



## **Variability of soil properties at different hierarchical levels of soil cover**

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Each soil scientist knows that properties of soil, even within of one soil profile, are expressed as a quantitative variety. That we name soil variability is as a matter of fact a quantitative profile of the sum of the soilforming processes expressed in space. The certain variability of properties of soil is formed during evolution, dynamics and functioning of a soil cover, therefore it is continuous in space and time. The different scale and hierarchy of levels of soil variability are determined by simultaneous action of chemical, physical, biological, geomorphological and geological processes which, naturally, appear on different distances. Value of soil variability is huge, as creates a variety of ecological niches for existence of an alpha - variety of soil microorganisms, animals and plants.

There are some systems of definition of levels of the organization of soil and a soil cover; in many respects they are similar. We use the table suggested by Bliss and Waltman (1994), which we added with corresponding factors. At each level of the organization the reasons of variability of soils is a distinction of expression of factors, if it is big then various soil objects may be allocated. Besides, lower levels of the organization bring the contribution to a variation of properties of soil as fluctuations. In this connection, it is offered by us to allocate at each level of the organization three categories of variability of properties of soil: heterogeneity - at significant change of factors of soil formation; variability - at their insignificant differences and fluctuation - at the leveled factors of soil formation.

We quantitatively studied these categories of a variation at the example of a soil cover of a southwest of the Kulunda steppe located in the south of Western Siberia. Within

of areas of soil varieties and their soil individuals (pedons) statistical characteristics of a variation were estimated, namely, average values, dispersions, factors of a variation, asymmetry, an excess, and percentiles. Probability distributions were identified. Statistical entropy for a continuous case is designed. Comparisons of categories of a variation of properties of soil at different levels of the organization of a soil cover in a various condition - a virgin soil, not irrigated arable land and an irrigated arable land are carried out.

We lead to some conclusions. 1. The further development of soil science demands transition to mathematical thinking and formalization of the basic concepts. Variability is fundamental property not only of soil, but also of biodiversity as a whole; hierarchical, probabilistic, statistical and information approaches are methodological basis for its quantitative studying and formalization. 2. At *each* level of the organization it is necessary to consider three categories of variability of properties of soil. The estimation of a ratio of categories of a variation is important for an estimation of stability of a soil cover as a hierarchical system. Structure of a variation of soil properties at different levels of the organization in virgin soil is similar. Changes of probabilistic and statistical characteristics according to transformation of soil at different levels of the organization occur similar. 3. The information characteristic of a variety is statistical entropy. Entropy as the characteristic of function of distribution of probabilities, is steadier, than other statistical characteristics, and can be used for an estimation of a condition and transformations of soil cover.