

# Spatial Structure of Mountain Forests of the Lake Baikal Southwestern Coast

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## Abstract

Spatial structure of mountain forests of the Baikal region is presented through geobotanical mapping. Correlated analysis of the vegetation cover structure and data of landscape investigations was done. The study area is characterized by a high natural diversity of plant communities with dominating forests reflecting the ecotopes differentiation in mountain conditions as well as by the contact of regional physical geographical structures and experiencing anthropogenic impacts. The map legend conveys the identified spectrum of forests diversity. Area is provided for the integrated stability areas of plant communities. Forest stability is regarded as ability of plant communities to retain their phytocenotic structure. An expert assessment of stability is made. This territory is notable for dominance of stable and moderately stable forest communities. The modern mosaicdispersed distribution of communities of equifinal successional stages gives evidence of the current favorable conditions for preservation of dark coniferous forests

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**Index terms**— forests spatial structure; mapping; landscape structure; forests stability.

## 1 Introduction

Studies of structural dynamic features, spatial organization of geosystems and environmental forming and environmental retention role of vegetation in the territory next to the Lake Baikal are conducted for the purpose of nature management policy developing of the Baikal natural territory, priority of which are the actions, directed toward the maintenance of geosystems in the natural state of functioning, providing conditions for unique natural water resource forming. The complicated geological engineering conditions of this area require the realization of approaches of rational mountain nature management in such place.

In this article on the basis of the expert evaluation of the sustainability of plant communities and mapping of the contemporary geosystem states the attempt to assess bearings of their territorial stability was made. Case study is executed basing on the example of the territory of the south Baikal.

## 2 II.

## 3 Methodical Approaches

Regularities of forests communities distribution within the case study area are reflected on that carried out map by the authors of the contemporary state of the vegetation of the Slyudyanka region in 1:400 000 scale, that represent the existing variety and the state of plant communities taking into account their primary and derived structures (Novitskaya and Suvorov 2012). Map material for this paper was worked out with ArcView 3.2a programme. We gave the fragment of the investigated section (Fig. 1).

## 4 \* Taxon numbers are in Legend

The study of the natural conditions differentiation and their determining processes in the south of Baikal is conducted according to the thematic directions, which cover different nature components, and also by complex physical geography, which investigates variety, regional specific character and dynamics of natural complexes or geosystems. One of the fundamental directions of such studies-spatial presentation of territory differentiation, based on the mapping results.

Anthropogenic impacts are concentrated in the coast of the Lake Baikal dominated by areas of forest communities of stably long-lasting and short-lasting derivative stages of successional recovery. The lower mountain-taiga belt and adjacent submontane plains with tracts of Baikal's terraces are dominated by structures of weakly stable and unstable areas. Geosystem differentiation gives conditions for the occurrence of different forest communities as well as the spatial inhomogeneity of the stability areas in relation to primary and derivative structures in light of the existing kinds and intensity of anthropogenic impact. For mapping we used the materials of our field research routes for the different years with complex physical geographical descriptions, the results of aeroand space photograph deciphering, and extrapolating data of large-scale mapping of several key plots, materials of regional forest survey, and also the analysis of the existing literary sources, too (Epova 1960a, Epova, 1960b; Medvedev 1986; Olozhnikov 1986).

Representation of ecotopic structure for this map was based on the differentiation of the topographical structure and the assessment of the contemporary dynamic state of geosystems and it was connected with the carrying out the maps of the physical geographical chorological and landscape typological differentiation of geosystem structure in the south of Baikal (Suvorov and Titaev 1999; Suvorov 2002; Suvorov, 2012) according to properties of the facies (large scale geosystem unit) structure of this territory and taking into account its generalization with mapping on different scales.

As a whole the legend of geobotanical map transfers the variety of the region forest communities and reflects the genetic structure and dynamic principles of typification and construction of the plant communities classification (Sochava 1979). The characteristic of the primary lands of taxons contains fundamental fitosociology characteristic and information on conditions of locality, their dynamic states (the latter were designated by literal indices).

## 5 Legend to the map "Contemporary state of the vegetation of the southwestern Baikal region" Vegetation High mountain vegetation Mountain tundras

The South-Siberian formations

## 6 Spatial Cenosis Structure

The complex spatial cenosis forests structure of the southwestern Baikal area is caused by the existing contrasting natural conditions, connected with the mountain nature of relief, by the Lake Baikal influence, and it is complicated by anthropogenic impacts. Territory is characterized by the fold-block mountains, composed by the metamorphic rocks of Precambrian complex, and also by the contact of mountain morphostructures and basin of the Baikal Lake, whose tectonic development still continues. General regularities of spatial distribution are connected with altitudinal zonality, the exposition effects, the characteristics of local ekotopes, which determine the structure of biogeocenosis of the Khamar-Daban ridge, of the spurs of the Eastern Sayan and of the Olkhinskoe plateau. Two physical geographical oblasts were allocated here: Southern-Siberian mountain (A) and Baikal-Dzhugdzhur mountain taiga (B), within their landscape okrugs are represented by the specific spatial regional topological spectra (pattern) of geosystems (Fig. 2). For the southern part of the research area with the alpine form of landscapes and with the active slope processes (tooth pointed crests of ridge-spurs, erosional and glacial forms) it is more characteristic the open fragmentary groups of grassy (*Saussurea pricei*, *Tephrosia turczaninovi*, *Smelowskia bifurcata*) plants. In the golets belt there are approximately at the same heights extended alpine tundras, predominantly lichen, with the small sections of short grassy alpine meadows and nival small meadows.

In the high mountain northern part of the territory (Zun-Murin golets-mountain taiga okrug) golets geosystems with flattening relief forms and gently slopes dominate. The surfaces of plateau are occupied with stony scatterings and alpine tundras: stony, stonydryad, lichen, mosses-lichen, sedge-mosses. On the golets with the flattened surfaces and gently slopes there are extended mossy (*Aulacomnium turgidum*, *Dicranum elongatum*)-lichen (*Cetraria cuculata*) tundras with sections of dryad, grassy tundras and moors with the rarefied cover from bilberry (*Vaccinium myrtillus*), fillodotse (*Phyllodoce caerulea*), rhododendron of Adams (*Rhododendron adamsii*), bergenia (*Bergenia crassifolia*) and the lichens of the Stereocaulon. In the upper part of the southern slopes the small sections of desert type alpine meadows are noted with the dryad, rarely -kobresia moors.

The geosystems dynamics is connected also with the processes of bogging up and peat forming on the watershed depressions and on the solifluction slope terraces covered with sedge (*Carex bigelowii* subsp. *ensifolia*) and with cotton-grass (*Eriophorum* sp.) communities.

Along the slopes of water-collecting lows and the gently sloping sections of the blown snow-patches with mountain-meadow soils there are formed the characteristic south-siberian subalpine luxuriant forb meadows

(*Aquilegia glandulosa*, *Viola altaica*, *Campanula dasyantha*, *Diphasiastrum alpinum*, *Doronicum altaicum*, *Cimnifolia grandiflora*, *Carex atterima*, *Pedicularis amoena*, *Hierochloa alpina*, *Geranium krylovii*).

Lower located subgolets sparse woods are characterized by the propagation of dark coniferous forests with fir tree (*Abies sibirica*) and Siberian stone pine (*Pinus sibirica*).

In the western part of the territory, within Zun-Murin golets-mountain-taiga landscape okrug (6), the subgolets belt was formed by sparse woods with Siberian stone pines and larches (*Larix sibirica*) having ground birch underbrush (*Betula rotundifolia*). The single plants of the larch dwarfish form are observed up to 2000 m height and more. At the same altitudinal level as sparse woods and above there are some places of ground birch brushwood and, by places, especially on the southern slopes, -the brushwood of Adams's rhododendron. Subalpine and alpine meadows occupy insignificant areas.

At the forests border within subgolets belt there are extended fragmentary and compact mountain pine communities of Baikal-Dzhugdzhur formation of Bering phratry, which occupy predominantly the slopes of northern aspect. Mountain pines (*Pinus pumila*) form high density brushwood with height about 1,5 m and with single Siberian stone pine and fir. In the underbrush rhododendron golden (*Rhododendron aureum*), subshrub cover from bilberry, crowberry (*Empetrum nigrum*), cowberry (*Vaccinium vitis-idaea*), and Adams's rhododendron predominate. Grassy forms almost are absent, projective cover is about 5 %. They are encountered bergenia (*Bergenia crassifolia*), maylily (*Maianthemum bifolium*), from characteristic alpine plants -alpine whitlow grass (*Draba alpina*). Mossy cover is near 80 % (*Hylocomium splendens*, *Aulacomnium* sp.). Peaty-gley soils with peat horizon about 10 sm. Soil profile depth reaches 45 cm, ferrugination is observed in the middle part of the profile, the skeletal nature of soil substratum is expressed. Thus, near The Grassy summit (1550 m) such complex is located within altitude range 1530-1550 m and has relatively small area. It is located on the northern slope of narrow watershed with about 35° steepness which has stony outcrops of gneisses. Subalpine meadows are noted at the same heights on the southern slope of the same watershed in the upper part of the water-collecting low.

Below, in the altitudes range from 1000-1050 to 1470-1500 m, it is characteristic the propagation of fir mountain park type woods, taking place of relatively gently sloping slope-watershed surfaces with inclination 7-10°. The mesorelief of such locations is nival-fluvial formed as a result of refreshing freezing-thawing processes influence throughout year and loose surface deposits. Mountain forest turf medium-loamy soils are developed on the eluvium of the carbonate rocks, but they are lixiviated. Their depth is about 0,5 m, it is expressed gumus soil profile, skeletal nature of profile increases from depth 0,2 m.

Arboreal layer consists from fir tree and Siberian stone pine (standing formula 8Fir2Pine), the height of trees is 6-8 m, diameter 20-25 cm, crowns cover -0,2. The renewal of tree standing is not marked. Grassy cover is graminaceous-forb (moist grassy) with projective cover 80-100 %. Wood millet (*Millium effusum*), smallreed (*Calamagrostis obtusata*), geranium (*Geranium* sp.), violet (*Viola uniflora*), Siberian globe flower (*Trollius* sp.), hellebore (*Veratrum lobelianum*) have great abundance. The groups of Siberian stone pine with cowberry-bergenia cover takes places with gneisses outcrops.

Major part of the entire area is occupied by slope geosystems of mountain taiga belt with South-Siberian communities where fir and Siberian stone pine dominate, and also their derived communities with larch, pine (*Pinus sylvestris*) and small-leaved species (*Betula platyphylla*, *Populus tremula*), extended to a height 1400-1450 m. They are bilberry, cowberry, short grasses (*Trisetalia europaea*, *Maianthemum bifolium*), true mosses (*Pleurozium schreberi*, *Hylocomium splendens*) communities predominating. On the slopes of light exposure Siberian stone pine grassy forests prevail, on the shady -Siberian stone pine and fir with spruce (*Picea obovata*) marsh tea (*Ledum palustre*) true mosses.

For north-eastern, inverted to the Baikal macroslope of Khamar-Daban ridge it is characteristically significant propagation of fir tree, by places including shoots renewal, and it is typical the preserved relicts of the grassy plants of tertiary broadleaved forests.

Composition of the forest communities of northern macroslope of Khamar-Daban ridge is differed by first of all the large presence of larch and the altitudinal shift of the boundary propagation of mountain taiga light coniferous forests. In this case the larch is extended to upper boundary of subgolets belt. The lower mountain part of Zun-Murin landscape okrug is presented with larch forests: in common pine-larch small reed-forb communities which upwards are changed by cowberry-grass with the rhododendron dahurski (*Rhododendron dahuricum*), larch cowberrymarsh tea-mosses and Siberian stone pine-larch. And above Siberian stone pine subshrub-mosses forests grow.

Valley geosystems are ernik with riverside brushwood of willows, and also with sections of steppefication and swampy with carex-like kobresia (*Kobresia* sp.) meadows.

Mountain taiga communities of Southern-Siberian type occupy coming from the north outlying outspurs of Eastern Sayan with erosional-denudation low-mountain relief and heights of up to 1300 m and Olkhinskoe gently undulating plateau with height of up to 900 m (Okinsko-Sayanskaya province).

On the spurs of Eastern Sayan up to height about 900 m (the southern slopes to 1100 m) there predominate communities of light coniferous forests, which upward along the slope are replaced by dark coniferous mountain taiga, and else above they are changed by Siberian stone pine subgolets sparse woods. Here the watershed territories of flattened manes are represented with equifinal states of dark coniferous taiga with supremacy of

Siberian stone pine communities -subshrub (*Vaccinium myrtillus*, *V. vitisidaea*), short grass (*Trisetalia europaea*, *Maianthemum bifolium*) politric-true mosses (*Pleurozium schreberi*, *Hylocomium splendens*).

At dominating gentle slopes of Olkhinskoe platea (Verkhnepriangarie province) there are predominated recovered states of dark coniferous communities as light coniferous (*Larix sibirica*, *Pinus sylvestris*) and small-leaved rows of middle age and ripen with developing undergrowth of dark coniferous tree species (*Pinus sibirica*, *Abies sibirica*, *Picea obovata*), mainly Siberian stone pine, which have stable prolonged derived character (grassy, short grasscowberry-true mosses and cowberry-marsh tea-politrictrue mosses, at lower slope parts with sphagnum mosses). Distinctly there are manifested the exposure differences (north-south), expressed in variability properties of vegetation and soils.

The valleys of middle and upper reach of rivers, influent into the Baikal, are wide, planoconcave, bushy covered and frequently swamped. Bogging up in the planoconcave upper reaches of small rivers (actually this is interfluvium) can bear mesotrophic or even oligotrophic nature as, for example, in the upper reaches of the Bolshaya Shumikhara river, where in the plateau there is located sedge-sphagnum uneven raised bog with small pools swamp. The soils are peat and with longterm permafrost. Wood layer spare-stand is low-quality appraisal, with crowns cover of 0,1-0,2. It consists of larch, Siberian stone pine, spruce and birch with quantitative predominance of Siberian stone pine. In underbrush there are sweetbrier (*Rosa acicularis*), subshrub layer is great bilberry-marsh tea with cowberry and the large cranberry (*Oxycoccus microcarpus*). The mossy continuous cover consists on 60% of sphagnum mosses with impregnations of true and politric (*Polytrichum commune*, *Pleurozium schreberi*, *Ptilium crista-castrensis*) and lichens of *Cladonia* kind.

Submontane forests of the adjacent to the lake steep southern slopes and slopes of the intermediate exposure (Southwestern coast mountain taiga okrug) include pine with larch rhododendron (*Rhododendron ahuricum*), cowberry, forb-bracken with steppefication communities and with sections of exposure steppes. Area of steppe formations along the coastline slopes of the Baikal is elongated almost without breaks about 80 km with removal from the lake by places through the mountain river valleys by 2-4 km. At steep southern coast slopes with rocks outcrops steppe formations most probably has natural origin, caused by the activity of contemporary exogenous processes and by the absence of snow cover in winter. The sections of the steppe appearance have sedge-gramineous-forb in composition of grassy layer, wormwood -forb with chernozem-like soils, they contact within sloping gullies and depressions with meadow-forb cover, and also with pine and larch-pine forests of cowberry and forb with underbrush of dahurski rhododendron at more gently slopes.

The primary forest structure of this part of the Baikal coast is disrupted by fellings and forest fires, and inherent main background of contemporary vegetation composes of birch and aspen-birch forb forests. The slopes of different steepness near settlements are used for homestead sections and cattle pasturing. On the watersheds with the cut forests or on the bottoms of valleys there are located the small sections of haying land.

The fragment of mountain depression subtaiga landscape with steppe formations at slopes is represented within Bystrinskaya and Torskaya depressions, connecting Tunkinskaya and Baikal depression (Tunka depression steppe formed-subtaiga okrug). Climatic conditions here are more arid, that caused by depression location and isolation from the action of the advective processes, transferring moisture. Subtaiga light coniferous forests predominate, they are strongly disrupted and partially substituted by derived small-leaved communities. Submontane inclined plains of both depression sides are covered with larch and pine-larch small reed-forb forests. Also here at the slopes of southern aspect there are extended steppe formed-grass larch forests and fragments of real steppes. On sandy ouvals there are dry steppe formed pine forests with sparse grassy cover with black-berried cotoneaster (*Cotoneaster melanocarpus*), rhododendron daurski, Siberian pea-shrub (*Caragana arborescens*) in the underbrush. The fragments of spruce and poplar-spruce forests are encountered in the low floodlands, which alternate with the sections of meadows and brushwood of willows.

As a whole the variety of locations near the Baikal creates favorable environment for existence as for the most south-eastern center of developing of dark coniferous forests of Ural-Siberian phratry of formations (Sochava 1978), and for fragments of steppe formation, which have natural origin, and it also appears as a result of anthropogenic action.

Coastal area is subjected to the lake greatest impact. It is determined by zone of the direct climatic lake influence upon the surrounding territory. By places at flattened sections of the drained Baikal terraces were preserved dark-coniferous forests with primary structure -fir-Siberian stone pine with spruce bilberry true mosses (*Pleurozium schreberi*, *Hylocomium splendens*) and bilberry short grass (*Trisetalia europaea*, *Maianthemum bifolium*, *Mitella nuda*, *Oxalis acetosella*, *Waldsteinia ternata*)-true mosses, and also prolonged-derived larch-Siberian stone pine communities. The short and prolonged-derived communities of a small-leaved (*Betula platyphylla*, *Populus tremula*) row are concentrated predominantly near the residential territories.

At the same time in the coastal zone there is noted the manifestation of false goletz belt with the vegetation elements of the Baikal-Dzhugdzhur formation in brushwood in the form of the local spots of mountain pine with golden rhododendron and bilberry lichenmosses participation (within the South-Baikal taiga submontane-plain okrug).

In the flattened submontane plain at the foot of Khamar-Daban ridge there are extended oligotrophic swamps and mesotrophic bogs of sedge-sphagnum and subscrub (*Ledum palustre*, *Vaccinium uliginosum*, *V. vitis-idea*, *Oxycoccus microcarpus*)sedge-sphagnum with open woods of Siberian stone pines, spruces, the birches, which,

judging by the structure of the peat deposits and its botanical composition, were formed on the spot of large in the area shallow lakes (Novitskaya 1981).

In some locations of northeastern Khamar-Daban ridge macroslope as a result of specific mesoclimate there were created favorable conditions for some species retaining with particular kin connections and areas, which testify about the propagation in the past in this territory of the Baikal Siberia of coniferousbroad-leaved forests. The most of these species dwell in the dark coniferous (firry and Siberian stone-fir) forests and in the brushwood of the riverbed of the Bezymyannaya, the Utulik, the Babkha, the Solzan, the Langutay, the Khara-Murin, the Slyudyanka, the Snezhnaya, which characterized by increased humidity, rich soils, frequently with well manifested humus horizon. There are encountered male fern (*Dryopteris filix-mas*), enchanter's nightshade (*Circaea caulescens*), prominent (*Corydalis bracteata*), valdshteinia (*Waldsteinia ternate*), Baikal anemone (*Anemone baicalensis*), monkshood (*Aconitum sukaczewii*), dwarf bay (*Daphne mezereum*), wood falcebrome (*Brachypodium sylvaticum*), fescues (*Festuca altissima* and *F. extremiorientalis*), mountain bladderfern (*Oreopteris limbosperma*), Hancock's sedge (*Carex hancockiana*), fragrant bedstraws (*Galium odoratum*) and small bedstraw (*G. triflorum*), lady's slippers (*Cypripedium calceolus*, *C. guttatum*, *C. macranthon*). In the high mountain belt within the subalpine tall grass meadows, nival small meadows under the more extreme conditions there are encountered rhaponticum (*Fornicium carthamoides*), mountain willow-herb (*Epilobium montanum*), meadowgrass (*Poa remota*), saxifrage (*Chrysosplenium baicalense*).

On the ledges in the cliff foots and at the riverbanks with pebble and sandy sustratum there is physochlaina (*Physochlaina physaloides*). Endemic species of the Baikal region are tussock-grass (*Deschampsia turczaninovii*) and cherepoplodnik (*Craniospermum subvillosum*) growing on the riverbed sands and the pebbles. Furthermore, for Khamar-Daban ridge there are typical narrowly local endemiks: svertia (*Swertia baicalensis*), monkshood (*Aconitum sukaczewii*), poppy (*Papaver turczaninovii*), tridaktalina (*Tridactylina kirilowii*). The rare species of the southwestern Baikal region have different status of protection and are included in the Red Books of different levels (Krasnaya kniga Irkutskoi?2010; Krasnaya kniga Rossyiskoi?2008). phically integrated areas of stability were represented (Fig. 3).

Basing the map of contemporary state of vegetation (Novitskaya and Suvorov 2012) cartogra- To moderate-stable there are related the sections with the primary and prolonged-derived communities with active manifestation of the repetitive external factors of action, predominantly in the form of exogenous processes, which have an effect on background spontaneous dynamics. For them there is also peculiar retarded recovery and mainly limited development.

For the weak-stable sections it is characteristic the factor limited conditions for development, due to the narrow ecological range of plant communities existence and also caused by active exogenous relief processes.

To unstable it is related the sections with shortderivaed communities of restoring states of the different types of mountain taiga geosystems and with the high mountain communities under the extreme ecological conditions, and of also anthropogenic ally changed with the stable-derived communities of land active use.

The cartographically obtained integrated areas of sustainabilolity include different ecosystems, which have various mechanisms of the structure retention. Their uniting property is confinement to territorially compact areas with the retention of the existing structure. The high fragmented mosaic structure of the centers of the propagation of primary forest communities contributes to their steady retention.

V.

## 7 Conclusion

For major part of the south Baikal area it is characteristic the domination of stable and moderatestable preservable for estcommunities, extended in the mountain taiga belt of optimum development and the upper mountain taiga belt of limited development. Mosaic-dispersed distribution of forest communities of equifinal succession stages testifies about the up-to-date favorable conditions for retaining the dark coniferous forests in this region.

Anthropogenic impacts are noted mainly in the coastal zone along the railroad and the highways and next to the populated areas. There are concentrated the forest communities, which present in majority shortterm-derived stages of the succession recovery. Their existence, especially near the large populated areas, is stable with the permanent anthropogenic press, and they remain long time as stable prolonged-derived communities.

The weak-stable and unstable mosaics of areas are almost continuous in lower mountain taiga belt and within adjacent submontane plains with sections of Baikal terraces. The propagation here of relict and rare plant species, which find favorable conditions for the growth, testifies about their unstable position as a result of anthropogenic press encreasing. It is necessary the complex assessment of location conditions and of state of plant populations at large-scale topological level. The territory of active anthropogenic action, including up-to-date economic infrastructure, is attached to the lake Baikal coastal zone, and the expansion of weak-stable and unstable areas is limited to the mountain conditions of locality.

The prevailing structure of this territory nature management and spatial differentiation of forest communities of the the southwestern Baikal region characterize the unique physical geographical conditions of retaining the dark coniferous taiga on the southeast of its propagation under the mountain conditions with the unique mosaic structure of areas stability.

The presence of a significant quantity of Tertiary relicts testifies about the long duration of favorable conditions for their existence at northeastern macroslope of Khamar-Daban ridge in the comparison with the entire territory

of the Baikal Siberia, and also about the long continuance of interaction of the remainders of coniferous-broad-leaved and boreal flora through Holocene. To the retention of some species in the communities of mountain dark coniferous taiga it is contributed variety and mosaic propagation of locations (ecotopes) of mountain conditions.

For optimization of the regional system of nature management it is necessary to consider both the geosystem territory differentiation, which gives conditions for the propagation of different forest communities and species, and spatial heterogeneity of the areas of stability in the relationship of primary and derived structures under existing forms and the intensity of anthropogenic action.

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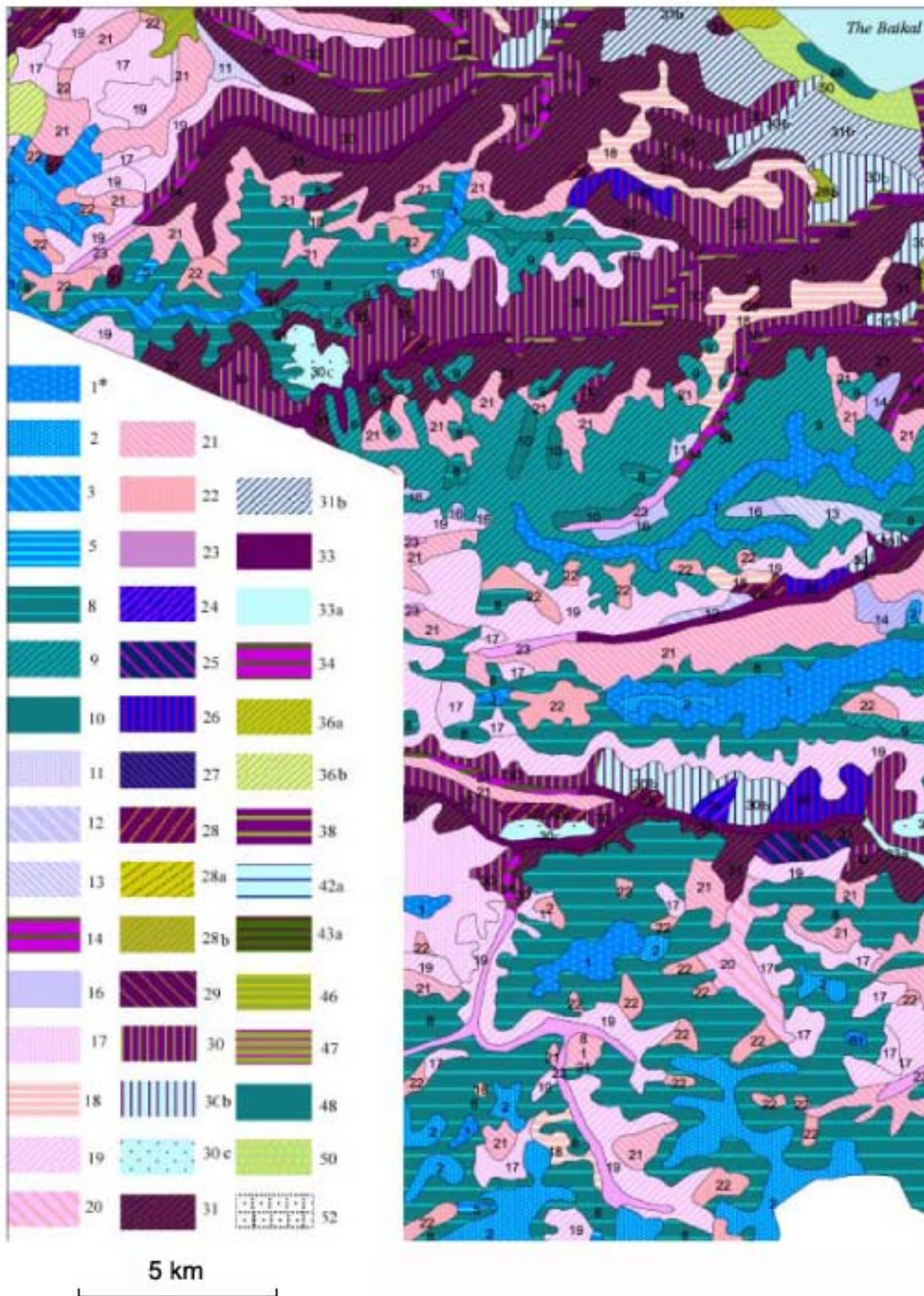
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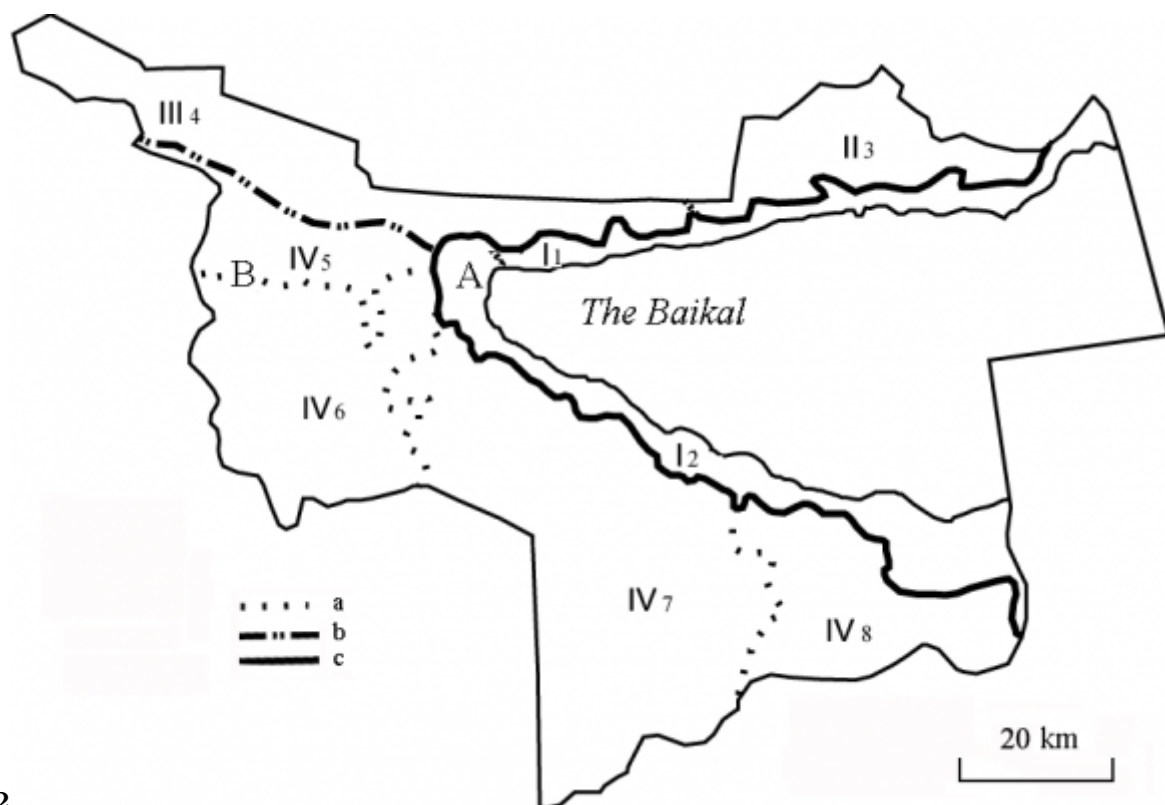
<sup>2</sup>temperatures in the high mountain part -20.-25 of °C, July -10-17 °C. In the coastal part because of the lake

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Figure 2: Fig. 2 :



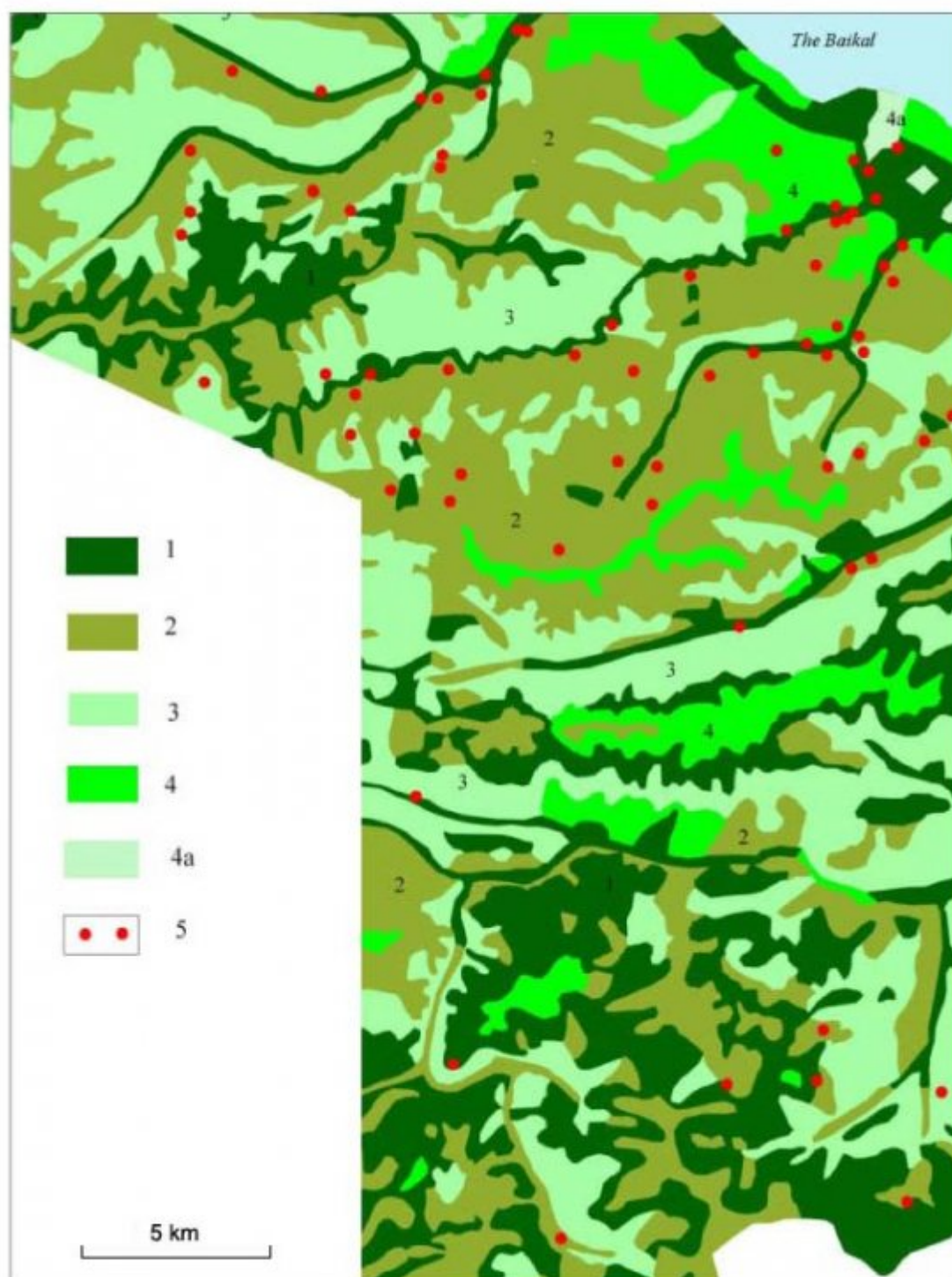


Figure 3: Spatial

(*Vaccinium* 32b. Birch and aspen cowberry-forb and cowberry-myrtillus, *Empetrum nigrum*,

1. Unclosed (Konspekt?2005), groups *Smelowskia bifurkata*) of the nival denudation and (*Saussurea pricei* T

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## .2 Year 2017

Spatial Structure of Mountain Forests of the Lake Baikal Southwestern Coast Regional natural complex, which was formed under the conditions of northern and eastern macroslopes of Khamar-Daban region, is unique. The high air humidity in summer and depth snow cover in winter create favorable conditions for the growth and domination of dark-coniferous taiga in the mountain taiga landscape okrugs (Suvorov 2002).

The species, composing dark coniferous forest group, possess at present the extensive Eurasian broken area. This was served as the proof of the myocene detachment of the dark coniferous taiga formation in the upper mountain belt from the Arctic Tertiary flora. The selection of species took place through whole period of dark-coniferous taiga existence (Malyshev and Peshkova 1984). Within the other territory of the Baikal Siberia with the low air humidity, contrasts of daily and seasonal temperatures, development of the seasonal and permafrost condition these conditions were, apparently, unfavorable for such species settling.

## .3 IV. Assessment of Forest Communities Sustainability

For revealing of contemporary area state, assessment of sustainability, functional connections between the components and composite parts of geosystems ecosystem approach has the most importance, its examines "ecosystem in the geographical medium" (Sochava 1978, p. 73). It is treated as revealing of interaction of biota, its elements and environment. Ecosystem approach is developing within the realm of the sciences of biological and geographical cycles: the landscape ecology (Forman 1986), landscape study (Sochava 1978; Mamai 1992), researches of vegetation and ecosystems (Schlueter 1987). The state of elements of physical geographical structures, landscape units of different levels is connected with the existing ecosystem connections, their manifestation in the longterm dynamics through the realization of the manufactured and fixed ecophysiological and genetic properties of plants in the prevailing ecologically differentiated environment.

Ecosystem sustainability depends on the comprising biotic components and stable existing system communications and living environment. Thus, variety and retention of plant communities within the specific territory reflects the stability of the retention of ecosystem connections. One of its characteristics variety of flora composition.

The sustainability of vegetation is considered as the ability of plant communities actively to support and to restore its phytocoenosis structure and regimes of functioning within geosystems (Belov and Sokolova 2011), preserving in this case ecosystem relations and connections. The dynamics of plant communities realizes within the framework of their invariant, which corresponds to the existing stage of the historically prevailing conditions of the natural environment (Sochava 1979).

Under the contemporary physical geographical conditions with the prevailing diverse structure of anthropogenic actions as the basic external disturbing factor, which influences the natural trend of the forests dynamics, it is possible to divide the area into parts of the different temporary sustainability degree and conservation. The whole spectrum of this territory forest communities in the first approximation, can be differentiated to classes, which reflect their retention in up-to-date conditions. It was carried out the ranking, based on the expert assessments of plant communities taking into account their retention and degree of proximity to equifinal stages of successional conversions (table ??

[Nauka and Novosibirsk] , Nauka , Novosibirsk . 266.

[Molozhnikov Vn Rastitelnye Soobshchestva Pribaikalia] , Molozhnikov Vn Rastitelnye Soobshchestva Pribaikalia . Nauka: Novosibirsk 272.

[Novitskaya and Suvorov ()] '1:400 000. Slyudyanski raion Irkutskoi oblasti: pryroda, kxozyaistvo I naselenie. Atlas. Izdvo Instituta geografii'. N I Novitskaya , E G Suvorov . *Rastitelnost. Map. Sc* 2012. (Irkutsk. CD disk)

[Novitskaya ()] *Botaniko-stratigraficheskaya kharakteristika Vydrinskikh bolot*, N I Novitskaya . 1981.

[Challenges of the New Millenium -Our Joint Responsibility: 3 rd European Conf. on Restoration Ecology] *Challenges of the New Millenium -Our Joint Responsibility: 3 rd European Conf. on Restoration Ecology*, 12.

[Mamai ()] *Dynamika landshaftov (Metodika izucheniya)*. Izd-vo Mosk. un-ta, I I Mamai . 1992. Moskva. p. 167.

[Epova NA (1960b) K kharakteristike pikhtovoi taigi Khamar-Dabana Trudy Buryat. Kompl. NII SO AN SSSP] 'Epova NA (1960b) K kharakteristike pikhtovoi taigi Khamar-Dabana'. *Trudy Buryat. Kompl. NII SO AN SSSP* 4 p. .

[Belov and Sokolova ()] *Estestvennaya ustoichivost rastitelnosti geosystem yuga Srednei Sibiri. Geografiya i prirod. resursi*, A V Belov , L P Sokolova . 2011. 2 p. .

[Waide ()] 'Forest ecosystem stability: Revision of the resistance-resilience model in relation to observable macroscopic properties of ecosystems'. J B Waide . *Forest Hydrology and Ecology at Coweeta. Ser. Ecological Studies Analyses and Synthesis* 1987. 66 p. .

- [Geograficheskie issledovaniya vostochnykh raionov SSSR. Izd-vo In-ta geografii SO RAN] *Geograficheskie issledovaniya vostochnykh raionov SSSR. Izd-vo In-ta geografii SO RAN*, p. .
- [Krasnaya Kniga Oblasti (ed.) ()] *Gl. Red. Gaikova OYu. Izd-vo Vremya strans. Irkutsk. 480*, Irkutskoi Krasnaya Kniga, Oblasti (ed.) 2010.
- [Integrated areas of sustainability of plant communities and ecosystems: 1 -stable, 2 -moderatestable, 3 -weak-stable, 4 -unstable, Integrated areas of sustainability of plant communities and ecosystems: 1 -stable, 2 -moderatestable, 3 -weak-stable, 4 -unstable, 4a -unstable anthropogenic transformed. 5 -rare species locations. To stable it is related the plots of the preserved different types forests and other communities, due to their dynamic state close to primary states with the ecologically tolerant conditions for existence and structure renewal, for which is characteristic the stability of spontaneous dynamics, (but at the same time retarded recovery after external structure disturbances)
- [Konspekt Flory Sibiri et al. ()] ; Konspekt Flory Sibiri , Sost , L I Malyshev , G A Peshkova , K S Baikov . *Sosudistye rasteniya*, 2005. 362.
- [Forman and Godron ()] *Landscape ecology*, R Forman , M Godron . 1986. New York: Wiley & Sons. p. 620.
- [Suvorov ()] 'Landshaftno-typologicheskaya structura. Fiziko-geograficheskoe raionirovanie'. E G Suvorov . *Map. Sc. 1:400 000. Slyudyanski raion Irkutskoi oblasti: priroda, 23. khozyaistvo i naselenie. Atlas. Izd-vo Instituta geografii SO RAN*, 2012. (CD-disk)
- [Shelyag-Sosonko Yur et al. ()] 'Metodologiya geobotaniki'. Krisachenko Shelyag-Sosonko Yur , Movchan Vs , Yai . *Nauk. dumka. Kiev* 1991. p. 272.
- [Kolomyts and Sharaya ()] 'Metody ischisleniya ? kartografirovaniya ustoichivosti lesnykh ecosystem'. A G Kolomyts , L S Sharaya . *Izv. RAN. Ser. Geogr* 2013. 6 p. .
- [Yuo ()] 'Nekotorye rezultaty botaniko-kartograficheskikh issledovani Yuzhnogo Pribaikalia Biogeograficheskie issledovaniya v basseine ozera Baikal. Izd-vo In-ta geografii SO RAN'. Medvedev Yuo . *Irkutsk. P* 1986. p. .
- [Suvorov ()] *Obschie fisiko-geograficheskie usloviya territorii. Ekologicheski orientirovannoe planirovanie zemlepolzovaniya v Baikalskom regione. Slyudyanski raion. Izd-vo In-ta geografii SO RAN*, E G Suvorov . 2002. p. .
- [Malyshev and Peshkova ()] *Osobennosti I genesis flory Sibiri (Predbaikalie i Zabaikalie)*, L I Malyshev , G A Peshkova . 1984.
- [Sochava ()] 'Rastitelnyi pokrov na tematicheskikh kartakh'. V B Sochava . *Nauka. Novosibirsk* 1979. 188.
- [Spatial Structure of Mountain Forests of the Lake Baikal Southwestern Coast 2. Epova NA (1960a) Opyt drobnogo geobotanicheskogo raionirovaniya Khamar-Dabana (yuzhnaya chast Srednei Sibiri). Problemy botaniki, 5 p. .
- [Suvorov and Titaev ()] *Struktura landshaftov Yuzhnogo Pribaikalia. Geografia I prirodnaye resursy*, E G Suvorov , D B Titaev . 1999. 4 p. .
- [Van Andel ()] *The interface between ecological restoration and restoration ecology*, J Van Andel . 2002.
- [Schlueter ()] 'Vegetation-ecological characterization and evaluation of natural regions and landscape units'. H Schlueter . *Ecology (CSSR)* 1987. 6 p. .
- [Sochava ()] 'Vvedenie v uchenie o geosistemakh'. V B Sochava . *Nauka. Novosibirsk* 1978. 320.
- [Mch et al. ()] 'Vysokogornaya geoecologiya v modelyakh'. Zalikhanov Mch , A G Kolomyts , L S Sharaya . *Nauka. Moskva* 2010. 487.