

Soil variability through spatial scales in a permanently disturbed natural spruce-fir-beech forest

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The Žofínský prales natural forest has never been exploited and strict protection was already declared in 1838. The restriction of human impacts makes the reserve a unique place for studying spontaneously occurring soil-forming processes at both fine (distances in the order of metres) and coarse (the order of hundreds of metres) spatial scales.

The goal of this study is (i) to characterize pedodiversity and soil spatial variability through spatial scales **(ii)** to compare our findings with studies from localities affected by humans to various extents and with general theories of soil genesis

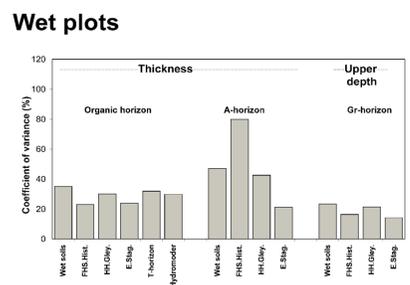
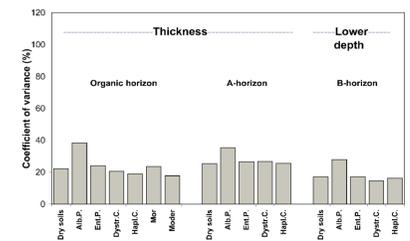
We expected that the continuous process of natural disturbances would have a positive effect on pedodiversity and spatial variability of soils at all study levels

Methods:

The variability of soils was assessed in a 74.2 ha area within the Žofínský prales natural forest. Parameters evaluated for 1765 soil profiles inside 353 graticule plots were as follows: (i) thickness of organic horizons, (ii) thickness and form of mineral horizons, (iii) humus form (HF), (iv) soil taxonomic unit (STU), and (v) anomalies (e.g. charcoals). Also, soil reaction (pH_{KCl}) and oxidizable carbon content (C_{ox}) were measured in the laboratory for 734 samples from the upper mineral (A) and lower mineral (B) horizons.

Results:

Fine scale, distance <10m



Overall and fine-scale coefficient of variance (CV) of individual soil variables

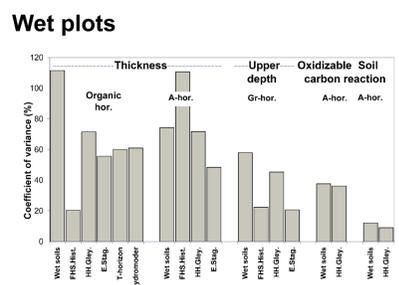
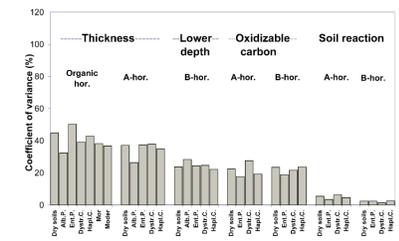
Hapl. C. = Haplic Cambisols,
Dystr. C. = Dystric Cambisols,
Ent. P. = Entic Podzols,
Alb. P. = Albic Podzols.

HH Gley = Histic or Haplic Gleysols,

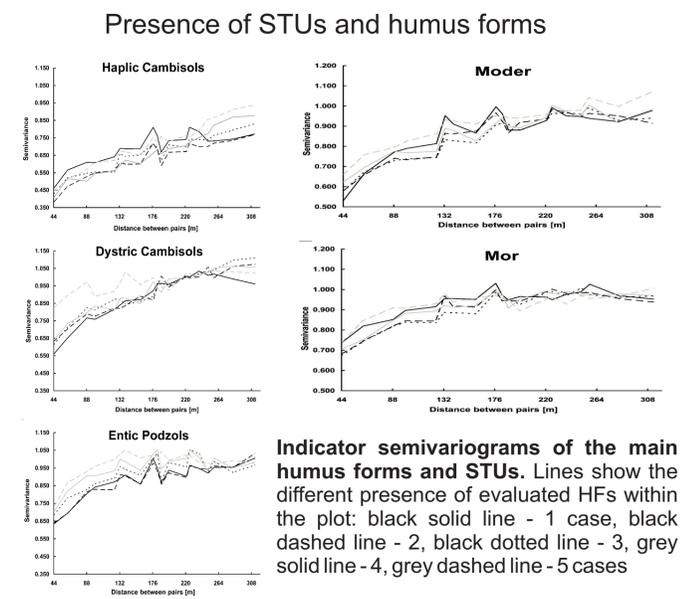
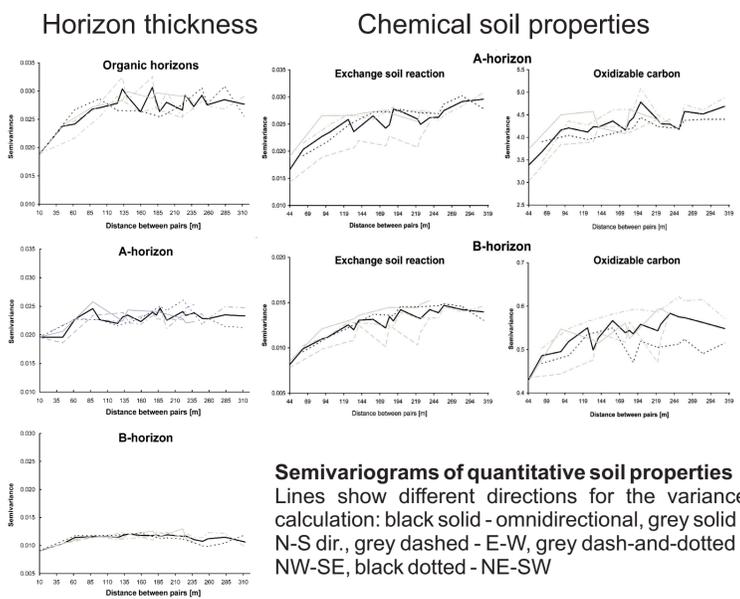
E Stag. = Endogleyic Stagnosols,

FHS Hist. = Fibric or Hemic or Sapric Histosols,
T = peaty horizon

Whole-locality scale, 74 ha



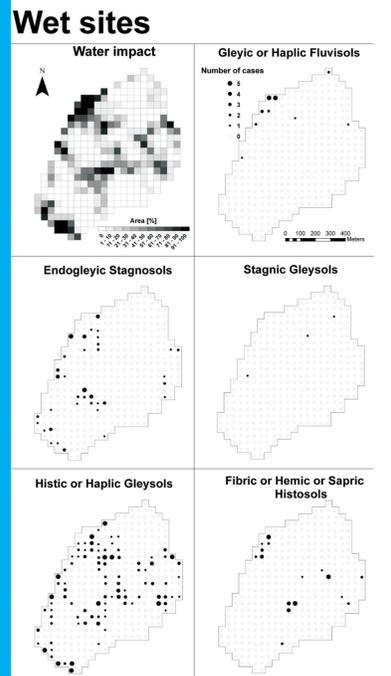
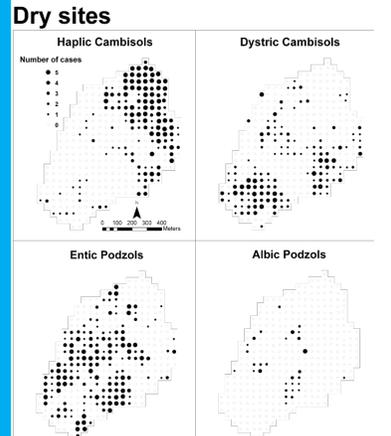
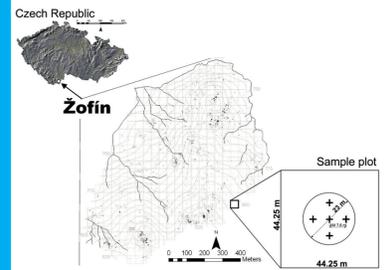
Scale from 10 m to 320 m



Indicator semivariograms of the main humus forms and STUs. Lines show the different presence of evaluated HFs within the plot: black solid line - 1 case, black dashed line - 2, black dotted line - 3, grey solid line - 4, grey dashed line - 5 cases

- Nine **soil taxonomical units** were found at the site despite its homogeneous geological bedrock.
- The most frequently occurring **humus form** was mor followed by moder, hydromoder and peaty T-horizon.
- **Overall CV** was lower in terrestrial (“dry”) soils compared with (semi-)hydromorphic (“wet”) soils.
- Overall **variance decreased** in dry as well as in wet soils **with increasing depth**, as did CV differences between the fine (up to 10m) and the locality scales.
- The **lowest CV** values occurred for C_{ox} and pH_{KCl} .
- The **CV values differed** between soil taxonomical units as well.
- Compared to lower horizons, **variograms of upper horizons showed greater spatial autocorrelation** ranging from 50 to 150 m.
- Semivariance values, however, reached **70-80% of sill** already at a distance of **10 m**.

The most significant factor of variability at all spatial scales is presumably the soil, disturbance regime, followed by terrain micro-topography and the effect of tree species.



Size of circles indicates the number of cases of evaluated STU within a plot

