Designing of general plan of reserved territories based on landscape cover analysis

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Modern conception of territorial forms of nature reservation bases on ecological network conception, which theoretical footing are statements of island biogeography – large "islands" connected with each other by a system of smaller islands of various size which among other play a role of "stones" which overcome areas useless for sustainable survival. IUCN defines Ecological network as a coherent system of natural and/or semi-natural landscape elements that is configured and managed with the objective of maintaining or restoring ecological functions as a means to conserve biodiversity while also providing appropriate opportunities for the sustainable use of natural resources (IUCN & Syzygy, 2005).

In accordance with existing perceptions Econet includes the following structural parts: 1) core areas, which conserve general biodiversity in natural landscapes, 2) corridors or stepping stones which allow species to disseminate and migrate between core areas, decreasing isolation and improving connectedness of natural systems, 3) recovery territories, usually close to core areas, which extend core area network to optimal size, 4) buffer zones protecting network from potential negative influence and permitting all types of activities not contradicting with biological diversity conservation aims. Evidently, the main idea on which this construction bases needs hierarchical organization of network. Three levels of eco-network hierarchical organization are: 1) objects of international and national significance, 2) national and regional level and 3) local level. According to general aims and criteria Econet is component of approach to sustainable development organization on the basis of landscape planning and management. Operational criteria for selection of all four types of Econet are very diverse and determined by: geographic conditions, history of region economy development, how fully region is studied, availability of scientific staff, which can realize wide range of work for specific projects, funding possibilities. When solving this task for Russia and CIS countries, we have to regard familiar difficulties.

The approach developed uses the following admissions: 1) landscape cover as multiple landscapes reflection is organized hierarchically and this hierarchy should naturally be reflected in Econet, 2) on any hierarchical level species biodiversity is a function of spatial diversity of ecosystem types and their territorial combinations, 3) due to fractal properties and hierarchy the relatively homogenous complexes of ecosystems exist on any level and they coincide with areas of ecological optimum for most of habiting species, 4) global geodynamics determines blocky and radial structures of different scale which generate quasi-linear forms with ecosystems seriously differing from surroundings and usually expressed by relief and in remote sensing data. They form a network of natural corridor ecosystems. The crosses of corridors are "nodes" which characterized by maximum diversity of landscapes (we should state here that most cities situated in such "nodes").

These admissions, basing on theory of landscape and landscape ecology theory allow developing the system of measurements that enables us to select quantitatively functional elements of Econet and to assess their potential quality.

Hierarchical levels of organization substracted using 2-dimensional Fourier spectral analysis of digital elevation model and satellite imagery bands. Basing on classified multispectral remote imagery (SPOT, VEG2000, GeoCover, MODIS) we develop maps of ecotope types. Usually it is possible to determine their physical meaning but in is not

necessary in general case. In all cases, natural ecosystems within specific climatic conditions are characterized by the ultimate absorption of solar radiation or by specific absorption spectrum. Such classifications can be used to assess landscape diversity with implementation of various metrics (diversity, evenness, fragmentation, number of borders, fractal dimension etc.). Each of these metrics reflects landscape spatial structure various aspects which have different functional meaning. At the same time, many of them correlate with each other. Leaving aside methods of their integrations we should note that each hierarchical level of organization contains ecosystems with various potential landscape diversity and with various functional values. Further using special procedure we outline lineaments (potential corridors) and nodes in their cross areas. Status of nodes can be determined by number of lineaments which form them. Integration of measured properties of spatial structures including territories of potential reservation and lineament system allows to design general scheme. Further, individual analysis of each potential object is processed and descripted. Proposed technology has been applied in designing general Econet scheme for Southern Siberia Mountains, south of Eastern Siberia, south of Far East, South Urals, Yakutia, vast Asia region, including all CIS countries. Detailed description can be found in paper about Yakutia Econet (Puzachenko, 2004, 2005).

When estimating the efficiency of practical use of developed technology we can say that on the first stage technology and its results evokes more or less negative reaction. After, when real work begins and emotions calm down it turns out that selected objects are very interesting ones, the scheme itself organizes further work on the stage of concrete objects designing. Finally, this experience demonstrates wide possibilities in decision of landscape planning tasks as on the preliminary stage almost without any information except remote sensing as during concrete objects designing on the basis of remote sensing information, digital elevation models and field data. Algorithms of relief and remote sensing information were realized in programs made by Gleb Aleschenko. The research is made with support of WWF grants.

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