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ИЗУЧЕНИЕ ФИТОЦЕНОЛОГИЧЕСКИХ ОСОБЕННОСТЕЙ ЗАГРЯЗНЕННЫХ ПОЧВ САМУР-ШАБРАНСКОЙ НИЗМЕННОСТИ В ТЕРРИТОРИИ «СИЯЗАННЕФТЬ»

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INVESTIGATION OF PHYTOSENOLOGICAL CHARACTERISTICS OF OIL CONTAMINATED SOIL IN SAMUR-SHABRAN LOWLAND AREA (SIYAZANNEFT AREA)

Аннотация. В статье излагается фитоценологические особенности растительного покрова, загрязнённых почв данной территории низменности. В результате исследований впервые выявлены 4 типа растительности (пустынная, полупустынная, чально-луговая и водно-болотная). Они объединяются в 5 классов формации, 11 групп формаций и 11 ассоциаций. Приводятся основные ассоциации видового состава, экологические группы, строение сообществ, а также определены жизненные формы или биоморфа, обилие, ярусность каждого вида и фенологические фазы растений исследуемого объекта с целью биологической рекультивации.

Ключевые слова: фитоценологическая характеристика, нефтезагрязнённые почвы, типы растений, жизненные формы, биологические рекультивации.

Abstract. The article deals with the phytosenologic features of the vegetative cover, the polluted soils of the given territory of lowland. As the result of the research 4 types of vegetation (deserted, semidesertic, cherno-meadow and water-marsh) are revealed for the first time. They are united in 5 classes of formation, 11 groups of formation and 11 associations. The basic associations of specific structure, ecological groups, and structure of communities are presented, and also vital forms or a biomorph, abundance, each type circle and phenological phases of plants of investigated object for the purpose of biological recultivation are defined.

Key words: phytosenological characteristics, oil contaminated soil, types of vegetation, vital forms, biological recultivation.

The restoration of soil fertility and vegetation contaminated by inherent oil products and interior layer water obtained from the deep underground is a scientifically important problem to be solved [6-7].

The recultivation of soil contaminated by oil products and gradual restoration of mining area in Siyazan region were indicated in the decree of the president of Azerbaijan Republic "The 2006-2010 Complex Developmental Program for improving of ecological situation in Azerbaijan Republic" that was signed on 28 September 2008. Therefore in May-July of 2010 the study of phytosenological characteristics of vegetation in contaminated area of "Siyazanneft" mining area was major purpose [8-11; 13-14].

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For that reason the phytosenological researches were performed by ecological methods [3; 12] in the soil of areas 1 and 5 contaminated by black oil, bitumen, asphalt etc., under use of the “Siyazanneft” Oil and Gas Production Department (OGPD) of the Oil Company of Azerbaijan Republic. As an object for appropriate research, the various relief of contaminated soil and plant samples were chosen for the first time from 10 meter of deepness of Caspian sea (Kandahar, Zarat, and fifth area) up to 280 meter of height (Gilgilcahy). These “objects” border Siyazan and Zarat municipality areas and Government forest area lands. The total area of “Siyazanneft” is 1424.00 hectares and the examined oil mine areas contain 290.4 hectares [12].

In the same area the expansion of phytosenoz in saline, sandy, gray, gray-brown gloomy soils and grassland and wetland soils was observed [1; 4].

The climate of Siyazan region where the “Siyazanneft” is located belongs to dry summer with moderate hot semi-desert and dry steppe types of climate [5]. In this area the average annual temperature is a 12-13°C and the annual precipitation reaches 300-600mm.

The characteristic plant samples from the area were collected, dominant and subdominant types which are considered as an edificatory were herbed, plants are also classified according to systematic taxonomy, and taxonomies are named according to S.K.Cherepanova [2].

According to the accomplished researches, the plant resources of “Siyazanneft” are divided into 4 types (desert, semi-desert, lowland-grassland and wetland), 5 formation classes, 11 formation groups and 11 associations (table 1).

The phytosenotic structure of species content of the association belonging to plant types is described below.

Table 1

The classification of plant resources of “SIYAZANNEFT”

Types 1	Formation Classes 2	Formation Groups 3	Associations 4
I. DESERT (SÖHRA)	Ephemera – wormwoody-annual- salinity	Petrosimonia / Petrosimonietum / Eremopirum- Petrosimonia / Eremopureto - Petrosimoniosum/ Wormwood- Petrosimonia / Artemisieto - Petrosimoniosum/	Branched Petrosimonia / Petrosimonietum brachiata/ East eremopirum - Branched Petrosimonia /Eremopuretum orientale - Petrosimoniosum brachiata/ Aromatic wormwood-branched petrosimonia /Artemisietum lerchianae - Petrosimoniosum brachiata /
II semi-desert grasslands (Hemideserta)	Ephemeral - salinity - wormwood	Ephemeral – Petrosimonia - wormwood /Ephemereta – Petrosimonietum – Artemisietum/ Ephemeral – saltwort - wormwood /Ephemereta – Salsoletum – Artemisiesum/ Ephemeral – wormwood /Ephemereta – Artemisiesum/	Ephemeral – Branched Petrosimonia –aromatic wormwoody /Ephemereta – Petrosimonietum brachiata - Artemisiosum lerchianae/ Ephemeral – woody saltwort - aromatic wormwoody /Ephemereta – Salsoletum dendroides Artemisiosum/ lerchianae / Ephemeral – aromatic wormwoody /Ephemereta – Artemisiosum lerchianae/

Continued from table 1

1	2	3	4
III. Hole-meadow Absinthe wormwood	Lowland-meadow	Camel's thorn – saltwort – wormwoody /Alhagieto – Salsoletum - Artemisiosum/	Requila wormwood– woody saltwort –wormwood /Alhagieto pseudoalhagi – Salsoletum dendroides – Artemisiosum szowitsiana /
	Wormwoody - camel's thorn – Couch grass	Wormwoody - Camel's thorn land /Artemisieto - Alhagietum/ Wormwoody - meadow / Artemisieto - Cynodonetum/	Wormwoody – regular Camel's thorn /Artemisieto szowitsiana – Alhagietum pseudoalhagi/ Wormwoody-fingerlike Couch grass (Artemisieto szowitsiana – Cynodonsum dactylon
IV. Water–wetland	Wetland –meadow	Broadleaf cattail /Juncuseto — Typhetum latifoliae/ cattail / Juncuseto/	Narrow-leaf cattail-sharp pointed rush /Juncuseto actus – Typhetum angustifolia/ Sharp cattail / Juncuseto actus /

Table 2

**The contents and structure of natural growth in “Siyazanneft”
(May-July, 2010)**

Order №	Ecomorph species	Ecological groups	Abundance (by points)	Stages and height (cm)	Phonological periods
1	2	3	4	5	6
1. Aromatic wormwood-branched petrosimonia association (Artemisieto lerchiana –Petrosimonietum brachiata) (With the dominance of Petrosimonia brachiata Pall. (Bunge.) the Area №1, Mine №1, Oil well № 1219)					
Shrubs					
1.	Halocnemum strobilaceum (Pall.) Bieb.	halophyte	1	III (20)	vegetation
yarəmkollar					
2.	Salsola dendroides Pall.	mezoxerophytess	1	II (70)	vegetation
Perennial grasses					
3.	Artemisia lerchiana Web.	xerophytess	2	II (40)	vegetation.
4.	Tragopogon graminifolius DC.	xerophytess	1-2	III (30)	flowering..
5.	Limonium meyeri (Bois.) O.Kuntze	xerophytess	1-2	III (25)	vegetation
6.	Aelurupus littoralis (Gouan.) Parl.	halophyte	1	III (20)	flowering.
7.	Alhagi pseudoalhagi (Bieb.) Fisch.	mezoxerophytess	1	III (15)	vegetation
Annual grasses					
8.	Petrosimonietum brachiata Pall. (Bunge.)	halophyte	2-3	III (10)	vegetation
9.	Gamanthus pilosus Pall. (Bunge.)	halophyte	1-2	III (5)	vegetation

Ephemeras					
10.	<i>Hordeum leporinum</i> Link.	xerophytess	1	III (20)	flowering
11.	<i>Eremopyrum orientale</i> (L.) Jaub.et Spach.	xerophytess	1	III (15)	flowering
12.	<i>Plantago lanseolata</i> L.	mezoxerophytess	1	III (10)	flowering

The project covers 10-30%

2. Ephemera-treelike saline - aromatic wormwood association (<i>Ephemereta salsoletum dendroides</i> – <i>Artemisieto lerchiana</i>) (With the dominance of <i>Artemisia lerchiana</i> Web. Mine №1, Oil well №1204, area № 5, beyond the hill contaminated with black oil)					
Undershrubs					
1.	<i>Salsola dendroides</i> Pall.	mezoxerophytess	2-3	II (55)	vegetation
2.	<i>Camphorosma lessingii</i> Litv.	xerophytess	1	III (25)	vegetation
Underbushes					
3.	<i>Artemisia Szovitsiana</i> (Bess.) Grossh.	mezophyte	1-2	III (30)	vegetation
Perennial grasses					
4.	<i>Artemisia lerchiana</i> Web	xerophytess	3-4	III (20)	vegetation
5.	<i>Limonium meyeri</i> (Bois.) O.Kuntze	halophyte	1-2	II (15)	vegetation
6.	<i>Puccinelli gigantea</i> (Grossh.) Grossh.	mezoxerophytess	1	II (40)	flowering
7.	<i>Alhagi pseudoalhagi</i> (Bieb.) Fisch.	mezoxerophytess	1	III (25)	vegetation
8.	<i>Cynodon dactylon</i> (L.) Pers.	mezophyte	1	III (15)	flowering
9.	<i>Aelurupus repens</i> (Desf.) parl.	mezophyte	1	III (5)	flowering
Annual grasses					
10.	<i>Avena clauda</i> Durieu.	xerophytess	2	II (40)	flowering
11.	<i>Petrosimonia barchiata</i> (Pall.) Bunge.	halophyte	1-2	III (10)	vegetation
1	2	3	4	5	6
12.	<i>Psylliostachys spicata</i> (Willd.) Nevski.	halophyte	1	III (5)	flowering
Ephemera					
13.	<i>Phleum paniculatum</i> Hids.	xerophytess	2	III (20)	flowering
14.	<i>Bromus japonicas</i> Thunb.	xerophytess	1-2		
15.	<i>Anisantha rubens</i> (L.) Nevski.	xerophytess	1-2	III (15)	flowering
16.	<i>Eremopyrum orientale</i> (L.) Jaub. et Spach.	xerophytess	1-2	III (10)	flowering
17.	<i>Lolium rigidium</i> Gaudin.	xerophytess	1	III (25)	flowering

The project covers 40-60%

3. Sagebrush-wormwoody-fingerlike Couch grass (<i>Artemisieto szovitsiana</i> – <i>Cynodonsum dactylon</i>) (With the dominance of <i>Cynodon dactylon</i> (L.) Pers. Mine № 2, oil well № 867, area № 5, between Gilgilchay and “Reservuar Park”, DSH 190 m)					
Shrubs					
1.	<i>Elaeagnus caspia</i> (Sosn.) Grossh.	xerophytess	1-2	I (250)	vegetation
2.	<i>Rubus sanguineus</i> Friv.	xerophytess	1-2	I (150)	flowering
3.	<i>Tamarix ramosissima</i> Lebed.	mezoxerophytess	1	I (100)	flowering
4.	<i>Punica granatum</i> L.	xerophytess	1	I (90)	flowering
Underbush					
5.	<i>Artemisia szovitsiana</i> (Bess.) Grossh.	mezophyte	2	II (60)	vegetation

Perennial grasses					
6.	<i>Cynodon dactylon</i> (L.) Pers.	mezoxerophytes	2-3	III (25)	flowering
7.	<i>Elitrigia eleongata</i> (Host.)	xerophytess	1-2	II (40)	flowering
8.	<i>Cichorium intybus</i> L.	mezophyte	1	III (30)	flowering
9.	<i>Centaurea iberica</i> Trev. ex Spreng.	xerophytess	1	III (25)	flowering
10.	<i>Alhagi pseudoalhagi</i> (Bieb.) Fisch.	mezoxerophytes	1	III (20)	vegetation
11.	<i>Phragmites australis</i> (Cav.) Trin.	hydrophytes	1	III (15)	vegetation
12.	<i>Aelurupus repens</i> (Desf.) Parl.	mezoxerophytess	1	III (5)	vegetation
Annual grasses (Ephemeras)					
13.	<i>Lolium rigidium</i> Gaudin.	xerophytess	1-2	III (20)	flowering
14.	<i>Hordeum leporium</i> Linc.	xerophytess	1	III (15)	flowering
15.	<i>Plantago mayor</i> L.	mezophytes	1	III (10)	flowering

The project covers 30-40%

4. Sharp blade – narrow leaves grasses association (<i>Juncus</i> <i>actus</i> – <i>Typhetum angustifoliae</i>) (With the dominance of <i>Typha angustifolia</i> (L.), Mine № 2, oil well № 455, area № 1)					
Shrubs					
1.	<i>Tamarix ramosissima</i> Lebed.	mezoxerophytess	1-2	ЫI (120)	vegetation-flowering
Undershrubs					
2.	<i>Salsola dendroides</i> (C.A.Mey.) Mog.	mezoxerophytess	1-2	II (70)	vegetation
Underbushes					
3.	<i>Artemisia szowitsiana</i> (Bess.) Grossh.	mezophyte	1-2	II (60)	vegetation
Perennial grasses					
4.	<i>Typha angustifolia</i> L.	hydrophytes	2-3	I (110)	vegetation
5.	<i>Juncus actus</i> L.	hydrophytes	2	I (90)	vegetation
6.	<i>Juncus inflexus</i> L.	hydrophytes	1-2	II (60)	vegetation
7.	<i>Alhagi pseudoalhagi</i> (Bieb.) Fisch.	mezoxerophytess	1-2	II (50)	vegetation
8.	<i>Limonium meyeri</i> (Boiss.) O.Kuntze.	halophyte	1-2	III (30)	vegetation
9.	<i>Phragmites australis</i> (cav.) Trin.	hydrophytes	1	III (40)	vegetation
10.	<i>Arundo donax</i> L.	hydrophytes	1	III (30)	flowering
11.	<i>Pycreus flavidus</i> (Retz.)	hydrophytes	1	III (25)	vegetation
12.	<i>Plantago lanseolata</i> L.	mezophyte	1	III (20)	flowering
13.	<i>Juncellus seratinus</i> (Rotib.)	hydrophytes	1	III (15)	vegetation

The project covers 20-50% (in 8420 meters were contaminated by black oil and deep interior layer waters.)

As seen in the table 2, the association of aromatic wormwood-branched petrosimonia (it was registered close to oil well number 1219 of main 1№) consisted of 12 species, According to biomorphological analysis, 1 of these species belongs to shrubs (8,3%), 1 species (8,3%) is a undershrub, 5 species (41,7%) perennial grasses, 2 species (16,7%) annual grasses and 3 species (25,0%) belong to ephemeral.

The humidity requirements of plants [8] and granulemetric index of soil [7] were accepted as major criteria for ecological classification. Because in a species composition of association 5 species (41,7%) which belongs to xerophytess hold majority, 4 species (33,3%) halophytes (salt resistant) and 3 species (24,0%) mezoxserophytes were determined (table 3).

The *Persimonia brachiata* is a dominant in association and *Artemisia lerchiana* is a subdominant. According to phytocenological structure, the abundance for branched petrosimonia is 2-3

Table 3

**Biomorphological and ecological indexes of the contamination of vegetation
in “Siyazanneft” area**

№	Plant associations	Biomorphs							Total	Ecomorphs					
		Shrub	Undershrubs	Bushes	Underbushes	Grasses				Xerophytess		Mezophyte	Mezoxerophytes	Hydrophyte	Total
						Perennial	Annual	Ephemeras		Xerophytes	halophyte				
1	Aromatic wormwood-branched petrosimonia association (Artemisieto lerchiana –Petrosimonietum brachiata)	1	1	-	-	5	2	3	12	5	4	-	3	-	12
2	Ephemera-treelike saline - aromatic wormwood association (Ephymereta salsoletum dendroides – Artemisieto lerchiana)	-	2	-	1	6	3	5	17	8	3	3	3	-	17
3	Sagebrush-wormwoody-fingerlike Couch grass (Artemisieto szowitsiana – Cynodonsum dactylon)	4	-	-	1	7	3	-	15	7	-	4	3	1	15
4	Sharp blade – narrow leaves grasses association (Juncuseta acutus – Typhetum angustifoliae)	1	1	-	1	10	-	-	13	-	1	2	3	7	13

points, and for aromatic wormwood is 2 points. In multilayer system the stages II and III were identified. The project cover equals to 10-30%.

The phytosenological characteristics of ephemera-treelike saline - aromatic wormwood association was investigated close to oil well 1204 of mine № 1.

Variety content of this phytosenoz consist of 17 species, 8 of which (47,2%) are xerophytess and remaining all 9 species (52,8%) are mezophytes, mezoxerophytess and halophytes (each group includes 3 species).

The same content by biomorphological analysis of these varieties (table 2) indicates that 2 species (11,8%) belong to undershrubs, 1 species (5,9%) is a underbush, 6 species (35,3%) perennial grasses, 3 species (17,6%) annual grasses and 5 species are ephemeras.

The dominant for this association is *Artemisia lerchiana*, and subdominant is a *Salsola dendroides* and ephemeras. According to phytosenological structure, in the II layer, the *Salsola dendroides* and in III layer the *Bromus japonica* etc. species were observed. The project cover equals to 40-60%.

The vegetation for wormwoody-fingerlike Couch grass association (*Cynodon dactylon*) was identified in area close to oil well 867 of mine № 2 contaminated by oil. The identified 15 varieties of this association by their lifestyle analysis arranged as 4 species (26,7%) of these varieties belong to shrubs 1 species (6,6%) underbushes, 7 species (46,7%) perennial grasses, and 3 species (20%) are annual grasses. From the same varieties 7 species (46,7%) are xerophytes, 4 species (26,7%) mezophytes, 3 species (20,0%) mezoxerophytes and 1 species (6,6%) belongs to hydrophytes.

The dominant species of this association is *Cynodon dactylon* and subdominant species is *Artemisia szowitsiana*. According to the structure of phytosenoz, in the I layer the *Eleagnus capsicum*, *Rubus sanguineus*, *Tamarix ramosissima* and in a II layer *Cynodon dactylon* etc. mezophytes species are encountered.

The project cover equals to 30-40%.

The sharp blade – narrow leaves grasses association is located close to the oil well 455 of mine № 2, the structure and diversity of this association were also identified (table 2).

As it is seen on table 2, specific for water-wetland vegetation of 13 varieties 1 species (7,7%) belongs to shrub, 1 species to underbush, and 10 species (76,9%) are perennial grasses. Besides their varieties, it was identified that more diversity belongs to hydrophytes 7 species (53,8%) and then mezoxerophytes 3 species (23,1%), mezophytes 2 species (15,5%), and halophytes 1 species (7,7%).

According to phytosenological structural analysis, on the first (I) layer of association *Tamarix ramosissima*, *Typha angustifolia*, on second (II) layer *Juncus acutus*, *J. inflexus*, on the third (III) layer *Arundo donax* and other hydrophyte species are met.

The project cover equals to 20-25% (black oil and water contaminated).

Thus, it can be concluded that due to contamination of soil and plant vegetation in the area of “Siyazanefit” in Samur-Shabran lowland with inherent oil products and interior layer water ob-

tained from the deep underground degradation is continued. In this respect for the reparation of indicated phytosenosis the study of vegetation in ecological aspects requires to develop biological recultivation.

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