Description for the general public (in english)

The discussion on certain aspects of the Chernozems origin as well as their Holocene and contemporary transformations is currently witnessing in most of Central European countries. In Poland, the steppe origin of Chernozems is not questioned, and the Chernozems developed on the loess highlands in south-eastern Poland are considered to be relic soils, degraded in comparison to Ukrainian and Russian Chernozems. Apart from them, soils of similar morphological, physical and chemical properties cover quite large areas in various regions of Poland, but they are located in the lowland plains that are periodically overmoistured/wet and gleyed. The latter soils are in Poland classified as a separate type called the black earths. In Polish pedological tradition, these soils were initially attributed to post-bog genesis, then their origin was linked to wet meadows, although the soils completely ungleyed that meet all the criteria for Chernozems exist in higher locations within contours of these wet soils.These findings were used as an argument supporting the thesis that all large areas of loess-derived black earths in Poland, even those which are currently wet, may be relic Chernozems that acquired new morphological properties, including the redoximorphic features. Therefore, one of the key aspects of research will be to establish genetic relation between dry Chernozems and wet Black Earths on the tested areas. The aim of the interdisciplinary research project is to verify the hypothesis of the join chernozemic initial origin of the loess-derived Chernozems (dry) and Black Earths (moist) in Poland, and the key importance of climate changes and human activity initiated in the Neolithic period for the persistence of Chernozems in Poland and Central Europe or their transformation into other soil units (Phaeozems, Gleysols, and in particular - Luvisols). The research will be conducted in the climatic transect from the north-western (strongest influence of the Atlantic moist climate) to the south-eastern (strongest influence of the continental climate) regions of Poland, in all larger loess/silt contours of the chernozemic soils. The project will base on the slope catenas (toposequences) with the use of a multi-proxy approach, combining pedological methods (including the macro- and micromorphological analysis, the analysis of composition/origin and the age of organic matter, and the analysis of secondary carbonates), geochemical, magnetometric, sedimentological, mineralogical, malacological, and archaeological methods.

The research planned under the project will involve the analysis of problems related to the genesis and classification of chernozemic soils, which will be of importance for the understanding of the history, current functioning and future evolution of these soils under the temperate climate conditions of Poland and Central Europe. The future of chernozemic soils is not only a theoretical problem. It also has practical relevance, as these are the most productive soils, which are considered fundamental for ensuring food security in many countries. These problems include the following issues: (a) how was it possible that the Chernozems have survived until today, if we assume their Pleistocene age/origin, (b) did the expansion of humans and agriculture in the Neolithic period contribute to the survival or even the renaissance of Chernozems, (c) why did Chernozems disappear in certain regions after the Neolithic period, (d) when were the Chernozems subject to moisture regime change (wetness increase) and why did the process occur only in some areas of Poland, (e) what role does high moisture play in maintaining the chernozemic features of soils, (f) which kind of transformation undergo the chernozemic soils at present, in particular the moist Black Earths, (g) how do the transformation of Chernozems affect their classification and does the international classification reflect correctly the properties of these soils under dry and moist conditions?

Although research on Chernozems and Black Earths has a long tradition in Poland, it is necessary to apply a completely different approach to their genesis, starting from the hypothesis on their join chernozemic origin, but also emphasising the influence of climate changes and human activity in late Holocene on the transformation of these soils or their different paths of evolution. Such hypothesis and integrated approach has not been applied so far in any research institution in Poland, apart from the research initiated in the Silesian Lowland. Such analyses are also uncommon in other European research centres, which analyse mostly the “dry” Chernozems, whereas the origin of wet chernozemic soils is either completely neglected or treated separately from the chernozemic concept. The outcomes of the research project, documented in a number of slope catenas situated in various locations and climate conditions will not only have a significant influence on soil sciences, but they might also improve the historical and cultural interpretations in archaeology and contribute to the verification and improvement of sedimentological, palynological, and paleozoological methods.