

## ANALYSIS OF OPERATING CONDITIONS FOR THE MANAGEMENT SYSTEM OF POST-MINING LANDSCAPE IN POLAND

Katarzyna Fagiewicz

Faculty of Geographical and Geological Sciences, Adam Mickiewicz University in Poznań  
Dziegielowa str. 27, 61-680 Poznań, kfac@amu.edu.pl

**Summary.** The paper presents the analysis of operating conditions of the post-mining landscape management system, including the organization of the management process, particularly legal – administrative, software and financial instruments, which give rise to two major processes that shape the post-mining areas: reclamation and development. This analysis pays attention to the need of building relations between the post-mining areas and the surrounding natural areas. Indications were made, based on the analysis carried out towards optimizing the operation of the landscape management system of post-mining areas, which will enable a comprehensive approach to restore degraded areas for use, that is, their revitalization.

**Key words:** post-mining areas, revitalization, environmental management

### INTRODUCTION

From the point of view of nature, a fundamental problem in the development of coal mining, is minimizing the effects of collisions in the natural environment resulting from the exploitation of this mineral, both now and in the future. Environmental aspect of particular importance is the restoration and development stage of mining areas, which begins during the exploitation of the deposit and continued after completion of the mining process, at the stage of de-commissioning of the mine.

Observation of reclamation processes in countries with highly developed coal mining, including Poland, shows that regarding the repair works, very often we don't talk about the restoration and development, but about the revitalization of post-mining areas. These definitions ought not be treated as synonyms, since the new terminology should involve a process of qualitative change in post-mining areas. For many years the concept of restoration in the Polish definition

was limited to technical and biological recovery of sites for the natural environment. A new approach is to adapt the post-mining areas to perform new functions while employing their natural attractiveness and the anthropogenic elements which were created in the process of exploitation [Pietrzyk-Sokulska 2006]. In order that these positive changes do not remain simply within the realm of ideas and projects, it is necessary to support them with formal instruments – legislation that will force the management system of post-mining areas – making the process of reclamation and development an element of spatial planning and environmental management. As a result of such integration, these activities will not be limited only to reclaiming degraded areas for valuable use, but to create new, post-mining landscapes in the system of geographical environment.

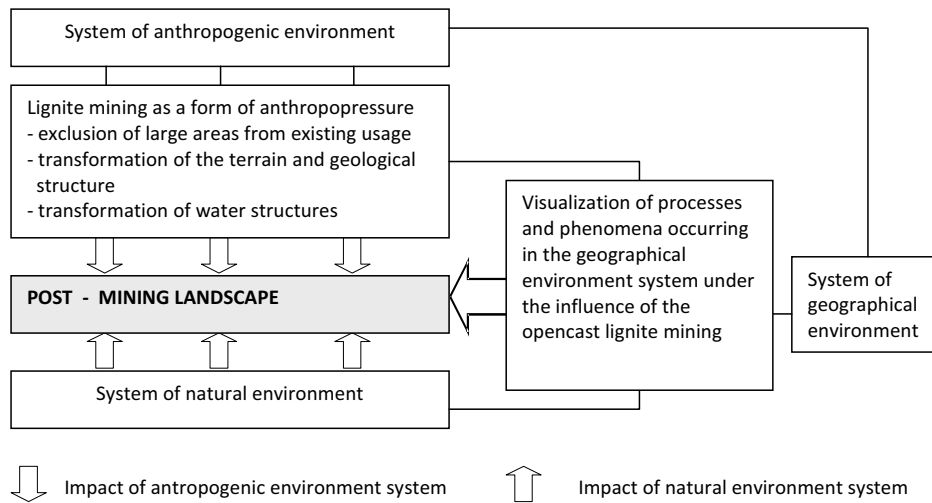


Fig. 1. Post-mining landscape in the system of geographical environment  
Source: own work based on Degórski [2006]

As proposed by Degórski [2005], the system of geographical environments combines two main categories of the geographical space, which are the natural environment system and anthropogenic environmental system, characterized by the attributes arising from human activities. The whole process of human creativity, from thoughts, ideas and concepts to the direct impact on the environment is the effect of human activity. In this case, the coal mining is a form of pressure on the natural environment. The post-mining landscape, which structure and operation depends on the interaction between post-mining geosystems and the natural environment system of its surrounding, is the objective visualization of processes and phenomena occurring in the system of geographical environment under its influence. The post-mining landscape, as a component of the natural environment system therefore requires a systemic approach to its management, particularly with regard to decisions of a spatial nature.

## OBJECTIVE AND RESEARCH METHODS

The aim of this paper is to analyze the determinants of post-mining landscape management system in Poland and its place in the environmental management system.

Environmental Management System is the science and practical activity engaged in designing, implementing, controlling and coordinating environmental management processes [Poskrobko 2003]. Within the Environmental Management System, the management sub-system stands out (organizer of the management process) as well as the environment which is the subject of management [Poskrobko 1998]. The management sub-system operates based on the current management measures (legal – administrative, financial) and measures of programming environmental protection – program documents, including those of strategic nature [Mizgajski 2008]. The management system and the subject of management, along with ongoing relations, form a system of management. On the basis of the presented model of environmental management, an attempt was made to analyze the determinants and performance assessment of post-mining areas management system in Poland.

POST-MINING LANDSCAPE MANAGEMENT SYSTEM  
– PROPERTY MANAGEMENT

Post-mining landscape which is the object of influence in the management process is characterized by a set of specific and relevant landscape features dependent on technical conditions and the exploitation of natural deposits. As a result, new forms of lands are created (external and internal waste banks, final excavations with a characteristic shape, morphology, engineering and technical parameters, with a wide range of changes in water relations), which are ultimately formed in the process of reclamation and development (Fig. 2).

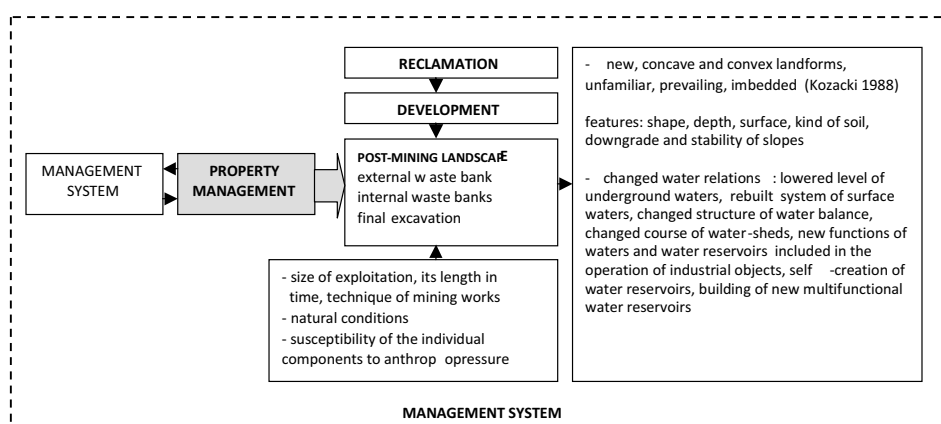


Fig. 2. Post-mining landscape management system – property management

Source: own work

POST-MINING LANDSCAPE MANAGEMENT SYSTEM  
– MANAGEMENT SUBSYSTEM

Management of the sub-system is focused on the administrative aspect of the management of post-mining areas, influencing them through acts and legal procedures (Fig. 3). Decision-makers in the managing system are the Minister

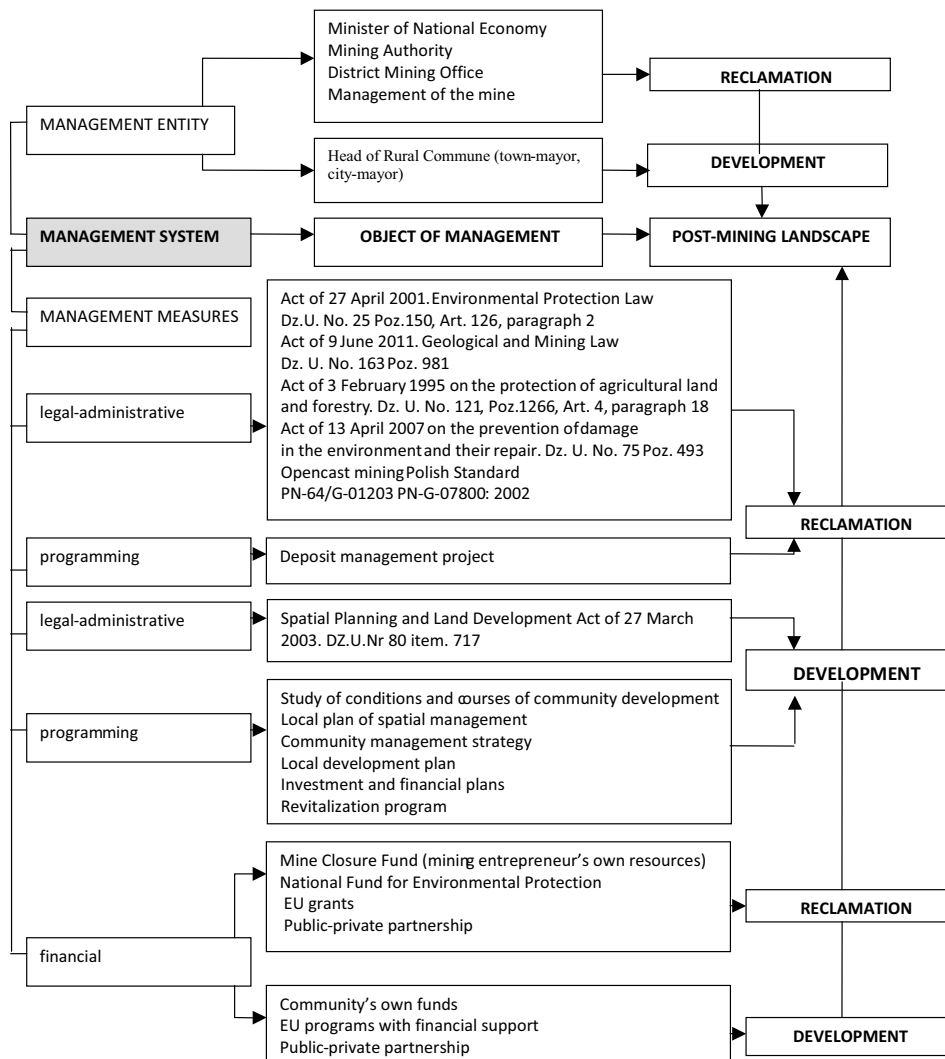


Fig. 3. Post-mining landscape management system – subject of management  
Source: own work

of National Economy, Mining Authority, District Mining Office, and the Management of the mine, which are obliged to carry out and supervise the reclamation activities and the local authorities responsible for its management. The measures for implementation are the legal-administrative instruments, which specify the main terms and conditions of restoration and development of the post-mining areas.

Guidelines for the restoration process are contained in the Environmental Protection Law (Article 126 paragraph 2 says, „whoever starts the exploitation of mineral deposits is required to undertake the necessary measures to protect the resources of the deposit, soil, water and the gradual restoration of abandoned mining areas”), The Geological and Mining Law, Act on the Protection of agricultural and forest land, Polish Standard Opencast Mining. However, the post-mining areas management issues are reflected in the spatial planning and land development act.

Another group of management tools are policy documents – the deposit management project in the event of reclamation of post-mining areas, the study of conditions and courses of management and local management plan in the event of their development.

The reclamation process is funded by its own mining entrepreneur, who is obliged by law to gather funds in the form of a copy (of not less than 10% capacity charge) for mine closure fund. These expenditures are also supported by the National Fund for Environmental Protection, whose revenues are the fees determined under the provisions of Geological and Mining Law. They are passed later on to cover the needs of mining in the scope of minimizing negative environmental impacts. The management of the post-mining areas is financed from the resources of future users.

At the stage of post-mining landscape management, the separation of administrative procedures for the two major processes that shape the post-mining areas (reclamation and development) is already clearly marked (Fig. 3). This is due to limitations in the functioning of the management system, as shown in Table 1 (A, B, C, D) taking into account the formal-legal and financial acts, and the resulting understanding from the terminology and the responsibility for carrying out certain activities.

Table 1. Legal-administrative and policy conditions of the post-mining landscape management

A. CRITERION: definition	
RECLAMATION	DEVELOPMENT
Giving or restoring the devastated or degraded land utility or natural value by appropriate landscaping, improving the physical and chemical properties, regulating waterways, restoring soils, strengthening embankments and reconstruction or construction of necessary roads (Art. 4 of the Act on the Protection of Agricultural and Forest Land)	Agricultural, forestry or other use of reclaimed land (Article 4 of the Act on the Protection of Agricultural and Forest Land)

PROBLEM	
<ul style="list-style-type: none"> <li>– the concepts of reclamation and development are not defined in the Geological and Mining Law, but in the regulations relating to agricultural and forest land;</li> <li>– lack of clear definition of reclamation and development, which would separate the objective scope of these activities;</li> <li>– no definition of „reclamation course” results in the indication of the overall, allowing freedom of interpretation courses of action;</li> <li>– lack of guidance on the scope, form and approval of documentation of reclamation.</li> </ul>	
B. CRITERION: entity responsible for carrying out the activities	
RECLAMATION	DEVELOPMENT
Mining entrepreneur	Future user of lands Regional Directorate of State Forests National Park Management Head of a Rural Commune (Mayor/City Mayor)
PROBLEM	
<p>The generality of the statutory provisions in relation to the course of reclamation and scope of reclamation work remains the responsibility of the mining entrepreneur and activities related to land development, which is the responsibility of the future user, leads to conflicts arising from a divergence of interests – the entrepreneur seeks to minimize the cost of reclamation while the future user expects solutions which would maximize the benefits.</p>	
C. CRITERION: formal-legal basis	
RECLAMATION	DEVELOPMENT
Acts and program documents in force	
PROBLEM	
<ul style="list-style-type: none"> <li>– separation of statutory provisions and regulations governing the two processes of post-mining area development: reclamation and development (Fig. 3);</li> <li>– lack of regulation on the courses and the scope of reclamation in the provisions of Geological and Mining Law, which sets out the general principles by referring only to the details of the provisions of the Law on the Protection of arable land and forest. Records of this Act do not include the specific characteristics of post-mining areas (Fig. 2), in particular the fact that the process of reclamation begins at the stage of exploitation of the deposit (internal and external waste banks) – only the final excavations are reclaimed during mine decommissioning;</li> <li>– lack of legal regulations to ensure the coherence of the ideas and actions in the scope of determination of the courses of reclamation and utility functions of the post-mining areas, does not favor a comprehensive and rational execution of the reclamation processes;</li> <li>– lack of connection between the concept of reclamation and management (deposit management project) and the local spatial management plans exclude the realization of a coherent vision of local development using the potential of the post-mining areas;</li> <li>– lack of clear guidance as to the scope of reclamation documentation;</li> <li>– limitation of the concept of reclamation and development to the agriculture or forestry reclamation course;</li> <li>– restrictions of the concept of reclamation and development to the boundaries of the mining area, without regard for the criterion of restoration of spatial coherence of post-mining areas and post-mining in their surroundings.</li> </ul>	

D. CRITERION: financing activities	
RECLAMATION	DEVELOPMENT
Costs of the ongoing reclamation work at the time of exploitation of the deposit are included in the cost of mining. Reclamation of post-mining areas at the stage of liquidation is financed by mine closure fund.	Resources worked out and acquired by local self-governments, regional directorates of state forests, the management of national parks.
PROBLEM	
<ul style="list-style-type: none"> <li>– lack of a detailed schedule of reclamation activities and its cost is associated with underestimation of the amount of deduction for liquidation fund does not allow for the generation of adequate resources in order to carry out reclamation;</li> <li>– lack of a detailed schedule of works and demand for funds clearly indicating what part of the costs will be funded by the mining entrepreneur, and to what extent by the future user;</li> <li>– no indications on the utility function of a future post-mining site at the stage of exploitation prevents the targeted profiling of the shape, downgrade, surface of waste bank or excavation, which could affect the reduction in the cost of reclamation.</li> </ul>	

Source: own work based on Kicki and Wanielista 2001, Gisman 2002, Dulewski and Uzarowicz 2005, Uberman 2011

#### POST-MINING LANDSCAPE MANAGEMENT SYSTEM – EXTERNAL RELATIONS

The system and its internal relationships is part of a larger whole and should be linked with the environment. The environment affects the particular elements of the system (input), and this influences the environment (output). The external relations are the weakest link within the post-mining landscape management system. This is so because in many cases the process of reclamation and management is not preceded by consultations, study of preferences, and expectations of the landscape receivers or local communities. Building these relationships should be implemented at two levels.

The first one concerns the change in approach to post-mining landscape management at the level of mining entrepreneur, future users and local communities. Post-mining landscapes, under the new paradigm, should be seen as an opportunity for development of areas where there are:

- the potential of post-mining areas as a field of interest of local self-governments,
- post-mining areas as part of the national cultural heritage associated with the course of one of the stages of civilization, what was the period of industrialization,
- post-mining areas (waste banks, excavations, final depressions) as an element of shaping a system of social values, forming of emotional associations with the place, based on a sense of identity with post-industrial physiognomy and its symbolic character,
- post-mining areas as conservation of flora and fauna rich in rare species, which are subject to legal protection of different rank,

– post-mining areas as the subject matter of the multi-thematic concepts of revitalization developed by landscape architects, planners, specialists in environmental management [Fagiewicz 2010].

The second element of building relationships between the management system and its environment is the need to include in the process of reclamation and development of mining areas the following conditions:

- environmental – which are based on a diagnosis of ecological structure which includes: the spatial coherence of post-mining areas and the natural areas in their surroundings, determining the types and kinds of habitats necessary to complete or strengthen the structure of the natural area, the application of ecological principles of shaping the landscape structure [developed by Żarska 2006],
- social – taking into consideration the preferences of the residents regarding reclamation and development, which are verified by socio-economic analysis of the community,
- cultural – diagnosis of the cultural values of the area,
- economic – amount of capital expenditures to carry out reclamation and development and maintenance of the post-mining areas and their profitability,
- location – accessibility to the post-mining areas, distance from urban, industrial, service and protected areas, water bodies as well as cultural assets.

## CONCLUSIONS

An efficient post-mining landscape management system is an opportunity for revitalization of the post-mining areas, which is a comprehensive approach to restore degraded areas of use-values through a process of reclamation and development carried out based on a common vision for the spatial management of the mining industry and the region, including the internal conditions of post-mining geosystems and external conditions of environment areas forming their surroundings. Optimization of operation of this system should integrate part of promoting a new perception of post-mining areas (not a threat but an opportunity for development) supported by the modification of legal regulations in the field of reclamation and development:– clarification of the scope of reclamation and development,

- clarification of the scope of the deposit management project,
- introduction, at the stage of exploitation, of the detailed concept of decommissioning of the mine along with the reclamation and development project, cost estimate and financial security of the costs of the activities; the development of measures enabling the changes and adaptation of these concepts to the changing internal conditions of the post-mining areas and their external surroundings within a long-term exploitation process,
- obligation of implementing the deposit management, reclamation and management projects to the planning documents.



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ANALIZA UWARUNKOWAŃ FUNKCJONOWANIA SYSTEMU ZARZĄDZANIA  
KRAJOBRAZEM POGÓRNICZYM W POLSCE

**Streszczenie.** Opracowanie przedstawia analizę uwarunkowań funkcjonowania systemu zarządzania krajobrazem pogórnym uwzględniającą organizację procesu zarządzania, a w szczególności prawno-administracyjne, programowe i finansowe instrumenty stanowiące podstawę dwóch głównych procesów kształtujących obszary pogórnice: rekultywacji i zagospodarowania. W opracowaniu zwrócono uwagę na konieczność budowania relacji między obszarami pogórnymi a stanowiącymi ich otoczenie obszarami naturalnymi. Na podstawie przeprowadzonej analizy wskazano kierunki optymalizacji funkcjonowania systemu zarządzania krajobrazem pogórnym, które umożliwią kompleksowe podejście do problemu przywracania wartości użytkowych terenom zdegradowanym, czyli ich rewitalizację.

**Słowa kluczowe:** obszary pogórnice, rewitalizacja, zarządzanie środowiskiem