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Introduction

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Metal-bearing areas are present on all continents. Some of them are of natural origin, but much larger areas are secondarily contaminated with metals by man as a result of mining and smelting. Such areas are covered with specific vegetation that is composed of species that require or tolerate high levels of heavy metals in the soil (Ernst 1974; Dierschke and Becker 2008; Baker *et al*. 2010). These areas are usually regarded as wasteland but in fact they are often of high conservation value and in need of protection. The vegetation of metalliferous areas has been studied by a range of natural scientists, among them botanists and ecologists.

Southern Poland has areas with high concentrations of heavy metals in the soil (zinc and lead), mainly on the Silesia-Cracow Upland. The Zn-Pb deposits in the Olkusz region are among Europe's richest. Their documented exploitation (initially silver, then lead and zinc) dates back to the 12th century. Today this area is secondarily contaminated by heavy metals. Centuries of human activity also transformed the surface. The terrain is marked by pits, settling ponds and landfills (slag heaps) left from ore extraction and processing. Plants cannot easily colonise those places. The soils usually contain high levels of zinc, lead, cadmium and other heavy metals. The difficult habitat conditions led to the emergence of morphological and physiological adaptations that allow plants to survive in this hostile environment.

The metalliferous area around the town of Olkusz, a fragment of the Silesia-Cracow Upland, has long drawn the interest of naturalists. Floristic studies have been conducted there since the second half of the 19th century (Uechtritz 1877, 1878, 1879, 1880; Zalewski 1886). The pace of research intensified at the end of the 20th century. Collaborative interdisciplinary studies were undertaken in 2008–2011 under the project entitled "Vegetation of calamine soils and its importance for biodiversity and landscape conservation in post-mining areas", financed by the European Economic Area and the Norwegian Financial Mechanism (EEA FM PL0265). The Department of Ecology of the W. Szafer Institute of Botany, Polish Academy of Sciences, coordinated the project. Staff of other units of the Institute took part in it, as well as scientists from the University of Silesia, Jagiellonian University, Pedagogical University of Cracow and the University of Oslo. The aims of the project were realised through the intensive work of a number of researchers in close cooperation

with Bolesław and Bukowno municipalities, the Bolesław Mining and Metallurgical Plant in Bukowno, and the Olkusz Forest District. This three-year research programme was the first attempt to elaborate a comprehensive description of the Olkusz Ore-bearing Region (OOR) and to assess its conservation value. It produced dozens of original papers, popular science articles and conference reports (Grodzińska and Godzik – Chapter 5, this volume). The full list of plant species in the OOR was included in the monograph *The vascular plants of the Olkusz Ore-bearing Region* (Nowak *et al*. 2011).

This book consists of 15 chapters. Besides this introduction, the subjects covered in the first three chapters include the characteristics of the studied area (B. Godzik), the history of mining (B. Godzik and M.W. Woch), and an inventory of landscape features associated with mining and processing of ores (M.W. Woch). The next chapter gives a brief overview of botanical research, a bibliography of articles published under the project, and a review of the literature (K. Grodzińska and B. Godzik). Further chapters cover the results of project work and describe the organisation of research (P. Kapusta and B. Godzik), the vegetation of the OOR (J. Holeksa, A. Błońska, A. Kompała-Bomba, G. Woźniak, P. Kurek, G. Szarek-Łukaszewska, K. Grodzińska, and M. Żywiec), the diversity of vascular plants (T. Nowak, M. Jędrzejczyk-Korycińska, P. Kapusta, and G. Szarek-Łukaszewska), mosses (R. Ochyra and B. Godzik), lichens (U. Bielczyk) and fungi (P. Mleczko and M. Beszczyńska), the physicochemical properties of soils (P. Kapusta, G. Szarek-Łukaszewska, and R.D. Vogt), groups of soil microorganisms (A.M. Stefanowicz), and the dynamics of Scots pine growth (T. Zielonka, N. Dubaj, and P. Malcher). The last chapter is dedicated to problems concerning Natura 2000 areas (M. Jędrzejczyk-Korycińska, M. Zagórna, and B. Godzik). In this chapter the authors also propose sites worthy of area protection in the OOR.

This monograph should be of use to researchers, conservationists and others interested in the vegetation of metalliferous areas. It documents the outstanding natural values of old mining areas in the Olkusz Ore-bearing Region, where Poland's only calamine grasslands evolved and where a great number of endangered and legally protected species are found. These sites are also a wonderful science laboratory where microevolutionary processes can be explored and the emergence of varieties adapted to extreme habitat conditions can be tracked. These varieties can be used to recultivate areas damaged by mining operations. The sites around Olkusz that remain after exploitation of zinc and lead also record centuries of Polish mining culture. We greatly need further research on this historically and economically important region's unique vegetation, and further measures to preserve and protect it. This volume is another step along that path.

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