Preservation of the natural potential of vegetation. Assessment in landscape planning

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Abstract. The priority purpose of landscape planning is preservation of natural environment with existing ecosystem interrelations under prevailing conditions for the territory development. Analysis of the contemporary state of plant cover is component part of the comprehensive program of studies on landscape planning, which reveals dynamics of vegetation, territorial differentiation, biological variety, degree of territory disturbance communities, and potential of their preservation. Natural stability of vegetation, which is supported not only at the level of biocenosis, but also at the level of spatial current connections of contemporary landscape, is one of the main conditions of preserving the biotope structure. Particularities of development and nature restoration determine ecologically favorable conditions of existence and renewal of plant cover structure. External disturbing factors set additional constraints on the motion of natural dynamics, slowing down restoration or completely leading to irreversible changes. The evaluation of sustainability of plant communities for the southern part of the Lake Baikal coast was carried out on the basis of expert estimation for multifactorial impacts upon dynamics and was represented using a cartographic method in the form of integrated areas of the sustainability of plant communities. Cartographic interpretation of contemporary vegetation state of investigated territory, the determining of the integrated areas of plant community’s sustainability, and further sequential carrying out of interconnected estimation maps, makes possible to differentiate territory in the categories of landscape planning for the complex preservation of natural environment and to develop the necessary measures for stabilization.

1. Introduction
Ecologically oriented nature management in the regions, with the prevailing particularities of the natural territorial structure and diverse anthropogenic activities, is directed toward the preservation of the natural potential of biota within the territory under contemporary conditions of the natural components dynamics and economy development [1, 2]. Vegetation, from one side, acts as the indicative component of the biota state and ecosystems as a whole, from another side, it is characterized existing natural variety. The variety of vegetation and the nature of its spatial distribution determines the natural potential of sustainability.

Landscape planning on the basis of the complex territory survey and indicative properties of nature components (nature environments) gives the estimation of state and possible use for economic activities (nature management) of both isolated grounds and of the entire territory as a whole.

2. Models and methods
The analysis of the contemporary state of vegetation cover in the landscape planning is a component
part of comprehensive program and it is carried out during field survey /observation of territory with the use of topographic maps, forest survey materials of different years, remote sensing data, and existing thematic maps. Studies for the vegetation block are conducted to reveal the differentiation of the plant cover structure, biological diversity, rate of territory disturbances and to determine the dynamic state of plant communities for the assessment of anthropogenic impact on the vegetation dynamics under conditions of the current and planned economic activity. Cartographical methods used practically and approved principles in different regions are basic to collecting and representing materials on vegetation of the territory [3]. Using obtained complex inventory data with the data of geobotanical inspections, the ranking of plant communities according to their preservation conducted, based on the expert evaluation, taking into account the multiple-factor influence on the dynamics.

Such approach was applied for researches on ecologically oriented nature management within the Baikal region: in Olkhonskii and Slyudyanski districts, at the Sarma field station; and for engineering researches of oil-pipe line Eastern Siberia - Pacific Ocean, gas pipe line Sobolevo – Petropavlovsk-Kamchatskii, for ecological impact study/feasibility report on Kovyktinskoe condensed gas deposit and others [4-6].

The preservation of the natural potential of vegetation is tightly connected with the sustainability and the sensitivity of phytocenosis to the external disturbing factors, which impact on the natural course of the ecosystem dynamics. The vegetation sustainability is considered as the ability of plant communities to actively preserve (to support and/or to restore) its phytocenosis structure and regimes of functioning in geosystems [7, 8], preserving ecosystem relations and connections in this case [9]. All existing spectrum of plant communities of some territory we can differentiate in grades of sustainability according to their preservation current conditions. This is necessary to depict in resulting materials of landscape planning, taking into consideration every nature components and economy perspectives of territory developments. In the category ‘preservation of the existing land use’ the stable-derived background communities with the natural potential is usually included.

3. Results and discussion

Based on the example of the territory of the southwestern Baikal region with the contrasting mountain taiga natural conditions, spatial cenosisis structure of plant communities, which characterizes their contemporary state, is examined and mapped [10]. The distribution of the alpine, mountain taiga of different altitudinal belts and submontane depression vegetation of South-Siberian and Baikal-Dzhugdzhur formations was studied.

The evaluation of the sustainability of plant communities was carried out on the basis of the expert estimation and represented by cartographic method in the form of integrated areas of the sustainability of plant communities and ecosystems for the southern part of the Lake Baikal coast (table 1).

| Sustainability level | Plant communities’ indicators                                                                 | Special features of development conditions and the nature of recovery                                      |
|----------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| **1. Stable**        | High mountain mountain-tundra willow-ternik and swampy sedge-cotton grass flattened            | Retard recovery under external disturbances.                                                            |
|                      |                                               |                                                                                                         |
|                      | Siberian dwarf pine of subgoletz woodlands                                                   | Low biotic diversity. Retard recovery after external disturbances.                                      |
|                      | Mountain taiga and submontane depression primary dark coniferous and light coniferous of slopes and of valleys | Ecologically favorable existence conditions and structure recovery. Optimal and partially limited development. Stable in spontaneous dynamics. |
| Type                | Description                                                                 |
|---------------------|-----------------------------------------------------------------------------|
| 2. Moderate-stable  | Bogs and swamped meadows: Of optimal development. Prolonged-derived recovery stages under periodic anthropogenic impacts. |
|                     | High mountain mountain-tundra of slopes: Delayed recovery under external disturbances. Intensive slope processes. |
|                     | Subgoletz dark-coniferous sparse woods, Siberian dwarf pine communities and shrub thickets: Low biotic diversity. Delayed recovery after disturbances. Intensive slope processes. |
|                     | Sections of subalpine meadows and catchment lows: High biotic diversity. Retard recovery after disturbances. |
|                     | Dark coniferous sparse woods with meadows by places of upper belt of reduced development: Narrow ecological species amplitude. High biotic diversity. Of limited development conditions. Slope processes. |
|                     | Dark coniferous sparse woods of reduced development upper belt, subshrub with Siberian dwarf pine: Of limited development conditions. |
|                     | Mountain taiga primary dark coniferous at steep slopes: Active slope processes. Of limited development conditions. |
|                     | Mountain taiga and submontane depression light coniferous prolonged-derived of successional stages and shrub-gramineus-forb meadow prolonged-derived: Of limited and optimal development conditions. Active slope processes. Under periodic anthropogenic impacts. |
| 3. Weak-stable      | High mountain alpinotype short grass meadow communities: Narrow ecological species amplitude. Active slope processes. |
|                     | Mountain taiga primary dark coniferous and sparse wood with Siberian dwarf pine of reduced development upper belt at steep slopes: Of limited development conditions. Intensive slope processes. |
| 4. Unstable         | Mountain taiga of different altitudinal belts, including false-goletz belt, of small-leaved short-time-derived successional stages: Favorable conditions of structure recovery. Intensive slope processes. |
|                     | Unclosed groups of grasses within high mountains with active slope processes: Active denudational processes. And unstable recovery under changeable conditions. |
| 4a. Unstable anthropogenic transformed | Stable-derived communities of active land use: Stable under constant anthropogenic impact. |

Grounds with the primary and weakly disrupted communities under the uniform conditions of the localities, which have the stable natural dynamic state and positive forecast of restoration, are related to stable. There equifinal succession forms of communities prevail.
Grounds with the primary and prolong-derived communities were related to moderate-stable. Their peculiarity is active manifestation of the repetitive external factors of impacts, predominantly of exogenous processes, which retard or change natural spontaneous dynamics and so they are of the limited development. Narrow ecological range, caused by factoral limited conditions for the development, such as temperature and altitude, and by the exogenous processes of relief formation promotes the development of weak-stable communities.

The sections were related to unstable, characterized with short-derived communities of restoring states of different types of mountain taiga geosystems and with the high mountain communities under the extreme ecological conditions, and of also anthropogenically changed with the stable-derived communities of active land use.

The obtained cartographically integrated areas of stability can have the fragmented mosaic of spatial structure, which includes different communities, and consequently have the distinguished mechanisms of preservation.

For preservation of the ecological prosperity of the territory in planning of new economic activity, according to the procedure of landscape planning, the estimation of the value of plant communities in qualitative gradations (very high, high, average and low) is conducted.

In this case we use the criteria of particularly significance for the region of the investigated territories: primary and rare communities, populations of rare species, valuable communities with priority functions for water protection and environmental preserving. During the estimation of the rare species populations the category of rare species status is taken into consideration. High value of importance (significance) is assigned to territories with plants and animals under the threat of disappearances, with the reduced number and the low natural population. The sensitivity of plant communities to the main disturbing factors, exerting by the planned activity such as fires, erosion, pollution, and other, is evaluated also in four gradations named above.

The phytocenosis sensitivity should be examined in close connection with the natural sustainability of ecosystems in the integrated areas, which present the naturally prevailing conditions of preservation of plant communities of the different stability categories. In accordance with the obtained characteristics evaluation and analytical maps are compiled/elaborated, which are the foundation for the integral map, which serves as basis for zoning and determining the use purposes and further development in categories: preservation of the existing use, development of the existing and planned use, improvement (sanitation).

Category the preservation of contemporary state presupposes refusal of the land use. There are communities with the primary structure, rare associations, communities which contain the populations of rare species and having determining water protection and environmental preserve functions. Here refusal of the forestry activity and refusal of any activity, except existing, is assumed. Into the category of development of the existing and planned use mostly the middle importance communities are included, which are actively utilized by population. This category supposed the regulation of activities that lead to the degradation of ecosystems, ecological examination of harmful productions, ordering of anthropogenic loads, and optimal use of forest resources. The cenosis of low- and middle importance with the tough disrupted structure by industrial fellings and fires and other economic activity through zoning, falls into the category of improved (sanitized) lands, where measures for preservation are recommended (for example, restoration series of Pinus sibirica forests) or extensive use. In this case it is expedient to take into account the structure of the integrated areas of the sustainability of plant communities.

4. Conclusion
The priority purpose of the landscape planning of a territory is the preservation of natural environment with the existing ecosystem interrelations. The natural sustainability of vegetation, which is supported not only at the level of biocenosis, but also at the level of the spatial connections of the state of contemporary landscape, is one of the main conditions of preservation of the biotope structure.
Cartographic interpretation of the contemporary state of the vegetation of the territory is investigated, the determining of the integrated areas of the sustainability of plant communities, and furthermore sequential carrying out of interconnected estimation maps makes possible to differentiate territory in the categories of landscape planning for the complex preservation of natural environment and to develop the necessary measures for the stabilization.

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