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Features Soil Mountain-Taiga Zone the Middle Urals

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ABSTRACT: Feature of the mountain soil formation is that the soil on the mountain slopes are formed in different bioclimatic and oro-geomorphologic condition and soil conditions are characterized by high contrast and variation. The features of the morphological structure, a truncated profile (35-75 cm), weakly expression in the differentiation of the soil profile into individual horizons, and a detritus (20-65 %), loamy fine layer, the signs of podzolization in the soil profile is not found, despite the presence of spruce - fir forest' acid litter. Perhaps the high content of total iron is the cause of the lack of morphological demonstration of the podzolic process. The coefficient of the eluvial-illuvial migration of Al_2O_3 and Fe_2O_3 (R_2O_3) shows the lack of trend, a weak decrease in the genetic component of the horizon relative to the class. Soils are characterized by a very acidic environment and high hydrolytic acidity, which was affected by exchange aluminum. The soils of mountain-taiga zone are enriched in organic matter, and humus profile characterized by prolixity, which is a feature of mountain soils. The investigated soils were specific, as they can find closer to the brown forest and podzolic type of soils. These soils were unique in terms of soil formation.

Keywords: Mountain-taiga zone, special soil formation, mountain soils, the soil profile, the genetic horizon

Orta Urallarda Tayga Dağ Bölgesinin Toprak Özellikleri

ÖZET: Bir dağın toprak yapısının özelliği gereği dağ yamaçlarındaki toprak farklı biyoiklimsel ve orogeomorfolojik şartlar altında şekillenir ve dağlık bölgelerde toprak şartları yüksek kontrast ve varyasyonla tanımlanır. Bu araştırmanın amacı Orta Ural'da dağlık tayga bölgesindeki toprağın özellikleri üzerine çalışmaktır. Kuzey Basegi dağındaki "Basegi" reservinde 2009-2010'da çalışmalar gerçekleştirilmiştir. Morfolojik yapı özellikleri: trunkat profil (35-75 cm), tekil horizonlarda toprak profilinde nadiren farklılaşma, detritus (20-65 %), killi ince toprak, ve asit kumlu adi ladin ormanlarının görülmesine rağmen toprak profilinde podzollaşma belirtilerinin olmamasıdır. Bu toprakta, alüminyum ve demir içerikleri arasındaki oran tayga orman bölgesinin podzolik tür düzlük bölümündeki topraktakinden daha azdır. Belki de podzolik süreçte morfolojik belirtilerin olmayışının nedeni yüksek oranda demir içeriğinin bulunmasıdır. Al2O3 ve Fe2O3 (R2O3) yıkanma-birikme hareketi katsayısı, soya bağlı genetik horizon içeriğinde hafif bir düşüş ve yelpazelerin olmadığını gösterir. Topraklar, alüminyum değişimi sebebiyle çok asitli bir ortam ve yüksek hidrolitik asitlik ile tanımlanır. Tayga Dağ bölgesinin toprağı, dağ topraklarının bir özelliği olarak organik madde ve humus profili bakımından zengindir. Humuslu dağ-orman kuşağı grup kompozisyonu organik maddenin taşınması açısından zayıftır. Aşırı nemlilik, düşük sıcaklık, asidik reaksiyon ortam, bitki artıklarından asit dönüşüm ürünleri, kalsiyum ve magnezyum profilinden süzülen yüksek değiştirilebilir alüminyum içeriği humusun (hidrolize edilemeyen artık) sabit kısmındaki organik maddenin muhafaza edilmesine katkı sağlar. g.Severny Basegi örneğindeki dağ-orman kuşağının belirlenen toprak özellikleri bu toprakları kahverengi ormanlar olarak tanımlamamızı sağlamaz. İncelenen topraklar spesifiktir, çünkü kahverengi orman toprakları ve podzolik tür topraklarla benzer yönleri bulunabilir.

Anahtar kelimeler: Tayga Dağ bölgesi, toprak oluşumu, dağ toprakları, toprak profili, genetik horizon

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INTRODUCTION

The richness of the soil can be estimated by the product inviolable by plant communities (Tilman, 1982). The considered dependence is known for different types of habitat (Stevens, Carson, 1999, Grime, 2001). Tilman model explains the role of spatial heterogeneity of soil for the coexistence of many species of plants, and gives directions for further studies of geochemical specialization. For natural systems, this model still has a limited application (Onipchenko, 2011).

The spatial patchiness of soil properties are characterized by two main parameters - contrast of spots and their size. Usually soils are formed with their performance of the spatial variation under each type of vegetation. Heterogeneity of forest soils occurs mainly at a distance of less than 1 m in the range 0.3-0.8 m (Dmitriev, Samsonova, 1979). Similar patterns observed in the forest soils of Great Britain (Farley, Fitter, 1999). Heterogeneity in the meadows and prairies were less pronounced (Wilson, Kleb, 1996, Kleb, Wilson, 1997), so the introduction of woody plants in these areas increased the spatial heterogeneity of soil resources. In the desert communities of the USA the characteristic dimensions of the soil of the non homogeneities were 1-3 m (Schlesinger et al., 1996). For the sagebrush steppe, the main variability of soil properties was marked at a distance of 1 meter (Jackson, Caldwell, 1993). In the alpine communities of the northwestern Caucasus soil properties were not changed in the same way (Onipchenko et al, 1998). In addition, there is a spatial dependence of organic matter in soils from the position in the landscape (Fromm et al., 1993). Horizontal heterogeneity of soils in the landscape may be associated with the peculiarities of snow redistribution, which was clearly noticeable in the high temperate zone (Brooks et al., 1997).

The richness of the soil may form a special horizontal structure of plant communities. A striking example of such effect is observed in the alpine lichen-heath, widespread community of the windward slopes of the humid highlands (Onipchenko et al., 2004). Feature of mountain soil formation is that the soil on the mountain slopes was formed in different bioclimatic and oro-geomorphologic conditions. The soil cover is characterized by high contrast and variability even within the same zone, resulting in soil formation, which has no analogues in flat areas (Mikhailova 1977; Urushadze 1979, 1987, Molchanov 1991; Urusevskay 2007; Molchanov 2009, 2010).

In the mountain-taiga zone,of the Middle Urals (300-600 m above sea level) a variety of soils was marked in the mountain brown forest, mountain forest podzolic, mountain sod-podzolic, and mountain soddy forest (Voronov 1988, Voronchihina 2003, Larionova 2004, Samofalova and others 2010a, 2010b). In the Perm region, Urals there are only 2 relevant reserves “Vishersky” and “Basegi.” The soil cover of reserves is a system of reference, and rare soils, which has an imperative scientific and practical importance. The question about the features of soils, formed in the mountain taiga of the Middle Urals, with no signs of podzolization, still remains debatable. Thus the study on the systematization of materials on the soil cover of reserves have been conducted.

The objective of the research is to study features of the soil properties and characteristics of the mountain-taiga zone in the Middle Urals (i.e. in the Federal State Nature Reserve «Basegi» Gornozavodskoy district of the Perm Kray).

MATERIALS AND METHODS

The Basegi is a ridge of the mountain range and it is located between 58°50’ and 60° northern latitude at the west side of the watershed of the Urals. The reserve relates to the ridge-outlier low mountains of the Middle Urals (Voskresensky 1980). Basegi are elongated meridian ridge of the three mountains: Northern Basegi (951.9 m), Average Basegi (994.7 m), Southern Basegi (851 m). The lowest point in the reserve is located near the mouth Korostelevki - 314 m (Loskutova 2003).

The climate is characterised as cold and wet with the manifestation of continental type (rainfall from 496 mm to 1071 mm, the average temperature of the coldest month January is -17.9°C and the warmest (July) +13.3°C). The mountain zone of the Urals, to which the territory of the reserve belongs, is composed of metamorphic rocks (Sofronitsky 1967, http://Perm-Kray.ru).

Zonal distribution of vegetation the middle taiga subzone (Middle Urals territory) are boreal forest zone, isolated mountain forest, bald (subalpine), and mountain-tundra (alpine) zone (Gorchakovskii, 1975). The mountain forest zone, with a a height of 450-600 meters above sea level, is covered with dark coniferous taiga and thick enough grass cover. Subalpine zone consists of three sub-zones (park woodlands, subalpine meadows, crooked). Park forest (sparse, low stocking undergrowth tall grass) with a height quite smoothly into a crooked. Subalpine meadows are located on the same altitude as the crooked, and often mixed with it. Meadow communities may rise up to almost stony placers. At the altitude of 800 m there is rockier, shrub, herb-moss tundra. In 2009-2010, the survey of the relief and vegetation communities of the mountain soils "Northern Basegi" was conducted for the mining purpose. Soil profiles laid down taking into account the altitudinal zones of vegetation.

The soil samples was analysed for skeletal soils (Soil Science Workshop, 1980), soil particle size distribution by pipette, N. Kaczynski method (the preparation of soil for analysis by pyrophosphate) (Ganzhara, 2002), the gross analysis of the soil (Alexandrova, 1986), the exchangeable aluminum by Sokolov metod (Theory and Practice of ..., 2006), exchange acidity potential metric method (GOST 26483 - 85), hydrolytic acidity by Kappen method (GOST 26 212-84), the sum of exchangeable bases by Kappen-Gilkovitsu (GOST 46-47-76), organic matter content by the method of Tyurin (GOST 26 213-91, Ganzhara, 2002), and a group composition of humus in mineral soil by M.M. Kononova and N.P. Belchikova (Ganzhara, 2002). Also there were calculated the cation exchange capacity, degree of saturation of soil bases, molar ratios of oxides, profile differentiation factors, the coefficients of ellyuvial and illuvial-migration, and the weighted average content of grain fractions (Ganzhara, 2002).

Performance of the optical density was determined with five filters at wavelengths of 420, 460, 510, 540, 600 nm in a universal photometer. To determine the ability of translucent, sodium humates were used that were recovered in the course of analyzing the composition of humus. The thickness of the liquid layer is determined in the photometer was equal to 1 cm (Laboratory and practical ..., 2009), and the coefficients of color and extinction was calculated. Statistical analysis of data was conducted by the "Data Analysis" in Microsoft Excel.

RESULTS AND DISCUSSION

In the mountain-forest zone, at different biocenosis, there are different conditions for the soils formation. Thus, at an altitude of below 400-430 m, the spruce forests with moss and grass cover formed by the mountain-forest nonpodzolized acid, at an altitude of below 500-560 m the spruce-fir forests mixed with birch, rowan mountain ash with fern-bilberry-moss, a brown mountain forest in depressions - marsh upland peat-gley soil at the top of the mountain-forest zone under the spruce-fir forests mountain forest of primitive accumulation soil was found.

The soil cover of mountain-forest zone in the Northern Basegi is quite diverse, and depends on the exposure of the slope. On the slopes the various exposures were created by the unequal distribution of heat and moisture, and as a consequence, a different degree of manifestation of erosion. Eluvium on the northern slopes was formed under less intense erosion. These differences affect the structure of the soil profile. Thus, on the cold slopes of the eastern and northern exposures, there were formed brown mountain forest soils with capacity of 45-50 cm and a mountain forest nonpodzolized (100-110 cm) respectively. The slopes of the southern and western exposure generated more gravelly and short (<30-35 cm) mountain forest of primitive accumulation of soil.

The main areas of grassland are concentrated in the eastern and western slopes of the ridge in the Basegi valley and saddles. Under high grass-forb meadows condition the mountain-meadow subalpine soils ranging from 13-17 to 40-55 cm layers are formed. The steeper the slope, the lower the power profile and the humus horizon and the closer to the surface of crystalline rocks were noted.

Conditions of soil formation on the top (alpine zone) are characterized by great severity, with the appearance of sharp fluctuations in temperature, lack of snow cover, the presence of strong winds. Such conditions are the primary for the formation of the primitive soil, which are confined to areas between the rocks, where the accumulation of silt and where it is not blown by the wind. Thus, in a zone of mountain tundra, soils were largely primitive and consist of one or two horizons. Moreover, the upper horizon, always are peat, as the harsh climatic conditions at the height of this zone and the minimum activity of microorganisms are responsible for a weak decomposition of plant residues. In soils of mountain tundra zone no signs of gleying was found.

Studies have shown that the territory of the reserve is unique with respect to the soil. The following morphological features of soils were the absence of morphological features of podzolization in the presence of spruce-fir forest litter and acidic, mild signs of illuvial process as fragile nutty structure, clear differentiation of the soil profile for the individual horizons, heterogeneity of the soil cover and a wide variety of soils (loamy and clayey fine), high detritus (20-65 %), and shorter profile (35-75 cm).

Gross and elemental composition of soils enables to determine characteristics of mountain soils and distribution of oxides in the profile as a function of altitude (r). Silica content in the soils of bald zone and mountain-forest zone were 53-58 % and 66-70 %, respectively. The correlation coefficient (r) between the content of SiO_2 and height above sea level was -0.8, and between the content of SiO_2 and the content of the clay fraction in soil horizons was 0.5. Thus, the accumulation of silt in the soil depends on the damage and we athering debris eluvium indigenous and parent materials.

The content of sesqui-oxide in mountain soils was 9-30 %. Ratio of aluminum and iron oxides and their distribution in the soil profile does not obey the expected range, typical of the soil in the plain area. The mountain soils contain more iron, that was created by a narrower relationship between the content of aluminum and iron than in the soils of the podzolic type from the flat part of the taiga-forest zone. Perhaps the high content of total iron caused the lack of morphological manifestations of the podzolic process.

In soils of the mountain-forest zone (400-500 m) the coefficient of the eluvial-illuvial migration of sesqui-oxides of iron and aluminum (Al_2O_3 and Fe_2O_3) show the lack of fans, a weak loss component in the horizon with respect to the breed/class. In bald zone soils, at an altitude of 700 m, the loss of sesqui-oxides from the humus-accumulative upper horizons, and its accumulation in the underlying horizons were noted. In soils at an altitude of 800 m there was a strong illuviation horizon of sesqui-oxide compounds with almost no fans in the upper profile. In all soils there was strong differentiation in the bulk content of alumina, and silica molar ratio to total iron, and low differentiation with respect to silica sesquialteral oxides (the lowest was in the soils of mountain-forest zone).

By analyzing data from physico-chemical properties, we have to note the following. First, the there is an extended humus amount in the soil profile as bald zone and in the soils of the mountain-forest zone (Table 1).

Studies have shown that soil in the mountain-taiga zone, regardless of altitude have very acidic soil solution (pH_{H2O} varies from 3.9 to 4.8, and in saline extracts [KCl] from 2.9 to 4.1). Hydrolytic acidity (H) varied from 11.6 to 27.1 mg-ekv/100 g soil in the humus horizon and from 2.9 to 19.9 mg-ekv/100 g soil and soil-forming rock due to presence of exchangeable aluminum (in Table 1).

Table 1. Physical and chemical properties of mountain soils

Horizon	Depth, cm	Humus, %	pH		mg-ekv/100 g of soil						V, %
			H_2O	KCl	exchange acidity			H	S	T	
					total	Al^{3+}	H^+				
Bald zone, cut № 8, 800 m above sea level											
A_1	5-18	4.3	4.9	3.8	4.99	4.99	0.00	11.6	7.5	19.1	39
A_1B	18-30	4.7	5.1	3.8	6.45	6.39	0.06	11.0	8.7	19.7	44
B	30-60	4.8	5.5	4.1	1.29	1.23	0.06	5.6	7.2	12.8	56
Cut № 5, 700 m above sea level											
A_1	6-11	7.9	4.3	3.6	1.72	1.66	0.06	17.8	13.9	31.7	44
B	11-29	4.9	4.6	3.8	3.98	–	–	15.2	10.4	25.6	41
BC	29-49	3.6	4.8	3.9	3.06	3.00	0.06	15.2	7.6	22.8	33
Cut № 1, 570 m above sea level											
A_1	2-13	4.8	4.9	3.9	0.82	0.78	0.04	11.9	13.8	25.7	54
A_1B	13-34	3.8	5.3	4.2	0.28	0.26	0.02	8.6	16.0	24.6	65
B1	34-42	2.8	5.6	4.1	0.74	0.72	0.02	6.3	13.6	19.9	68
C	42-66	1.6	5.6	4.0	0.74	0.68	0.06	2.9	12.4	15.3	81
Mountain-forest zone, cut № 9, 430 m above sea level											
A_1	5-10	7.8	4.3	3.2	4.88	4.74	0.14	27.1	1.4	28.5	5
A_1B	10-17	4.7	4.6	3.0	12.56	12.54	0.02	25.3	2.3	27.6	8
B	17-32	1.4	4.8	3.4	12.15	10.93	1.22	14.8	4.0	18.8	21
C	32-70	1.6	5.0	3.5	11.04	10.90	0.14	19.9	5.7	25.6	22
Cut № 10, 400 m above sea level											
A_0A_1	4-8	14.9	3.9	2.9	–	–	–	23.2	13.9	37.1	37
A_1	8-21	5.5	4.3	3.2	6.47	6.12	0.35	27.1	0.4	27.5	1
B_1	21-41	5.6	4.8	3.5	1.04	0.94	0.08	21.4	1.3	22.7	6
B_2	41-60	3.2	5.4	3.5	4.43	4.41	0.02	9.2	10.9	20.1	54
C	60-104	1.5	5.8	3.7	1.35	1.31	0.04	6.5	21.4	27.9	77

Table 2. Group composition of humus in the surface soil horizons on the Northern Basegi

High sub-zone	Height above sea level, m	C_{total}	$C_{extract}$	$C_{humic\ acid}$	C_{fulvic}	NR	Degree of humification	$\frac{C_{humic}}{C_{fulvic}}$
		%						
Bald zone								
Crooked	900	3.63 100	1.94 53.44	0.37 10.2	1.57 43.25	1.69 6.56	53	0.2
	890	3.85 100	1.95 50.65	0.13 3.4	1.82 47.27	1.90 49.35	51	0.1
Subalpine meadows	607	3.98 100	3.64 91.45	0.59 14.8	3.05 76.63	0.34 8.55	91	0.2
Park woodlands	590	3.80 100	3.64 95.79	0.66 17.3	2.98 78.42	0.82 4.21	96	0.2
Mountain forest zone								
Mountain forest zone	565	2.81 100	2.11 75.09	0.37 13.1	1.74 61.92	0.70 24.91	75	0.2
	315	2.76 100	2.17 78.62	0.69 25.0	1.48 53.62	0.59 21.38	79	0.5

The investigated soils are enriched with exchangeable aluminum and unsaturated exchangeable cations (S). Cation exchange capacity (T) ranged from 19.1 to 37.1 mg-ekv/100 g soil in the surface layers with a gradual decrease down the profile (in Table 1). The degree of saturation with soil cations (V) in soils was above the waist bald due to the greater development of herbaceous vegetation (33-65 %), and in the soils of mountain-forest zone by the leaching of calcium from the upper horizons. At pH <5.0 aluminum is easily mobilized, and becoming more mobile, competes with hydrogen and other cations in the soil-absorbing complex (SAC). In such acidic conditions exchange aluminum due to its valence displaces Ca^{2+} from SAC. There was a clear inverse relationship of their content in the soil profile. Thus, the correlation coefficient (r) between the content of exchangeable bases and Al^{3+} was -0.6. In addition, inverse correlation between the content of Al^{3+} and height above sea level -0.7 was found. It is revealed to the facts that no saturation of soil substrates and high levels of exchangeable aluminum in soils depends on the height above sea level, since the processes of soil formation and weathering occur differently in different mountain zones.

Thus, on the basis of soil exchange properties it can be noted presence of the conditions for the podzolic process, both under forest and under meadow vegetation. However, in the mountain soils there were processes that limited the expression of podzolization. Studies KK Giedroyc showed that colloidal clay minerals, associated with the aluminum salt, form of silicates, which have greater resistance to the damaging effects of water on them. This explains the absence of signs of podzolization in the soil profile at a fairly high acidity

Soil condition by the humus is characterized by a set of indicators that reflect the levels of accumulation of humus in the soil, its distribution in the profile, qualitative composition, and migration ability of humic substances. The soils of the mountain-taiga zone are enriched in organic matter, and humus profile characterized by prolixity, which is a feature of the mountain soils. Humus in mountain soils is very mobile, since more than half of humic substances goes into pyrophosphate extract (Table 2).

NR – nonhydrolyzable residue

The highest solubility of humic substances happened in the bald zone. The solubility of humic substances depends on degree of saturation by the cations of alkaline-earth metals. In addition, at pH <3 a complete peptization of humic substances is occured. Thus, due to the very low saturation of mountain soils with strongly acid and base reaction, the humic substances in the mountain soils (Table 2) are well-soluble ($C_{extract}$ 50-95%). Humic substances in the investigated soils are presented in the range of 43-78 % fulvic acid, which determine the nature of the acidic humus. Humic acids are less formed in the sub-zone crooked, and more formed in the mountain forest zone.

Table 3. Ratio of color and absorption (extinction), carbon of humic acids

High		Exposition of the slope	Height above sea level, m	Cut №	$D_{460}: D_{600}$	$E_{460}^{0,001}$
zone	sub-zone					
bald (subalpine)	crooked	south-east	900	32	356.54	0.34
		south-east	890	30	73.31	0.49
	subalpine meadows	south	607	28	42.97	0.11
	park woodlands	east	590	17	88.87	0.09
mountain forest		north	565	19	356.54	0.34
		north	315	26	71.02	0.09

Type of humus in mountain soils are characterized as a fulvic, where the ratio of $C_{humic\ acid}:C_{fulvic\ acid} < 0.5$. $C_{humic\ acid}:C_{fulvic\ acid}$ reflects the structural features of humic acids, which assess the degree of hydrolysis and the properties of the humic acid, its friability. In these soils rate $C_{humic\ acid}:C_{fulvic\ acid}$ varied between 0.1 to 0.5 (in Table 2), which characterize the degree of hydrolysis of humic acids as very high, and therefore possibility of the formation of double bonds was very low. Thus, the humic acids were fairly loose and able to hydrolysis, that is not very stable, and consequently easily pass into the solution.

The degree of humification of humic acids represents the fraction of total humic substances. Mountain soils have a low degree of humification of organic matter. Maximum residues usually are transformed into humus under sub-alpine meadows, that is, under herbaceous vegetation (in Table 2). Nonhydrolyzable residue characterizes conservative, a stable part of the humus. In the soils under the sub-alpine meadows, woodlands in the park and mountain-forest zone, the content of nonhydrolyzable residue is low, which again confirms the high mobility of humic substances (Table 2).

Chemical nature of humic substances also determines the optical parameters, the optical density of the absorption ratio (extinction) of humic acids, and the ratio of color. Determining the ability of translucent showed that presence of humic substances rise the nature of light transmission with the greatest attenuation in the short wavelengths (460 nm), and the lowest in the long-wavelength (600 nm), which indicates that the homogeneity of the chemical nature of humic substances in mountain soils. The calculated optical density of humic acid had the maximum values in subalpine meadows soils under herbaceous vegetation,, which characterized the enrichment of the more humified products with benzoid structures and conjugated double bonds (which increases the degree of aromatization). The mountain soil is characterized by very large values of the ratios $D_4:D_6$ (ratio of color), indicating a less complex structure of the molecules of humic acids regarding the connection with the peculiarities of mountain soils formation (Table 3).

These color ratio pointed to a very low degree of condensation of the aromatic core of humic acids. The complexity of the aromatic core structure of humic acids varied depending on the type of vegetation. The most complex structure of humic acid was marked by grassy vegetation of subalpine meadows ($D_4:D_6$ = 42.97); under forest vegetation in the mountain forest zone simplification of the core structure of the molecules of humic acids ($D_4:D_6$ = 356.54) was noticed (Table 3). In addition, the color ratio showed that the molecular structure of humic acids predominates in the developed peripheral portion (aliphatic chain) and had a low degree of aromatization of the nucleus with weak formation of double bonds. It promotes hydrolysis of humic acids to fulvic acids (according to the hypothesis of D.S. Orlov). The ratio of the color does not depend on the solution concentration of humic acids, and therefore may be an important diagnostic feature of soil, and explain the results.

Excessive humidity, lack of heat, acidic reaction medium, acid transformation products of plant residues, the high content of exchangeable aluminum, leaching calcium and magnesium from the profile contribute to preservation of organic matter in the stable part of the humus (nonhydrolyzable residue). Humification process in the studied mountain soils was in their first step according to the hypothesis of humification L.N. Aleksandrova (Orlov 2005), which confirms the youth and immaturity of humic acids.

CONCLUSION

The soils of mountain-forest zone are constantly interact and contact with soils overlying high-altitude zone and adjacent areas through the gravitational movement of weathering products. In soils of the mountain-taiga zone processes of soil formation and weathering occur simultaneously. Conditions of mountain soils, and the particular combination of soil-forming factors in different altitudinal zones provide specifics on soil morphological characteristics, particle size and bulk composition, humus status, which distinguishes them from the lowland soils of the taiga-forest zone.

Selected characteristics of soils of the mountain-taiga zone makes them unique in terms of soil formation, and we can conclude that the soils of mountain-forest zone as well as bald can be considered as specific mountain soil formation. The soils cover of the reserve is a system of standard soils and can be characterized as an unique objects. The soils of the reserve can be recommended for inclusion into Red Book of the Soils of the Permskiy Kray.

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