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The ecological characteristic of the soil cover of middle mountains of the Zhongar-Alatau State National Nature Park (by the example of Nikonov Cordon)

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The mid-mountain Dzhungarskaya area adjoining to the high-mountain is located on the northern slopes of Dzungarian Alatau in the basin of the Lepsy River at the altitudes of 900-1300 meters.

The climate of middle mountains is much softer than the climate of highlands. The average level of temperatures in January changes from -7 ˚ C up to -10 ˚ C. In the closed Lepsinsky Valley, where in winter the anti-cyclonic weather prevails and there is a radiation cooling of the cold air flowing down from the mountains, average temperatures in January are much lower. An average temperature in January is -19 ˚ C here. Winter is severe. The sums of negative temperatures change from -1000 ˚ C up to -1700 ˚ C, and in closed valleys they reach - 2000 ˚ C.

In general the Dzungarian Alatau differs from the Zailiysky Alatau in a smaller amount of precipitation. Its quantity logically increases with the height. Up to the altitudes of 1500 meters, the vertical gradient of precipitation is 40 mm, above that it decreases to 15 mm. The absolute amount of precipitation continues to increase.

Relative humidity of air at the altitudes up to 1500 - 2000 meters reaches maximum in winter (60 - 70%), at the altitudes of more than 2000 meters, on the contrary, it reaches the maximum in spring and summer, and the minimum (20-40%) in winter.

Nikonov Cordon of the Zhongar-Alatau State National Nature Park is located in the belt of mountain fruit woods, where there is a concentration of many types – relatives of cultural plants. Among them a special place is taken by Sivers apple-tree, which is recognized as a progenitor of apple cultivars.

The complex assessment of the current state of the Nikonov Cordon territory was done on the basis of a comparative analysis and monitoring of the pollution of atmospheric air, soils and waters in the anthropogenic abnormal buffer zone in the reserved area conditions of Zhongar Alatau National Nature Park.

The area of the cordon is characterized by a great variety of natural and territorial units, and their difficult special organization. Different types of landscapes have their individual morphological structure reflecting the genesis of the natural - territorial complex and their features. The landscape morphology is one of assessment criteria of the scientifically based planning and project decision at choosing protection modes and the amount of recreational and tourist activities.

In the first year, when performing scientific research work, we used the methods of research works for the determination of ecological conditions of the air environment, the soil cover and the water environment in buffer zones of the State National Nature Park "Zhongar Alatau". A relative to Nikonov Cordon, it includes main soil types and their timing to certain relief elements. The main soils types in the cordon territory are characterized as mountain and forest dark gray soils. They are formed in a lower circle of the mid-mountain relief on steep northern slopes in the middle part of the forest- meadow-steppe zone at absolute altitudes of 1350 (1400) - 1700 (1750) meters.

They seldom form a continuous belt; most often lying in combinations, including exposition interfaces to the mountain leached black earth, mountains and forests of the black earth type, mountain meadows and steppe soils. Only in the areas of the Lepsy and Topolevki villages, small-leaved woods form continuous massifs. Soil-forming breeds are represented with forest-like and eluvial-dealluvial crushed stone loamy soils.

In the superficial horizon the soils contain a significant amount of humus (7-17%), which is sharply decreasing deep down, and have a wide relation of carbon to nitrogen in the top horizon (11-12%), which is narrowed down in the profile up to 7-8%.

For researching the tasks of analyzing the soil in the territory of Nikonov Cordon, the following methods were used:

1. Routes of research, borders and coordinates of the experiment sites were chosen and coordinated with the administrations of national parks.
2. Soil samples of different landscape types were selected.
3. Samples were analyzed according to standard methods in certified laboratories of ZSU named after I. Zhansugurov, Biology and Biotechnology Faculty, Department of Molecular Bology and Genetics of the KazNU named after Al - Farabi,

and the Test Center of Taldykorgan Branch of "National Center of Examination and Certification" JSC.

The selection of a joint soil sample is conducted by the envelope method. This method is used for researching the soil of humus horizon. Usually when researching the soil, samples of humus horizon (A) are selected from the depth of about 20 cm that corresponds to the depth to which a spade would go. From each point, about 1 kg (about 0.5 l in volume) was selected.

For determining the soil content of chemical substance, not less than one joint sample weighing 1 kg is taken, the size of the test site is from 0.5 to 1 hectare – at the complex soil cover. Samples selected for the chemical analysis are numbered and registered in a journal, and the following data are written down: sequence number and the place of taking the sample, land relief, soil type, purpose of the area, type of pollution, date of selection (State Standard 17.4.3.01-83).

For assessing the soil cover of different landscape zones of the southern exposition with a separated relief according to requirements of State Standard 17.4.3.01, we selected samples of soils on 8 experimental sites of Nikonov Cordon.

Different types of Nikonov Cordon soils are neutral, subacid. The content of organic substance in the soil is within 9-15%, chlorides 0.02-0.04%, sulfates 0,01-0,02% (Table 1).

The analysis of Table 2 shows that the concentration of heavy metals slightly exceeds the values of the maximum concentration limit.

№ of sample	Soil type	pH	Acidity	Content of organic substance if the soil	Chlorides,%	Sulfates,%
№1	Mountain-forest chernozem-like soils	6.0	subacid	12-15%	0.02	0.01
№2	Mountain leached chernozem soils	6.0	subacid	12-15%	0.02	0.02
№3	Mountain-meadow-steppe soils	7.0	neutral	9-11%	0.04	0.03
№4	Mountain-forest chernozem-like	6.5	subacid	10-11%	0.02	0.02
№5	Mountain leached chernozem	6.0	subacid	12-15%	0.02	0.01
№6	Mountain-forest dark coloured soils	7.0	neutral	14-15%	0.02	0.01
№7	Mountain-forest dark gray soils	7.0	neutral	9-11%	0.03	0.02
№8	Mountain-forest chernozem-like	6.0	subacid	12-15%	0.02	0.02

Table 1. Results assessing the soil cover of Nikonov Cordon.

Points of selection	Metals									
	Pb	Cd	Cu	Zn	Ni	Fe	Co	Mn	Sr	Cr
1	2	3	4	5	6	7	8	9	10	11
Experiment site № 1 (1) Nikonov Cordon	27.73	0.40	5.75	17.67	102.40	144.00	10.26	336.00	16.96	26.40
Experiment site № 2 (2) Nikonov Cordon	30.68	0.15	1.03	23.37	163.20	160.00	12.16	457.80	21.73	66.00
Experiment site № 1 (1) Nikonov Cordon	31.86	0.38	6.50	21.66	70.40	336.00	10.26	386.40	21.73	37.40
Experiment site № 2 (2) Nikonov Cordon	26.55	0.40	6.25	19.38	67.20	256.00	9.50	357.00	21.20	28.60
Experiment site № 3 (1) Nikonov Cordon	28.32	0.48	6.00	19.38	65.20	128.00	9.88	352.80	24.38	28.60
Experiment site № 3 (2) Nikonov Cordon	28.91	0.40	7.00	23.37	35.20	240.00	10.26	416.60	24.91	26.40

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Experiment site № 4 (1) Nikonov Cordon	28.91	0.46	4.75	20.52	28.80	144.00	9.50	357.00	19.61	22.00
Experiment site № 4 (2) Nikonov Cordon	27.73	0.38	4.25	17.10	22.40	160.00	9.12	315.00	20.14	24.20
Experiment site № 5 (1) Nikonov Cordon	30.09	0.38	5.00	18.24	32.00	144.00	9.88	260.40	19.08	19.80
1	2	3	4	5	6	7	8	9	10	11
Experiment site № 5 (2) Nikonov Cordon	34.81	0.53	5.75	18.81	92.80	208.00	10.26	315.00	19.08	22.00
Experiment site № 6 (1) Nikonov Cordon	27.73	0.46	6.25	19.95	19.20	128.00	9.12	415.80	18.56	22.00
Experiment site № 6 (2) Nikonov Cordon	27.14	0.48	5.75	23.37	28.80	144.00	9.12	420.00	22.26	24.20
Experiment site № 7 (1) Nikonov Cordon	22.42	0.44	4.50.00	13.11	32.00	160.00	7.60	361.20	21.20	46.40
Experiment site № 7 (2) Nikonov Cordon	25.96	0.40	4.75	14.25	54.40	144.00	7.98	378.00	23.85	30.80
Experiment site № 8 (1) Nikonov Cordon	24.78	0.44	5.00	17.10	22.40	192.00	7.22	273.00	20.67	22.00
Experiment site № 8 (2) Nikonov Cordon	25.37	0.418	4.75	15.39	25.60	208.00	7.22	277.20	21.73	84.20

Table 2. Concentration of heavy metals in soil sample (mg/kg).