

# The Examples of Post-Mining Land Reclamation in the Public Opinion

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## Abstract

*Nuisance for the people living in areas covered by the direct or indirect impact of the mining industry is an important social problem. The development of the mining industry depends on high environmental requirements, in particular, it is closely related to the fulfillment of obligations of safety for human health and life. Through consultation with the local society and targeted actions degraded land can become attractive. In contrast, the lack of reclamation leads to the intensification of negative phenomena: erosion, surface mass movements, changes in the ecosystem, eutrophication of water tanks.*

*Maintaining balance in the natural environment is the basic criterion for the proper functioning of industrial facilities. Mining activity is a threat to the environment, including human health and life.*

*Use of the environment by mining is subject to adjustment to the legislation and carrying out mining activities in line with environmental requirements.*

*Mining activities and nature protection can operate in a sustainable manner. Appropriate selection of methods for mineral exploitation allows you to minimize the impact on the environment components. The positive impact of opencast mining is reflected in the creation of new habitats of plants and animals in post-mining areas, in the creation of new recreation places, in diversifying the landscape thanks to the construction of water reservoirs. Lakes formed after use of natural aggregates overgrown vegetation reed, acting convenient place to settle of the water birds.*

**Keywords:** mining, post-mining areas, environmental protection, nature conservation

## Introduction

In 1965 eminent Polish scientist Valery Goethel introduced the term *sozology*, meaning the science about the causes and consequences of the changes taking place in nature due to human activities. *Sozology* deals with complex changes in the natural environment under the influence of technical progress. It also indicates the ways to prevent or mitigate these effects [Dziwański 1993]. Primary energy carriers are organic fossil fuels, nuclear fuel, geothermal and unconventional sources. The fossil fuels include: coal, lignite, oil and natural gas. Forecasts of world mining of coal and lignite are promising. According to the currently identified resources of its sufficiency is estimated at 200 years, assuming a constant rate of consumption. Highly developed countries gradually bring to power a cleaner conventional fuels, e.g. natural gas, shale gas. Increasingly important role play alternative sources of primary energy. Poland is a leading coal producer and consumer of energy based on this medium. The high share of coal and lignite in domestic electricity production makes it implemented economic development model should be compatible with social acceptance.

## The Impact of Mining on the Environment

The natural environment includes the external part of the Earth's crust and soil cover, part of the atmo-

sphere, hydrosphere, fauna and flora. The environment is transformed by human activity through economic, industrial and human living. Mining activities cause transformations in the environment, which are called as mining damage. On the negative change in the most vulnerable are the lithosphere and hydrosphere, and to a smaller degree, atmosphere and biosphere [Kulczycka i in. 2015, Pietrzyk-Sokulska 2001]. According to the geological and mining law [Czaplicka 2001] mining damage includes damage to objects on the earth's surface or underground and other damages caused by mining works. In fact, these are different kinds of deformation of the earth's surface and damages to buildings and infrastructure in mining areas, or in close proximity. The most common are: deformation of the land surface, pouring depressive, pollution of rivers of mine waters (especially salinity). The costs of removing the consequences of the damage are covered by special legislation.

In Poland three methods of mineral extraction are used:

- hole (sulfur and salt mining),
- pit (brown coal, minerals and rock materials common)
- underground (coal, copper ore, barite, zinc and lead).

Each of these methods has a negative impact on the environment.

Mining affects on the elements of the environment directly and indirectly. Direct impact is occupying of



Fig. 1 The residue of the installation used in the sulfur mining in Basznia, Lubaczów district (the Podkarpackie voivodship) [fot. M. Dral]

Fig. 1 Pozostałość instalacji wykorzystywanej przy eksploatacji rud siarki [fot. M. Dral]



Fig. 2 Bełchatów Lignite Mine . The view from the observation deck at Żłobnica [photo by S. Bazan]

Fig. 2 Kopalnia węgla brunatnego Bełchatów. Widok z tarasu w Żłobnicy [fot. S. Bazan]

agricultural land, forests and recreational activities at mines and landfills.

Indirect impact is broad influence of mining activities, including the geomechanical transformation, soil degradation, water and atmosphere pollution.

Assessment of the impact of mining on the environment should include information on the impact on human, flora and fauna, air, water and soil in the landscape, material assets and cultural heritage [Barteczek et al. 1993 Kowalska, Sobczyk, 2010 Sobczyk et al. 2014 Kowalska, Sobczyk 2014].

After the completion of the exploitation at the mine is obliged to restoration of degraded land. The main environmental problems of coal mining are deformations with the secondary effects (mining damage and the impact of the rock mass to buildings, roads, infrastructure, agricultural and forest lands), the discharge of saline waters from the drainage of mining plants, mining waste (fig. 3), lands requiring reclamation and management, emissions of methane, emissions of dust and gases. Coal mining discharges to surface waters millions of tons of salt along with unused mines water.

At the same time in the coal mines generate millions of tons of mining waste (fig. 4). Waste economically used on the surface are used for leveling areas (reclamation and removal of mining damage), production of construction materials, engineering and hydraulic engineering works. Coal mines lead reclamation and revitalization on the surface covering more than 80 hectares of land degraded by industrial activity (fig. 5, 6).

### The Study Public Opinion on the Post-Mining Reclamation

The use of the environment by mining is subject to adjustment to the legislation and carrying out mining activities in line with environmental requirements. The public discussion gives the opportunity to speak to people affected the industrial nuisance, both the government and the local community. In an efficient manner conducive to optimal decisions take into account the interests of all stakeholders. It can also be an excellent example of a process of environmental education.

The public opinions about the harmful impact of mining on the environment have been the subject



Fig. 3 Eroded dump in Trzciana [photo by A. Kowalska]

Fig. 3 Zerodowana hałda w Trzcianie [fot. A. Kowalska]



Fig. 4 Settlement ponds. Mine "Boleslaw" [photo by A. Chybiorz]

Fig. 4 Stawy osadowe. Kopalnia "Boleslaw" [fot. A. Chybiorz]

of many studies, including scientists from the Polish Academy of Sciences in Krakow, AGH University of Science and Technology and the Central Mining Institute in Katowice.

Conflict areas, the existence of which is the result of a conflict of interest of industry and the public, should comply with safeguards for human health and biological life. Residents of areas of ecological threats realize that they are paying the price for the region's development, and environmental damage are offset by the benefits to the community (important role of mining in the stabilization of the labor market).

Analysis of selection techniques of revitalization of industrial areas in Tarnobrzeg, Miechów, Jastrzebie Zdrój and Krakow pointed to an important aspect of the social factor in the sustainable development of degraded areas [Sobczyk, Pawul 2010 Pawul, Sobczyk, 2010 Sobczyk, Pawul 2012]. In the opinion of local communities on environmental nuisance of mining problem of revitalization works is the inaccuracy of solutions, e.g. negligence landscape context, the location of objects without regard to the existing local

development plan, lack of consistency functional. Equally important, if not the most important, is ignoring and even disregard the opinion of inhabitants by decision-makers.

It is rare that harmony all three aspects: natural, visual and functional. The implemented projects do not meet the expectations of citizens and are not always in line with market demand. Tourism and recreation are the most desirable directions of reclamation in the area devastated by the mining industry. The local population sees the future of the region in these two directions, as well as the opportunity to relaxation and the chance for finding seasonal work in the field of services.

„Zakrzówek” – the area after finishing of the exploitation of limestone, is located in the southern part of Kraków, near Vistula River and Twardowski's Rocks (fig. 7, 8). The quarry after pouring constituted and continues to be an attractive place to dive due to the high water clarity of up to 15 meters. Currently, there is a diving base "Diving Centre Kraken" – school diving instructors.



Fig. 5 Reclaimed northern escarpment dump of "Pochwacie" [photo by KWK „Zofiówka”]

Fig. 5 Zrekultywowana północna strona skarpy zwałowiska "Pochwacie" [fot. KWK „Zofiówka”]



Fig. 6 Reclaimed escarpment dump of „Borynia-Jar” [photo by KWK „Borynia”]

Fig. 6 Zrekultywowana skarpa zwałowiska "Pochwacie" [fot. KWK „Borynia”]

For amateurs of extreme sports the climbing walls were created (fig. 9). The land use has no negative impact on the landscape of "Zakrzówek".

In "Zakrzówek" area several bicycle paths and jogging tracks are functioning (trainings organized with an instructor). Functions are several bicycle paths and jogging tracks, which are organized training with an instructor (fig. 10, 11). When planning the rehabilitation of "Zakrzówek", please remember to keep as much of the beautiful natural landscape of the area.

Prolonged lack of work of revitalization in the area of (Podkarpacie) disappoint the expectations of the inhabitants of the municipality Lubaczów (fig. 12) [Sobczyk, Pawul 2013]. The development of tourism on reclaimed mining areas is an opportunity to create new jobs.

Causes of conflicts of mining activities and the European ecological network Natura 2000 in Poland are objects of interest for many years [Kowalska, Sobczyk 2011 Sobczyk, Kowalska 2013]. Difficult partnerships surface mining and Natura 2000 causes exacerbations of conflicts, so you should aim to rationalize the princi-

ples of cooperation miners and naturalists. Significant error in designating Natura 2000 sites is the lack of consultation with geologists and mining entrepreneurs. Consequently, to obtain a decision about the possibilities of exploitation of many fields is very difficult or impossible.

Mining activities and nature protection can operate in a sustainable manner. Appropriate selection of methods for mineral exploitation allows you to minimize the impact on the environment components. The positive impact of opencast mining is reflected in the creation of new habitats of plants and animals in post-mining areas, in the creation of new recreation places (fig. 13), in diversifying the landscape thanks to the construction of water reservoirs. Lakes formed after use of natural aggregates overgrown vegetation reed, acting convenient place to settle of the water birds (fig. 14, 15).

## Conclusions

Mining areas often are adjacent to protected areas, natural and valuable, arable land, or simply from the



Fig. 7 Aerial view of the quarry on the "Zakrzówek" [<http://www.ccr.com.pl>]

Fig. 7 Widok z lotu ptaka na dawny kamieniołom "Zakrzówek" [<http://www.ccr.com.pl>]



Fig. 8 Limestone rocks in the lagoon "Zakrzówek" [photo by M. Adamczyk]

Fig. 8 Skały wapienne wynurzające się z zalewu "Zakrzówek" [fot. M. Adamczyk]

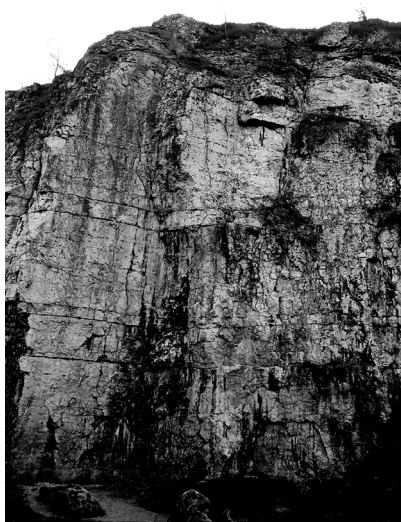


Fig. 9 Climbing wall as an example of the post-mining land use [photo by M. Adamczyk]

Fig. 9 Ściana wspinaczkowa jako przykład wykorzystania terenu pogórniczego [fot. M. Adamczyk]



Fig. 10 The bike path and jogging track in the "Zakrzówek" [photo by M. Adamczyk]  
 Fig. 10 Ścieżka rowerowa i trasa biegowa przy zalewie "Zakrzówek" [fot. M. Adamczyk]



Fig. 11 Designation of a bicycle path [photo by M. Adamczyk]  
 Fig. 11 Ścieżka rowerowa jako przykład wykorzystania terenu pogórniczego [fot. M. Adamczyk]



Fig. 12 Areas of the sulfur ore mining that are not reclaimed. Basznia, Lubaczów district (the Podkarpackie voivodship) [photo by M. Dral]  
 Fig. 12 Nie zrekultywowane tereny po eksploatacji rud siarki [fot. M. Dral]



Fig. 13 The recreation areas in post-mining limestone-pit in Trudolubovka village, Bakhchisaray region, Crimea [photo by M. Gizun]

Fig. 13 Tereny rekreacyjne po kopalni wapienia we wsi Trudolubovka, region Bakhchisaray, Krym [fot. M. Gizun]



Fig. 14 The ponds water generated in the process of reclamation of the northern part of the deposit Trzciana II, field B. The refuge of water birds [photo by A. Kowalska]

Fig. 14 Stawy wodne utworzone w procesie rekultywacji północnej części złoża Trzciana II, pole B. Siedlisko ptactwa wodnego [fot. A. Kowalska]



Fig. 15 The habitat of ducks on the old gravel pit in Trzciana [photo by A. Kowalska]

Fig. 15 Siedlisko kaczek na starej żwirowni w Trzcianie [for. A. Kowalska]

housing estates. By this fact are areas of conflicts [Sobczyk, Kowalska 2015].

The environment is subject to unfavorable changes in the mining districts. Therefore, you must create a protective zone around the mining facilities in order to prevent the negative consequences of their impact on the environment, and consequently, on the health and lives of people. Most of the respondents underlines the paramount importance of the human factor as the object of most sentient effects of mining activity. Deter-

mination of the degree of nuisance industrial facilities is an indispensable step to identify the real environmental risk. Understanding the views of the public on environmental nuisance mining sector will develop a proper environmental policy in the region.

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### *Przykłady rekultywacji terenów pogórnich w opinii społeczeństwa*

Uciążliwość dla ludności zamieszkującej tereny objęte bezpośrednim lub pośrednim oddziaływaniem przemysłu górniczego jest ważnym problemem społecznym. Rozwój górnictwa zależy od spełnienia wysokich wymagań środowiskowych, w szczególności występuje w ścisłym związku ze spełnieniem zobowiązań zachowania bezpieczeństwa dla zdrowia i życia ludzi. Dzięki konsultacjom z lokalnym społeczeństwem i ukierunkowanym działaniom zdegradowany teren może stać się atrakcyjny. Natomiast brak rekultywacji prowadzi do nasilenia zjawisk negatywnych: erozji, powierzchniowych ruchów masowych, zmian w ekosystemie, eutrofizacji zbiorników wodnych.

Utrzymanie równowagi w środowisku przyrodniczym jest podstawowym kryterium właściwego funkcjonowania obiektów przemysłowych. Działalność górnicza stanowi zagrożenie dla środowiska naturalnego, w tym dla zdrowia i życia człowieka. Korzystanie ze środowiska przez górnictwo jest uwarunkowane dostosowaniem do przepisów prawnych oraz prowadzeniem działalności wydobywczej zgodnie z wymaganiami środowiskowymi.

Działalność górnicza i ochrona przyrody mogą funkcjonować w sposób zrównoważony. Rezultaty badań pozwalają na odpowiedni dobór metod eksploatacji kopalin, pozwalających na zminimalizowanie wpływu na komponenty środowiska. Pozytywne oddziaływanie górnictwa odkrywkowego odzwierciedla się w powstawaniu nowych siedlisk roślin i zwierząt na terenach poeksploatacyjnych, tworzeniu nowych miejsc wypoczynku, urozmaiceniu krajobrazu dzięki budowie zbiorników wodnych. Akweny powstałe po eksploatacji kruszywa naturalnego zarastają roślinnością szuwarową, stanowiąc dogodne miejsca osiedlania się ptactwa wodnego. Dzięki konsultacjom z lokalnym społeczeństwem i ukierunkowanym działaniom zdegradowany teren może stać się atrakcyjny. Natomiast brak rekultywacji prowadzi do nasilenia zjawisk negatywnych: erozji, powierzchniowych ruchów masowych, zmian w ekosystemie, eutrofizacji zbiorników wodnych.

Słowa kluczowe: górnictwo, tereny pogórnice, ochrona środowiska, ochrona przyrody