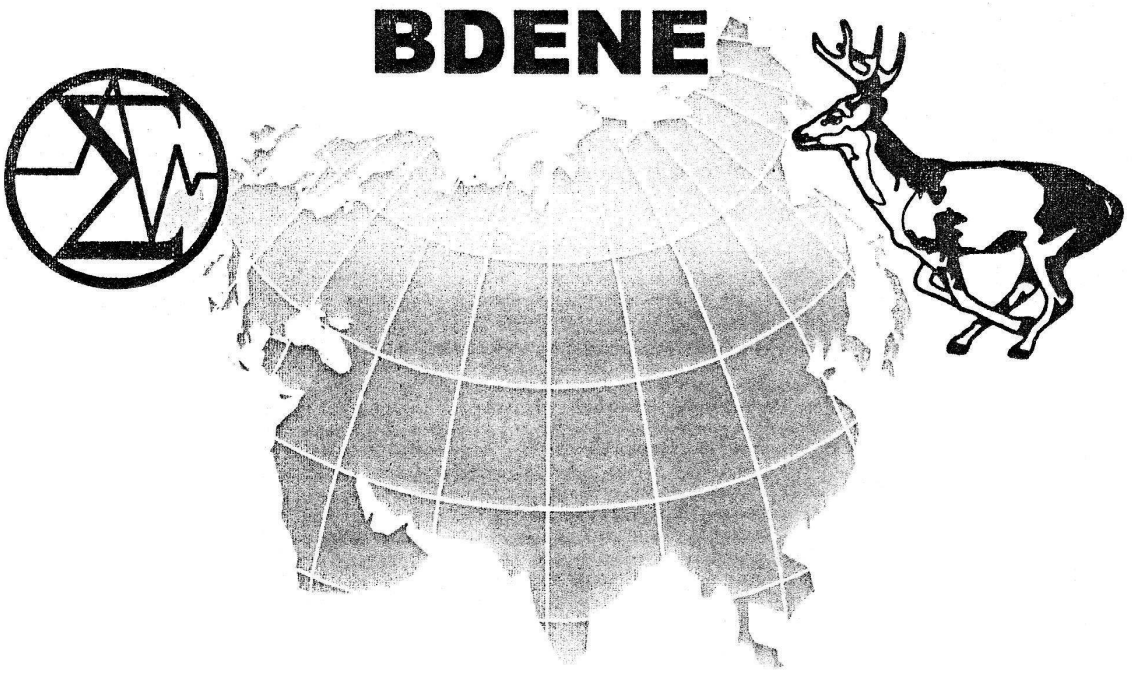
# BIODIVERSITY AND DYNAMICS OF ECOSYSTEMS IN NORTH EURASIA




## VOLUME 2

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# THE CLASSIFICATION OF BUREINSKIY HIGHLAND ECOSYSTEMS BASED ON THE CONCEPT OF THE LIFE FORM OF VEGETATION

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**Summary**

The concepts of "the life form of vegetation" and "the life form of biota" are discussed. The ecosystem classification approach based on these concepts is considered. The classification of ecosystems of the Bureinskiy highland (Far East) is presented.

**Introduction**

The existing ecosystem classifications were combined by Y.A.Isakov with co-authors (1980) into the three groups: morphological (physiognomical) typification, factorial typology and functional typology. The same authors offered the multilevel classification of the Earth ecosystems, using various attributes on different levels of classification hierarchy. H.Walter and E.Box (1976) and E.P.Odum (1983) discussed biome ecosystem classifications of the Earth. The biogeoclimatic ecosystem classification is well developed for British Columbia (Krajina, 1965; Pojar et al., 1987).

The task of this paper is to discuss the concepts of "the life form of biota" and "the life form of vegetation" as tools for ecosystem classification (using materials from taiga-goltsy landscapes of the Bureinskiy highland, the Amur-Uda interfluve, Far East).

**The concept of the life form as a tool for ecosystem classification**

The uncertain notions on life forms exist during several thousands years. As a scientific concept it was formed in XIX century by A.Humbold, A.Kerner, A.Grisebach, R.Hult, E.Warming and others. The original concept of the life form covered plants and also fungi and lichens, which were considered as plants. H.Gams (1918) formed more general system of life forms which covered also animals and microorganisms. Y.G.Aleyev and V.D.Burdak (1984) and Y.G.Aleev (1986) developed the united system of life forms (ecomorphs) which covered also viruses.

Traditionally the term of life form is associated with organisms. However it also was applied to species of organisms and to the objects which organization is intermediate between organisms and communities (lichens, corals). Finally A.G.Dolukhanov (1961) formed the concept of the life form of plant community which further was developed by A.G.Krylov (1974, 1984). S.V.Osipov (1998, 2000) showed that the life form concept is also applicable to plant synusiae, aggregations (open vegetation), combinations (complexes) and developed more general concept – the life form of vegetation. Thus the life form concept is being applied to bigger and bigger set of objects.

An application of the life form concept to the populations, consortiums, communities, biomes and other systems of superorganismic level is not a vulgar analogy. It becomes more obvious if to distinguish two aspects of using of the concept: for designation of the object under study or for designation of the object' characteristic. The life form as the object' characteristic reflects the same property, the same aspect for organismic as well as superorganismic systems – their conformity or adaptation to environment. Such understanding of the life form existed since the moment of scientific definition of this concept. Despite of distinguishes of the life form concept in different papers the same understanding presents at all approaches to investigation and classification of life forms of organisms and species of organisms, and Dolukhanov's and Krylov's concept of the life form of plant community is based on the same sense. The life form concept reflects various particular adaptations of system to the separate environment factors as well as an adaptation of whole system to whole environment

(certainly a degree of adaptation of system to environment is not absolute). All these allow to conclude that the life form is the same characteristic for systems of both organismic and superorganismic levels.

About the terms. On the one hand, the life form concept reflects the same property for organismic and superorganismic systems. From this point of view it is inexpedient to introduce a new term. On the other hand, the life form concept is enriched with some particular sense when applied to the systems of different types and levels of organization. From this point of view it is expedient to use the different terms expressing different features of the sense of this concept in each case. In this situation most right decision is to use the term "the life form" for a general concept (covering systems of both organismic and superorganismic levels) and to use such terms as "the life form of an organism", "the life form of a population", "the life form of a community" etc. for particular concepts (reflecting peculiarities of systems of different levels and types of organization).

The concept of the life form of biota has the paramount importance for classification of all ecosystem diversity on the basis of the life form approach. However A.G.Tansley (1935) and many other ecologists emphasize the importance of vegetation in biomes and ecosystems. B.A.Bykov (1988, p. 93) directly connects the note with classification problems: "As an autotrophic part of biota heads ecosystems so an ecosystem classification must be based on vegetation classification". From this point of view the concept of the life form of vegetation is necessary and sufficient basis for classification of the vegetation-dominated ecosystems.

"The life form" is an integral morpho-functional (not only morphological) attribute formed as a result of genofund (gene pool of biota or vegetation) and environment interaction. This complex characteristic must be split into more particular characteristics serving as classification criteria or, from other point of view, as axes in classification space. Generally "the life form" consists from the following three more particular (but nevertheless multidimensional and multilevel) characteristics. 1. Structural type or type of organization. For vegetation these are terms of community, open vegetation, combination (complex) etc., for biota these are community, biome etc. 2. Dynamic type. These are terms of the monoclimax (Clements, 1936) and polyclimax (Tansley, 1935; Daubenmire, 1968) and R.H.Whittaker's (1974) terms of eu-, super-, cata-, cyclo- and aclimax reflecting the features of successions and climaxes in different environment. 3. Eco-physiognomic type. The distinguishing of eco-physiognomic types as well as structural and dynamic ones is based on a combination of integral and analytical parameters. The integral component includes complex biological, ecological and geographical characteristics of biota as a whole. The main analytical component is a spectrum (composition and importance value) of organism life forms (ecobiomorphs). The importance value of each plant life form is estimated with the qualitative scale according to its role in the spatial and functional structure and in the succession of the vegetation.

**Ecosystems of the upper part of the Bureinskiy highland**

The ecosystems studied in this work have area approximately 1 km$^2$ and correspond to vegetation mesocombinatons (mesocomplexes). The ranks of the classification hierarchy correspond to the ranks of the eco-phytocenotical approach in vegetation classification. Taxa of the higher rank correspond to the types of vegetation and types of vegetation cover (Dochmann, 1960; Norin, 1966), taxa of the lower rank correspond to the subtypes of vegetation according to many authors or to the classes of formations of G.I.Dochmann (1960). The taxa are named on the basis of eco-physiognomic characteristics.

***1. Boreal forest:* Boreal forest.** Form the taiga belt. Dark coniferous (*Picea ajanensis (Lindl. et Gord.) Fisch. ex Carr.*) or deciduous coniferous (*Larix cajanderi Mayr*) forests prevail.

***2. Forest-tundra:* Gypoarctic krummholz.** Form the podgoltsy (subalpine) belt. Dwarf-pine (*Pinus pumila (Pall.) Regel*) thickets prevail.

***3. Boreal forest-meadow:* Boreal forest-meadow.** Very sparse in the podgoltsy belt. Wide valleys. Shrubs (*Salix krylovii E. Wolf, S. udensis Trautv. et Mey.*) and meadows prevail.

***4. Tundra:* Tundra.** Rather sparse in the tundra belt. Tops, slopes. Lichen-dwarf shrub (*Cladina stellaris (Opiz) Brodo, Cassiope ericoides (Pall.) D. Don, Vaccinium uliginosum L.* etc.) tundra prevails.

***Rocky tundra.*** Very frequently in the tundra belt. Slopes, tops. Lichen-dwarf shrub (*Cladina stellaris, Cassiope ericoides, C. redowskii (Cham. et Schlecht.) G. Don fil., Rhododendron redowskianum Maxim.* etc.) tundra and epilithic lichens (*Asahinea chrysantha (Tuck.) Culb. et Culb., Ophioparma ventosa (L.) Norman* etc.) prevail.

***Tundra-mire.*** Very sparse in the tundra belt. Goltsy terraces. Tundra (*Cladina stellaris, Cassiope ericoides, C. redowskii, Rhododendron redowskianum* etc.) and moss (*Sphagnum imbricatum Hornsch. ex Russ., S. warnstorfii Russ.* etc.) mires.

***5. Gypoarctic-boreal mire:* Hillocky (pingo, mound) bog.** Very sparse in the podgoltsy belt. Wet sites in valleys. Bogs (*Sphagnum warnstorfii, S. fuscum (Schimp.) Klinggr., S. imbricatum, S. russowii Warnst., S. riparium Aongst.* etc.) prevail.

*6. Epilithic lichens: Epilithic lichens.* Rather frequently in the tundra and in the podgoltsy belts. Rocky slopes and tops. Epilithic lichens (*Ophioparma ventosa* etc.) prevail.

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