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European Regional Development Fund

Environmental and social conflicts associated with mining – case studies from Lower Silesia

Jan Blachowski, Miranda Ptak, Urszula Kaźmierczak

12-13 December, 2017, Poland

Analyses of mining impacts

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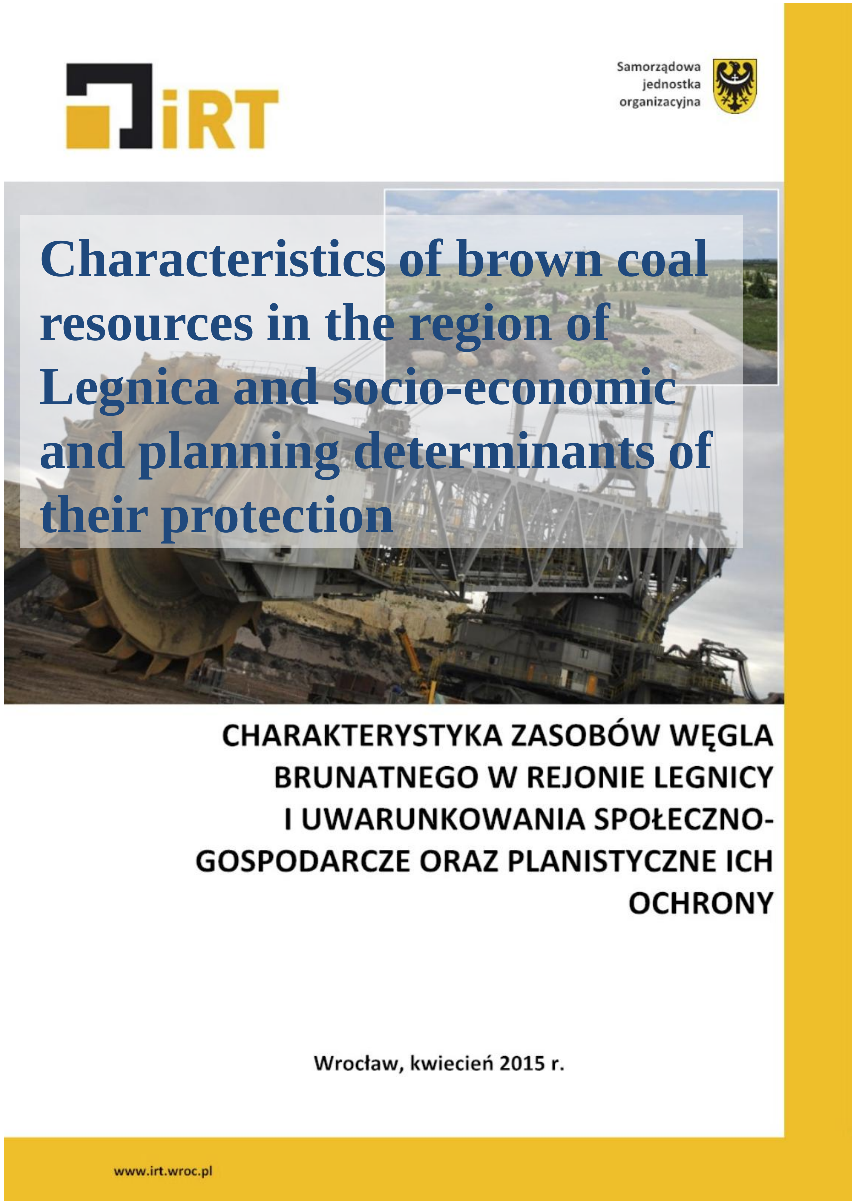
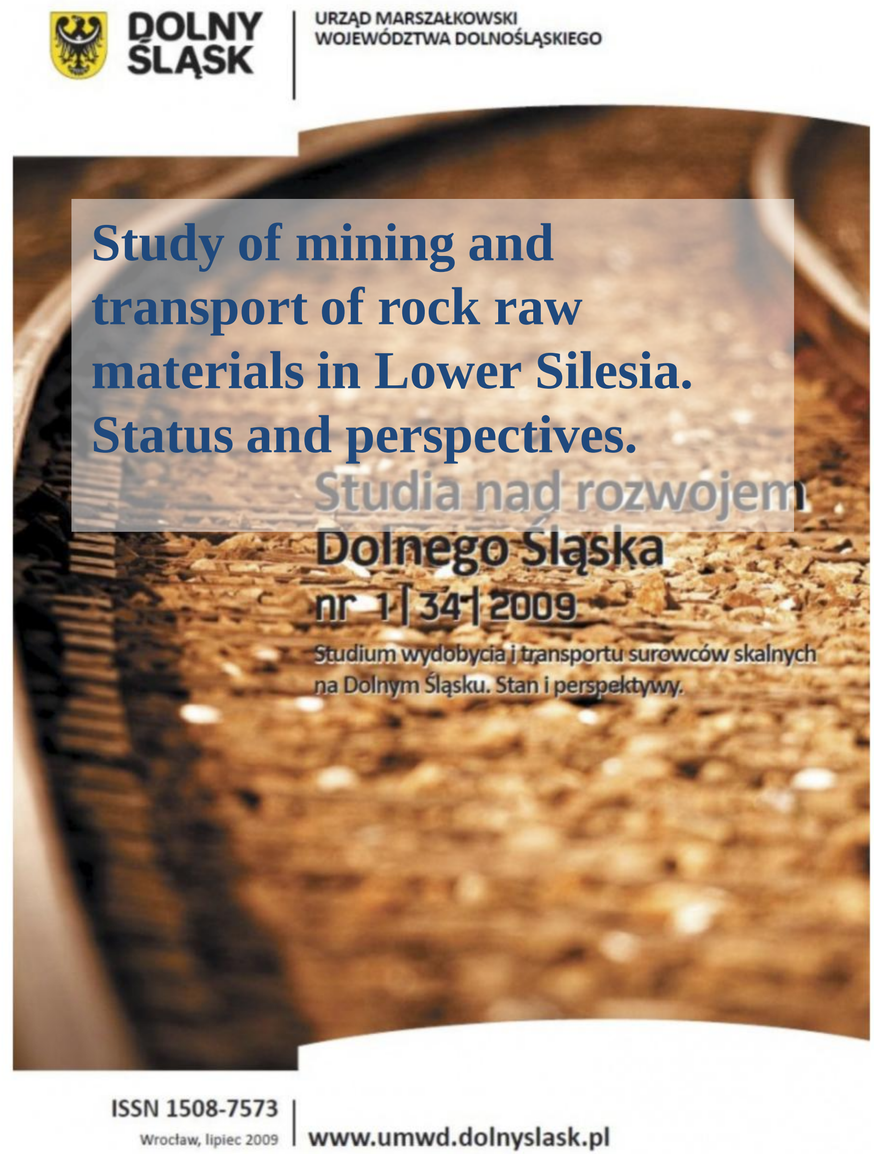
Characteristics of brown coal resources in the region of Legnica and socio-economic and planning determinants of their protection



Study of mining and transport of rock raw materials in Lower Silesia. Status and perspectives.



Case study I. Potential of brown coal mining

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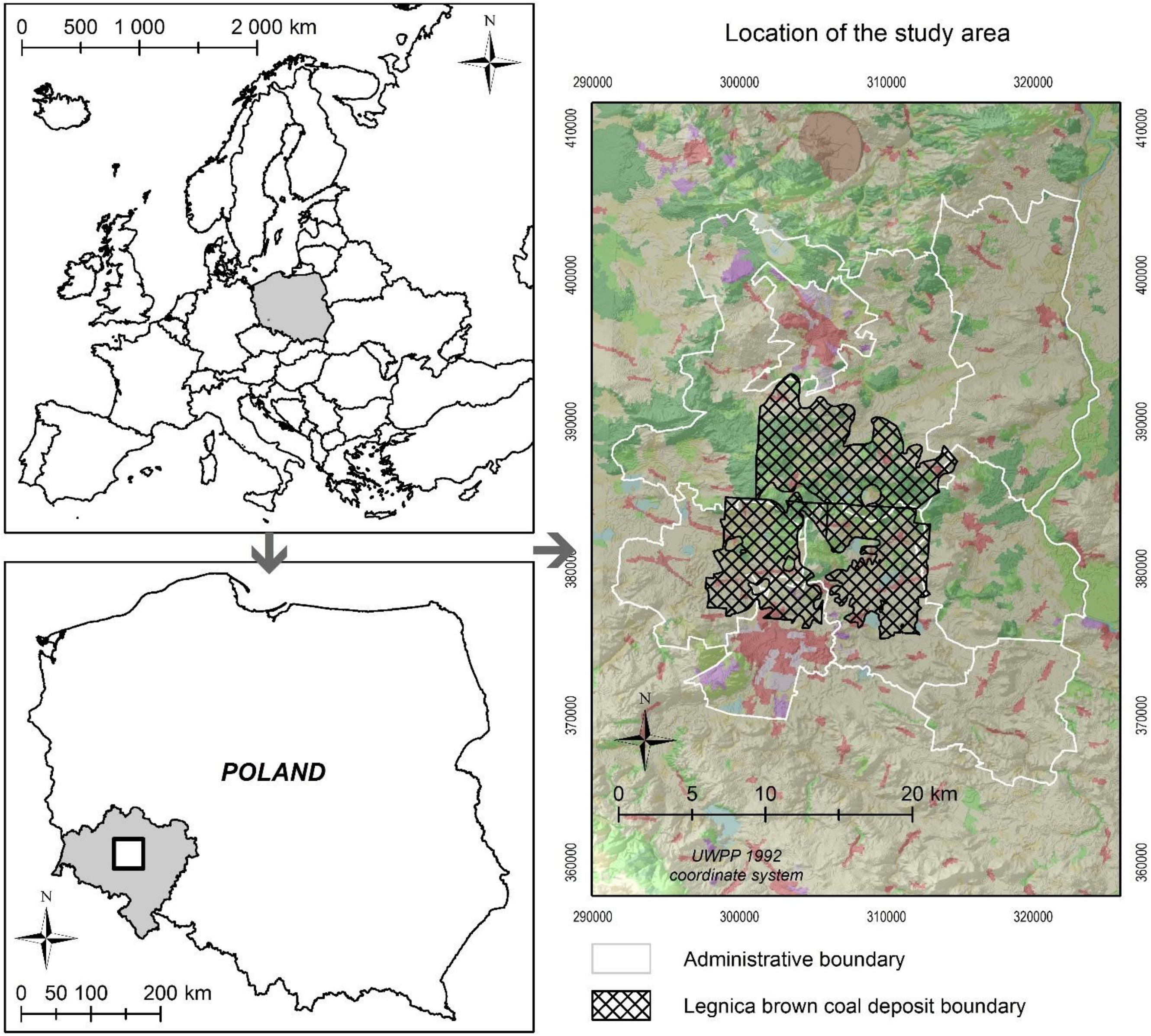

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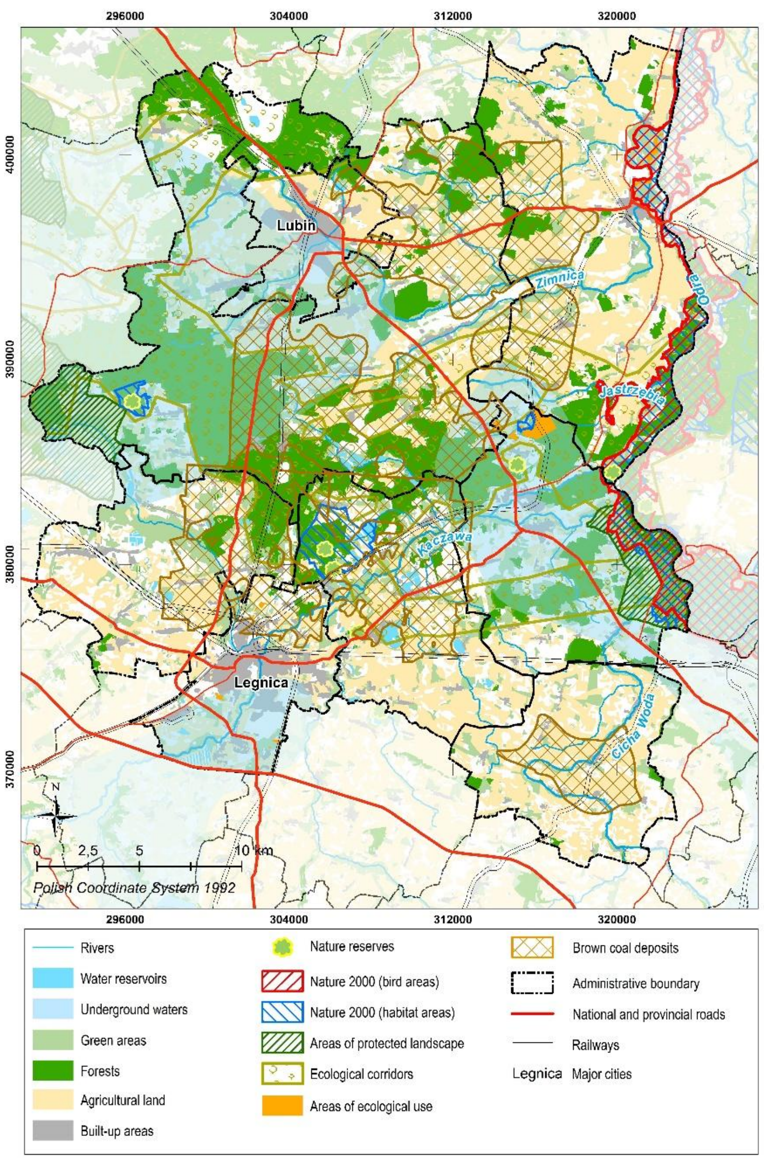

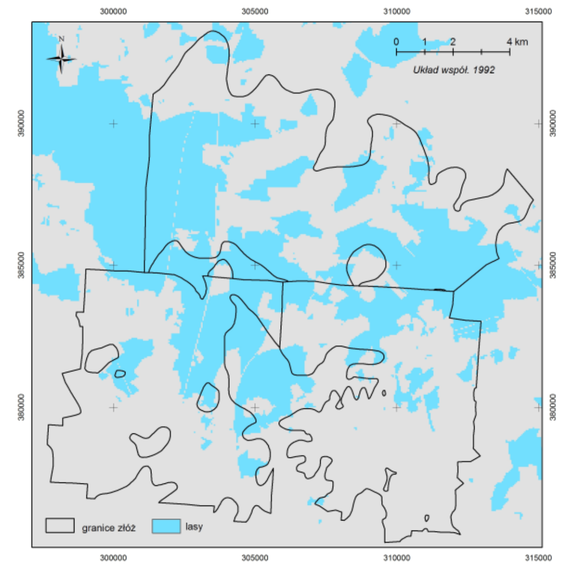

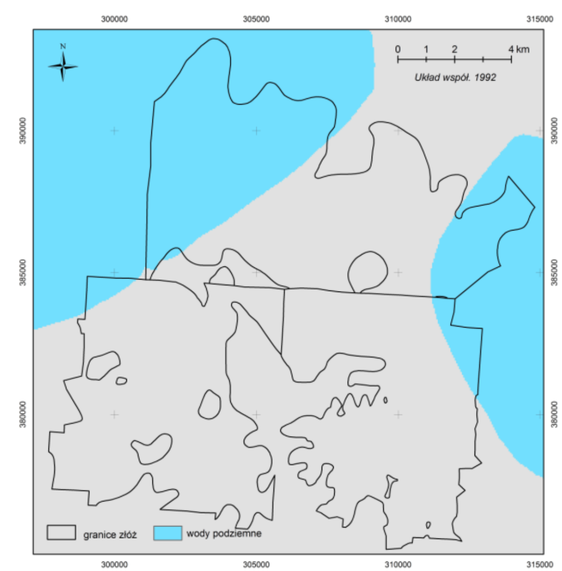

Case study I. Potential of brown coal mining

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Analytical Hierarchy Process + Weighted Linear Combination

Analysis of deposit accessibility
GIS

Identification of criteria and constraints ← Workshop with participation of an interdisciplinary group of experts

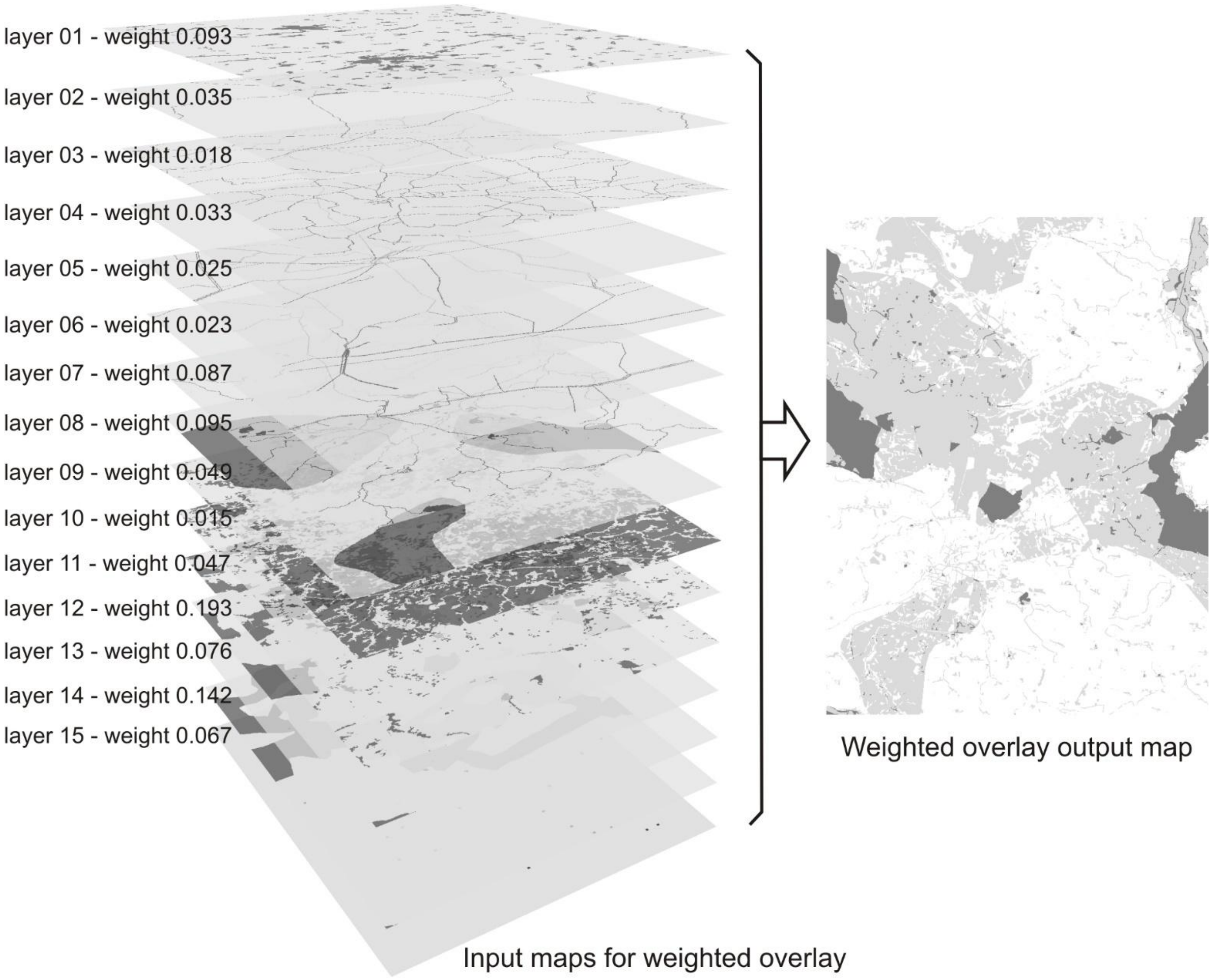
Determiantion of criteria weights ← Workshop with participation of an interdisciplinary group of experts

Development of maps representing criteria

Weighted linear combinaton of criteria maps

Presentation and interpretation of results ← Workshop with participation of an interdisciplinary group of experts

Case study I. Potential of brown coal mining



Case study I. Potential of brown coal mining

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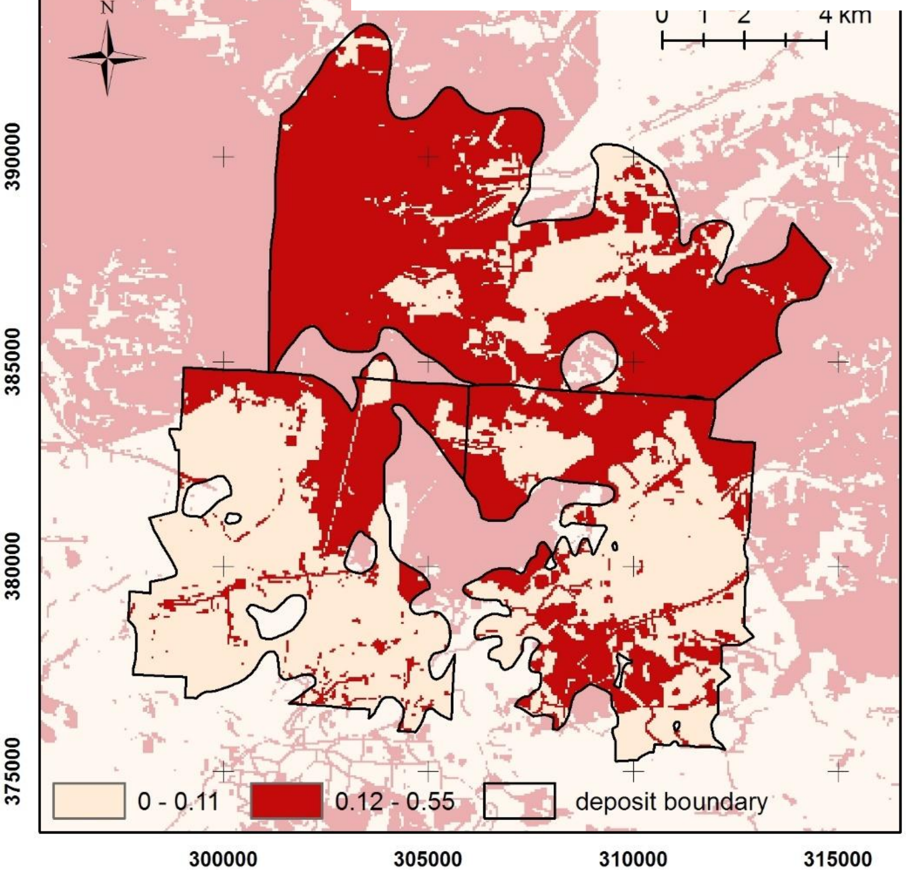
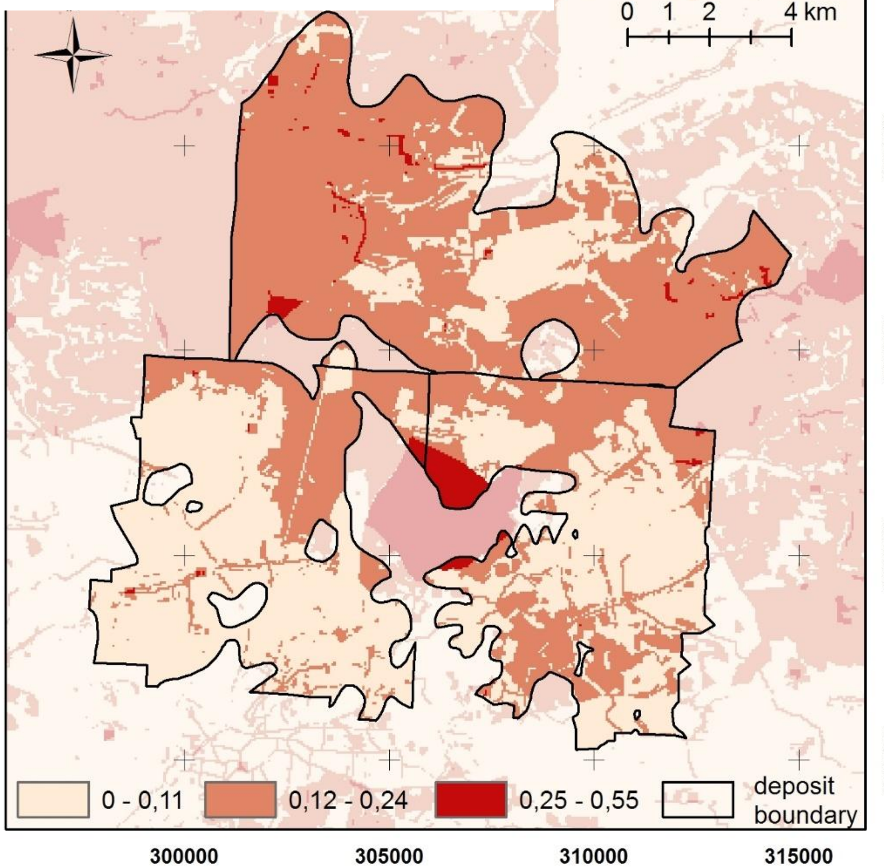
Table 8 Results of the Legnica deposit area accessibility classification

Name of deposit field	Total area (km^2)	Most inaccessible		Relatively inaccessible		Least inaccessible	
		(km^2)	(%)	(km^2)	(%)	(km^2)	(%)
Legnica W	47.18	0.26	0.6	13.32	28.2	33.60	71.2
Legnica N	68.43	1.37	2.0	52.88	77.3	14.18	20.7
Legnica E	45.65	1.78	3.9	17.88	39.2	25.99	56.9
Alltogehter	161.26	3.41	2.1	84.08	52.1	73.77	45.8





Analyses of mining impacts

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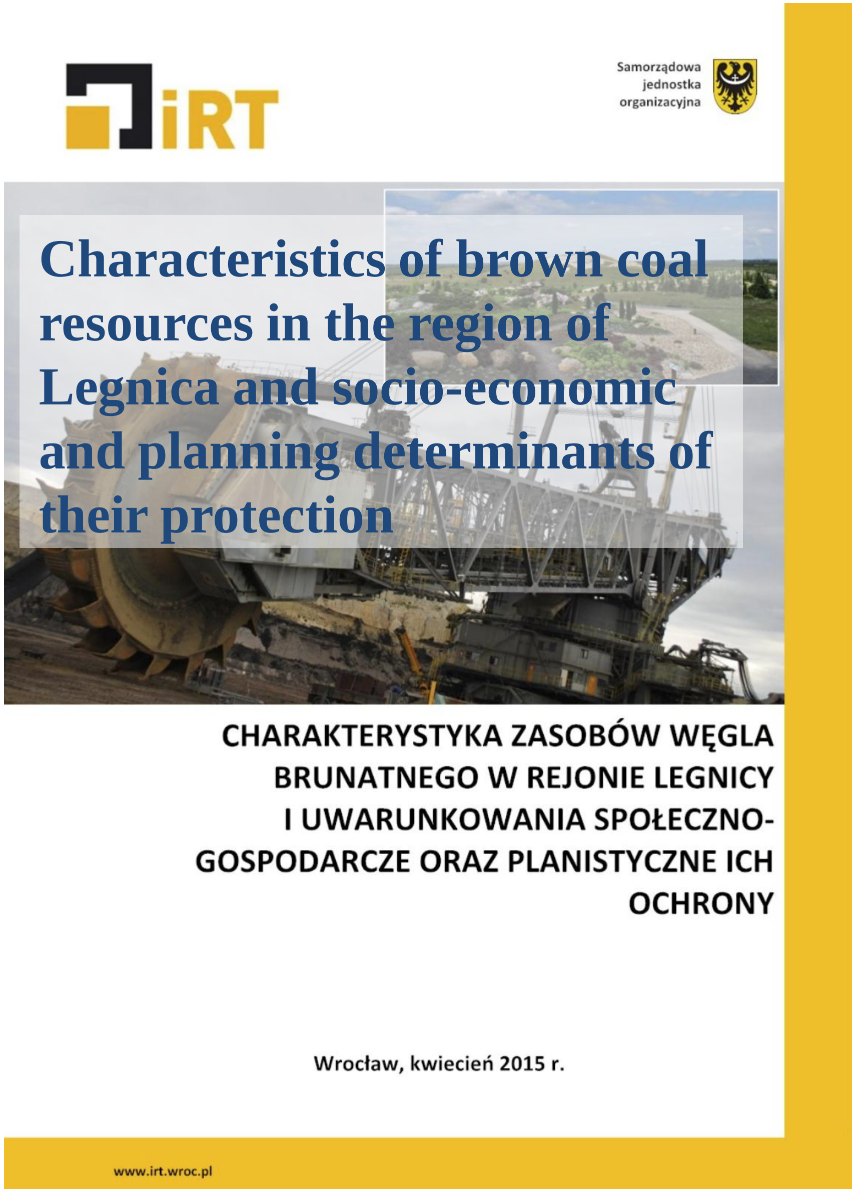

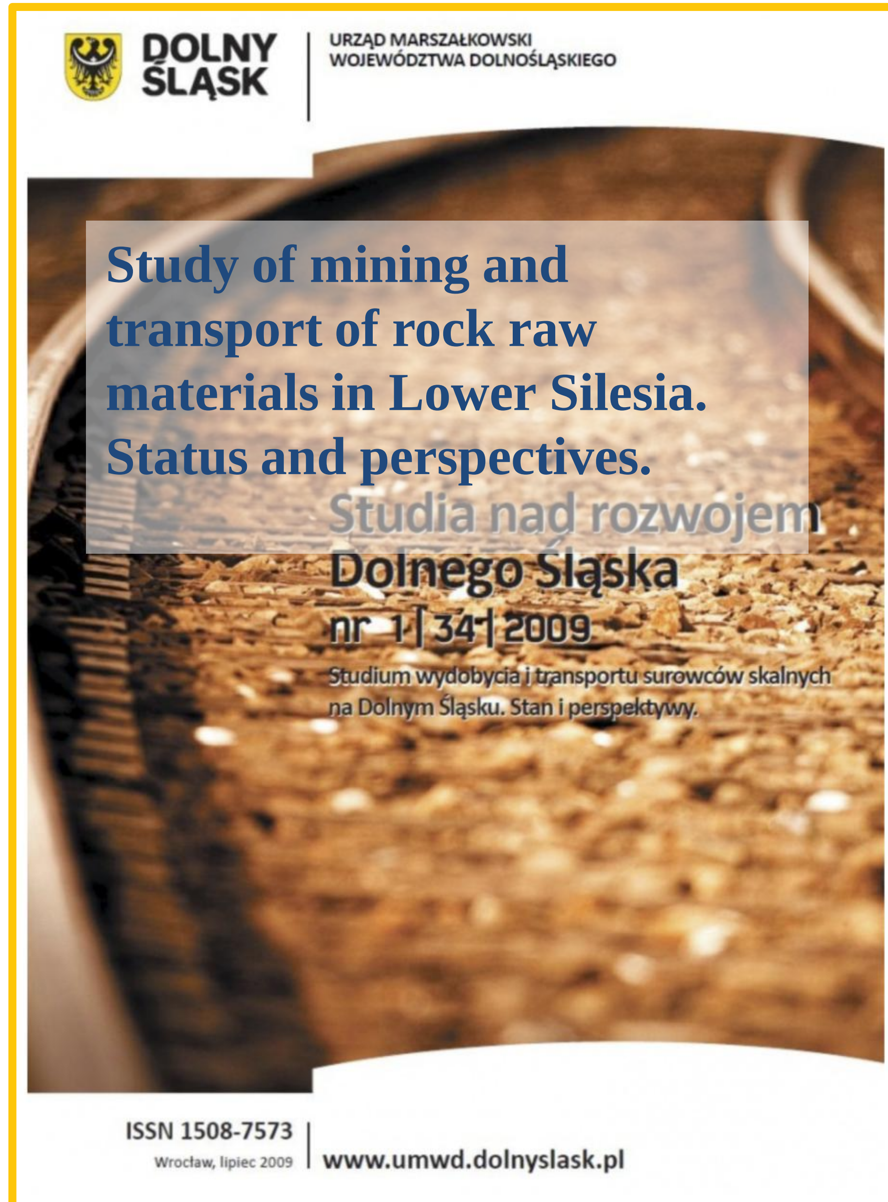

Case study II. Rock raw materials mining
Problem and aim

Case study II. Rock raw materials mining
Concentration of mining

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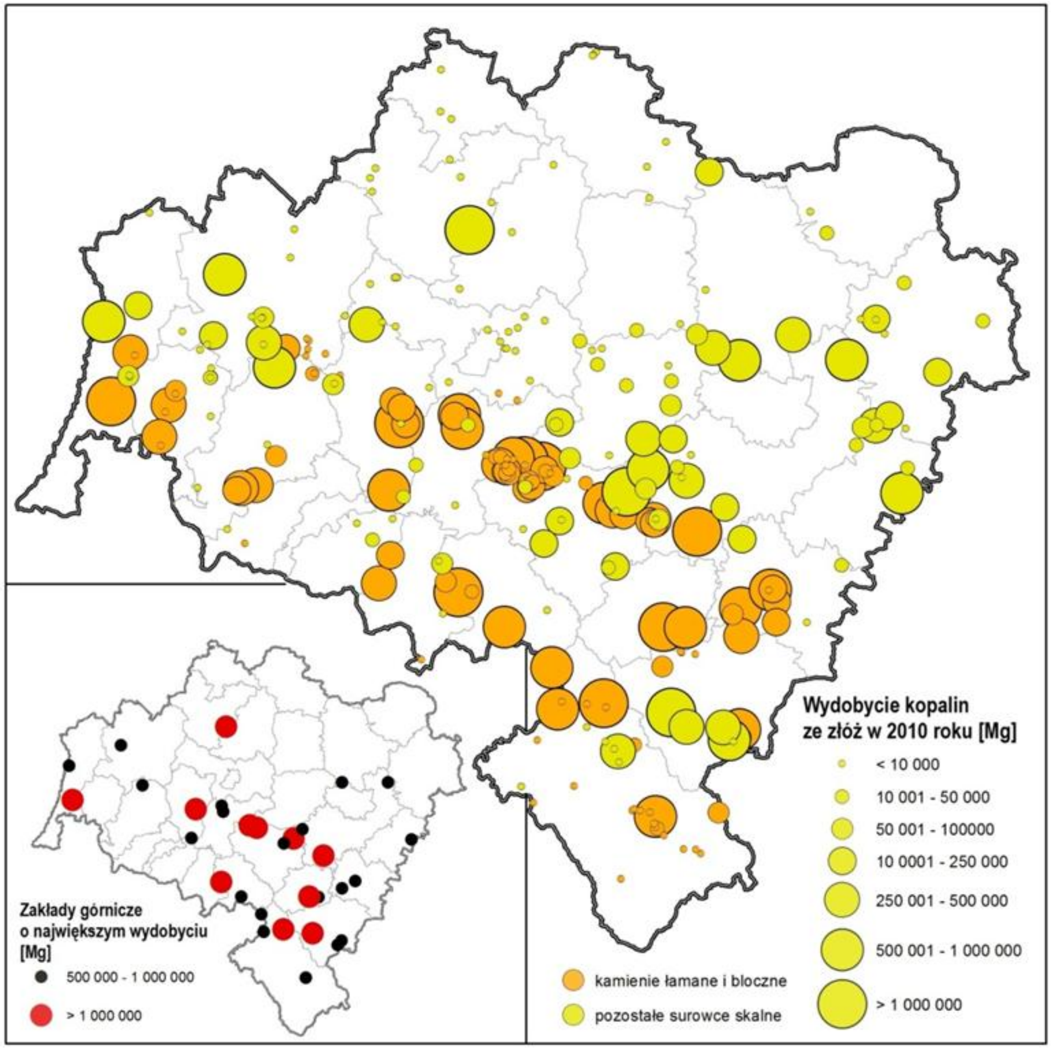
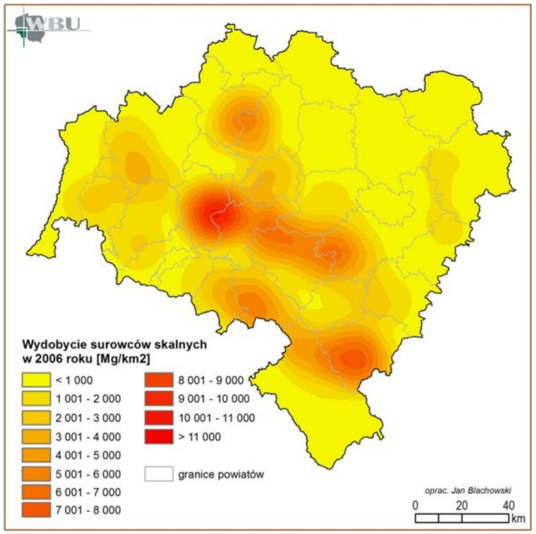
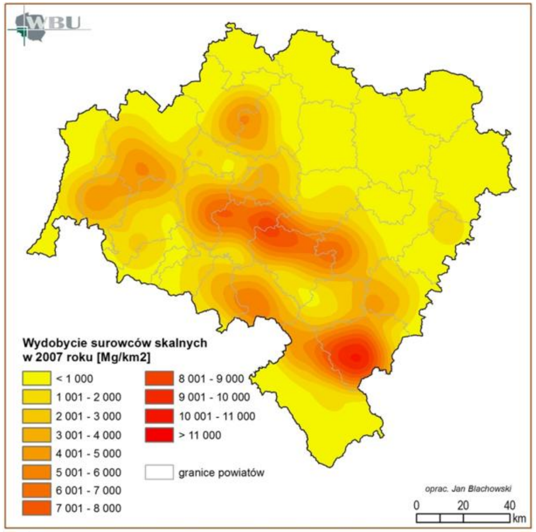
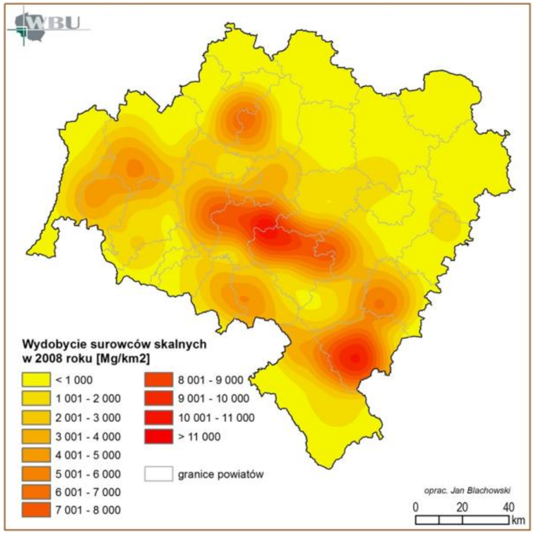


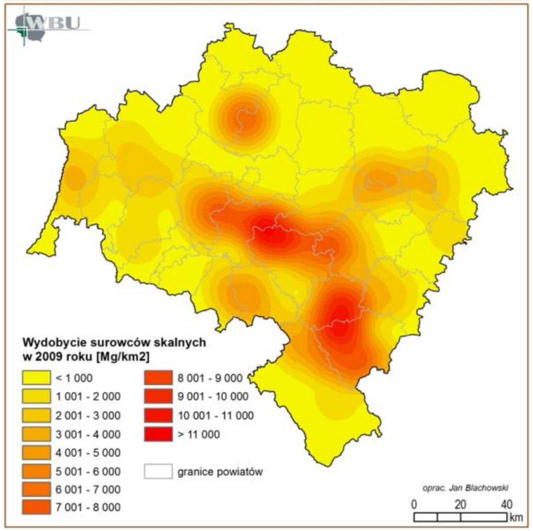
Case study II. Rock raw materials mining

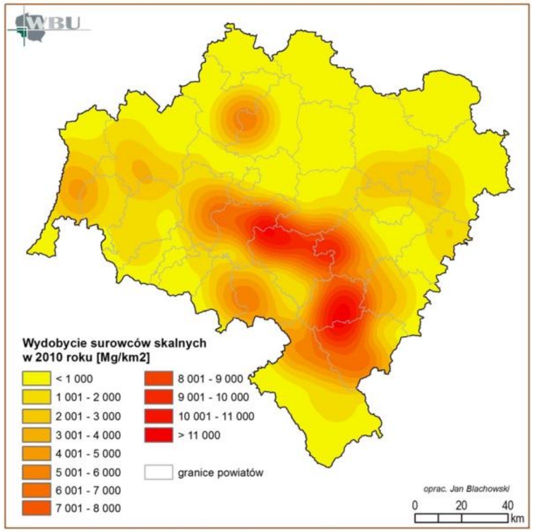
Spatial distribution and density



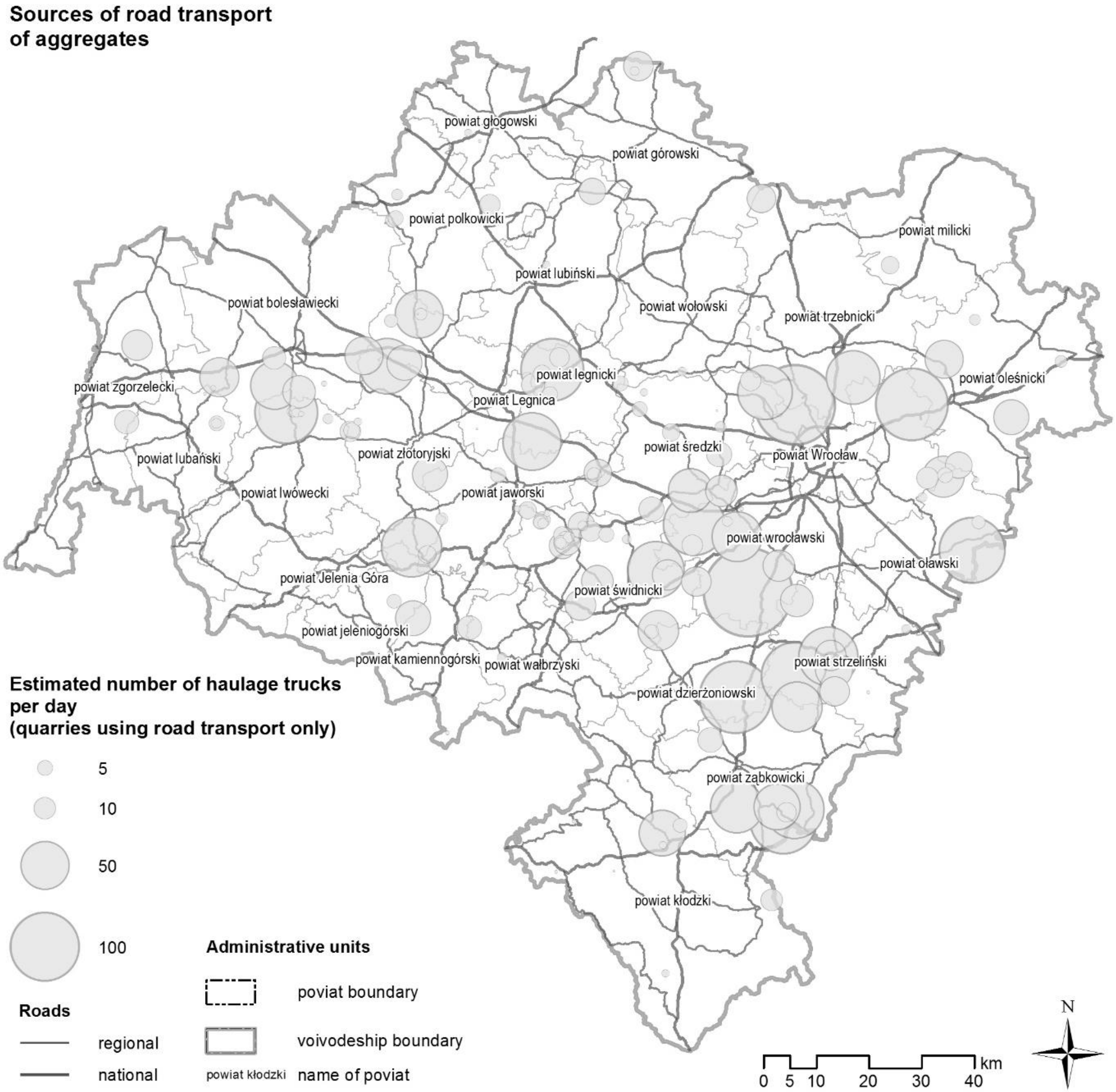






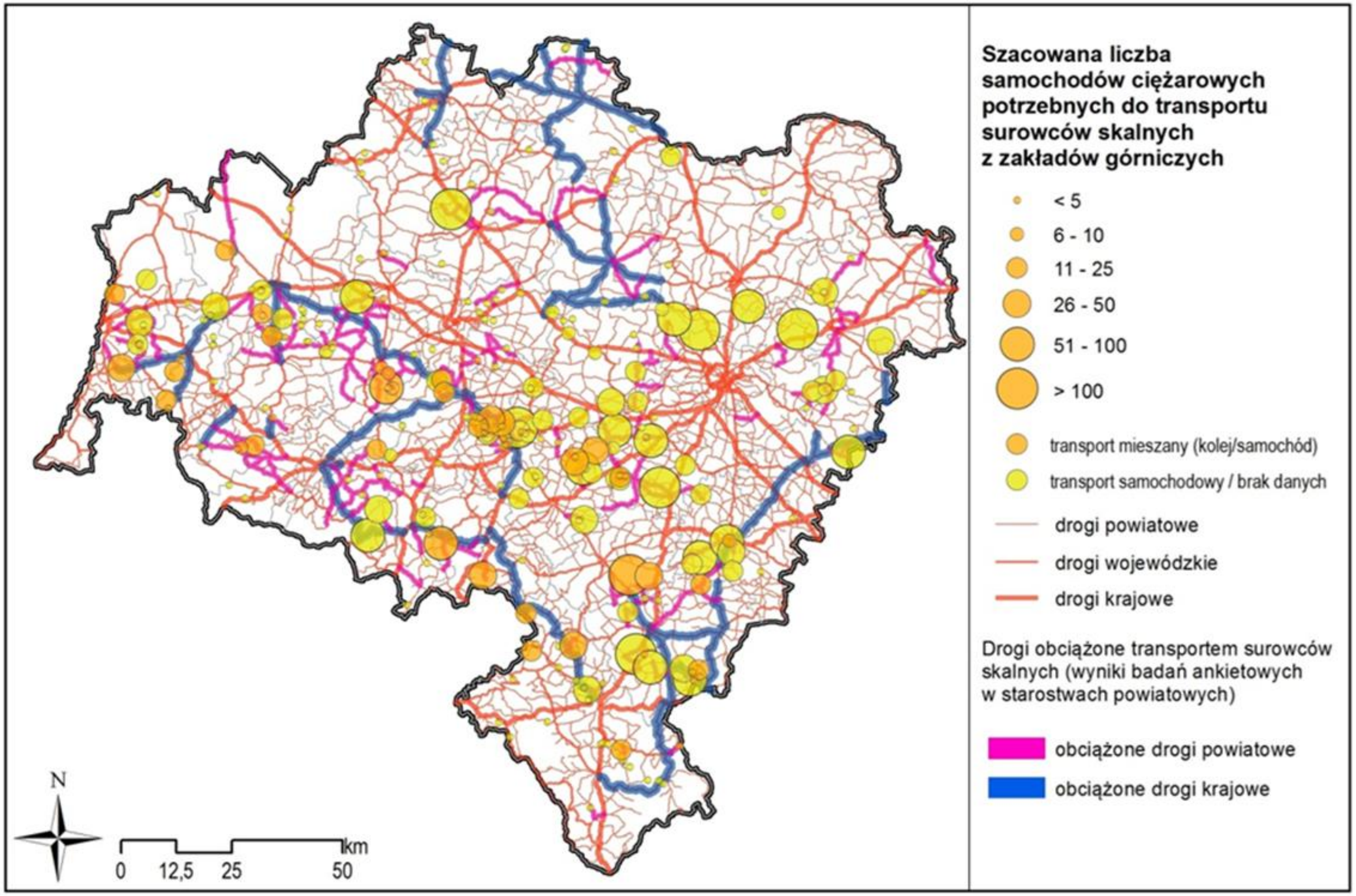


Case study II. Rock raw materials mining
Sources of road rock minerals transport



Case study II. Rock raw materials mining

Sources of road rock minerals transport



Case study II. Rock raw materials mining
Potential of railroad transport

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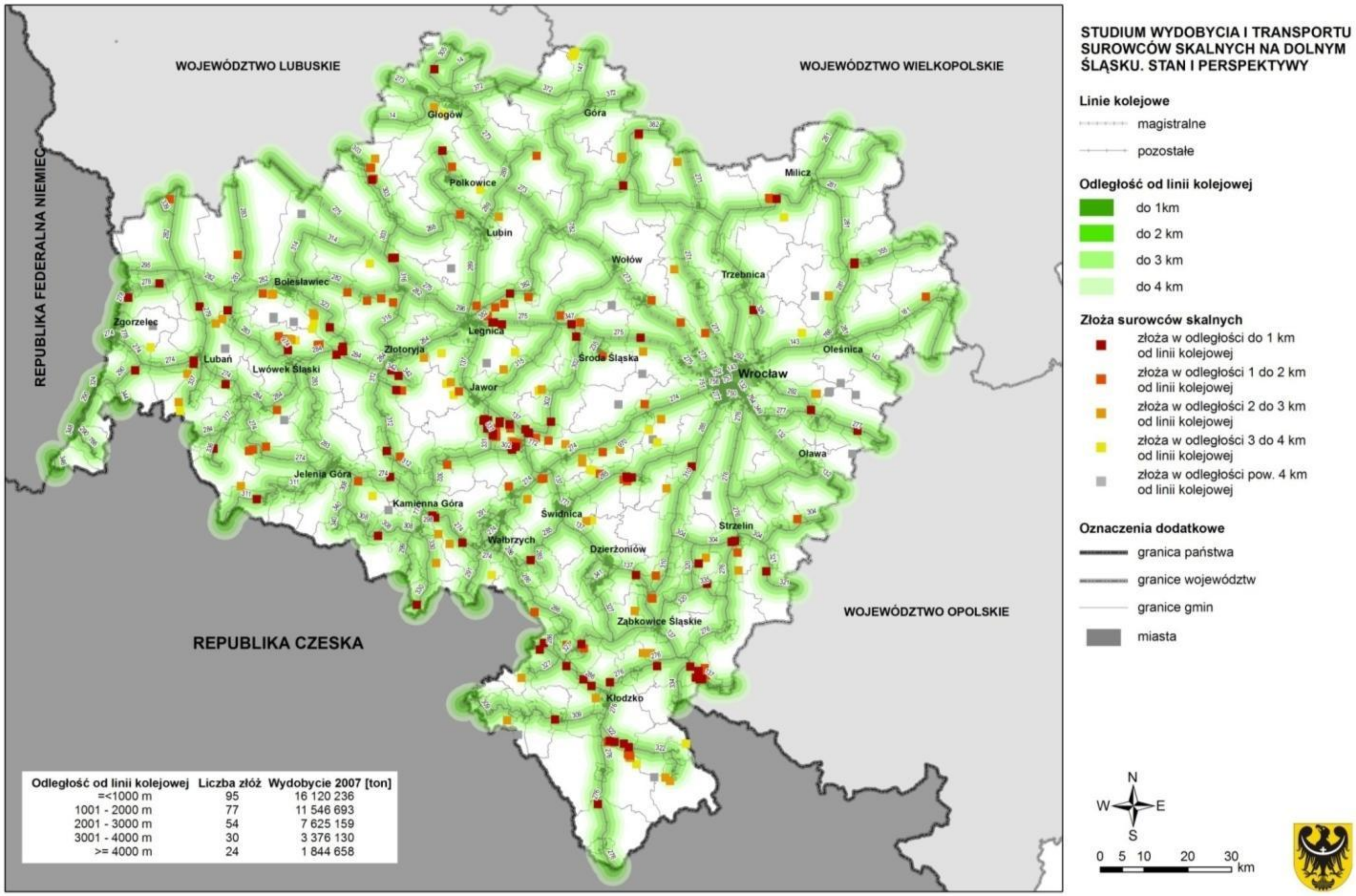

Fig. Map of rock mineral deposits located at a distance of up to 4 km away from railway lines

Case study II. Rock raw materials mining
Potential of railroad transport

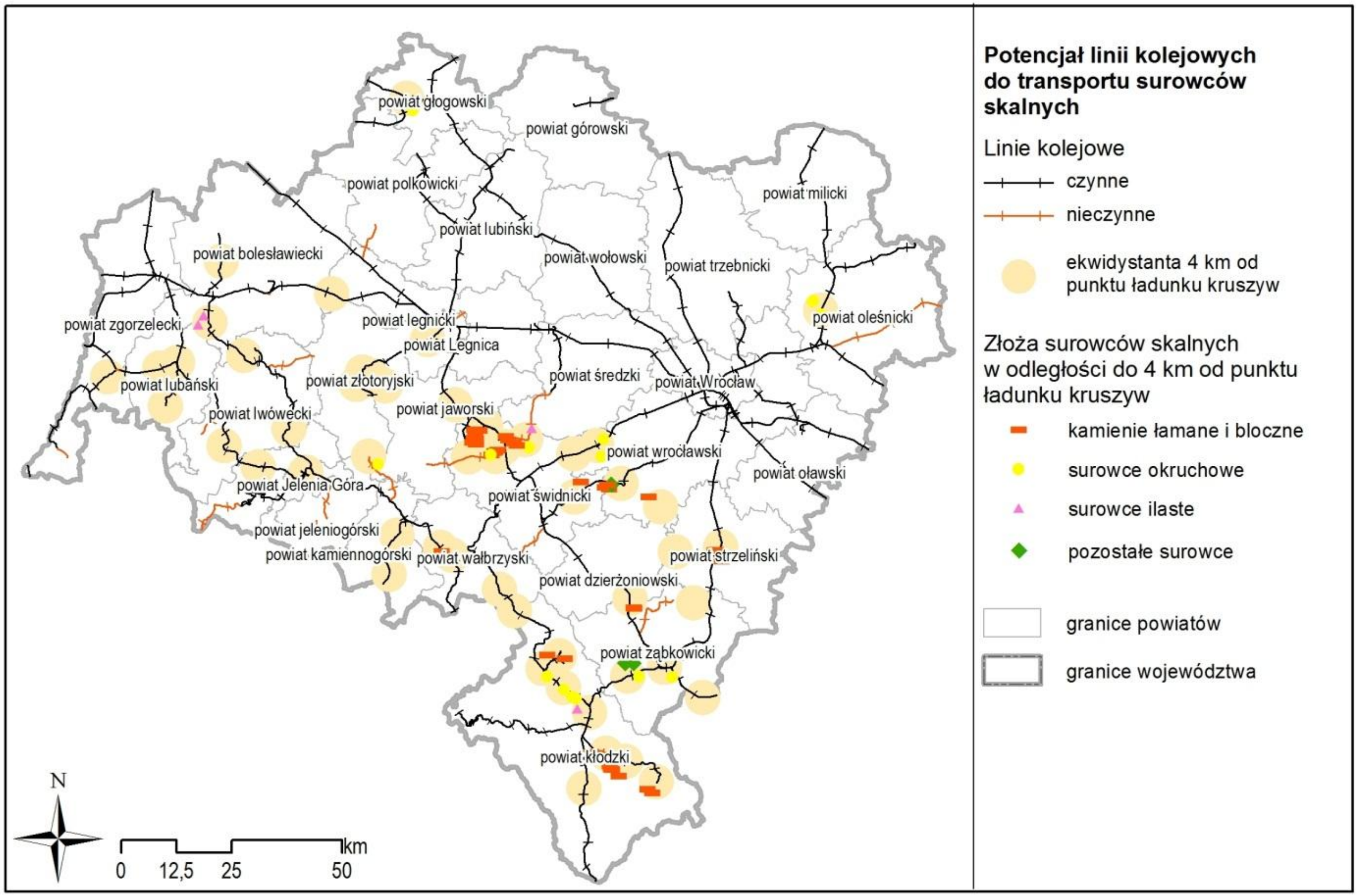

Fig. Map of rock mineral deposits located at a distance of up to 4 km away from existing and potential load points

Thank you ☺

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Environ Earth Sci (2015) 74:4119–4131
DOI 10.1007/s12665-015-4461-0

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ORIGINAL ARTICLE

Methodology for assessment of the accessibility of a brown coal deposit with Analytical Hierarchy Process and Weighted Linear Combination

Jan Blachowski[1]

Received: 5 March 2014 / Accepted: 24 April 2015 / Published online: 5 May 2015

Abstract The research aimed to assess the accessibility of a brown coal deposit for development with respect to environmental and land use functions of the terrain. A combination of the Analytical Hierarchy Process (AHP) and the Weighted Linear Combination methodology was proposed to determine weights of environmental and spatial (land use) factors conditioning development of an open-cast mine project and to produce a composite accessibility map in a geographic information system (GIS). The environmental and spatial factors (criteria) were identified in a survey of a group of experts, and the weights were determined by pairwise comparison of criteria by the same group of experts. The following ones were identified as the most significant factors constraining development of a brown coal open-cast mining project: nature protection areas, cultural and historical monuments, populated areas, underground water reservoirs and surface waters. The research was done on a case study of the Legnica brown coal deposit located in the Dolnoslaskie Province in SW Poland. The identified criteria were mapped and standardized in GIS. The final composite map was obtained in the result of a weighted map overlay analysis with the weights determined in the result of AHP analysis. The results, presented graphically and statistically, show that the western area of the three analysed Legnica deposit coal fields is the least inaccessible with respect to the analysed criteria and that the northern one is the most inaccessible. The results can be used to support sustainable spatial policy and development on all levels of public administration.

Keywords AHP · WLC · GIS · Brown coal · Deposit · Accessibility

Abbreviations

AHP	Analytical Hierarchy Process
CI	Consistency Index
CR	Consistency Ratio
GIS	Geographic information system
MCA	Multicriteria analysis
MCE	Multicriteria evaluation
OWA	Ordered Weighted Averaging
RI	Random index
WLC	Weighted linear combination

Introduction

Assessment of the accessibility of a particular mineral resource deposit for development requires consideration and evaluation of numerous, known, factors, included among these being geological and mining conditions, resource quality, environmental and spatial planning constraints, and social factors (Radwanek-Bak 2007; Uberman 2011). Environmental and spatial planning, including social factors are of major importance because of today's awareness of environmental issues. The objective information on the accessibility of a given deposit for development is important for public authorities responsible for spatial policy, environmental protection, investors and local communities.

The aim of this study has been to propose and apply, on a case study, a geographically referenced, objective method to evaluate the accessibility of a large brown coal deposit

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Environ Earth Sci (2014) 71:1327–1338
DOI 10.1007/s12665-013-2539-0

ORIGINAL ARTICLE

Spatial analysis of the mining and transport of rock minerals (aggregates) in the context of regional development

Jan Blachowski

Received: 19 August 2012 / Accepted: 8 May 2013 / Published online: 17 May 2013

Abstract Rock minerals such as dimension and crushed stones and sands and gravels (aggregates) are indispensable materials for the building and construction industries. The growth in demand for these resources causes intensification of mining operations (and their consequent environmental impacts) and transport problems in regions abundant in rock minerals. The balanced management of these resources by regional policy-makers is difficult as it requires, among other things, comprehensive and up-to-date information on the spatial distribution and temporal changes of available reserves, demand, production, and transport. This information can be provided by means of spatial and temporal analyses through geographic information systems (GIS). In this research, the focus is on the following aspects of rock mineral (aggregates) resources and mining management in the context of regional spatial planning in the example region of Lower Silesia in Poland: the spatial and temporal changes in distribution and intensity of mining, the availability of economic reserves in active mines, the magnitude and distribution of road transport flows of aggregates, the potential of railways as an alternative means of transport, and the valorisation of undeveloped aggregates deposits to assess their suitability for future use. For the purposes of this study, cartographic models have been developed using GIS to facilitate analyses of these mineral resources, mining, and transport. The results of these analyses provide current and comprehensive information on the state of aggregates mineral resources, production and transport in the Lower Silesia region. They also give an insight into availability of rock mineral resources for the future. Knowledge of these processes is important for spatial development planning, especially physical infrastructure, conducted by national, regional, and local governments.

Keywords Rock minerals · Mining · Transport · Spatial analysis · GIS · Regional development

Introduction

Rock minerals such as dimension and crushed stones and aggregates (sands and gravels) are raw materials vital for the construction of buildings, roads, and other types of infrastructure. For simplicity, in this paper the term "aggregates" will be used to cover all of these various types of rock mineral raw materials. Deposits of these raw materials, the locations of which are conditioned by geology, are usually unevenly distributed across any given area (e.g., region or a country). This is especially true for magmatic, metamorphic and sedimentary dimension, and crushed stones. Deposits of sands and gravels are more common and widely distributed. On the other hand, in many cases, the users of these materials, e.g., road construction sites and large cities, may be located at considerable distances away, even hundreds of kilometers, from available sources. The demand for aggregates results in pressure to increase output from existing sources and to start new mining operations. This in turn increases loads on communication networks (i.e., road and railways) used to transport these materials from sources to receiver areas.

The typical means of transport for aggregates are railways and roads. Road transport, using tipper and semi-trailer tipper trucks is usually appropriate for shorter

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