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THE ROLE OF MICROSITES IN OLD-GROWTH FORESTS IN MAINTAINING EARTHWORM DIVERSITY

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Introduction

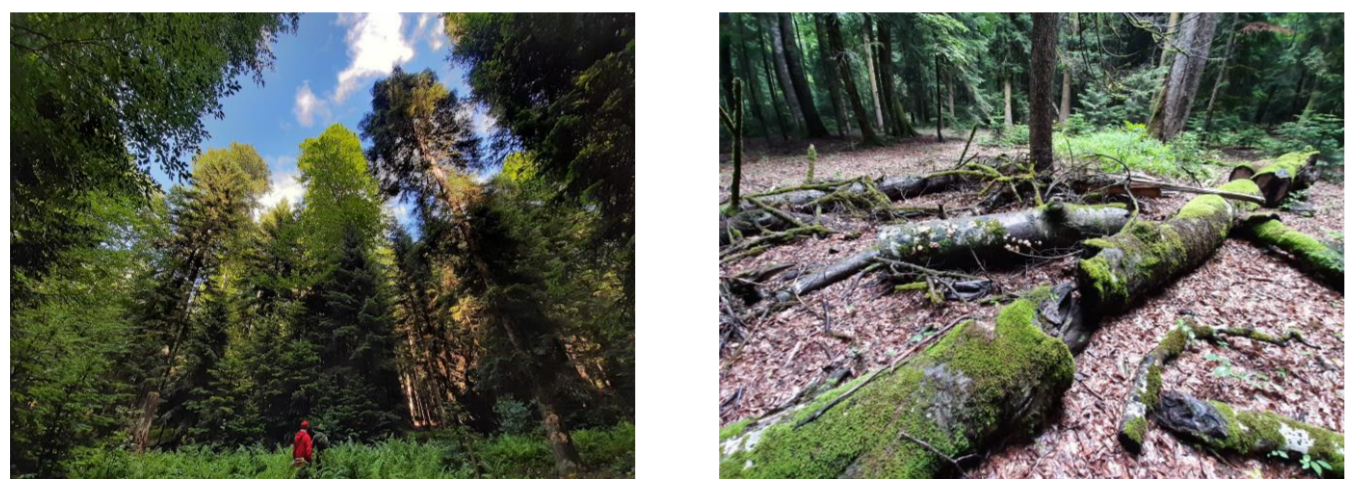
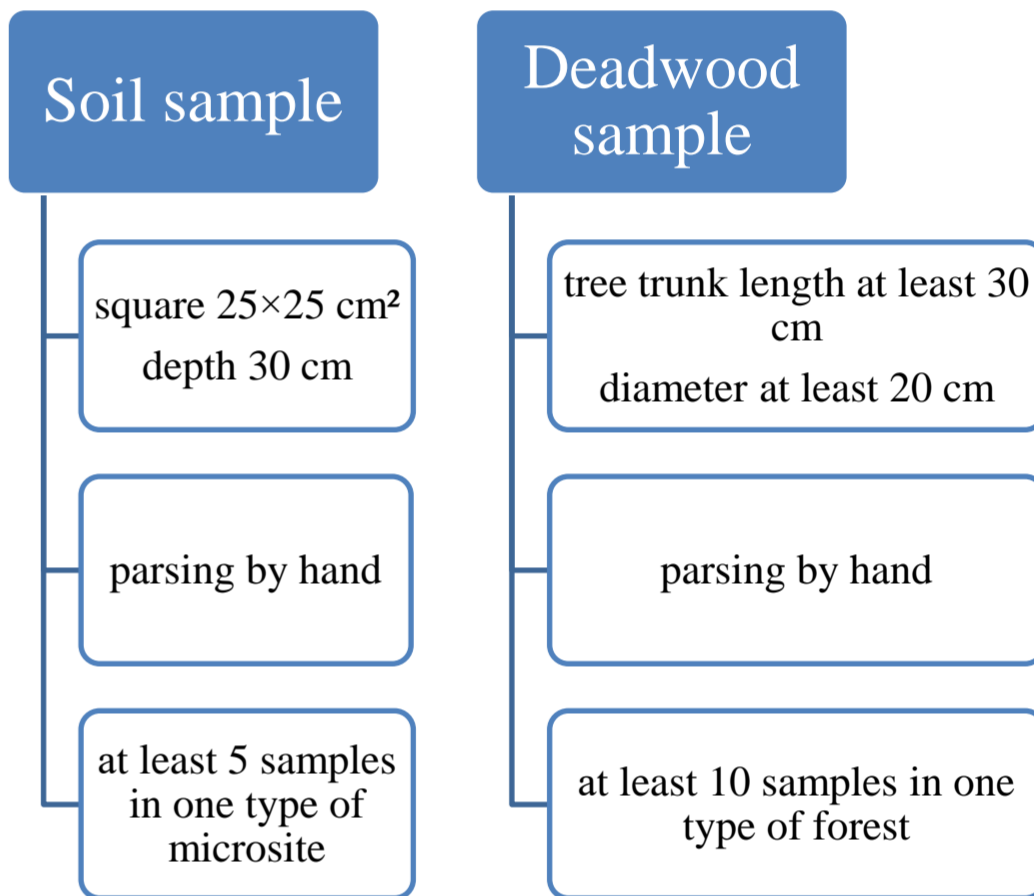
The efficiency of earthworms performing ecosystem functions is largely determined not so much by the species composition as by the ecological group composition of earthworms. The consist of ecological groups is determined not only by the type of forest and soil type, but also depends on the horizontal spatial heterogeneity of the forest cover. In old-growth forests, in addition to the undercrown and intercrown areas, important elements of the mosaic for soil invertebrates are deadwood of different stages of decomposition and tree-fall canopy gaps.

The purpose of this research: to identify the role of forest microsities (deadwood and tree-fall canopy gaps) in maintaining the taxonomic and ecological diversity of earthworms.



Objects and Methods

Field researches conducted in 2013-2022 in the old-growth forests of the Northern Urals (Pechora-Ilych Nature Reserve), the Middle Urals (Visim Nature Reserve) of the Northwest Caucasus (Teberda and Caucasus Nature Reserves), the Far East (Ussuriysk and Komsomolsk Nature Reserves) and European part of Russia (Smolensk Lakelands National Park, Moscow region, Bryansk Forest Reserve). Microsites were selected: soil of intercrown areas, soil of undercrown areas, deadwood 2-3 stages of decomposition and canopy gaps (size 20x20 m). To compare deadwood earthworm data to those from standard earthworm soil sampling, the results were calculated per surface area (Ashwood et al. 2019). The calculation used the area of the lateral surface of the cylinder: $S = 2 \pi R h$ (Geraskina & Shevchenko 2019). Total about 3000 soil and 500 deadwood samples were surveyed in 380 location.



Canopy gap and deadwood in Caucasus Nature Reserve

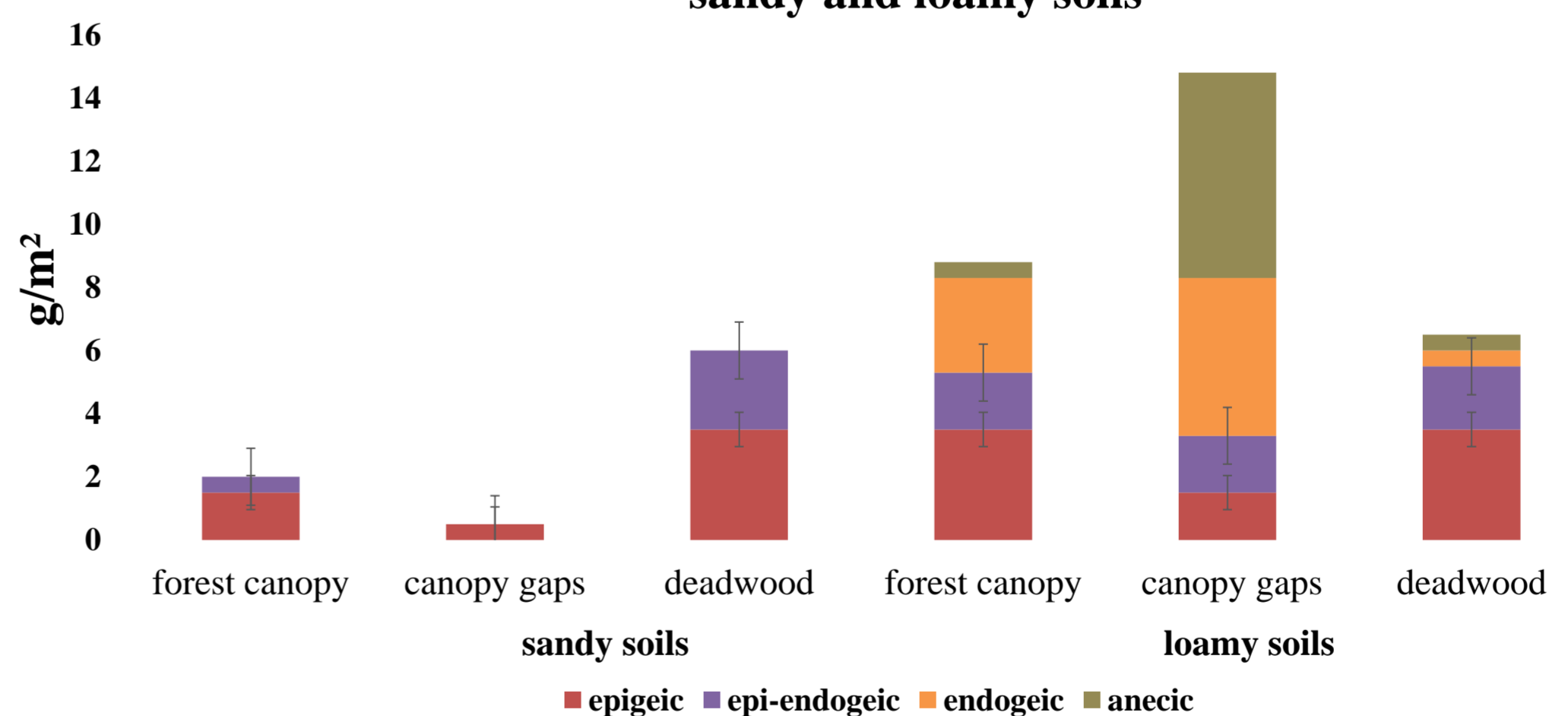


Canopy gap and deadwood in Smolensk Lakelands National Park

Results

No differences were found between undercrown and intercrown microsities, so the data for these two microsities were pooled and averaged. Differences between the forest canopy, gaps and deadwood are established. At the same time, in the canopy gaps, the biomass and diversity of earthworm groups depend on the granulometric composition of the soil. The studied forests can be divided into two groups according to the granulometric composition of soils: forests on soils of light granulometric composition (sandy soils) and forests on soils of heavy granulometric composition (loamy soils). All microsities on loamy soils are more diverse in earthworm populations than those on sandy soils. Epigeic earthworms colonize deadwood from the early stages of decomposition, especially oak deadwood is characterized by rapid colonization of earthworms. The diversity of earthworms in deadwood grows with the intensification of the stage of decomposition.

Biomass of ecological groups of earthworms in three types of microsities in forests on sandy and loamy soils



Conclusion

In old-growth forests on loamy soils with a well-defined gap mosaic, the diversity of ecological groups of earthworms is maintained due to deadwood of late stages of decomposition and large breaks in the forest canopy - gaps. It is these microsities that are more humid, more precipitation gets into the windows, and deadwood better retains moisture in the summer season. Deadwood ensures the survival of epigeic and epi-endogeic species, canopy gaps - endogeic and anecic earthworms.

In old-growth forests on sandy soils in the summer season, the biomass and diversity of earthworms in deadwood is higher than under the forest canopy, but in the canopy gaps, biomass and diversity can be very low, since sandy soils do not retain moisture well and evaporation from gaps is higher than under the canopy of the forest. These forests are even more vulnerable to the conservation of earthworm populations, so deadwood is even more important in them than in forests on loamy soils.

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Total biomass of earthworms in deadwood at different stages of decomposition

