1	1	
20	*Medicago minima* Grufberg							1		1				1					1		
21	*Melilotus caspius* Gruner	1		1					1										1		
22	*Nitraria schoberi* L.	1							1				1	1	1						
23	*Plantago indica* L.	1		1	1		1		1				1	1				1			
24	*Poa bulbosa* L.	1			1	1	1		1				1	1				1			
25	*Salsola dendroides* Pall.						1		1		2(3)		4	2	1			1		1	
26	*Tamarix ramosissima* Ledeb.				1	2(3)												2(3)			1
27	*Tournefortia sibirica* L.				1		1	1(2)			1		1			1		1			
28	*Artemisia scoparia* Waldst.	3			1(2)		1-2			1		2		1(2)						1(2)	2(3)
29	*Astragalus caspius* M.Bieb.	1			1			2	1										1-2		
30	*Atriplex fomini* Iljin				1	1	1		1						1			1	1		
31	*Bolboschoenus maritimus* (L.) Pall.		1(2)	1			1			1		1(2)				1	1				1
32	*Butomus umbellatus* L.			1																	
33	*Carex compacta* Lam.		1	1								3					2(3)				1
34	*Centaurea iberica* Trevir	1			1	1	1														
35	*Clematis orientalis* L.	1																			
36	*Convolvulus persicus* L.	1(2)			1				1		1		1(2)						1		
37	*Cyperus longus* L.		1	1						1		1				1	1				1
38	*Daucus carota* L.	1							1												
39	*Eleagnus angustifulia* L.					1			1										1		
40	*Equisetum ramosissimum* Desf.							1				1				1					1
41	*Galium palustre* L.	1			1				1												
42	*Glycyrrhiza glabra* L.	1(2)				1(2)		1		3(4)			1					1(2)	1		
43	*Heleocharis eupalistrus* Lindl.				1			1													
44	*Holoschoenus vulgaris* Link.			1				1													
45	*Juncus acutus* L.		1	2(3)									1(2)				3(4)	1			
46	*Juncus littoralis* C.A.Mey.		1	2						+						2(3)	2				1(2)
47	*Juncus maritimus* Lam.			1(2)													1	1			
48	*Phragmites communis* (L.) Trin.		5	2(3)				3									1(2)	1			1(2)
49	*Salsola pestifer* A.Nels.										1(2)									1(2)	
50	*Corispermum caucasicum* (Bge.) Grossh.				1																
51	*Halocnemum strobilaceum*(Pallas.) Bieb.									1											
52	*Polypogon monspeliensis* (L.) Desf.	1			1	1			1										1		
53	*Salicornia europae* L.							1													
54	*Secale silvestre* Host	1																			
55	*Suaeda confusa* Iljin	1				1		1			1		2	1				1			
56	*Psylliostachys spicata* (Wild.) Nevski	1											1(2)								
57	*Cladium mariscus* (L.) R.Br.						1						1								
58	*Carex bordzilowskii* V.Kruz.		1	1						1		2									1(2)
59	*Imperata sylindrica* (L.) Beauv.	1			1	1		1													
60	*Picris strigosa* Bieb.				1		1		1										1		
61	*Chondrilla juncea* L.	1			1				1												
62	*Salsola nodulosa* (Mog.) Iljin.										2(3)			2	1(2)					3	
63	*Kalidium caspicum* (L.) Ung.-Sternb.					1(2)															
64	*Salsola crassa* M.Bieb.												2(3)	2	1					3	
65	*Salsola soda* M.Bieb.											1(2)	1(2)		1	2				2	

Table 2: Continued

No.	Species	Associations																			
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
66	*Salsola glauca* M.Bieb.											2			2	1(2)				1(2)	
67	*Halostaclys caspica* (Pallas.) C.A.Mey.														1	1(2)				1(2)	
68	*Suaeda microphylla* Pallas.				1	1			1				3(4)		1(2)	1		1	1	1(2)	
69	*Thypha angustifolia* L.		1	1(2)							3							2			1(2)
70	*Atriplex turcomonica* (Moq.) Boiss.	1			1		1									1					1
71	*Salsola pellucida* Litv.										1				1(2)	1		1			
72	*Plantago loeflingii* L.	1		1(2)		1						1(2)			1(2)					1(2)	
73	*Aeluropus repens* (Dsf.) Parl.		1	1(2)								1	1(2)						1(2)		1(2)
74	*Phleum paniculatum* Huds.											1									
75	*Zerna sterilis* (L.) Panzer.	1			1	1	1											1(2)	1		
76	*Setaria viridis* (L.) Beauv.							1		1	1										
77	*Puccinellie gigantea* Grossh.							1					1								
78	*Phalaris bulbosa* L.			1							1	1					1				1
79	*Paspalum digitaria* Poitr.		1(2)	1(2)			1				1(2)		1				1(2)		1		1
80	*Salsola ericoides* M.Bieb.														1					2	
81	*Petrosimonia brachiata* (Pallas) Bunge.													1	3(4)		2(3)			1	
82	*Artemisia szovitsiana* (Bess.) Grossh.	2(3)			2	2(3)			2									2	1		
83	*Artemisia fragrans* Willd.	3(4)			2			1					1								
84	*Polygonum caspicum* Kom.	1			1	1															
85	*Zerna rubens* (L.) Grossh.	1(2)			1						1(2)		1(2)	1			1				
86	*Hordeum leporinium* Link	1			1(2)		1	1(2)						1(2)	1			1	1	1	
87	*Medicago coerulae* Less.ex.Lebed.	1			1			1(2)													
88	*Bromus variegatus* Bieb.	1			1			1						1					1(2)	1	
89	*Stipa szovitsiana* Trin.	1			1		1(2)														
90	*Peganum harmala* L.	1					1(2)														
91	*Gypsophilla bicolor* Freyn.	1			1	1			1					1					1		
92	*Kochia prostrata* (L.) Schrad.								1												
93	*Lepidium draba* L.	1			1	1		1	1					1							
94	*Lycium ruthenicum* Willd.					1				1			1								
95	*Galium ruthenicum* Willd.	1			1			1	1												
96	*Limonium caspium* (Willd.) Gams.		1	1		1				1											
97	*Suaeda dendroides* (C.A.Mey.) Mog.	1				1			1	1			2(3)	1						1(2)	
98	*Avena eriantha* Dur.	1			1				1(2)		1				1					1	
99	*Lepidium erassitolium* Waldst.				1						1		1								
100	*Chenopodium album* L.	1				1			1					1				1	1	1	
101	*Bromus japonicus* Thunb.				1	1	1		1					1	1			1	1		
102	*Aegilops cylindirica* Host.	1			1		1(2)		1(2)						1(2)	1					
103	*Eryngium campestre* L.				1		1		1										1		
104	*Nonnea caspica* (Willd.) G.Don.					1			1		1								1		
105	*Lactuca tatarica* (L.) C.A.Mey.							1													
106	*Chondrilla juncea* L.	1			1																
107	*Carex divisa* Huds.		1	1								2				1	1(2)				1(2)
108	*Polygonum patulum* Bieb.			1													1				
109	*Trachynia distachyua* (L.) Link	1			1(2)			1(2)		1					1						
110	*Carex riparia* Curtis		1									2(3)				1	1(2)				1
111	*Tragopogon graminifolius* DC.	1				1			1												
112	*Anabasis aphylla* L.				1		1		1					1	1				1		
113	*Ephedra distachya* L.						1(3)														
114	*Callugonum petunnikowii* Litv.								1(2)												

(2) *Artemisetum fragransae ass. nov.* (3) *Phragmetum commucommunisae ass. nov* (4) *Junco littorali-Phragmetum communisae ass. nov.* (5) *Hordeto leporini-Artemisetum szovitsii ass. nov.* (6) *Tamarixo ramassisimae-Artemisetum szovitsii ass. nov.* (7) *Ephedro distachiae-Phragmetum communisae ass. nov.* (8) *Astragalusetum hyrcanae ass. nov.* (9) *Artemiso arenariae-Ephedretum distachii ass. nov.* (10) *Thypho angustifolii-Glycyrrhizetum glabrae ass. nov.* (11) *Salsolo dendroidesaeo-Artemisetum szovitsianae ass. nov.* (12) *Carexetum ripariae ass. nov.* (13) *Suaedetum dendroidesae ass. nov.* (14) *Salsoletumo dendroidesae ass. nov.* (15) *Petrosimonietum brachiatae ass. nov.* (16) *Juncusetum acutusae ass. nov.* (17) *Carexo compacta-Petrosimonietum brachiatae ass. nov.* (18) *Tamarixetum ramasissimii ass. nov.* (19) *Artemiso arenarii-Astragaletum hyrcanae ass. nov.* (20) *Salsoletum ericoides ass. nov.* (21) *Calamastrostisetum giganteae ass. nov*

RESULTS AND DISCUSSION

Between 1950-1960 and between 1995-1997 the water level of the Caspian Sea first raised about 2 m and then decrease 1,2 m (Titlyanova *et al*., 1988). This periodical increase and decrease has caused the some formations especially the psammophyte-littoral and halophyte-meadow-arid vegetations to stay under the water. The increase in the level of water has caused the low ground level to fill with water and caused a change of the psammophyte vegetation to the arid-meadow vegetation (Prilipko, 1965, 1970; Prilipkpo *et al*., 1961).

On the Caspian shore enclosed by Yalama, Hazmaz, Deveci and Lenkeran plains, there are widespread swamp-

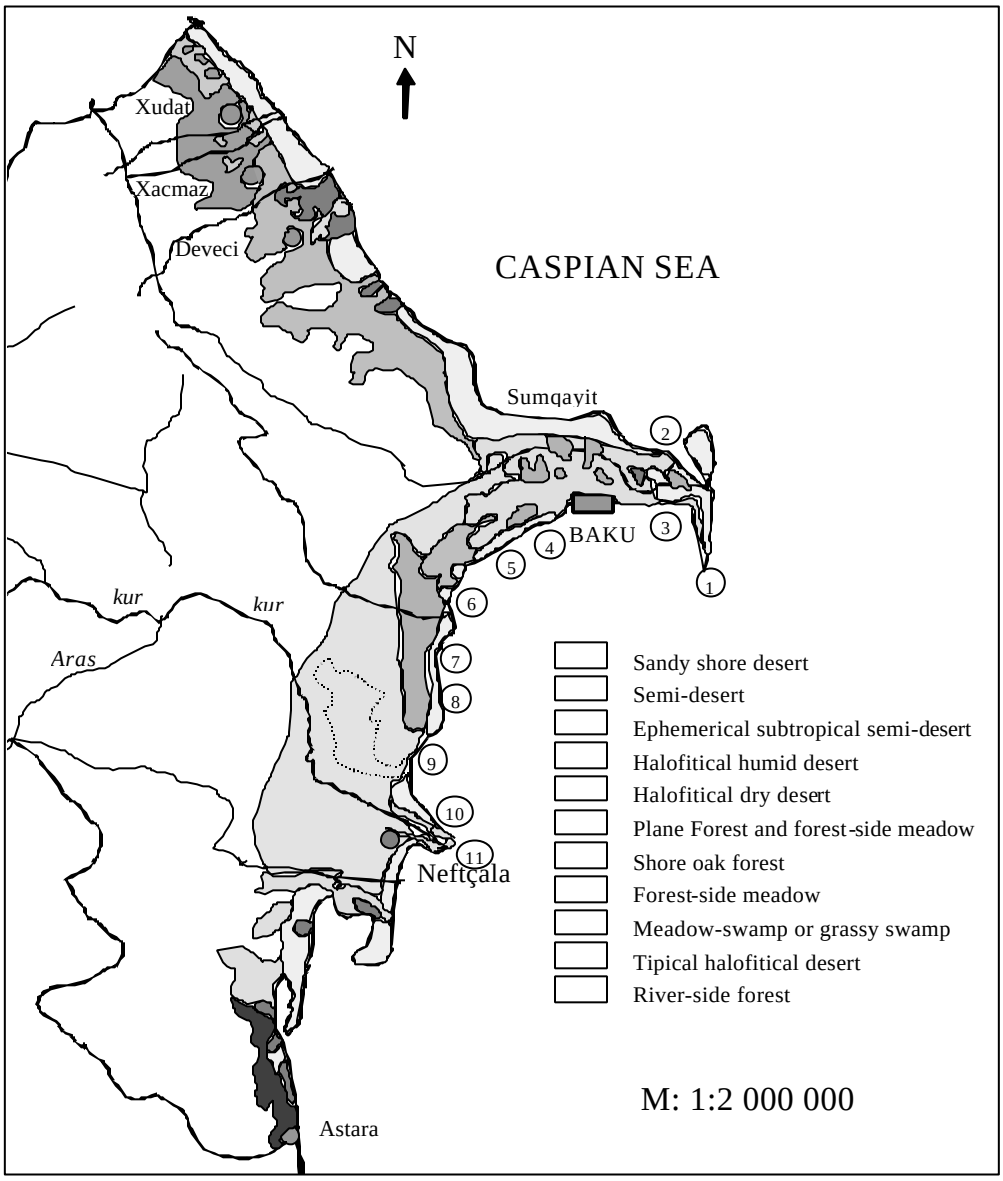


Fig. 1: The map of caspian shores vegetation of Azerbaijan. 1 Schahdili; 2 Buzovna-Bilgeh; 3 Schikhov; 4 Elet; 5 Gobustan; 6 Sangacal; 7 8 9 Schirvan; 10 Saratovka;11 Neftcala

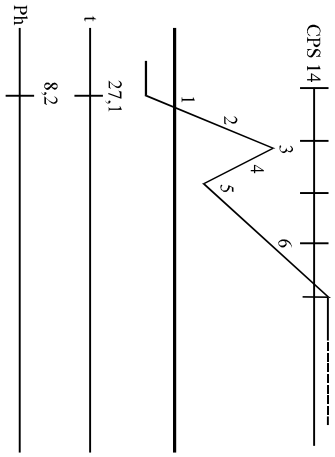
meadow and grass-swamps. The Kizilagac golf, a sanctuary region for the wild life preservation, was also within the limit of our study area. There are wide swamp-meadow and real swamps and they are a niche for birds and fish and form a good fishing place.

Juncus littoralis C.A.Mey and *Phragmites communis* (L.) Trin. species, widespread around Deveci, Abseron, Masalli and Lenkeran, generally form homogenous associations and often form polydominant association with *Juncus littoralis* C.A. Mey. ve *Phragmites communis* (L.) Trin. *Glycyrrhiza glabra* L., *Alhagi pseudoalhagi* Desv., *Artemisia szovitsiana* (Boiss.) Grossh., *Limonium meyeri* (Boiss.) Ktze., *Psylliostachys spicata* (Willd) Nevski., *Tripolium vulgare* (L.) Nees. (Table 3, Fig.1-9).

The following species are more common on the coasts of the shore: *Scirpus tabernaemontani* Gmel., *S. lacustris* L., *Carex bordzilowski* V. Krecz,

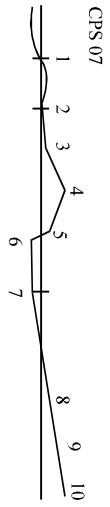
Table 3: Vegetation types and dominant species of Caspian Shores of Azerbaijan

No:	Specimen areas	Vegetation types	Dominant species
1	Hövsan	Semi-desert, Wet-swamp	*Artemisia szovitsiana, Phragmites communis, Artemisia fragrans*
2	Türkan	Semi-desert	*Artemisia szovitsiana, Tamarix ramasissime*
3	Zıre	Wet-swamp	*Phragmites communis*
4	Şıkhov	Wet-swamp	*Phragmites communis, Astragalus hyrcanus*
5	Artyon	Semi-desert, Wet-swamp	*Artemisia fragrans, Thypha angustifolia, Glycyrrhiza glabra*
6	Şangacal	Desert	*Salsola dendroides, Artemisia szovitsiana, Carex bordzilowskii*
7	Gobustan	Desert, Semi-desert	*Salsola dendroides*
8	Taşgil	Desert	*Suaeda mycrophylla, Salsola crassa*
9	Elet	Desert, Semi-desert	*Artemisia fragrans, Calluganum petunnikawii*
10	Şirvan koruğu	Desert, Semi-desert	*Salsola crassa*
11	Neftçala	Desert, Wet-swamp	*Thypha angustifolia, Petrosimonia brachiata*
12	Kızılağaç körfezi	Wet-swerap	*Juncus marittimus, Phragmites communis*
13	Saratovka	Wet-swamp, Desert	*Carex divisa, Petrosimonia brachiata*
14	Buzovna-Bilgeh	Sandy-desert	Dispersed vegetation
15	DREC	Semi-desert	*Artemisia fragrans*
16	Daşgil	Desert, Semi-desert	*Tamarix ramasissime, Artemisia fragrans, Astragalus bakuensis*
17	Şahdil	Semi-desert, Wet-swamp	*Salsola dendroides, Tamarix ramasissime, Phragmites communis, Calamagrostis giganteum, Juncus littoralis, Ephedra distachya*



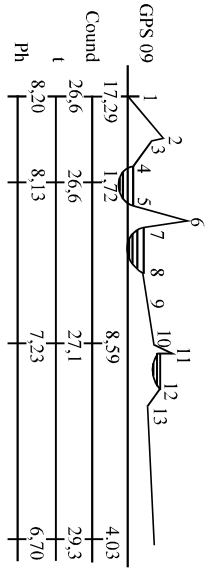
Region	Assosation	Species
1 2		
3-4 5	Tamarixo ramasissima-Artemisetum arenariae	*Tararix ramasissima* *Tamarix ramasissima* *Lepidium draba* *Artemisia arenaria*
6	Artemiso arenariae-Astragaletum hyrcanusae	*Astragalus hyrcarus* *Alhagi pseudoalhagi* *Alyssum deserforum* *Centaurea arenaria* *Lolium rigidum* *Limonium meyeri* *Poa bulbosa* *Medicago coerulea* *Hordeum leporinium*

Fig. 2: At Şahdili station, according to distance from the seaside, the distribution of topography and plants



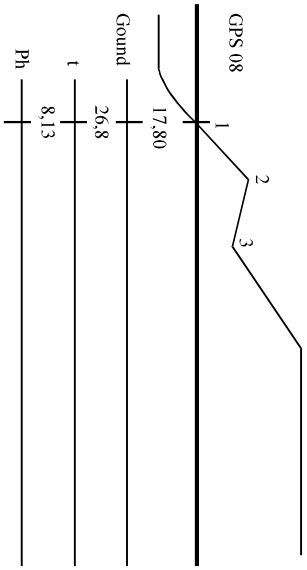
Region	Assosation	Species
1-6		
6-7 7-8	Juncuseto marittimae-Phragmisetum communisae Limore to neyeriae Juncusetum littoralisae	*Juncus littoralis, Juncus acutus, Juncus maritimus, Carex campacta, Phragmites conmuis, Bolboschoenus maritineus* *Limonium meyeri, Glycyrhiza, Calamagrostis gigantea, Artomisia aronaria, Cunodon doctulon, Alhagi penialhagi, Juncus littoralis, Carex compacta Carex divisa*
8-9	Glycytioglabrae-Junguseturn littoralisae	*Glycirrhizo glabrae, Juncus littoralis, Phragmites communisae, Alhagi pseudalhagiae, Limonium meyeri Cynodon dactylon, Centauria arenaria, Madicago coerulea, Polygonum patuium, Hordeum leporirum*
9-10		*Cynodon dactyion, Aduropus littoralis, Glycirrhizo glabrae, Juncus littoralis, Alussum desertorum Alhagi pseudalhagi*
11		*Juncus littoralis*

Fig. 3: At Buzovna-Bilgeh station, according to distance from the seaside, the distribution of topography and plants



Region	Assosation	Species
1-3 3-5	Phragmisetum commurisae	*Phragmites communis*, *Phragmites conmuis*, *Atriplex fomiri*, *Lepidium draba*, *Salicormia europea*, *Salsola pestifer*, *Bolboschoenus manitimus*
5-6	Typho angustifoliae-Phragmisetum commurisae	*Typha angustifalia*, *Bolboschaenus maritimus*, *Carex exteusa*, *Phragmites communis*
6-7	Typho angustifoliae-	*Limanium caspium Suaeda Dendraides*, *Salsoia sada*, *Petrosimonia braclacta*, *Artemisia arenaria*, *Tamarix ramasissima*, *Gynodon dactylon*
7-8		*Phragmites communis*, *Carex exteusa*, *Typha angustifalia Bolboschaenus maritimus*
8-10		*Tamarix ranasissima*, *Hobeneum strobilaceum Saisola pestifer*, *Salsola foliosa Namea caspica*
11-12		*Tanarix ranasissima*
13	Halocnemo strobilisae-Salsoletum pestiferae	*Halocnemum strobilaceum Salsola pestifer*, *Salsola faliosa*
14>		

Fig. 4: At Schikhov station, according to distance from the seaside, the distribution of topography and plants



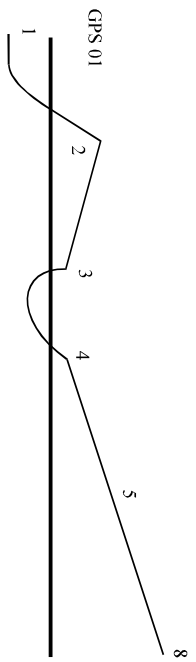
Region	Assosation	Species
1	Phragmitesetum commurisae	*Phragmites communis*, *Salsola crassa*, *Limonium meyeri* *Alhagi pseudalhagi*
2	Salsolo dendroidesae-Artemistietum fragransae	*Lepidium draba* *Artemisia fragrans* *Salsola dendroides* *Tamarix ramasissima* *Licium ruthcnicum* *Alhafi pseudalhagi* *Salsola crassa* *Centauria arenaria* *Medicago coerulea* *Zerna rubens*
3	Salsolo dendroidesae-Artemistietum fragransae	*Salsola dendroides* *Salsola pestifer* *Salsola crassa* *Galium palustre* *Picris strigosa* *Chondrilla juncea* *Ephedra distachya* *Medicago coerulea* *Cynodon dactylon* *Artemisia fragrans*

Fig. 5: At Elet station, according to distance from the seaside, the distribution of topography and plants

C. compacta Lam, *C. divisa* Huds., *C. riparia* Curt., *Carex bordzilovski* V. Krecz, *C. compacta* Lam., *C. divisa* Huds., *C. riparia* Curt., *Thypha latifolia* L., *T. angustifolia* L., *T. laxmannii* Lep., *Sparganium polyedrum* (Asch. and Glaebun.) Juz., *S. neglectum* Beeby, *S. microcarpum* (Neum.) Cel., *Juncus acutus* L., *J. littoralis* C.A.Mey., *J. gerardi* Loisel., *J. maritimus* Lam.

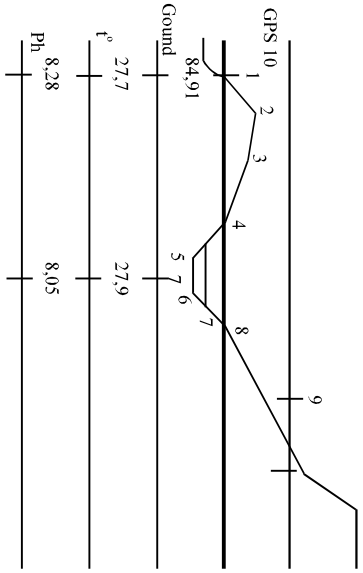
There are monodominant associations formed by *Juncus littoralis*, *J. acutus* and *J. marittimus* species in the region between Deveci Harbour in the North and the Celilabad and Masalli in the South. The floristic content of these associations varies with the ratio of the salinity and humidity.

The diameter of the shrub structures formed by *Juncus littoralis* in the Sihov and Masalli regions is around 1 m and spread with 2-4 m space. The soil covering species in the region *Cynodon dactylon*, *Limonium meyeri*, *Alhagi pseudoalhagi*, *Glychyrriza glabra* are more abundant. As it gets farther inward the



Region	Assosation	Species
1-3		
3-4	Junco littoralisae-Phragmitesetum communisae	*Juncus littoralis*, *Imperata cylindrica*, *Bolboshoenus maritimus* *Cladium mariscus* *Salicomia europea* *Salsola pestifer* *Cynodon dactylon* *Pragmites communis* *Carex hordzilowshii* *Juncus lampocarpus* *Atropis bulbosa*
4-5	Artemisetum arenariae	*Artemisia arenaria* *Picris stricosa* *Chondrilla juncea* *Astragalus hyrcanus* *Glycyrrhiza glabra*
5-6	Convolvulo persicusae-Artemisietum arenariae	*Convolvulus persicus* *Zema rubens* *Daucus carota* *Hordeum teporinum* *Bormus japonicus* *Artemisia arenaria* *Medicago coerulea* *Astragalus hyrcanus* *Artemisia arenaria*
7	Arterniso arenariae-Astragalusetum hyrcansae	*Medicago coerulea* *Astragalus hyrcanus*

Fig. 6: At Sangacal station, according to distance from the seaside, the distribution of topography and plants

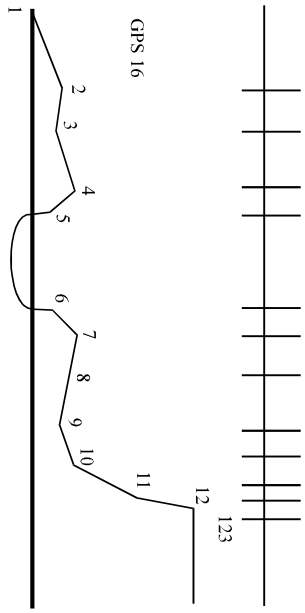


Region	Assosation	Species
1-2		
3	Arterniso arenarsiae-Astragaletum hyrcanusae	*Artemisia arenaria* *Agropyrum elongatum* *Alhagi pseudalhagi* *Elumus giganteus*
4-6	Tuzlasmus kumul	*Lepidium draba* *Salsala crassa* *Atropis gigantea* *Salsala pestifer* *Picris strigosa* *Chondrilla juncea* *Tamarix ramasissima* *Astragalus hyrcanus*
7 8	Arterniso arenarsiae-Astragaletum hyrcanusae	*Artemisia arenaria* *Astragalus hyrcanus* *Suadea dendroides* *Astragalus hyrcanus*
9	Arterniso fragransae-Salsoletum dendroidesae	*Alhagi pseudalhagi* *Artemisia fragrans* *Artemisia szovitisiana* *Eremopyrum triticum* *Salsala dendroides* *Convolvulus persicus*

Fig. 7: At Gobustan station, according to distance from the seaside, the distribution of topography and plants

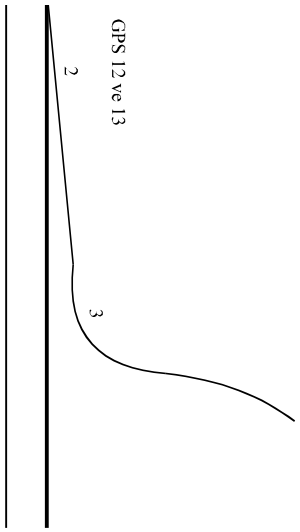
abundance of *Juncus littoralis* increases. The average height of this association is about 1 m and the covering level is about 90%. *Phragmites communis* in the Sihov region is widespread in the 20-30 m in length (Prilipko and Agacanov, 1972; Haciyev *et al*., 1991).

In the Northern part of Abseron peninsula, until Astara in the South the following vegetation types are found: water-swamp (Hövsan, Zire, Şıhav, Kızılağac Körfezi, Şahdili), sandy-desert (Hövsan, Türkan, Artyom, Sangaçal, Elet), halophytic-desert (Taşgil, Şirvan koruğu, Sangaçal, Saratovka, Neftçala) and semi-desert (Hövsan, Türkan, Artyom, Elet, DRES, Daşğili) (Table 3, Fig. 1-9). Because the area has different ecological conditions, different vegetation types have developed. The



Region	Assosation	Species
1		*Aleropis gigantea* *Halocnemum strobilaceum*
2-6 7 8		 *Salicornia europea* *Atropis gigantea* *Tamarix ramasissima* *Salicornia europea*
9	Salicorno europeae-Kalidetum caspicae	*Salicornia europea* *Kalidium caspicum* *Polugonum patulum*
10	Suaedo dendroidease-Artemisietum fragransae	*Artemisia fragrans* *Artemisia arenaria* *Salsola soda* *Salsola crassa* *Halostachys caspica* *Kalidium caspicum* *Psyllostachys spicata* *Suaeda dendroides*
11-13	Artemisio fragransae-Salsoletum dendroidesae	*Artemisia fragrans* *Kalidium caspicum* *Salsola dendroides* *Petrosimonia brachiata* *Poa bulbosa* *Bromus japonicus* *Zerna rubens* *Agropyrum elongatum*

Fig. 8: At Schirvan station, according to distance from the seaside, the distribution of topography and plants



Region	Assosation	Species
1	Carexo compactae-Phragmisetum communisae	*Juncus littloralis* *Carex bordzilowskii* *Carex compacta* *Cyperus loncus* *Phragmites communis* *Atropis gigantea*
2	Salsolo crassae-Salicomietum europeae	*Salicomia europea* *Salsola crassa* *Salsola soda* *Salsola glauca* *Atropis gigantea* *Cynodon dactylon* *Zerna rubens* *Salsola nodulosa* *Suaeda microphylla* *Salsola crassa* *halocnenum strobilaceum* *Suaeda confussa* *Agropyrum elongatum*
3		

Fig. 9: At Neftcala station, according to distance from the seaside, the distribution of topography and plants

vegetation map of the region was drawn according to its ecologic, floristic and phytosociologic features. In Table 1, the vegetation types and subtypes of the Caspian Shores are given. The characteristic dominant and edificatory species of these types are as following:

Sandy-desert: Found especially in the sandy coasts of the region. The following dominant and association-forming species are common in these areas. *Artemisia szowitsiana*, *A. arenaria*, *Astragalus hyrcanus*, *A. caspicus*, *Collugonum petunnikovi*, *C. bakuensis*, *Carex bordzilovski*, *C. divisa*, *Ephedra distachya*.

Halophytic wet-desert: Found especially in clayey soil with high salt and humidity. The following association-forming species are common in these areas. *Salsola crassa*, *S. soda*, *S. glauca*, *S. ericoides*, *Limonium caspium*, L. meyeri, *Glycyrrhiza glabra*, *Juncus*

Table 4: The productivity of common associations of Caspian Shores of Azerbaijan

No.	Associations	Above ground phytomass (g/25 cm^2)			Under ground phytomass (g/25 cm^2)		
		Wet	Dry	Humidity	Wet	Dry	Humidity
1	*Juncusetum littoralisae*	4000	135	1650	1200	2060	5140
2	*Juncusetum marittimae*	900	208	693	-	-	-
3	*Junco marittimii-Limonietum. meyeriae*	1440	640	800	6400	2480	3920
4	*Junco marittimii-Glycyrrhizetum glabrae*	160	65	95	100	47	53
5	*Ephedretum distachyae*	1150	665	485	250	163	88
6	*Astragaletum hyrcanusae*	200	158	43	50	40	10
7	*Astragalo hyrcanae-Juncusetum littoralisae*	4800	280	2000	5440	4560	880
8	Ephedreto distachya-Artemisetum szovitsianae	250	75	175	448	112	336
9	*Calamagrosto giganthei-Phragmetum communisae*	640	470	170	4300	1164	3136
10	*Thyphetum angustifoliae*	536	224	312	3392	1520	1872
11	*Carexetum divisae*	644	434	210	389	202	187
12	*Kalidetum.caspicumae*	550	252	298	252	195	57
13	*Salsoletum dendroidesae*	2048	640	1408	464	240	224
14	*Artemisetum szovitsianae*	550	129	422	184	144	40
15	*Artemisetum,fragransae*	255	154	101	69	47	22
16	*Salsoletum ericoidesae*	990	648	342	596	364	232
17	*Alhagetum pseudalhagiae*	400	339	61	118	42	36
18	*Tamarixetum ramassisimae*	810	447	343	725	367	358
19	*Alhago pseudoalhagi-Hordetum leporiniae*	102	50	52	258	170	88
20	*Atropo gigantei-Halocnemumetum strobilaseae*	172	78	935	505	170	335
21	*Salicorno europea-Kalidietum caspicae*	2600	291	2309	692	250	445
22	*Petrosimo brachiata-Salicornietum europeae*	1210	470	740	304	91	213
23	*Salicornietum europeae*	714	187	527	320	130	190

maritimus, *J. littoralis*, *Suaeda confusa*, *Petrosimonia brachiata*, *Salicornia europea*, *Kalidium caspicum*, *Halostachys caspius*, *Halocnemum strobilaceum*, *Alhagi pseudoalhagi*.

Halophytic arid-desert: Found especially in the areas with high salt and low humidity. The following dominant species are characteristic of this sub-vegetation type. *Salsola dendroides*, *Salsola crassa*, *S. soda*, *S. glauca*, *S. ericoides*, *Suaede dendroides*, *S. confusa*, *Artemisia szovitsiana* and *A. scoparia*.

Semi-desert: Found especially in clayey and lime soil with very low level of salt and humidity. The associations formed by many dominant or co-dominant ephemerid and ephemerid-like species such as *Astragalus hyrcanus*, *A. caspius*, *A. bakuensis*, *Artemisia fragrans*, are common in these associations.

Wet-swamp: This type is commonly found in the water-edge or in the water or in the swamp areas. The following associations formed by the edificative species such as *Phragmites communis*, *Calamagrostis giganthea*, *Tamarix ramasissima*, *Junsus littoralis*, *J. acutus*, *Thypha angustifolia*, *Carex bordzilovski*, *C. compacta*, *C. divisa*, *C. riparia*, are common in these associations.

Forest: Found in the areas with 5-10 m (Yalama and Lenkeran plain) or more above the water level. They are formed by the following species either as mono-dominant forms or as mixed forests (Karyagin, 1950; Prilipko, 1965, 1970; Grossheym, 1948). *Quercus iberica* Stev., *Q. longipes* Stev., *Carpinus caucasica* Grossh., *Acer laetum* C. A. Mey., *A. campestre* L., *Coryllus avellana* L., *Prunus spinosa* L., *P. divaricata* Ledeb., *Mespilus germanica* L.

Tugay (edge) type forests are found at the site where the Kur river joins to Caspian Sea. The following species form pure or mixed Tugay (edge) type forests in these areas (Fig. 1). *Populus hybrida* M. Bieb., *P. tremula* L., *P. nigra* L., *Ulmus densa* Litv., *Tamarixs ramasissima* Ledeb., *Salix purpurea* L., *S. alba* L., *Elaeagnus ancustifolia* L.

On the Caspian Shores within Azerbaijan borders, there are 48 formations and 57 associations belonging to 4 vegetation types (desert, semi-desert, wet-swamp and forest) and 9 subtypes (Sandy-desert, halophytic wet-desert, halophytic arid-desert, ephemerous subtropical semi-desert, subtropical semi-desert, wet-swamp and swamp-meadow, edge (tugay) forest and coastal forest (Fig. 1-9, Table 1).

Phytomass: The wet and dry weight of the above and under-ground phytomasses of the 23 associations common to the study area was investigated and the changes in the absolute humidity level of each of the association were defined (Table 4). The phytomass values were taken in 0.25 cm^2 surfaces.

The results of phytomass analysis of these associations are as following: the wet-mass in 1 m^2 above the ground of *Phragmites communis* is 5 kg and its average height is 2, 5-3 m. On the arid parts of

the shores, the height of this plant reaches to 1, 8 m and the number of the trunks is 24 and the wet mass above the ground is 3, 5-4 kg per 1 m^2 (Haciyev *et al*., 1991; Prilipkpo *et al*., 1961).

Above-ground phytomass: As shown in the Table 4, the values of above ground phytomasses and absolute humidity change according to the floristic composition of the associations and the edafic ecologic conditions of the environment. The associations formed according to the absolute humidity level can be grouped as following: associations with absolute humidity level of :

- 50-99 g low level absolute humidity.
- 100-999 g mid level absolute humidity.
- 1000-3000 g high level absolute humidity.

The humidity level of the associations with high absolute humidity level changes between 1000-3000 g. The following are examples of such associations, whose absolute humidity level changes between 1408-2309 g: *Salicorno europea-Kalidietum caspicae*-2309 g, *Astragaletum hyrcanusae*-2000 g, Juncusetum littoraliae-1650 g, *Salsoletum dendroidesae*-1408 g (Table 4).

The following are the examples with mid-level absolute humidity (100-1000 g): *Petrosimonio brachiatae*, *Salicornietum europea*, *Junco maritimus*, *Limonietum meyeriae*, *Juncetum littoraliae*, *Salicornietum europae*, *Salsoletum dendroidesae*, *Artemisietum fragransae*, *Thyphetum angustifoliae*, *Ephedretum distachiae*, *Kalidietum caspicae*, *Carexetum divisae*, *Phragmetum communisae*, *Ephedro distachyii* and *Calamagrostisetum giganteumae*.

The following are the examples with low level absolute humidity (50-100 g): *Junco maritimus*, *Glycyrrhizetum glabrae*, *Astragaletum hyrcanusae*, *Alhagetum pseudoalhagae*, *Alhago pseudoalhagii*, *Hordetum leporiniae*, *Atropiseto gigantei*, *Halocnemetum strobilaseumae*.

Under-ground phytomass: The humidity of the under ground phytomass of the associations also showed variation. Like that of above ground, this variation was classified as following:

- 10-99 g low level absolute humidity.
- 100-999 g mid level absolute humidity.
- 1000-5500 g high level absolute humidity.

The absolute humidity level for some of the associations is as following *Juncusetum littoralisae* (5140 g), *Junco maritimii-Phragmetum communisae* (3920 g), *Phragmetum communisae* (3136 g), *Thyphetum angustifoliae* (1872 g), show a varying degree of high humidity level between 1872-5140 g. Some other associations show low humidity level between 22-880 g.

As can be seen from the Table 4, in some formations, such as *Salicorno europae-Kalidietum caspicae* (2309 g), *Astragaletum hyrcanusae* (2000 g), *Juncusetum littoralisii* (1650 g), *Salsoletum dendroidesae* (1408 g), the ratio of the above ground phytomass is much higher than that of under ground phytomass. However, in some other formations, such as *Juncusetum littoralisae* (5140 g), *Junco littoralisii-Phragmetum communisae* (3920 g), *Phragmetum communisae* (3136 g), *Thyphetum angustifoliae* (1872 g), this ration is reverse, meaning the above-ground phytomass is much less than that of under ground phytomass. Yet, in some other formations these ratios are very similar. For example, the above and under ground phytomass of the following associations are respectively as following: *Junco littoralisii-Glycyrrhizetum glabrae* için 94, 8-53, 2 g, *Astragaletum hyrcanusae* 42, 5-10 g, *Carexetum divisae* 210-187 g, *Salsoletum dendroidesae* 342-232 g, *Alhagetum pseudoalhagae* 61-36 g, *Tamarixetum ramasissimusae* 343-358 g.

Over-ground dry grass yield of the associations in the searched area changed between 40-6400 g per 25 cm^2 while that of underground (40 cm in depth) changed between 50-4560 g. The underground and above ground yield of *Junco littoralii-Phragmetum communisae*, *Astragalo hyrcanusae-Juncusetum littoralisae*, *Phragmetum communisae*, *Thyphetum ancustifoliae* change between 1164-4560 and 470-640 g per 25 cm^2, respectively. For the other associations, the above ground yield per 25 cm^2 changes between 50-470 g while that of underground changes between 40-1164 g. The absolute humidity of the above ground phytomass ranges from 60-1650 g while that of under ground phytomass changes between 10-5140 g. The reason for the high level of the absolute humidity is because these associations develop in the vicinity of the water.

The absolute humidity level in *Astragaletum hyrcanusae*, *Artemisetum szovitsianae*, *Alhagetum pseudoalhagae*, *Ephedretum distachyae*, *Junco marittimusae*, *Glychyrrizetum glabrae*, *Alhago pseudoalhagii-Hordetum leporiniae* is 10-88 g, while in *Juncusetum littoralisae*, *Phragmetum communisae*, *Thyphetum angustifoliae* 1872-5140 g. In the other associations changes between 187-445 g. The absolute humidity level in *Alhagetum pseudoalhagae*, *Alhago pseudoalhagii-Hordetum leporiniae*, *Junco marittimusii-Glycyrrhizetum glabrae* is 52-95 g while in the other associations this value changes between 101-2309 g. The

absolute humidity level of the under ground phytomass is relatively less than that of above ground. The reason for this fact is that the system of the plants adopted to a watery environment is less developed than those adopted to the arid environment.

Present results indicate that the absolute humidity level of the varying associations in the Caspian Shore vegetation differs. This depends on the morphological (one year, multi-year, rhisomous, shrub, grass, wood, etc.), phytosociological (abundant, covering level) and phytoecological (succulent, mezophyte, higrophyte, xerophyte, mezoxerophyte) features.

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