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MOUNTAIN NATURAL BIODIVERSITY CONSERVATION IN RUSSIA

ABSTRACT. High biodiversity and degree of endemism of mountain biota strengthen the mountain regions' status for the territorial nature conservation. Analysis of the protected areas' representativeness in various mountain regions of Russia shows some discrepancy between their quantity, square and regional biodiversity originality. The biggest divergences are marked for the Northern Caucasus. The main problems: small area of the protected territories and also cluster character of their spatial distribution, mostly in the high mountains are not supposed to conform with the highest values of the regional flora's and fauna's uniqueness, to compensate representativeness of the protected biota and, in anyway, to correspond with the purpose of nature protection frame - the protected territories ecologic network's forming. The situation in the Urals, Siberia and the Far East seems to be better. The large areas of the protected territories are in general agreement with the high originality of the nature ecosystems. Nevertheless each concrete case needs analysis of the regional biota's and ecosystems' biodiversity distribution within the protected areas, including character and (or) unique elements of the regional biodiversity to be held. The development of the effectual territorial conservation of mountain regions needs differential approach. The creation of the large representative parcels of nature landscapes in the key-areas has the considerable meaning in the low-developed regions, difficult to access. And well-developed regions have the necessity of nature protected territories' network development and the planning of the ecological frame's forming. The territorial biodiversity conservation, including the system of federal, regional and local levels with protective conservation of the rare species has to be combined with ecosystem's restoration, especially in the zones disturbed by erosion, recreation and military actions. Also it is necessary to develop the new types of the protected areas – ethnic-cultural territories of traditional mountain land-use. The biological resources', ecosystems' and ecological detriments' evaluation is appropriate for the mountain biodiversity conservation. The last, is aimed to raise the effectiveness of the nature conservation activities and to prove the introduction of new mechanisms of their financing.

KEY WORDS: biodiversity conservation, ecosystems, nature protected areas, high mountain, altitudinal zonality, subalpine and alpine belts, endemics

INTRODUCTION

The mountains occupy nearly 50% of the territory of Russia. The nature of mountain regions is characterized by features, distinguishing them from surrounding plains. From the point of view of biogeography, mountains territories may be considered as "isles", which differ completely from the adjacent plains. On the one hand, mountains could serve as refuges of the plain's biota during the glacier and sea transgression periods. Mountains are considered to be the nature boundaries of states, parts of world (for example, the Urals) and the serious

biogeographical obstacles on the ways of the biotic exchange.

On the other hand, mountains supposed to be the ways for penetration of the northern biotic forms to the South and the southern biotic forms to the North. As a result, taking into account the above mentioned factors, mountains are characterized with a high biodiversity at all levels: intraspecies, species, ecosystem, landscape. The biological diversity degree depends on the palaeogeographical factors, geographical situation, dominating heights, massiveness of the mountain region. The high degree of mountain vascular plants' endemism, reaching 13,5% in the mountains of Central and Southern Siberia and up to 25,2% in the Caucasus, strengthens the value of mountain regions for territorial biodiversity conservation and increases their nature-conservative status. Therefore, at this moment, the analysis of biodiversity representativeness of the mountain protected areas network is of great interest.

SPECIES DIVERSITY

The majority of the vascular plant species of Russia grow in mountains. For example, the Caucasian flora in total consists of 6350 species and only 433 of them are spread on the abutting plains and don't rise above the level of low mountain belt (500 m above the see level).

It is necessary to mention that the detection of the mountain flora taxonomic composition has not been finished yet. In some cases species diversity is in the direct relation with the level of the floristic studying of the region. Moreover it needs to appraise the species diversity of the mountain region only with regard to its not representative part: administrative area (oblast or region) or its protected area (reserve or national park).

As for diversity of lichens, there are nearly or more than 200 species of lichens in the Khibiny, in the Northern Caucasus, and in the Siberian mountains. In the Urals there are nearly 150 of them. Unfortunately, the number of lichens in the regional data also depends on the study level and cannot be considered as exhaustive. Furthermore, to a greater extent, these data show low belts of mountains. Data about the lichens flora in the upper belts are very poor. That's why the regional lists don't reflect the real diversity of lichens.

Concerning animals, it should be mentioned, that the vertebrates have been studied better than other groups. More than three fourth of terrestrial animals inhabits the mountain ecosystems. This fact indicates high species diversity of the mountains comparing with the lowlands. For example, more than 90% of all amounts of animals in the Urals and surrounding territories are met in the mountains, which square is lesser than that of the abutting plains [Bolshakov, Berdyugin, 2001]. There are nearly 50% of the former USSR fauna of birds in the Greater Caucasus. Data of the plants and animal species diversity of Russian mountain regions are resulted in the table 1.

The degree of endemics – important aspect of biodiversity – is higher in the mountains than on the plains. Most of endemics are concentrated just in the mountain regions. Mountains of the middle latitude with moderately warm climate are characterized with high level of species richness and endemism. In the Greater Caucasus 1600 plant species, which introduce 25.2% of the total amount of species, are usually identified as endemics [Belonovskaya et al., 1984]. 13.5% of endemics are revealed in the mountains of the Southern and Central Siberia [Klimesh, 1999]. In the Khakassia mountains the total number of plant species counts 1526, and 7.4% of them (113 species) are endemic ones. The diversity of endemicc plants consists of 85 Altai-Sayanian species (5.6%) and 85 narrow local Preenisenian endemics (1.8%) [Kuminova, 1976]. Mountains of the Northern Russia are characterized by low degree of species diversisty and minute amount of endemic species. There are 412 vascular plants in

Table 1. Diversity of flora and fauna in the mountain regions of Russia (after ANENKHONOV, 2001; AMIRKHANOV et all., 2002; GROSSHEIM, 1949; KUMINOVA 1960, 1976; MALYSHEV, 1988; VOROSHILOV, 1985,) In the brackets – number of endemic (for all groups) and rare, including endangered (for vertebrates) taxa

Regions	Vascular plants	Lichens (genera)	Mammals	Birds	Reptiles	Amphibia	Fishes
The Khibini	429	188	47(0;1)	161(0;12)	2(0;0)	3(0;0)	29(0;2)
The Greater Caucasus	6350(1600)	218	126(26;16)	253(13;52)	73(24;14)	11(5;6)	73(5;11)
The Polar Urals	460	136	36(0;0)	114(0;12)	1(0;0)	1(0;0)	34(0;2)
The Subpolar Urals (mountain taiga, northern taiga and tundra)	611	179	45(0;1)	128(0;7)	3(0;0)	4(0;0)	28(0;1)
The Central and Southern Urals	1495	182	72(0;1)	227(0;26)	7(0;0)	8(0;0)	53(0;2)
The Southern Urals (forests, the upper Ural-river)	815	179	90(0;2)	244(0;30)	10(0;0)	11(0;0)	67(0;7)
The Kuznetskiy Alatay	820	203	77(0;3)	240(0;19)	5(0;0)	3(0;0)	29(0;0)
The Altai (**A**), the Sayany (**S**), the Tuva-mountains (**T**), the Khamar-Daban (**Kh**)	**A** – 1840(113); **S** – 973; **T** – 1782; **Kh** – 1242	**A, S** – 224	111(16;11)	294(16;37)	10(3;2)	5(0;0)	34(2;0)
The Byrranga-mountain	–	–	42(0;1)	129(0;13)	0	0	34(0;0)
Putoranskoe upland (the central and southern parts), Leno-Olenyokskoe upland	412(7)	403	43(0;1)	139(0;15)	1(0;0)	3(0;0)	37(0;1)
Angaro-Tunguskoe upland; the Yeniseiskiy range	818	–	57(0;1)	209(0;18)	4(0;0)	4(0;0)	31(0;1)
Tungusskoe; Northern Baikalskoe (**NB**), Patomskoe (**P**) uplands, Olekmo-Charskoe plateau and Stanovoe high plateaus, the Stanovoi range (**S**)	**NB** – 593; **P** – 702; **S** – 684	– – **C** – 190	80(1;5)	280(0;33)	5(0;0)	4(0;0)	101(0;2)

Continue tab. 1

Regions	Vascular plants	Lichens (genera)	Mammals	Birds	Reptiles	Amphibia	Fishes
Sayan region plateau; the Baikal region mountains	1037	–	77(0;0)	254(0;14)	6(0;0)	5(0;0)	33(0;0)
Vitimskoe and Selenginsko-Olyokminskoe high plateaus	857	–	90(1;1)	273(0;17)	8(0;1)	5(0;0)	90(0;1)
Chitinskoe-Daurskoe lowland (southern part)	870	130	40(0;4)	170(0;25)	3(1;1)	3(0;0)	15(0;0)
Plateau between the Malkhanskiy and Daurskiy ranges	965	–	55(0;4)	193(1;25)	3(0;1)	3(0;0)	34(0;0)
Yano-Oimyakonskaya mountain oblast (region)	643	146	50(0;0)	167(0;9)	1(0;0)	2(0;0)	45(0;0)
Anyuisko-Chukotskaya and Anadyrskaya mountain regions (**A**), Koryakskoe plateau (**K**)	**A** – 931; **K** – 847	165	48(1;9)	160(9;25)	0	1(0;0)	38(7;2)
Okhotskaya mountain oblast (region)	901	–	55(0;8)	170(0;18)	0	2(0;0)	36(0;0)
The Sredinny Range (Kamchatka peninsula)	931	153	43(1;8)	126(2;10)	0	1(0;0)	19(1;1)
Kuril islands	918	171	32(1;11)	117(4;18)	5(4;2)	1(0;0)	28(0;0)
Sakhalin (southern taiga)	1173	380	41(0;2)	160 (1;28)	2(0;0)	3(0;0)	32(2;1)
Sakhalin (central taiga)			45(0;2)	153(0;25)	2(0;0)	4(0;0)	26(0;1)
The Far East mountains	1838	205	91(18;15)	266(34;63)	15(11;5)	8(2;1)	99(34;6)

the Putoran-mountain, and only 7 species of them (1.7%) could be considered as endemics [Kuvaev, 1980].

Fauna of the most of the Russian mountains is not original. It has few of endemics. For example, there is only one endemic subspecies of northern pica among vertebrates in the Urals. But in the mountains, located near the Southern border of Russia, the number of endemics is rather high: 42 species – in the Caucasus, 35 species – in the Sayany, Altai, Tyva and Transbaikalian mountains, 95 species – in the mountains of the Far East.

The highest number of endemics is observed in high mountains. Strongly rugged relief and insuperable abiotic (from the top) and biotic (from the bottom) obstacles strengthen high mountain's isolation. The extraordinary environment forms specific communities and life forms of the organisms. These factors cause the astonishing biodiversity in the high levels of the mountains. Thus, in the Greater Caucasus flora of the alpine belt consists of 800 vascular plant species, 420 species of them (more than 50%) are endemics [Belonovskaya et al., 1998]. The high mountain mammals' fauna is characterized by Promethean vole – the species of the endemic genera *Prometheomys* and by Caucasian stone goats (*Capra caucasica* and *C. cylindricornis*), the birds' fauna is characterized by Caucasian black grouse and Caucasian snowcock.

LANDSCAPES DIVERSITY

The mountains are characterized by increased ecosystems' diversity per unit of area, high nature borders' saturation and biotic complexes' patchiness. As well as in the case with the regularities of species richness distribution, the complexity of altitudinal zonality structure in many respects depends on the combination of warm and moistening. Thus the mountains of the arctic and tundra zone are characterized by the simplest altitudinal belts' composition. The mountains of the taiga zone have more complex structure of the altitudinal zonality. In the mountain regions situated in the South, in the broad-leaved forests or steppe zone changing of mountain belts – analogues of almost all latitudinal zones of Russia are observed (Table 2).

The concrete set of the altitudinal belts and regularities of their changing are found very specific not only in the separate mountains, but often in the separate parts of one mountain region. For example, on the Greater Caucasus 8 types and 7 variants of altitudinal zonality can be differentiated, and on the Northern Caucasus – 4 and 2 of them correspondingly. On the Urals, due to its meridional extension, one or several types of altitudinal zonality structure go with each latitudinal zone. As a result 7 types and 4 variants of altitudinal zonality are distinguished there [Gorchakovskiy, 1968]. In the Altai there are 4 and 3 correspondingly, and in the Sikhote-Alin – 4 and 4.

Table 2. Altitudinal zonality structures' diversity in the mountains regions in Russia (according to Ogureeva, 1999)

Latitudinal zone	Number of mountain regions	Number of altitudinal zonality types	Number of altitudinal zonality variants
Arctic and tundra	10 (including the Polar Ural)	9	8
Taiga (boreal)	65 (including the Northern and Middle Ural)	40	71
Broad-leaved forests (nemoral)	10 (including the Southern Ural and the Caucasus)	16	16

Table 3. Number of endangered plant species (Red data book of RSFSR, 1988) and endangered animals (Red data book of Russia, 2001) (including * – endemic, ** – relict), of the mountain regions

Region	Plant species: rare, with local area and under conservation					Animals species: rare, with local area and under conservation						
	Lichens	Mosses	Ferns	Angio-sperm	Total	Invertebrates		Vertebrates				Total
						Annelida	Insects	Fishes	Amphibia	Fishes	Mammals	
The Khibins	1	1	–	5(1*)	**7**	–	–	–	–	–	–	**–**
The Caucasus	7	2	1(1*)	119(62*)	**129**	2(1*)	6(4*,1**)	1(1*)	10(7*)	5(1*)	8	**32**
The Ural	4	–	–	14(7*)	**18**	1(1*)	6(1**)	–	–	1	–	**8**
The Kuznetskiy Alatay, the Salairian range	2	–	–	3(1*)	**5**	2(2*)	–	–	–	–	–	**2**
The Altai	3	1	1	27(19*)	**32**	2(2*)	5(3*)	–	–	4(1*)	4(1*)	**15**
The Sayany	2	4(1**)	–	14(10*)	**20**	–	1(1*).	–	–	1	3(1*)	**5**
Tuva	1	–	–	20(10*)	**21**	–	4(2*)	–	–	1(1*)	4	**9**
Baikal region mountains	6	–	–	7(6*)	**13**	–	2(1*)	–	–	1	2	**5**
Buryatia, Chitinskiy region	3	–	–	11(5*)	**14**	–	1	–	1	1	3	**6**
North-Eastern Asia: Magadanskaya oblast (region), Yakutia, Chukotskaya AO,	4	1	–	9(8*)	**14**	–	–	–	–	–	3	**3**
Kamchatka	1	–	–	2(1*)	**3**	–	–	–	–	–	–	**–**
Kurilian islands	1	–	1	11	**13**	1	1	–	–	1	–	**3**
Khabarovskiy krai (territory)	2	–	–	1	**3**	-	2(1*,1**)	–	1	2(1*)	–	**5**
Primoriskiy krai (territory)	7	–	1	18(7*)	**26**	1(1*)	10(1*,1**)	–	1	3(1*,1**)	3	**18**
Sakhalin	5	–	1	6(1*)	**12**	-	3(1*)	–	–	2(1*)	1	**6**

RARE SPECIES AND ECOSYSTEMS OF THE RUSSIAN MOUNTAINS

Due to high environmental instability and biotic systems' vulnerability great amount of rare and endangered plant and animal species, mentioned in the Red data books of Russia are met in the mountains [Red data book..., 1988, 2001]. Among these 533 plant species there are 282 mountain ones and among 415 animal species – 95 (Table 3).

Insufficient minuteness and lack of unificated methods of the vegetation survey prevent to reveal rare ecosystems in the mountains in full extent. Nowadays there are only preliminary data about quantity of the rare plant communities in the mountains of Siberia and former USSR [Green data book of Siberia, 1996, Red data book..., 1997]. Meanwhile only 100 mountain communities of various ranks, chosen by various criteria, are called rare and endangered, worthy of conservation (Table 4).

MOUNTAIN ECOSYSTEMS' TRANSFORMATION

Favorable environments, high diversity of high-yield ecosystems have been attractive for man during all time. Thus, even from the middle of Holocene, human economic activity became an important factor, which has, to some extent, had an influence on the trend and intensity of changes in primary mountain vegetation communities. Each historical period of the socio-economic and political development of the mountain regions was characterized by various combinations of impacts and by different loads on the natural ecosystems. From the beginning of historical time to the end of the 19th century the forms of using the natural resources remained practically unchanged. The gradual increase in the load and the development of the new lands were the main process. A sharp leap in the transformation of natural environment began from the middle of the 20th century and this caused a destabilization of ecosystems. At that traditional forms (hunting, timber cutting, cattle breeding, ploughing of land) were intensified, and some previously unknown forms appeared. For example, assignment territories by the collective farms in combination with high livestock and allotment of lands for industrial projects, roads, water amelioration, ploughing up limited development of traditional pasturing, which took in account the natural peculiarities of natural forage grounds (moistening of slopes, degradation of grass layer, seasons of using). During this period some new types of economic impact such as mining (including open cast), industrial and civil building, industrial forest cutting, recreation (popular mountain-skiing and summer tourism) were added. If in the past ecosystems could adapt themselves to new conditions because of the low intensity and uniformity of the impact, nowadays the high speed of transformations and change in the forms of impact in one area (felling, then hay-mowing, then grazing, then ploughing, then building) make it very hard for ecosystem biota to adapt. In many cases they exclude the ecosystems' self-recovery possibilities [Belonovskaya, 2000].

The main centers of ancient settlings and, therefore, of land degradation were the low and middle mountains of the Greater Caucasus, Urals, Southern Siberia and Transbaikalia mountains. On these territories natural ecosystems are destroyed and replaced by their less valuable and productive modifications and also by anthropogenic ecological complexes. Other mountains regions are not characterized by so sustained history of developing and have comparably small localities of anthropogenic destructions.

According to the First National Report "Biological diversity conservation of Russian Federation" [1997] almost 67% of the whole mountains area of Russia is occupied by transformed ecosystems (Table 5). The 29,2% of this territory is totally transformed.

Among the most typical processes of the mountains ecosystems' and their biodiversity

Table 4. Number of the endangered mountain ecosystems in the mountains of Russia

Mountain region	Type of vegetative	Number of associations
The Greater Caucasus	Forests	8
	Highmountain meadows	6
The Southern Urals	Mountain steppes	4
	Forests	3
	Highmountain meadows	1 alliance and 2 subaliances
	Spring communities	2
The Altai	Mountain steppes	7
	Forests	10
The Kuznetskiy Alatay	Mountain steppes	1
	Highmountain meadows	5
Sayany	Mountain steppes	2
	Forests	8
Tuva	Mountain steppes	7
	Forests	2
	Highmountain meadows	6
Baikal region	Forests	2
Transbaikalia region	Mountain steppes	6
	Forests	5
Buryatia	Mountain steppes	2
	Highmountain meadows	1
Yakutia	Mountain tundra	2
	Mountain steppes	2
	Forests	4
	Highmountain meadows	1
Aldan	Tundra-steppe	1
	Forests	2
The Chekanovskiy range	Mountain tundra	1
Far East mountains	Mountain tundra	1
	Forests	5

transformation the following could be mentioned:

– fragmentation of the ecosystem cover, its ecotonization, and forming of the nature "isles" in the man-caused and agrarian landscapes;

– unification of the vegetative cover and biota; disappearance of the altitudinal belts' limits, anthropogenic convergent phenomena in the composition and structure of the biota communities;

– indigenous floras' and faunas' pauperization, increasing of the rare and alien species' share in their composition, intensification of biotic exchange and confusion, floristic and faunal complexes' transformation, biota synanthropization, contemporary "movements" of the areas' limits [Tishkov et al., 1995];

Table 5. Degree and main factors of anthropogenic transformation of the mountain regions in Russian Federation (according to The First National report..., 1997; Regions of Russia, 1999 with additions and changes)

Region	Constituent entity of Russian Federation with the prevalence of the mountain territories	Area, thousand square km	Ratio of entirely anthropogenic disturbed lands, %	Main factors of anthropogenic transformation
North of Russia	Murmanskaya oblast (region)	145.0	3,6	Mining, air pollution, building
The Northern Caucasus	Krasnodrskiy krai (territory)	76.0	61,1	Ploughing, recreation
	Adygeya	8.0	60,9	Cattle-breeding, ploughing
	Stavropolskiy krai (territory)	67.0	65,2	Plouhing, cattle-breeding, building
	Karachaevo-Cherkessia	14.0	39,2	Cattle-breeding, ploughing, felling, recreation
	Kabardino-Balkaria	12.0	39,0	Cattle-breeding, ploughing, felling, mining, recreation
	Northern Ossetia	8.0	36,5	Cattle-breeding, ploughing
	Ingushetia	4.2	30,3	Cattle-breeding, ploughing, felling, recreation
	Ichkeria	14.8	30,5	Cattle-breeding, military activities
	Daghestan	50.0	18,1	Cattle-breeding, ploughing
The Urals	Bashkiria	144.0	43,1	Cattle-breeding, ploughing, felling, mining
	Sverdlovskaya oblast (region)	195.0	12,2	Mining, natural pollution, felling
Southern Siberia and Transbaikalia	Kemerovskaya oblast (region)	96.0	23,2	Mining, building, felling, ploughing
	Altai	93.0	19,1	Cattle-breeding, ploughing, felling, recreation, building
	Khakasia	62.0	24,5	Cattle-breeding, mining, building, felling, air pollution
	Krasnoyarskiy krai (territory)	710.0	5,2	Mining, air pollution, building, felling
	Buryatia	351.0	10,7	Cattle-breeding, mining, building
	Tyva	170.0	10,5	Cattle-breeding, ploughing
Northern Siberia	Yakutiya	3103.2	1,5	Mining, felling
	Evenkiya (north of Krasnoyarskiy krai)	768.0	1,4	Felling
	Taimyrskiy autonomous okrug	862.1	0,5	Mining, air pollution
	Kamchatkiy krai	170.0	2,6	Felling, building, recreation
	Magadanskaya oblast (region)	461.0	0,5	Mining, building
Far East	Primoriskiy krai (region)	166.0	7,8	Felling, building, mining

– replacement of the natural ecosystems by their anthropogenic modifications, including cultivated crops, highlands, secondary forests, etc.

Current mountain biodiversity status and problems of its conservation and use in Russia

Recently, the mountain biodiversity status could be characterized extentially as critical one. On the one hand it is explained by continuance of high and above all uncontrolled anthropogenic load on the ecosystems and with insufficient development of the mountain protected territories' network, on the other hand. All these is redoubled by centralized authority's weakening, absence of administration's control and practically total lack of environmental actions' financial backing at the local level. The biodiversity status is negatively influenced by poaching, which is caused by poverty and wide unemployment among local population. Unprecedented increase of "private" weapons, local wars and armed interethnic conflicts also create considerable threat for mountain vegetative cover and wildlife. For example, the local military conflicts affected 30–35% of the Greater Caucasus territory in general, caused the extinction of the whole hoofed animals' populations, unique protected ecosystems' destruction. The use of modern weapon technologies during local conflicts results the irreversible erosion, which cause the impossibility of ecosystem reconstruction. The wars' and conflicts' consequences double difficulties concerned with reservation and sustainable use of biodiversity resources. After military activities termination large territory of the region is found in the area of weakly forecasting catastrophic changes of the nature complexes.

But, in spite of such pessimistic forecast, the search of ways for reduction of the man-induced negative effect is possible. The specificity of anthropogenic mountain ecosystems transformation lies in the fact, that due to the transitory locations on the slopes of high potential energy caused by dissected relief and sometimes by special conditions of redundant wetting, biota of mountain ecosystems, taken separately, are more vulnerable to many aspects of anthropogenic impact on its structure and functioning, than that of plain ecosystems. An equal intensity of load leads to more severe results and a greater degree of transformation in the mountains than on the plain thanks to the "cascade" effect. On the other hand, the mosaic structure of ecosystem cover and the proximity of analogous ecosystems with differing degrees of accessibility (and therefore safety) combine with the more intensive biological relations allow the restoration of the biotic structure of destroyed ecosystems via the active inter ecosystem's exchange. Thus the biological diversity conservation can be guaranteed more easily in mountains than on the plain, where horizontal links between isolated fragments of ecosystems are far weaker, and the changes in the destroyed fragments more severe [Belonovskaya, 2000].

Such specificity of mountain ecosystems permits to maintain stability for anthropogenic impact and restore ecosystem cover's structure after application of conservation regime. That's why among recommended measures for reservation of biodiversity in the mountain territories of Russian Federation, the creation of natural protected areas' network becomes very important. This network is a kind of nature preservation framework, which maintains the biodiversity on all levels of its display [Tishkov, 1995].

Nowadays the ratio of protected territories in the mountain region, which are "the highest biodiversity's zones", for some extent exceed the mean value of the country (about 3–4%), but considerably yield to that in Russian arctic Region, where biodiversity conservation problems are not so vexed as in the mountains. Complete data of the protected areas' network in the mountain regions of Russia are represented in Table 6.

Table 6. Geographical distribution of the mountain protected areas (reserves and national parks) in Russia and some characteristics of their biodiversity

Region	Reserves	Area, hectar	National parks	Area, hectar	Ratio of endangered animal species, %				Number of rare plant species (including endemics)	
					vascular plants	fishes	birds	mammals		
The Khibins	2	325.893	–		2	6	6	0	7	(1)
The Northern Caucasus	6	502.46	3	345.3	4	9	13	11	134	(65)
The Ural	9	1452.676	4	2117.15	3	10	9	3	10	(9)
The Kuznetskiy Alatay	1	412.9			1	3	5	1		
The Altai	3	1073.609	1	418,200	8	8	7	5	47	(26)
The Western Sayany	4	9699.18	1	39,178	3	6	6	2		
The Eastern Sayany	1	300,390	1	1183,700	4	1	5	5		
Middle Sibirian plateau	2	3669.179			1	2	5	1	9	(5)
Baikal region and Transbaikalia mountains	5	2023.155	3	801.2	1,5	1,5	4,5	1,5		
Eastern Siberia	5	2629.456	–	–	0,5	1,5	8,5	2		
The Far East	9	2913.507	–	–	4	6	10	6	25	(9)

Results of the analysis of protected natural areas existence in different mountain regions of Russia show some disparity between quantity and square of the reserves and values of local biodiversity uniqueness. The greatest deviations are noted for the Northern Caucasus: the least area of protected territories and cluster characterizing of their distribution cannot conserve the greatest flora and fauna uniqueness in a proper way. The problem of fragmentation overcoming has not been solved yet (comparably great amount of reserves and national parks with slight total area doesn't correspond to the nature conservation framework – ecological network of protected areas in no way).

There is a sufficiently large degree of uniqueness and large spaces of protected territories in the Urals, Altai and Primoriskiy krai. However only formal quantities biodiversity features registration could hardly show a reality of sufficiency of the protected territories' forms in a region. It's necessary to take into account biota's composition quality and its representativeness on the protected area. In each specific case, the analysis of biota's diversity, with character and (or) unique species and communities, inhabited on the protected territories, needs to be held. Thus, as for rare mountain animal species there are comparably few problems, because a lot of reserves were found for the purpose of their conservation. 75–90% of rare species of mountain animals are presented in reserves. It's quite another situation, concerning rare and endogenous plants. They are presented in reserves only for 55–60%.

Traditionally the foundation of reserves and other types of the protected areas in the mountain regions of the former USSR based on the principle of "unique high mountain (generally subalpine and alpine) ecosystems' priority". The greatest number of flora and fauna endemic species has been found there. According to some structural and functional characteristics high mountain ecosystems cannot be compared with their plain analogues. Especially it is typical for the Greater Caucasus. The main reserves of the Northern Caucasus are situated in the high mountains while the territories in the middle and low belts with their high biodiversity have not been protected yet.

One fact has also to be mentioned: the principle of "protected priority of high mountains" was associated not only with doubtless natural uniqueness of the high mountain ecosystems, but also with the peculiarities and spatial organization of mountain land use: at the moment of the reserves' foundation only high mountain territories could pretend to the status of "wildlife territories"; while the most transformed landscapes of middle and, especially, low belts and lowlands, where the absence of protected areas with strict regime of reservation occurs practically. The wildlife sanctuaries are not taken from the land use and are actually related to the protected area in formal sense. Besides, within the limits of some reservations, difficult to access territories are "lifeless", practically they are lack of biota (rock-crevices, screes, glacio-nival landscapes), in the same time the landscapes, most valuable for reservation (first of all mountain forests) are represented unsufficiently.

For example, in the Kabardino-Balkarskiy reserve rock crevices, screes, subnival and glacio-nival landscapes occupy nearly 55% of the total territory, while forests grow on the less than 4.5% of the reserve's area. On the opposite, in the Russian part of the Eastern Caucasus (Daghestan) almost the high mountains have appeared to be lack of preservation. "The internal structure" of the protected areas in the Urals looks to be more optimal: owing to the absence of the large high mountain with rock crevies, screes and glacio-nival landscapes the share of the biotic complexes here happens to be higher (particularly, ratio of the forests in the area of many reserves reaches 85–95%).

The other problem deals with the protected territories' limits, which often is marked arbitrarily and is not related with nature

borders. In optimal case they correspond to the longitudinal parts of the river valleys and mainly – to the land use or administrative borders. By our opinion, it is effective to orient on the river-basins limits as the natural spatial units of the mountain territory, while planning the configurations of the protected areas (especially in the high mountains). In the same time within every basin there are fragments of various altitudinal belts isolated from typologically similar belts of adjacent valleys by watersheds. Each basin according to its altitudinal status is characterized by certain complex of exogenic processes (for example glacio-nival in the highlands, erosion in the middle belt, etc.). The observation these processes in the aspect of their relations with biota has to become one of the purposes of the protected territory, as plant reduction stages caused with avalanches, mudflows, landslips, etc. are also natural variants of the mountain ecosystems as valuable as typical complexes of altitudinal belts.

At present the main direction of the mountain protected areas' network's development should become the overcoming of its "fragmentarity": inclusion of the "not high mountain" landscapes and ecosystems to the preservation regime for the achievement of the complete altitudinal belts' spectra. This process could develop both in the way of the enlargement of the existing protected areas, first of all reserves, and in the way of foundation of the new ones. In the same time, in the condition of the increasing of politic and economic independence of the autonomies and authority centralization, the possibility of considerable "noncommercial" reserves' areas' enlargement could hardly be forecasted. In this case the priority should be given not to the reserves', but to the national parks' development. The last permit combine recreational (economic) and nature-oriented activity. The creation of new protected areas is especially effective in the densely populated and industrial regions. On the other hand, even in the condition of the "land use press", increasing creation of new reserves with comparably small areas ("microreserves"), is quite possible. It doesn't contradict with the principle of the sufficiency of the reserve's area: in the mountains the natural abiotic processes and biota's vital activity often run on the comparably small space. It's quite enough for allocation of the complete natural complex, which could become the object of conservation.

In contrast with the old-aged developed territories in the mountains regions of the North and North-East of Russia the diversity of the landscapes and ecosystems are almost represented in the protected areas. Moreover considerable part of these regions is hardly accessible and doesn't need the introduction of special conservation regime. Evidently, for some similar regions the main tendency of environmental activity's perfection has to be prevented of the negative consequences of the large-scale open mining of the mountain chemical mineral raw materials and anthropogenic pollution. In any case the development of the regional and local protected areas' network (wildlife sanctuaries, national monuments, small reserves, animal reproduction zones, etc.) could make up the deficit of the total ecosystem's diversity presentation in the Russian federal mountain protected areas' network.

It is necessary to note, that all above mentioned measures, directed to the regional protected areas network's optimization, have to be fortified by improvement both by federal and regional environmental legislation, the main role of which is to solve the problems of wildlife conservation and land use by civilized methods. Lawmaking of the constituent entity of the Russian Federation with mountain territories according to its traditions and priorities could define itself, how many, where and what status of protected areas have to be created. But all of them are authorized to occupy not less than 15–20% of the region territory. Only in this case a region (on the assumption of the principles of the nature protection ubiquity) could turn to the model of the sustainable development. Using only territorial forms of nature protection, there are no perspectives of the mountain flora and fauna conservation.

Therefore, in addition to the territorial forms of protection for the mountain territories, the system of management strategies ought to be changed. For that, the establishment of the exclusive land use regime on the non-protected territories, including preservation of extensive management forms, directed to the spared regime of the nature resources use, is required.

STRATEGIC PRIORITIES OF BIODIVERSITY CONSERVATION

Among the priorities for the preservation of the Russian mountain biodiversity the following ones can be mentioned:

1. Legislation and ecological regulation development;

2. Progress in the international relationship of the mountain biota conservation;

3. Removal of the socio-political, economic and administrative obstacles for introduction of the regional adapted types of biodiversity conservation management;

4. Restoration and enlargement of the mountain regions biodiversity conservation measures' information support;

5. Realization of the large-scale activities for the ecologic reconstruction of the disturbed mountain territories;

6. Development of the scientific (biologic and geographic) surveys, among which the most actual are following:

- analysis of the specific features of the mountains as the extreme (borderline) environment for organisms and communities: ultraviolet and other insolation parameters, daily range of temperature, short vegetative period, low air pressure, wind's regime, environmental unpredictability;

- research of the specific features of the mountain relief as a special environmental factor, affecting biodiversity: natural barriers, isolation, high degree of the habitats' diversity and patchiness, river-valleys' and intermountain basins' drainage;

- the mountain biota evolution, including mountains-plains' relationship survey;

- the high latitude mountains survey;

- survey of the local specificity of the man-mountain ecosystems' mutual relation, combining ecologic and sociologic approaches;

- development of the ideas of the altitudinal and basin mountain territories' structures;

- study of the correlation of the environmental and anthropogenic factors of the mountain ecosystems' evolution, identification of the mountain landuse retrospectives and perspectives, elaboration of the biodiversity conservation economic mechanisms and evaluation of the input of the mountain ecosystems into the global biosphere functioning;

- development of the scientific legislative and normative bases of the mountain ecosystems and biodiversity conservation and use;

- elaboration of the principles of the mountain protected territories and its regional ecologic networks' establishment.

CONCLUSION

What should be done for increasing of the efficiency of the Russian mountain territories biodiversity conservation?

First of all, it is necessary to change the strategy of the protected areas system's establishment by the way of realization of the principle of the ubiquity of the environmental conservation and development of the protected areas ecological networks.

In the second place, it is necessary to maintain the extensive agriculture and to revive the traditional land use in the mountain regions on the base of the examples of the international and national legislative initiatives, regional and multiregional agreements; to introduce the economic incentives for the agrarian activities and the development of the mountain ecologic tourism and other recreational use of the nature ecosystems.

In the third place, it is necessary to develop large-scale activities for the reconstruction of the disturbed ecosystems. Regional ecological funds have to be created for financial support of these activities. These establishments ought to be fulfilled by deductions of subsurface, forest and land use, plant and animal resources utilization. It is important to organize the mountain wild flora's nursery-gardens and centers of rare animals breeding for the planting and seeds materials' supplying.

In the fourth place, the actions on the biodiversity inventory and on the monitoring of their status on the base of the representative reserves and national parks, using the data of the long-term biota and ecosystems observations need to be carried out.

In the fifth place, the development of ecologic and economic evaluation of the mountain territories, their nature resources and consequences of the economic activity has to be realized on a broader scale. In perspective it permits to include the nature capital into the parameters of the regional richness, to practice use of economic mechanism of stimulation for passing to the sustainable use of the mountain biological resources both during the choice of the alternative nature ecosystems use and during the cases when there elimination or degradation are planned.

And finally, in the sixth place, it is necessary to recommend the regions to accept special legislative acts for biodiversity conservation, mountain land use, and participation of local communities in the managing of these processes. ■

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