

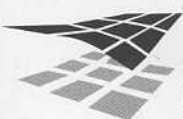
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LANDSCAPE ECOLOGICAL APPROACH TO HIERARCHICAL SPATIAL PLANNING

Planning human activity in a landscape requires adaptation to natural heterogeneity as well as stakeholders' needs. Severe ecological restrictions and penalties should not be considered the only possible instruments to make the behaviour of stakeholders more environmentally friendly. Hierarchical landscape planning is an effective tool to regulate spatial and temporal organization of land use. Understanding the role of each landscape unit in functioning of the higher-order one is critical to distribute activities within and among landscapes, river basins and patches. Lateral interactions between landscape units are dramatically underestimated. Landscape ecology is expected to work out effective criteria for assessment of this kind of linkages. We should elaborate methods of how to compensate loss of ecological functions in any landscape unit by correct management of neighbouring or even distant unit connected by matter and energy flows. Rational distribution of human activity in time could enable to avoid simple ecological prohibitions. We provide examples from case studies of forest and recreation management in Russia, that illustrate opportunities for hierarchical spatial planning needed for adaptive management using a landscape approach.

Introduction

The landscape planning deals with large heterogeneous territories. Heterogeneity is both the cause and the condition for diversity of land use opportunities. Moreover, uniformity of land use practice is in most cases harmful for landscape, since its units differ in provided ecosystem services, resilience, and sensitivity. Planning human activity in a landscape requires adaptation to natural heterogeneity as well as stakeholders' needs and desires. Multifunctional landscape planning is gaining more and more support (Brandt et al., 2000). Unavoidable conflicts of interests require looking for the best ways for adapting land use to landscape heterogeneity (Haines-Young and Potschin, 2000; Nieschulze, 2003; Bettinger et al., 2005; Musio et al., 2007; Dyakonov et al., 2007). The common challenge in land use planning is contradiction between regional priorities and local land use conditions (Perera et al., 2007). Often the roots of the problem are traced in disagreement of administrative borders with natural boundaries especially with those related to river basins (Saunders, Briggs, 2002; Kazmierski et al., 2004). Land use priorities and decisions are the products of complex interaction of factors acting at different hierarchical levels. Hierarchical approach to landscape planning is dictated by hierarchical organization of nature. Forestry, agriculture, recreation have a number of requirements for nature conditions which involve spatial interaction between landscape units. On the other hand, nature imposes restrictions on opportunities for land use. Evaluation of opportunities depends both on own properties of landscape unit and its functional role in broader landscape, basin and regional context. Hence, hierarchical geographical analysis is needed to make correct assessments (Wickham et al., 2000; Hrnčiarova and Izakovičova, 2000; Neave, Neave, 2005).

Our research focuses on review of several landscape-ecological and geographical concepts that afford to make correct environmentally friendly and economically effective land use decisions. Case studies in forest regions of Russia have provided material for elaborating methods for regulation of spatial and temporal organization of land use. We argue that rational distribution of human activity in time and space could ensure a kind of trade-off between strict ecological prohibitions and stakeholders' interests. Below we analyze opportunities and demands for landscape planning on the levels of region, river basin, landscape and catena.

Regional geographical analysis

Regional scale of landscape planning provides preliminary framework for choosing land use priorities. Assessment of landscape value requires examining wide geographical context. It means that a landscape unit with unique or rare attributes should be preserved for the sake of landscape and biological diversity in the whole region. Landscape rarity can result either from unique combination of geographical factors or from palaeogeographical history or from vast anthropogenic or natural disturbances. The geographical analysis aimed at assessment of degree of landscape rarity relies upon a set of thematic maps, topographic materials, remote sensing data and field investigation. Huge amount of work involves landscape classification. In Russia usually genesis-based principle of landscape classification worked out by N.A.Solnetsev (1948) and V.A.Nikolaev (1979) is applied. It assumes priority of geomorphologic and geologic attributes at higher levels of classification, while plant cover, soil attributes and anthropogenic disturbance are considered at the lower levels.

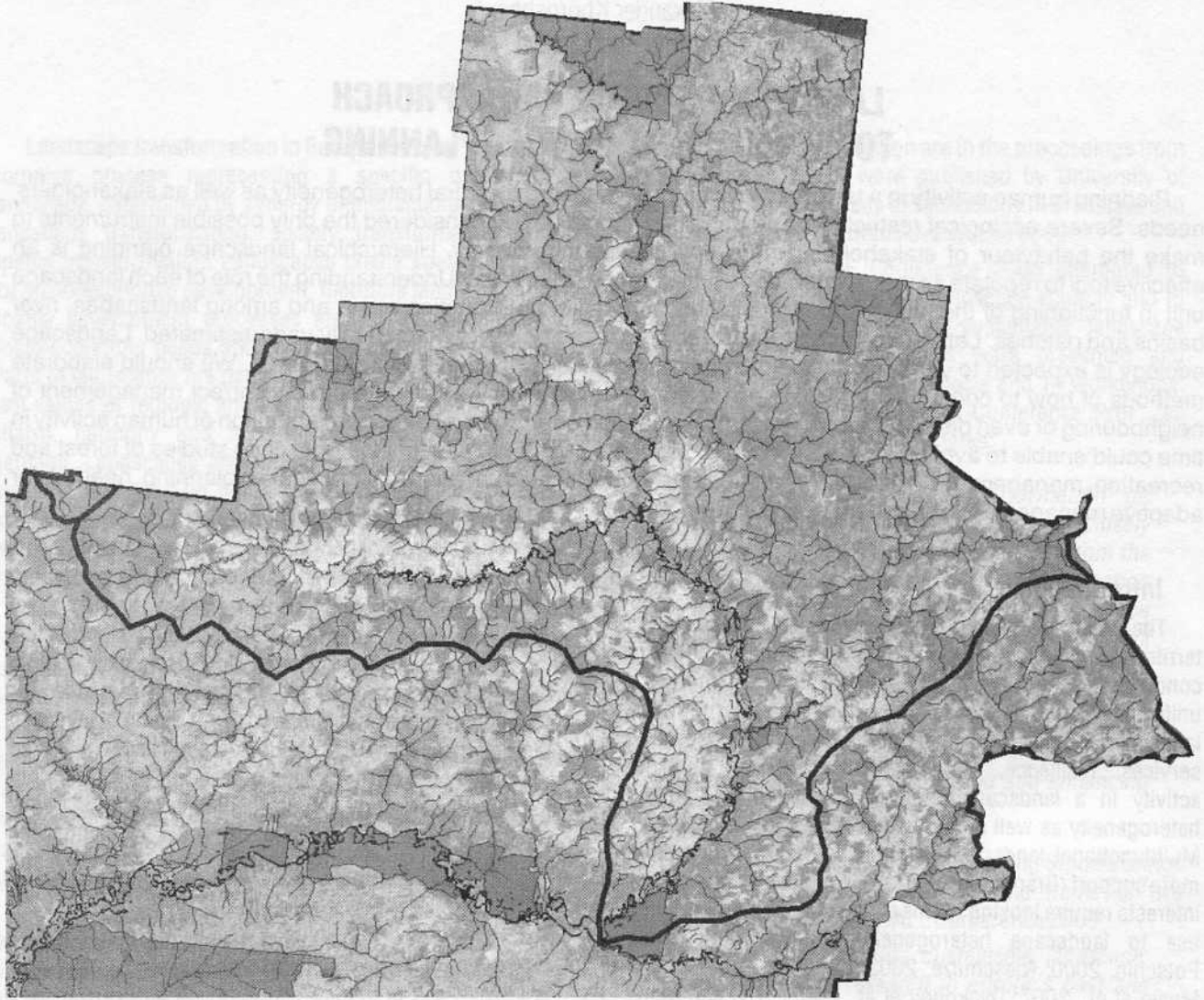


Fig. 1: Unique sandy dune landscape of the Curonian Spit (photo by A.Khoroshev)

The example as follows illustrates anthropogenically induced rarity. In the Kostroma southern taiga region intact spruce and fir-tree stands can be assessed as rare units despite their zonal nature since concentrated harvesting in 1960-1980s resulted in present-day dominance of secondary small-leaved forests. Special restriction measures are now required in forestry planning to protect zonal boreal species having refuges in zonal taiga stands. At the same time pine forests, also typical for the southern taiga in sandy habitats, do not require severe restrictions since recovery succession do not include stages of dominance of different tree species. Hence, pine-oriented plant and animal species are subject to much less threat as compared to spruce forests. It should be noted that restrictions in most cases can be temporal and last for several decades until recovery of zonal communities embraces vast areas.

Natural rarity of landscape units can be related to a number of factors. Below we show the approach to rarity assessment on the example of the Curonian Spit. The

Curonian Spit is a narrow sandy strip that stretches north-eastward between the south-eastern Baltic Sea and the Curonian Lagoon. Approximately half of the Spit by length is located within Russia, the other part within Lithuania. The eolian sandy landscape is covered mainly by planted pine forests (*Pinus silvestris* – 53.6 %, *Pinus mugo* – 6.4 %) with patches of alder (*Alnus glutinosa* – 17.5 %), spruce and broad-leaved forests. Since 2000, the Curonian Spit has been on the UNESCO's World Heritage List under cultural criteria as „an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture, or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change“.

For Russia sandy landscape of combined marine and eolian genesis on the Curonian Spit is assessed as unique though some similar landscapes occur within the Baltic region as a whole (Fig. 1). At the national level it gained status of Nature Protected Area (NPA) as the National Park. Since preservation of biodiversity is one of the principal

