New Concept of Digital Structuring Landscape of the Island Systems of the Vladivostok City District

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Abstract

A new concept of digital vector-layer structuring of landscape space at the local level (on a scale of 1:25,000) is considered on the example of Russian island and adjacent island systems of the Vladivostok urban district. Synthesis, analysis and evaluation of the internal and external content of landscape systems are carried out and altitude complexes of tracts are identified, in each of which altitudes are distinguished. It is noted that one of the main criteria for identifying high-altitude complexes and levels is the high-altitude criterion and the quantitative and qualitative changes in their internal content, taking into account the state of erosion-denudation lowland and mountain landscape systems formed under the influence of the Earth’s real material-energy flows and first of all gravitational energy. According to these criteria, landscape areas are classified and vertex, saddle, upper slope, middle slope and other altitude complexes of tracts are distinguished in each of which altitude levels are distinguished. Structuring and classification proposed to the reader are presented for further study of structures as objects of industry-specific indication and possibilities of using high-landscape complexes as development areas. Noted, as well as the fact that the study was conducted for the first time and is aimed at the practical implementation of the landscape approach in the development of landscape systems, defines the relevance of the work performed.

Keywords

Concept, Digital, Structuring, Landscape, Tract, Complex, Level, Relief, Development

1. Introduction

The article proposed to the reader is a continuation of the presentation of the
results of the research of the Far East Federal University Pacific International Landscape Center on the strategic program study of the Pacific landscape belt of Russia. In this article for the first time proposes a new concept of digital vector-layer structuring of landscape space at the local level (on a scale of 1:25,000) using the example of Russian island and adjacent island systems of the Vladivostok urban district. Previously, this could not be done. This is due to the fact that there was no published in the open press morphological digital vector-layer map of the tracts and groups of tracts of the territory under consideration. In 2018 at the Far East Federal University Pacific International Landscape Center under the guidance of Professor V.T. Starozhilova such a morphological map (that is, a digital map of the geographical structure) was compiled and published (Starozhilov, Oznobikhin, Dedeva, & Kudryavtsev, 2018). With the advent of such a cartographic basis, aimed at the practical implementation of the landscape approach during development, it became possible to carry out a synthesis, analysis and assessment of the internal and external content of landscape systems and to identify high-altitude complexes of tracts, each of which has high-altitude levels. The classification is based on the synthesis, analysis and evaluation of the lithological-geomorphological structure, the fundamentals of landscape, taking into account the landscape-forming orographic, climatic and phytostating factors, marginal continental dichotomy, the nature of the development of erosion-denudation and other geosystems. One of the main criteria for identifying high-altitude complexes and levels is the high-altitude criterion and the quantitative and qualitative changes in their internal content, taking into account the state of erosion-denudation lowland and mountain landscape systems formed under the influence of the Earth’s material-energy flows and first of all gravitational energy. According to these criteria, landscape areas are classified and vertex, saddle, upper slope, middle slope and other altitude complexes of tracts are distinguished in each of which altitude levels are distinguished. Structuring and classification proposed to the reader are presented for further study of structures as objects of industry-specific indication and possibilities of using high-landscape complexes as development areas. Noted, as well as the fact, the study was conducted for the first time and is aimed at the practical implementation of the landscape approach in the development of landscape systems, determines the relevance of the work performed.

2. Materials and Methods

Considered unpublished materials of the results of field scientific and practical geological, geographical and geographical long-term research about. Russian (as an object of Southern Primorye, materials are in the funds of “Primgeolkom”). The work is based, first of all, on the author’s results obtained when conducting special predictive geological and geographical assessments of the prospects for the 1980s about. In Russian island of location quartz-feldspar raw materials for the production of porcelain, as well as prospects for the discovery of phosphate
rock. State tasks, works were performed using not only geological, but also geographic integrated methods. As a result, field materials were obtained on geology, geomorphology, vegetation, moisture, water exchange, erosion-denudation systems, and other components of the internal contents of landscapes. In addition to these materials, materials from field work performed in 2014 (Starozhilov & Oznobikhin, 2015), as well as the results of route profiling and interpretation of satellite images made by the author and graduate students of the second year of study Kudryavtsev A.A. and Deleva A.A. Materials of correlations and inter-relationships of rather significant data samples were studied not only on relief, vegetation and soils, but also on bedrock and loose rocks, climate. Also, the power of loose accumulations, transit of detrital material, moisture, depth of cut, thickness of dismemberment, intensity of physical and chemical weathering, meso and microclimatic features were analyzed. First of all: solar radiation and radiance, temperature, wind, humidity, precipitation, snow cover, depth of freezing, various natural and extreme phenomena. In addition, based on the presentation of the significance of all components and factors of the landscape, including the foundation as a material component and a factor of its dynamics, we studied the high-altitude complexes of the tracts as a fundamental and loose foundation.

The materials of perennial (more than 30 field seasons) geological and geographical studies of the nature of the Pacific landscape belt of Russia were also used (Figure 1).

As the cartographic basis, the author’s Landscape Map of the tracts and tracts of the tracts was used. Russian and adjacent islands of the Vladivostok urban district in the scale of 1:25,000 (Starozhilov, Oznobikhin, Dedeva, & Kudryavtsev, 2018).

In the study applied methods: the method of conjugate analysis of intercomponent and interlandscape connections of landscape components (basement, relief, climate, water, vegetation, soil); the method of typological mapping in the classification system developed by us: tract, terrain, species, genus, subclass, landscape class; the concept (methodology) of the vector stratified landscape zoning and the study of the hierarchical structure and internal geographic content of the taxons of such zoning within the framework of mountain landscape science.

3. Results

In general, based on the analysis, synthesis and evaluation of significant field and theoretical material, the fundamental result of these studies has been established, namely, to implement the concept of structuring high-rise landscape structures as natural bases for conducting areas harmonized with nature, the development of sectoral areas should be primarily digitized Layered morphological landscape basis (for example, Russky Island is a vector-layered local morphological landscape map of Russian Island.), which at the digital level gives knowledge of the
Figure 1. Pacific landscape belt of Russia. Belt areas: 1. Sikhote-Alinskaya, 2. Low-Amurskaya, 3. Priokhotskaya, 4. Kolymskaya, 5. Anadyrskaya, 6. Chukotskaya, 7. Koryakskaya, 8. Kamchatskaya, 9. Sakhalinskaya.

structure of the geographical space involved in the development of landscape structures. Such results make it possible to analyze the areas being mastered by digitized landscapes.

As a result of research tracts on. Using a vector-layered digital landscape map, Russian island has established that in structures according to altitude criterion, slope angles and internal landscape content (taking into account the state of erosion-denudation lowland and mountain landscape systems formed under the influence of the real energy flows of the Earth and first of all gravitational energy) on the example of Russian stand out high-altitude complexes tracts. They are different and the upper slope, middle slope and other altitude complexes of the tracts are distinguished, each of which, in turn, distinguishes the elevation levels (Table 1, Figure 2). Below, for example, only some of them are described, it is simply impossible to describe everything in this work.

Upper slope altitude complexes of stows are slope-like stows, the height is occupied by the upper third of the slope and characterized by slopes of surfaces from 3 - 5 to 45 degrees or more. They have low moisture content, slowed down, in terms of the development of gravity processes, the dynamics of erosion-denudation...
Figure 2. Map and profile of high-altitude complexes of tracts and their levels (fragment).

High-altitude complexes of tracts and their levels: (tie numbers on the map fragment and the profile correspond to the figures on the map of the tracts of Russian island) (Starozhilov et al., 2018):

- **Vertex:** 1. Vertex high
  2. Vertex medium-high with xerophytic forests on brown forest eroded soils.

- **Saddle:** 7. Saddle of uneven elevations.
  9. Upper-slope steep xerophytic oak trees on brown forest primitive soils
  10. Upper slope steep with mesophytic oak forests on brown forest low-power soils
  11. Upper slope medium steep with oak forests on medium brown forest soils
  12. Upper-middle powerful gentle slope under mesophytoic forests on brown forest soils of the low-power.

- **Mid-slope:**
  13. Mid-slope with oak forests on brown forest soils eroded
  14. Mid-slope with xerophytic oak forests on brown forest poorly eroded soils

- **Lower slope:**
  16. Low-slope precipitous xerophytes from oak forests on brown low power soils
  17. Low-slope with shrub-grassy oak forests on brown forest thin soils
  18. Low-slope middlecoiled with fern oak trees on brown forest low-power soils

Processes. They are divided into high-altitude levels of the tracts: gently sloping with slopes 3 - 5 with mesophytic oak forests of mongolian oak with ash nasolithicforbred and lespedetseyv on brown forest powerful loamy-stony soils; srednekrutya with slopes of 20 - 30 with oak forests with fern on brown forest medium-thick loamy-stony soils; steep with slopes of 20 - 45 with mesophytic
Table 1. Fragment of the classification of high-altitude complexes and levels of tracts Russian island and adjacent islands of the Vladivostok urban district.

| High-rise systems tracts | Height levels of tracts | Slope angle |
|-------------------------|-------------------------|-------------|
| Upper slope             | steep with shrub xerophytic oak forests and their overgrown thickets on brown forest primitive low-power highly stony eroded soils | more than 45° |
|                         | steep with mesophytic oakwoods from mongolian oak with ash nosolithicforbred-lepedetsyeve on brown forest thin loamy-stony soils | 20° - 45° |
|                         | middle-spruce with fern oak forests on brown forest medium-thick loamy-stony soils | 20° - 30° |
|                         | gentle with mesophytic oakwoods from mongolian oak with ash nosolithicforbred-lepedets on brown, thick forest loamy-stony soils | 3° - 5° |
|                         | steep with xerophytic specid oak forests on brown forest thin stony eroded loamy-stony soils | More than 45° |
| Mid-slope               | steep with xerophytic grassy oak forests on brown forest typical thin and soddy brown loamy-stony eroded soils | 20° - 45° |
|                         | srednekrutye with mesophytic oak forests, their light forests on soddy brown thin loamy-stony poorly eroded soils | 20° - 30° |
|                         | gently sloping with mesophytic oak forests, their light forests on sod-brown medium-thick loamy-stony soils | 3° - 5° |
|                         | steep with xerophytic oak forests and grassy meadows on brown forest thin and fragmented soils | More than 45° |
|                         | steep with xerophytic shrub-grassy oak forests on brown forest thin stony eroded soils | 20° - 45° |
| Lower slopes            | middle-sprouted with fern oak forests of mongolian oak with japanese alder, maples and lindens, forbs and grass meadows on brown forest typical and sod-brown gley powerful and medium-sized loamy-gravelly soils | 20° - 30° |
|                         | gentle slopes and plumes with light forests and forests of alder Japanese forbs and shrubs combined with forb, forb-sedge and sedge-reed meadows on brown forest gley heavy loamy stony soils | 3° - 5° |

It is important to note that the differences in the high-altitude complexes of the tracts are reflected in the boundaries of the tracts of the groups highlighted on the morphological map, and the differences in the elevation levels within the high-altitude complexes coincide with the boundaries of the corresponding tracts on the map. Such a cartographic coincidence of boundaries will in many respects help to further carry out the sectoral indication and practical implementation of the landscape approach to solving the problems of land development.

As an example of the necessity and usefulness of the analysis and evaluation of materials on high-altitude complexes and levels of stows, we present some possibilities for applying the proposed new structuring of landscape space in the construction industry. Already at the design stage, such materials will help designers in assessing the landscape space for urban purposes, for example, when choosing...
construction sites. From the internal content (height, angle of inclination, the
dynamics of the erosion-denudation system, the development of physiographic
processes, etc.) of the high-altitude complexes of the tracts depends largely on
the appropriateness of their choice. When choosing construction sites, first of
all, they pay attention to their sizes, slopes of surfaces, development of physiographic processes and dissection. Construction use of sites is limited to active landside and subsidence processes. They require special attention, because quite often, after the construction of a building, these processes become very intense due to the additional load and violation of the groundwater regime.

Significant deviations from the planning norms and the neglect of natural
conditions cause the natural dismemberment of the construction site, and this
leads to the appearance of negative consequences of construction.

4. Conclusion

The proposed structuring and classification of landscapes are important not only
from the point of view of the development of the scientific foundations of land-
scape science, but also as a direction of research on the strategic possibilities of its
use in the integrated and sectoral development of landscape space. The concept of
high-altitude complexes of tracts and their high-altitude levels proposed to the
reader is considered as a promising direction of landscape geography in carrying
out practical tasks in the development of territories. Subject to the use of vec-
tor-layer mapping, the study of tracts using component, morphological, areal,
multi-scale vector-layer display (Starozhilov et al., 2009b, 2009c, 2009d, 2012;
Starozhilov, 2017) will allow cartographically using modern digital computer
technologies to proceed to the consideration of scientific and practical planning
tools harmonized with nature forecasting of economic, social, ecological and
other geosystems. Structuring will be conducive to solving the problems of op-
timizing the natural environment of the regions. At present, the Far East Federal
University Pacific International Landscape Center continues to develop a con-
ceptual methodology for digitizing structuring the practical implementation of
the method and the possibility of using these materials in practice. The geo-
graphers of Far East Federal University have already prepared a basic landscape
map of Primorsky Krai at a scale of 1:500,000, a landscape map of the Russian
island at a scale of 1:25,000, a landscape classification of the Sakhalin region
(Starozhilov, 2004, 2011, 2016, 2018; Starozhilov & Zonov 2009a), continue re-
search in other regions of the Pacific landscape belt of Russia.

Fund

The studies were carried out with the financial support of the Russian Founda-
tion for Basic Research (Project-18-05-00086-A).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this pa-
per.
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