



Negative and Positive Effects of the Exploitation of Gravel-Sand

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Summary

Environmental restrictions of sand and gravel exploitation in the areas of nature and landscape conservation cause significant difficulties in mining operations in these areas. The Natura 2000 network is in conflict with the industry, especially in opencast minEng. The article describes the impacts of aggregate exploitation on the environment. It was pointed out the negative impact of the exploitation of sand and gravel on the habitats and species of fungi, plants and animals. It was emphasized the positive aspects of mining operations.

Keywords: smining, natural aggregates, valuable natural areas, nature conservation

Introduction

Since 2006, the term natural aggregates has been changed to sands and gravels [Łochańska, 2010]. As literature still gives two terms, it has been decided that this publication will use both names interchangeably. Sands and gravels are classified by law as common minerals. It is a loose mixture of clastic material, which consists of pebbles, gravel and sand. In Poland, the deposits of natural aggregates are present in 98 % of the Quaternary period [Miziołek 2007].

Gravel-sand deposits are located in the majority of cases on the mountain and river valleys, often in environmentally valuable areas [Martyniak 2011]. Technical extraction of sand and gravel, regardless of size and method of operation, always has a negative impact on the environment. Aggregate extraction violates the ecological balance of the place being exploited and ecologically related areas. In the river valleys, exploitation refers to sands and gravel extracted both from the bottom of the river (from the flowing water) and from the exposed part of trough (sandbanks and wide edges) at low water levels. Aggregates are extracted without the use of drastic environmental methods.

Adventitious exploitation, also called cottage, consists in the extraction of sand and gravel for their own perpetrators with use of hand tools. Accumulated exploitation consists in the extraction of sand and gravel by few or several of such offenders by use of hand tools, what simultaneously contributes to devastation of the bottom of the river or stream. Technical exploitation is to extract sand and gravel using mechanical equipment, mostly excavators and trucks, often in different places, so as not to cause an interest of environmental services. Industrial exploitation refers

to extraction of the sand and gravel using mechanical equipment on a large scale. Such activity results in destroyed banks of the river or stream, inundated oxbow lakes, riparian forests cut or devastation.

The above-mentioned modes of extraction of aggregates are related to main stream and the closest banks of the river or stream. It is the most common way of extraction of sand and gravel in Carpathians.

Whether the location of exploited aggregates will affect the environment and how on the neighboring areas, including protected areas (especially Nature 2000), is determined by:

- The location of exploitation land in a protected area, including the area of Nature 2000;
- Occurrence, within exploitation land, of the species of fungi, plants and animals that are protected by European and national law;
- The technical conditions of exploitation of aggregates (adventitious, accumulated, technical, industrial);
- The size of the mining area of aggregates extraction (from several acres to several hundred acres);
- Time of exploitation of aggregates, determined by the size of bed (from few to several years);
- The range of impact on the ecosystem (range limited solely to the extraction site; local range on flora and fauna as well as water regimes; supra-local on flora, fauna, habitat types and protected areas) (Tab.1.)

Summarizing the previous deliberations, it can be concluded, that the exploitation of aggregates impacts on the environment: negatively, positively, there is no impact (Tab.2.). Third possibility should be rejected as it does not occur in the natural nature. Any kind of human activity has an impact on the environment.

Tab.1 The types of impact on the environment due to exploitation activities [Martyniuk 2011]

Tab. 1 Rodzaje oddziaływania eksploatacji kruszyw na środowisko [Martyniak 2011]

Type of impact	Types of aggregates and minerals		
	Sand and gravel	Rocks and boulders	Aggregates from inland waters
Direct impacts			
The loss of existing landscape features	+	+	-
Destruction of protected habitats	+	+	+
Destruction of protected species of fungi, plants and animals	+	+	-
Destruction of inanimate nature	-	+	-
Inreased mortality of animals being result of the exploitation	+	+	+
Changes of water regime (dehydration, hydration) that are relevant from ecological point of view	+	+	-
Noise	+	+	+
Destructive phenomena – erosion, abrasion, mud slides	+	+	+
Intensive transport of extracted aggregates	+	+	+
Unforseen events prior to the operation	+	+	+
Appearance of new invasive and alien plant species and animals	+	+	+
Indirect impacts			
Changes of water regime (dehydration, hydration) that are relevant from ecological point of view	+	+	+
Destructive phenomena – dust pollution (dustiness)	+	+	-
Unforseen events prior to the exploitation – failiures of technical equipment accompanied with contamination of the area with fuel, lubricants and oils	+	+	+

The general principle of Standard Data Form (SDF) on Nature 2000 is that the positive impact of exploitation of gravel on area of Nature 2000 is not mentioned [Zajac 2011 b].

A negative aspect of mining activity

Negative impacts on habitats, species of fungi, plants and animals related to aggregates extraction include:

- Destruction of natural habitats in the early exploitation of aggregates: removal of overburden soil, cut-out or progressive entombment of trees, cut-out of bushes, entombment of oxbow lakes that are important places of protected animals and plants presence
 - Habitat destruction of bottom of the river or stream
 - Destruction of habitat of rare fungi, gradual destruction of natural habitats and trees strictly related to these habitats
 - Destruction of relict habitat of rare plants
 - Change of the type of habitat: destruction natural habitats, creation of new habitats in the place of damaged plants, alien plant succession, synanthropic

plant succession

- Depletion of biodiversity of transformed habitats
- Increased pressure on neighboring areas
- Disturbance of animals along with exploitation process
 - Increase in mortality among animals caused by intensive transport of aggregates, the way how they are extracted, works carried out in a working sites
 - Changes in the waters regime as a result of intensive exploitation of aggregates leading to reduction in waterlogging of areas adjacent to the excavation site
 - Increased noise in the extraction zone and on the roads leading to it: operation of mechanical equipment in the zone where such activity have not occurred before, causing increased concern of animals, frequent animal disturbances, especially during reproduction period, migration of animals beyond the area of negative impact
 - Excessive dusting associated with intensive use of mechanical vehicles

Tab.2 The types of impact on the Nature 2000 areas due to exploitation activities [A. Kowalska]

Tab. 2 Typy oddziaływań miejsc eksploatacji kruszyw na obszary Natura 2000 [opr. A. Kowalska]

Type of impact on Nature 2000 area	Features of impact on the Nature 2000	Species affected	Notes
No impact	-	-	-
Positive	Creation of new reproduction and presence places of animals	Many species of waterfowl and mud species, colonial species building nests at steep banks of excavations; number of mammals and amphibians	Two sites have been established within Nature 2000: PLB040005 Żwirownia Skoki and PLH020049 Żwirownie in Stara Oleszna
Negative	Physical destruction of protected habitat; the loss of site taken by protected species	Riparian forests, myricaria communities, meadow habitats; many species of birds, mammals, reptiles, fish, clams and other invertebrates	Aggregates exploitation is listed in SDF for 95 sites within Nature 2000 as negative activity

- Contamination of ground water with substances harmful to the environment and affecting indirectly on fish and aquatic invertebrates, causing poisoning or death (Tab.2.)

Positive side of mining activity

For many years, mining has been seen as an activity that is very harmful to the environment. This is reflected in the strong opposition (not always reasonably explained) of local communities and local authorities on undertaking exploitation of mineral deposits. Media informs about damage caused by this kind of activity, while one can hardly find the data on the positive aspects of the mining industry. Balance is important in delivering the message so that society should be informed about positive and negative aspects related to specific activity. Negative effects are long-lasting and more visible, but that does not mean that the positive effects do not exist [Poros, Sobczyk 2013, 2013b]. One should look at surface mining not only in destructive categories, but also in creating or transforming categories that are associated with protection of animals and plants.

The positive side of mining activity is manifested by:

- Replacement of low class soils on those having better quality during the process of recultivation
- Renovation and improvement of forest stand
- Creation of new habitats of plants and animals on the excavated areas
- Creation of new leisure areas
- Diversification of the landscape through creation of new water reservoirs [Gładysz-Oczalska 2010; Czaja, Koziół 2010].

The secondary succession occurs on the excavated areas, on which recultivation activities have not been carried out.

Conclusions

Nature condition in Europe is under important transformation processes. This also applies to Nature 2000 areas. In the past two centuries, man contributed to this phenomenon. Changes in nature are normal, because living organisms, to a greater or lesser extent, modify their habitat. If this organism is a miner, changes are inevitable. On the other hand, naturalists fear of intervention that interfere with the functioning of existing system and cause adverse consequences [Engel, 2009].

Within the Natura 2000 network one can find many mineral deposits that are important for development of Poland in an economic point of view.

It has long been known that extraction of natural aggregates negatively impacts the environment [Badera 2010; Kowalska 2013; Kowalska, Sobczyk 2011]. However, changes related to mining are considered too critical. No positive sides of this activity are seen. Without looking ahead one is not able to see potential profits which are brought along with mining activity when it is carried out correctly and recultivation brings a new quality.

European Union members implement an economic program consistent with sustainable development. Building engineering and road engineering in Poland are based on the natural aggregates that are extracted throughout the country. Cessation of extraction or its significant reduction would cause escalation of the prices and increase of unauthorized extraction.

When we want to protect the environment, we may harm it unwittingly, since the illegal extraction of aggregates from riverbeds or shallow layers of deposits can threaten not only the flora and fauna, but also resources that are part of the environment.

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Streszczenie

Ograniczenia ekologiczne eksploatacji piasków i żwirów na obszarach ochrony przyrody i krajobrazu powodują znaczące trudności w działalności górniczej na tych terenach. Sieć Natura 2000 znajduje się w konflikcie z przemysłem, zwłaszcza z górnictwem odkrywkowym. W artykule opisano rodzaje oddziaływania eksploatacji kruszyw na środowisko. Wskazano negatywny wpływ wydobycia piasków i żwirów na siedliska przyrodnicze oraz na gatunki grzybów, roślin i zwierząt. Podkreślono pozytywne aspekty działalności górniczej.

Słowa kluczowe: górnictwo, kruszywa naturalne, tereny przyrodniczo cenne, ochrona środowiska