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BOOK OF ABSTRACTS

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Heavy Metals Distribution, Environmental and Health Risk, Sources, and Origin in Soil from European Beech Forests

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Figure 1. Sampling sites across European mountain beech forests.

Forests cover about 40% of Earth's surface, while is 42% of the European Unions' total land area is covered by forests and wooded land [1]. Forest ecosystems are open and dynamic systems that exchange matter with other systems such as the atmosphere, hydrosphere, and biosphere [1]. Nowadays, in addition to the exchange of substances necessary for its functioning, there is also an exchange of polluting substances. Heavy metals in forest soil can originate from natural and anthropogenic processes and their high concentration can be toxic for ecosystems and humans [2]. The aim of this study is to determine: (i) heavy metal distribution in forest soil; (ii) environmental and health risk; (iii) the source of heavy metals; (iv) the origin of heavy metals; and (v) influence of the geological substrate on heavy metal contents.

Soil samples were collected from European mountain beech forests in 11 countries: Bosnia and Herzegovina, Bulgaria, Czech Republic, Germany, Italy, Poland, Romania, Serbia, Slovakia, Slovenia, and Spain. Since European beech forests grow on a wide range of geological settings, during this research terrestrial ecosystems that lie on five major bedrock groups (andesite, carbonate, conglomerate, granite, and sandstone) were investigated.

The average abundance order of heavy metal contents in forest soil samples is Cr > Zn > Ni > Pb > Cu > Co > Cd. According to geo-statistical analysis soil samples with the lowest heavy metal contents belong to cambisol soil type, on sandstone, and granite substrate, and with the highest contents belong luvisols and rendzina soil types on limestone and dolomite substrate. The concentration of most heavy metals doesn't show a systematic pattern with depth. Considering enrichment factor (EF) Pb, Sb, Cd and As, have moderate enrichment, or moderately severe enrichment in the surface soil layer. Mercury has severe enrichment. The highest values of hazard quotient pathways are noticed for ingestion in the children population, especially in the case of Pb. The Pearson correlation coefficient revealed a positive correlation among most of the elements indicating one or more common sources of heavy metals. Based on the Positive Matrix Factorization (PMF) V, Ni, Cu and Th were provided the highest percentage contribution for Factor 1, As, and Se for Factor 1 and Factor 3, Hg for Factor 4, and Cd for Factor 5. Principal Component Analysis (PCA) showed that Principle Component 1 (PC1) was mainly loaded with V, Ni, Cu, As, Se, and Th with similar high values, and Cd and Hg were strongly correlated in the Principle Component 2 (PC2).

Taking into account all results it can be concluded that heavy metal concentrations in European beech forests soil are mainly determined by the geological substrate.

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