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Pedogeochemical Anomalies in Surroundings of Great Cormorant Colony (Case Study in Lithuania)

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Abstract. The area where the colony of great cormorants in Curonian Spit (Lithuania) prospers from 1989 is the study object of "Koreko" project. Based on geochemical results of 90 samples of topsoil from 6 zones which differ according to the influence of the great cormorants the following main accumulating chemical elements were revealed: S, Cu, P, Cl, Ti and Ca. The contents of some other harmful chemical elements (Cr, Zn, Ni, Pb and Sb) are also elevated in the influence zones of cormorants. Energy-dispersive analysis was used for determination of the contents of 33 chemical elements.

Keywords: great cormorant colony, topsoil, XRF analysis

Introduction

The number of cormorants increases in various European countries. In forests with their dense colonies not only tree branches fall down on the forest litter, but also huge amount of cormorant excrements which can exceed 1 t/ha per month. So there is drastic influence of cormorants on forest ecosystem. Though the colony of the great cormorants near Juodkrantė town in the northern part of the Curonian Spit settled only in 1989 and despite that since 2004 different measures were taken to restrict its spreading and successful breeding, the area affected by cormorants exceeds 19 ha. Geochemical disbalance caused by them can be one of the possible reasons of natural ecosystem disturbance. The project "Koreko" is aimed at interdisciplinary investigation in order to reveal environmental changes caused by cormorants. Pedogeochemical investigations of topsoil comprised part of this study. The aim of this research is to reveal chemical elements with anomalous contents which are unusual for background (natural) soil of Curonian Spit.

Materials and Methods

Topsoil sampling was done in 6 zones which differ according to the influence of cormorants: E and F zones are relatively less influenced and were used as background, D zone (transitional) is characterized by their moderate activity, C zone is distinguished by their active breeding (many nests), meanwhile B and A are mostly devastated zones with dead forest. In each zone 3 sites were selected and 5 samples were taken from each site. All samples were analysed by energy-dispersive x-ray fluorescence equipment SPECTRO XEPOS with TurboQuant for pressed pellets calibration method for determination of total contents of Al, Ba, Ca, Ce, Cl, Cr, Cu, Fe, Ga, Hf, I, K, Mg, Mn, Mo, Na, Nb, Ni, P, Pb, Rb, S, Sb, Th, Si, Sn, Sr, Te, Ti, Y, Zn, V, Zr. In search of possible anomalies of chemical elements their maximum contents in A and B zones were divided by respective minimum contents from E and F zones.

Results and Discussion

The following 6 chemical elements had the highest (>3) enrichment factors: S (120), Cu (12.5), P(7.7), Cl(5.8), Ti(4.1), Ca(3.7). Lower than 3 but higher than 2 enrichment factors were characteristic of Cr, Zn, Nb, Ni, I, Hf, Pb, Zr, Fe and Mn, meanwhile lower than 2 but higher than 1.3 – of Th, Y, Mg, Ga, Si, Te, Sb. So the set of anomalous chemical elements includes not only usual harmful elements Cr, Zn, Ni, Pb and Sb, but also important elements of parent rocks Ti, Fe, Mg, Si, Zr. Presumably anomalous contents of some chemical elements were caused by natural geochemical properties of parent rocks. Normalisation by conservative chemical

element as well as chemical analysis of excrements of cormorants could help to distinguish the elements with anomalies caused by cormorants.

Conclusion

Pedogeochemical anomalies caused by excrements of great cormorants are characterised by the prevalence of S, Cu, P, Cl, Ti and Ca. The contents of other harmful chemical elements (Cr, Zn, Ni, Pb ir Sb) are also elevated in their influence zones. The final decision about accumulating chemical elements can be done after normalisation by conservative chemical element and analysis of excrements of cormorants.

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