

Local plant and soil diversity in secondary boreal forests: properties and interactions.

Maria Smirnova and Maxim Bocharkov

Faculty of Geography, Lomonosov Moscow State University, Russian Federation (summerija@yandex.ru)

Secondary forests occupy vast territories within the boreal zone. They are spatially inhomogeneous: groups with different plant composition follow one another at distances of several meters even on flat watershed areas. Are the soils formed under these plant groups different from each other? How do plant and soil diversity compare in such areas? Is the heterogeneity of parent material the reason for changing plant groups and soils?

We conducted research on 19 sites describing the entire diversity of vegetation cover in the southwestern part of the Ustyanskiy Plateau (Arkhangelsk oblast), the interfluve of the Zayachya and Strugwitsa rivers. We characterized vegetation, soils and parent material in detail. The texture, elemental composition and pH were determined. Feedbacks and interactions between vegetation, soils and parent material were determined by the indirect ordination and correlation analysis.

Vegetation of the Zayachya and Strugwitsa interfluve is secondary small-leaved-coniferous (*Picea abies*, *Pinus sylvestris*, *Betula pendula*, *Populus tremula*) forests. The predominant soils are various Podzols. The parent material is bi-layered: lacustrine-glacial sandy loams rest on glacial loams (often calcareous) at 30-40 cm depth. The territory belongs to the area of long-term economic use, however, since the 1940s, natural vegetation has been restored on the watershed.

The vegetation is characterized by a greater variety than the soil component: different plant groups can be formed on the same soils types. Plant diversity, determined by Shannon and Simpson indices, does not closely associate with the change in the morphological properties of soils, but is related to pH. The greatest variety of vegetation is formed in conditions of weakly acid-neutral values. At pH <4, the number of species does not exceed 20. The increase in species diversity is associated with the development of horsetail (*Equisetum sylvaticum*) – fern (*Dryopteris expansa*) – large-herb (*Aconitum septentrionale*, *Filipendula ulmaria*) groupings that develop under the canopy of small-leaved dark-coniferous trees, or in forest "windows".

The composition and structure of shrub, herb and moss-lichen layers does not have a significant effect on the morphological structure of the soil profile, but it is significantly associated with the content of some elements. With the increase in Mn₂O₃ in the upper horizons (Pearson correlation coefficient is 0.81-? with a significance level of 0.01), and the decrease in MnO content in the lower horizons of soils (correlation coefficient is 0.52 with significance level 0.05), the projective coverage of boreal species in the grass and shrub layer increases. The participation of nemoral species does not reveal statistically significant relationships with the parameters of parent material. The participation and ratio of small-leaved (birch, aspen), dark-coniferous (spruce) and light coniferous (pine) in vegetation are reflected to the greatest extent in the soil horizons diversity and their thickness. The area of the closest interrelationships falls on the upper horizons of soils: litter, humus and eluvial.

This research was supported by the Russian Foundation for Basic Research (project № 16-35-60056 mol_a_dk)