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

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Analyses of mining impacts

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


CHARAKTERYSTYKA ZASOBÓW WĘGŁA BRUNATNEGO W REJONIE LEGNICY I UWARUNKOWANIA Społeczno-Gospodarcze oraz Planistyczne ich Ochrony

Wrocław, kwiecień 2015 r.
Case study I. Potential of brown coal mining
Case study I. Potential of brown coal mining
Case study I. Potential of brown coal mining
Case study I. Potential of brown coal mining

Analytical Hierarchy Process + Weighted Linear Combination

Analysis of deposit accessibility
GIS

Identification of criteria and constraints

Determination of criteria weights

Development of maps representing criteria

Weighted linear combination 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

layer 01 - weight 0.093
layer 02 - weight 0.035
layer 03 - weight 0.018
layer 04 - weight 0.033
layer 05 - weight 0.025
layer 06 - weight 0.023
layer 07 - weight 0.087
layer 08 - weight 0.095
layer 09 - weight 0.049
layer 10 - weight 0.015
layer 11 - weight 0.047
layer 12 - weight 0.193
layer 13 - weight 0.076
layer 14 - weight 0.142
layer 15 - weight 0.067

Weighted overlay output map

Input maps for weighted overlay
Case study I. Potential of brown coal mining

Table 8 Results of the Legnica deposit area accessibility classification

<table>
<thead>
<tr>
<th>Name of deposit field</th>
<th>Total area (km²)</th>
<th>Most inaccessible</th>
<th>Relatively inaccessible</th>
<th>Least inaccessible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(km²)</td>
<td>(km²)</td>
<td>(km²)</td>
<td>(km²)</td>
</tr>
<tr>
<td>Legnica W</td>
<td>47.18</td>
<td>0.26</td>
<td>13.32</td>
<td>33.60</td>
</tr>
<tr>
<td>Legnica N</td>
<td>68.43</td>
<td>1.37</td>
<td>52.88</td>
<td>14.18</td>
</tr>
<tr>
<td>Legnica E</td>
<td>45.65</td>
<td>1.78</td>
<td>17.88</td>
<td>25.99</td>
</tr>
<tr>
<td>Alltogether</td>
<td>161.26</td>
<td>3.41</td>
<td>84.08</td>
<td>73.77</td>
</tr>
</tbody>
</table>
Analyses of mining impacts

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


CHARAKTERYSTYKA ZASOBÓW WĘGŁA BRUNATNEGO W REJONIE LEGNICY I UWARUNKOWANIA SPOŁECZNO-GOSPODARCZE ORAZ PLANISTYCZNE ICH OCHRONY

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Studium wydobycia i transportu surowców skalnych na Dolnym Śląsku. Stan i perspektywy.

Wrocław, lipiec 2009
Case study II. Rock raw materials mining

Problem and aim
Case study II. Rock raw materials mining
Concentration of mining
Case study II. Rock raw materials mining
Spatial distribution and density

Fot. Piotr Celiński
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

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

Jan Blachowski

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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 accessible 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 (Rudwanek-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.