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The structure of the plant communities in the different environment contact sites on the base of the soil-geobotanic profiling in the changing climate of Lake Baikal region

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ABSTRACT

The results of studies of the peculiarities of formation of phytocenoses in environments contact sites of the western and eastern coasts of the Lake Baikal has been showed in this paper. On the base of geobotanic profiling combined with soil one, the structure and dynamics of phytocenoses forming under the conditions of mutual development of light-coniferous taiga forest and of extra zonal steppes. Edaphic conditions and placement of phytocenoses are main trigger factors determining the ways of plant cover development in this part of Lake Baikal basin. We discuss the characteristics properties inherent in the linkage of the dynamics and spatial variability of the vegetation with the change of climate in the Baikal region. The regional conditions of the physiogeographic environment had given rise to structurally highly contrasting plant communities in this region. The increase in yearly mean summertime amounts of rainfall, combined with the rise of yearly mean winter temperatures over the last years were conducive to changes in the spatial structure of vegetation. The boundary between the types of vegetation undergoes smoothing. The upper boundary of forest is altered because of changes of the environment that are responsible for the zonality and properties of vertical zonality of the vegetation on the mountains surrounding Lake Baikal. Changes in the vegetation serve as indicators of climate change as well as providing diagnostic tools for the genesis of the Baikal region's natural environment.

Keywords: Phytocenoses; Environments Contact Sites; Soil-Geobotanic Profiling; Spatial Variability of Plant Communities; Taiga-Steppe Communities; Lake Baikal Region

1. INTRODUCTION

The systems of environments contact sites are somewhat models reflecting practically all changes occurring in any hierarchic systems. There are some suppositions on manifestation of polyzonality (binarity) of the environments, especially at the local level of their organization of the background of climate changes. Here, on the author's opinion, the geomorphology peculiarities and edaphic conditions in polyzonality formation at the regional level of the environment organization are manifested. The validity of use of concrete terms characterizing one or other environments is discussed. In particular, conclusions on the opportunity of use the term "zonal habitat" in the characterization of flat interfluve vegetation and soils [1] are very curious. In this context, the use of polysystem modeling method [2] and of ones of systematic mapping analysis of environments organization and dynamics will promote resolution of concrete tasks for indication and forecasting of environments contact systems.

2. BACKGROUND

The vegetation structure of the Lake Baikal coasts reveals a certain relation to the evolution history of the natural environment of the entire Baikal region. In the tertiary era the territory of the present-day some of the part of the Prebaikalia was occupied by broad-leaved forests where valleys and dry depressions between mountains were dominated by xerophyte grass commu-

nities [3,4]. Tectonic movements and changes of climate were responsible for the disappearance of the heat-loving flora. The landscapes of the Baikal region have attained their modern character during the last 10 - 12 thousand years. The development of the vegetative cover in the Prebaikalia dates back to the Holocene [5-7]. Climate fluctuations over the course of the Holocene were responsible for the characteristic properties of spatial variability and dynamics of the interrelationship between the various types of vegetation in the region, in the character of changes in the species composition, of the predominant kinds of layers, and of change sin the areas occupied by different types of communities (forest and steppe communities) at different periods of the Holocene. The relative increase in the amount of yearly mean summertime precipitation and yearly mean winter temperatures [8] qualitatively alter the conditions of the forming environment, the cause for the tendencies of the region's vegetation (and the natural environment as a whole) to develop.

3. AIM AND TASKS OF INVESTIGATION

The aim of our studies is determining of main peculiarities of structural and dynamical communities organization forming under the conditions of mutual development of extra zonal steppes and taiga with identification of nowadays tendencies of communities genesis under the conditions of changing climatic situation and of dynamics of anthropogenic impacts in the region.

The selection of a territory where profiling is to be performed requires always natural phenomenon analysis, its concrete characteristics or a particular structure and is always individual. The relief structure, taking into account differences in relative heights, the situation of a territory in a mountain system, if available, as well as driangle system analysis (river basin, lake coasts, etc.) determine the profile site and length. A geobotanic profile aimed to reveal the spatial variability of communities structure is established taking into account the peculiarities of vegetation on a territory depending on the range-topologic, regional, zonal, etc. One of the methods for revealing structure, spatial variability and interaction of phytocenoses in environments contact sites with edaphic conditions, on our opinion, can be combined soil-geobotanic profiling. Due to the application with materials of perennial monitoring and geobotanic survey, soil-geobotanic profiling favored the resolution of such tasks as establishing of the structure of communities forming at mutual development of forests and extra zonal steppes, correlation of phytocenoses with soils, as well as allowed to generate some forecasts. The profiles were designed with the aim to present all the diversity of phytocenoses and soils at the contact site of taiga and extra zonal steppe as completely as possible. The profiling was carried out at key sites using basin approach in environmental studies, in this case-within boundaries of rivers basins at the coasts of Lake Baikal. A highly instructive example with regards to identifying the dynamic properties of the communities that develop in the zone of contact of the types of vegetation, and the factors that are responsible for them, is provided by a publication [9] which treats the problem of vegetation changes in the "forest-steppe" ecotone zone in Northern Patagonia.

4. RESEARCH METHODES AND AREAS

This study is based on using the method of large-scale mapping of the vegetation in conjunction with field aerospace photography interpretation of a different scale, by generating maps on a scale 1:25,000 - 1:100,000. By laying profiles and using geobotanical descriptions for different years, it was possible to identify areas reflecting the whole spectrum transect-of the typological composition of the region's communities. These model areas are representative throughout the entire spatial structure of vegetation and were the objects of monitoring of the dynamics and genesis of communities that develop in different environmental conditions and reflecting different types of the region's vegetation. A many-year (15 years) monitoring in the model areas using aerospace photographs from different years (1972-2002) for the territory of the some parts of the Prebaikalia was instrumental in revealing the typological composition of communities, with a certain set of plant species, diagnostic tools for communities of different conditions of development. The set of model communities reflects the whole spectrum of ecotope conditions, the spatial variability, and dynamic trends of the modern vegetation in the changing climate of the region. The areas our investigation are coasts of the Lake Baikal at all.

5. RESULTS

The history of investigations into the vegetation of the basin of Lake Baikal was most thoroughly described. The cited reference gives a detailed outline of all main stages of botanical studies in the region. The characteristic features of the floristic and phytocenotic composition of vegetation were addressed by many workers engaged with the study of the vegetative cover of the region [10]. The vegetation structure in the studied area reflects some links with the history of environmental development in the whole Baikal region. For example, during Tertiary, on the territory of modern Pre-Baikal there were broadleaf forests, in the valleys and dry cleavages herbaceous xerophytic communities dominated. Tectonic shifts and climate changes caused disappearance of heat-loving flora. Formation of nowadays landscapes in the Central Baikal and one of modern vegetation in the Western

coast of Lake Baikal are related to Holocene. Climate oscillations during Holocene determined the peculiarities of spatial variability and relationship dynamics between different vegetation types in the region, in particular, variability of areas occupied by forest and steppe phytocenoses during different Holocene periods. During last decades, climate in the Lake Baikal coasts considerably varies. Average annual winter temperatures and average annual precipitation in summer increase.

Many researchers consider steppes in taiga zones as relicts which remained since vegetation formation during xerothermic periods. V. B. Sochava and V. V. Lipatova [11] believe that steppe communities (steppoids) formation is the reflection of regional topologic peculiarities on the environment in the spatial structure of the vegetation cover of a concrete territory. In their opinion, such communities are not native, and during neogenetic changes they are replaced by forest ones. It is in accordance with the opinion of Ya. P. Preyn [12] who affirmed that all steppe islands (out of steppe zone) have a temporary character of their existence it is so. The modern structural and dynamic organization of vegetation on the background of climate dynamics allows us to support a viewpoint concerning the formation of communities in the area studied as a result of climatogenic succession, secular dynamics and forests evolution with formation of taiga-steppe communities specific for the Pre-Baikal territory.

5.1. Current Structure of the Region's Vegetation

The main spatial structural-typological characteristics and dynamic attributes of the Prebaikalia's vegetative cover were represented on the small-scale map of vegetation for the southern part of Siberia. According to the scheme and principles of forest-vegetation regionalization of the mountain territories of Southern Siberia, the forests of the study area were assigned to the Prebaikalia's mountainous forest-vegetation province of larch and pine forests, of the Primorsky district of sub-taiga-forest steppe pine (*Pinus sylvestris*) and mountain-taiga larch (*Larix sibirica*) forests. These forests occupy the Primorskaya and Baikalskaya (southern part) mountain systems too. Here there is a pronounced Prebaikalia's sub-boreal dry type of zonality due to increased aridity of climate that is caused by the position of the territory in the systems of the Baikal region's mountains. The basis of the region's forest vegetation is formed by pine (*Pinus sylvestris*), shrub (*Rhododendron dauricum*, *Duschekia fruticosa*) and grass, green-moss forests of the lower parts of slopes, and shrub (*Rhododendron dauricum*) grass pine stands of the gentle southward slopes, in combination with shrub and foxberry (*Vaccinium vitis-idaea*) grass forests of slopes of different exposures. Shrub (*Rhododendron dauricum*) sedge-grass-moss larch stands develop in the lower and middle parts of slopes of different exposures. Along the bottoms of valleys between mountains, ridges and slopes of southward exposure there occur steppe-like grass larch stands. All of these forests are, to some extent, in contact with steppes to form ecotone features. Pine shrub (*Rhododendron dauricum*), green-moss grass and grass-steppe-like forests hold a central position, which-in combination with the steppes-develop along insolated slopes and can reach the sub-golets zone.

The region's steppe vegetation reflects the traits inherent in the steppes of the South-Siberian formations that refer to the Mongolian-Chinese of the formations. The communities are dominates by grasses, in combination with steppe shrubs. The mountains of South Siberia are characterized by a combination of forests and steppes on slopes of eastward and southward exposures. This is typical of the mountains of Tuva, Altai, and Western Transbaikalia too. Although the steppes of the western Prebaikalia are ascribed to the mountain-steppe zone, they have an island (extrazonal) character. The development of the steppes of the western Prebaikalia is associated with the character of their exposure and the stone composition of the substrate, the insufficiency of rainfall, and with strong winds that intensify transpiration in plants. Overall all steppes of the Baikal region bear specific traits that reflect the evolution of the flora and vegetation of the region.

5.2. Soil Structure of the Region's Vegetation

Soils types characteristic for the steppes areas-mountain-chestnut colored with salinization cases together with grey forest soils occur in the area studied. A more detailed structure of soil cover is given in the papers by some scientists determining soils types which were not reported for this region before. Ts. Kh. Tsybzhitov *et al*. [13] give rather unambiguous soils characteristics, stating that the base of the soil cover consists of peat-humus taiga-permafrost gleys together with gley permafrost podzols, typical brown forest soil and acidulous taiga sod. Soils are characterized from viewpoint of height and exposition heterogeneities of the relief on the territory considered. Lithogenic coarse-humus, brown forest soil, podzols; primitive organogenic-rubbly (taiga-lithogenic), sod-podzol and sod forest; sod lithogenic, sod forest and sod-carbonatic; sod-forest-steppe, mountain-steppe carbonate-free, mountain chernozem-like, mountain-steppe-chestnut-colored-like soils are determined. On the slopes of different expositions and watersheds organogenic rubbly taiga (forest) soils develop often jointly with brown soils, sod-forest ones with fragments of steppe carbonate-free ones and organogenic rubbly weakly developed

ones. Steppe soils are underdeveloped and not always correlate with steppe communities; they are often developed under forests. On the sites of southern exposition slopes and on flattened surfaces with dense carbonatic rocks, a friable loamy-sandy humus grey horizon with unexpressed structure is characteristic. Such soils are related to humus carbo-petrozems, a subtype of dark-humus carbo-lithozems. Contrary to the opinion existing before on a wide distribution of chernozems and chestnut-colored soils, organogenic-rubbly, chernozem-like-carbonate-free grey forest and sod forest steppificated soils dominate in the region.

5.3. Soil-Geobotanic Profiles

Tracing of soil-geobotanic profiles on the key sites reflecting the most diverse forms of forests and steppes contacts allowed, in the different parts of Lake Baikal coasts, to reveal the territorial diversity of the communities cenotically and typologically as well as cenoses correlation with the relief structure and with the conditions of communities habitats. The revealed character of alternation of forest and steppe communities under the conditions of extrazonality suggested that there are no clear floristic and cenotic links with edaphic conditions (mainly with soils) in the area studied in difference with zones or sub-zones (wooded steppe, sub-taiga). Here extra zonal effects are the most expressed in the vegetation development with manifestation of continuality (course) when there are in the communities species characteristic for dark-coniferous-light-coniferous taiga as well as xerophytic plants which make a base of cereal-motley grasses and petrophytic steppes. The occurrence of the arboreal vegetation of different ages in steppe communities under the form of their gradual spatial expansion, suggest mutual development and integrity of forest and steppe communities as of a united system. The formation of taiga (forest) soils here without a clear connection of steppificated soils with steppe communities shown by soil profiles combined with geobotanic ones confirms as well the opinion on the development of taiga-steppe communities specific for the area studied as on a peculiarity of the dynamics of forest type vegetation in the area studied.

5.4. Soil-Geobotanic Studies

Soil-geobotanic studies in the region allowed to reveal the peculiarities of phytocenoses dynamics reflecting present-day tendencies of vegetation cover development due to changing environmental conditions-humidity increase in summer and increase of average annual temperatures in winter. Good indicators of such changes are taiga-steppe communities of the central part of Lake Baikal coasts manifesting the peculiarities of relationship in spatial variability of forests and of steppes communities. These communities formed by plants species with different ecological amplitudes respond very rapidly and reflect visually changes in ecotops conditions at topological and regional levels of environment organization. The presence of one or other plant species (or species group) in a concrete community allows to suppose dynamic tendencies of vegetation due to environmental changes.

Taiga-steppe communities on all the coasts of Lake Baikal can be representative models reflecting peculiarities of structural-dynamic organization of the vegetation on the background of climate dynamics in the region during last decades. The structure of the taiga-steppe communities may be represented as a system where the coenoses consist of the tree layer dominated by *Pinus sylvestris* or *Larix sibirica.* (depending on the genesis or on the recovery stage) of different age groups. The character of occurrence of *Betula platyphylla* and *Populus tremula* in tree stands is taken into account according to the genesis or recovery stage. Undergrowth is notable for an abundance of *Rhododendron dauricum* and *Duschekia fruticosa*. The soil cover includes the species composition of different variations, and often complexes of *Vaccinium vitis-idaea*, *Bergenia crassifolia*, sinuosities of *Pleurosium Schreberi*, *Dicranum polisetum*, *Climacium dendroides*, *Rhytidium rugosum*, and for the involvement (predominance) of xerophytes, such as *Festuca lenensis*, *Thalictrum foetidum*, *Artemisa frigida*, *Chamaerthodos altaica*, *Iris humilis*, and others. The taiga-steppe communities are characterized by the one- or two-age composition of tree species, and by the polydominance of the shrub zone and grass cover depending on the type of coenose habitat. Taiga-steppe communities are notable for dramatic restructurings of their vertical and spatial coenostructures. In additional to the development of stable young trees consisting of *Pinus sylvestris* and *Larix sibirica* in forest stands, tree ecobiomorphs are observed to actively penetrate into grass communities forming part of taiga-steppe communities in the form of curtains or isolated undergrowth aged 5 - 15 years. In recent years, the composition of grass communities, with xerophytes forming their basis, such as *Artemisa commutata*, *Heteropappus altaicus*, *Phlomis tubirosa*, *Poa attenuata*, and *Agropyrom cristatum*, revealed saplings of tree species, pine and larch. Also, the boundary is disappearing between forest and grass phytocoenoses. The composition of the soil cover shows an ever increasing predominance of forest species with a spatial increase of sinuosities of *Drepanocladus uncinatus*, *Mnium cuspidatum*, *Dicranum polisetum*, *Rhytidium rugosum*, and *Vaccinium vitis-idaea*. A central position in grass stands corresponds to *Astragalus versicolor*, *Galium verum*, *Aster alpinum*, *Trifolium lupinaster*, *Potentilla tanacetifolia*, and *Campanuta glomerata*, whereas steppe herbage: *Festuca le-*

nensis, *Koeleria cristata*, *Poa attenuata*, and *Agropyron cristatum*, are somewhat less abundant and are the stage of dynamics of the community during the growth period.

5.5. Some Examples of the Connections the Spatial Structure of Plant Communities with the Soil

It is to notice thereupon that the spatial structure of the vegetation in the area studied is particular because forest (taiga) and steppe communities form often on the same soils quite uncharacteristic for zonal steppes. Modern processes of cryolithogenic humus formation due to modern environmental conditions, to the history of formation and to vegetation cover genesis suggest that the base of soils formation is a "forest type" with some specific features due to the situation of the territory studied in the mountain system of the Lake Baikal region.

e.g., pine with motley grasses, larch (*Larix sibirica*)-pine (*Pinus sylvestris*) motley grasses-cereal forests and steppe communities with cereals domination form on organogenic rubbly-taiga (forest) soils on the slopes of different expositions. On the same soils, larch-pine sparse grass forests and steppe polydominant communities, as well as larch-pine-rhododendron ones (*Rhododendron dauricum*) with *Dushekia fruticosa*, red bilberries (*Vaccinium vitis-idaea*) with motley grasses ones from different habitats are developed. On chernozem carbonate-free soils, there form pine-larch forests and motley grass-steppe communities, as well as larch-pine rhododendron forests with *Spiraea media* Fr. Schmidt on the slopes of South-Western expositions. For organogenic-rubbly steppe soils from different slopes expositions, the presence of sparse larch groups with developed underwood expanding out of a canopy among motley grass steppe communities is characteristic. In a new soil of larch-pine-rhododendron forests and larch-motley grass forests developing on sod-forest and sod-brown soils a considerable role belongs to mosses characteristic for polydominant dark-coniferous-light-coniferous taiga. On regosols with rocks outcrops there form everywhere motley grassed sparse pine groups with underwood and steppe communities of petrophytic series. Motley grassed steppe communities with several pine-trees aged from 2 to 60 years, are found on podzol permafrost soils jointly with organogenic-rubbly taiga (forest) soils on the slopes of different expositions.

Forest species have improved their position in the ground layer, and synusiae with *Drepanocladus uncinatus*, *Mnium cuspidatum*, *Dicranum polisetum* have expanded. Such tendencies of changes in the cenotic structure of communities on contact between forest and steppe are characteristic of the vegetation of the research area. During the past decade larch seedlings and young trees have appeared in herbaceous communities dominated by xerophytes (such as *Heteropappus altaicus*, *Phlomis tuberose*, *Poa botryoides and Agropyron cristatum*) and, hence, the boundary between forest and herbaceous phytocenoses has become less distinct. Young trees often form individual phytocenoses beyond the forest canopy. The area occupied by steppe communities has decreased over the past 30 years, which is confirmed by results of a comparative analysis of satellite images obtained between 1972 and 2002. Current natural processes going on the coasts of the lake Baikal have the paradoxe features. On the one hand it is observed expansion of forests in limits extrazonal steppes and development of mezophytisation of vegetation. On the other hand there is no essential increase of the wood increment of the main coniferous trees, though these trees intensively expand into steppe zone. The reason of these processes be the increasing of the air temperature connection with might of humidification during the one year. The maximum of disproportion precipitation during a summer period is shifted to late summer and autumn. Similar structure-dynamic peculiarities of phytocenoses and of soils in the contact zone of larch forests and extra zonal steppe cenoses are found out also at other key site. Here the boundaries of links of taiga-steppe communities with edaphic conditions are more unclear independently on types of phytocenoses habitats.

6. DISCUSSION

Many years of studies of the region's vegetation revealed some structural and dynamic features of the plant communities that reflect the present tendencies of development of the vegetative cover in connection with the changing environmental conditions: an increase in moisture content in the summer season, and the rise of yearly mean winter temperatures. Communities that develop in conditions of contact of the forest and steppe types of vegetation in the region may serve as good indicators of such alterations. These communities are formed by plant species with different ecological amplitudes; they respond very rapidly to and visually clearly reflect changes in ecotope conditions at the topological and regional levels of organization of the natural environment. The presence of a particular plant species (or a group of plants) in the composition of a community of the transitional type between forest and steppe suggests that there are dynamic tendencies of the vegetation in connection with changes in the ambient environment. One of such model objects that accumulate the consequences of dynamic changes of the main parameters (rainfall, temperature) if the climate in the region does include the taiga-steppe communities. Occurring throughout the western Prebaikalia, such communities are representative models for monitoring the changes in the natural environment for the last 100 years. During the last several decades the

trends of development of the region's vegetation in ever changing conditions (an increase in yearly mean summer rainfall and yearly mean winter temperatures) reflect an increasingly more gradual character of the forest to steppe transition thus smoothing away the boundaries between forest and steppe and reducing the size of territories occupied by steppe communities. In some cases it is difficult to draw a demarcation line between steppe and forest. In this connection, the problem of interrelationship between forest and steppes acquires a different aspect-the dynamics of climate at a local-regional level is becoming a decisive factor of development of the vegetation and, as a result, of the entire natural situation in the region. Along with a secular dynamics of the taiga whereas a consequence of the internal (coenotic) environment of phytocoenoses-there is occurring a change of forest-forming species. There are taking place spatial changes in the structure of communities, with an increasing predominance of mesophytes, or plants that demand increased moisture content of their habitats.

The results of studies of phytocenoses in the contact zone between taiga and extra zonal steppes in the some parts of the coasts of the Lake Baikal have shown that at present, rather considerable changes in the vegetation development occur in this region. The data obtained allow to afform that xerophytic vegetation here is not zonal one, but these are dynamics of forest type vegetation under the conditions of aridity coming at late stages of Holocene on the background of anthropogenic impact during several centuries. The structure of soil cover and the character of soils formation, data of recent paleogeographic studies suggest that steppe vegetation of the area studied has a temporary character and reflects specifics and dynamics of forests evolution. Communities of the coasts of the Lake Baikal as a stage of coniferous forests formation at the present stage of vegetation development are indicators of character of environment formation in the whole region.

7. CONCLUSIONS

Due to the peculiarities revealed among spatial-structural links of soil vegetation and soil cover in the area studied using combined soil-geobotanic profiles on the key sites, it is possible to make a conclusion that it is not so rightful to characterize the vegetation as forest and steppe types. In this very case, forest and steppe communities at environments contact site (taiga-steppe) are genetically united. Under the contrast conditions of the environment of the area studied, vegetation formation is due to climatogenic paragenesis as indicated by the results of our studies.

The present-day tendencies of vegetation development reflect a transitional character of the steppes in the central part of the coasts with tendencies of disappearing of a boundary between forest and steppe communities. Thereupon the problem of finding out the character of relationship between forest and steppe communities is brought to the task to determine a way and dynamics of climatic factors at local-regional level under the conditions of changing of the environment as a whole. Along with secular dynamics of taiga, when due to changes in the internal (edapho-cenotic) environment of phytocenoses, forest-forming species change, and there are other changes in the spatial structure of the communities. On upper soil cover in the forests, spatial expansion of mosses synusia characteristic for a polydominant dark-coniferous-light-coniferous taiga occurs. Appearing of *Pinus sibirica* underwood among light-coniferous forests can also suggest that in this region, along with recoverable vegetation dynamics, there occur change sin communities structure responding to changing climatic situation in this region. It is to notice thereupon that among the forests of Primorsky and Baikal'sky Ridges a stable canopy is forming of tree species more exigent to humidity-*Abies sibirica*, *Picea obovata*. Among mountain tundras there are some trees *Pinus sibirica* and *Abies sibirica* aged from 2 to 20 years too.

The presence of undergrowth and pine and larch saplings in steppe grass communities is indicative of trends toward a spatial expansion of tree ecobiomorphs in connection with an increase in yearly mean precipitation in the Baikal regiona for the last 30 years. There has been a reduction of areas occupied by steppe communities, and an active penetration of mesophytes into steppe coenoses. There is a spatial expansion of mosses characteristic for the polydominant light-coniferous-dark-coniferous taiga. The appearance of undergrowth of *Pinus sibirica* in the composition of light-coniferous forests is a further indication that the region undergoes a change of climate towards an increase of moisture content and temperature. This is also supported by structural changes in the composition of the region's dark-coniferous forests where the forests of *Pinus sibirica* develop a stable canopy of tree species demanding more moisture content-*Abies sibirica*, and *Picea obovata*. The sub-golets zone of the mountains surrounding Lake Baikal reveals individual *Pinus sibirica* and *Abies sibirtica* trees, which indicates a change of the forest boundary, with a tendency towards an increase and forestation of the territories occupied by mountain-tundra plant groups as well.

The spatial variability in the structure of the plant cover reflects changes of the climate occurring during the last several decades in the Baikal region. The vegetative cover in this case serves as an indicator of the changing natural situation in the region. This would be reflected not only in the formation of the environmental conditions for the period of relative warming, as was the case at different stages of the Holocene, but also in the

policy of economic development of the region as a whole. Steppe communities in this region are extrazonal, and complex of the soils more characteristic for light-coniferous zonal forest.

So, soil-geobatanic profiling are reflection and indication of the genesis direction and ties between type of the plant communities and type of the soil for all. In our case it make place between extrazonal steppe and the zonal forest around of the Lake Baikal everywhere.

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