

A COMPREHENSIVE INVENTORY OF FAUNA AND FLORA OF THE MINE “SZCZYTNIKI” AND PREPARATION GUIDELINES FOR REHABILITATION

**Students Scientific Associations
University of Wrocław**

RESEARCHERS

PROJECT COORDINATOR

Sławomir Solak
slawomir.solak@wp.pl
tel. +48 669 962 545

SECOND PROJECT COORDINATOR

Sebastian Salata
rubisco198@gmail.com
tel. +48 723 500 118

PLANT TAXONOMIST SSA

Marta Czarniecka
Iwona Kuras
Renata Łojko
Agnieszka Możanowicz
Sławomir Solak
Grzegorz Swacha
Katarzyna Szczęśniak
Magdalena Zboińska

ENTOMOLOGISTS SSA

Agata Kiałka
Agnieszka Sala
Sebastian Salata
Magdalena Tomalak
Ewa Zaremba

HERPETOLOGISTS SSA

Kinga Mielcarska
Patrycja Pikoń

ORNITHOLOGISTS SSA

Konrad Łysowski
Katarzyna Jasnosz

Spis treści

ABSTRACT	3
1. INTRODUCTION	3
2. GOALS	4
3. STUDY AREA	4
4. RESULTS	4
4.1. BOTANICAL SURVEY	4
4.1.1. GOALS	4
4.1.2. METHODS	4
4.1.3. RESULTS	5
4.1.3.1. RARE AND PROTECTED PLANT SPECIES	5
4.1.3.2. INVASIVE AND EXPANSIVE PLANT SPECIES	5
4.1.3.3. HABITATS OF NATURA 2000 AND PLANT COMMUNITIES	5
4.1.3.4. SUMMARY OF BOTANICAL SURVEY	6
4.2. ENTOMOLOGICAL SURVEY	6
4.2.1. GOALS	6
4.2.3. RESULTS	6
4.2.4. SUMMARY OF ENTOMOLOGICAL SURVEY	7
4.3. ORNITHOLOGICAL SURVEY	7
4.3.1. GOALS	7
4.3.2. METHODS	7
4.3.3. RESULTS	7
4.3.4. SUMMARY OF ORNITHOLOGICAL SURVEY	7
4.4. HERPETOLOGICAL SURVEY	8
4.4.1. GOALS	8
4.4.2. METHODS	8
4.4.3. RESULTS	8
4.4.4. SUMMARY OF HERPETOLOGICAL SURVEY	8
5. CORRELATION BETWEEN ORGANISMS	8
6. RECLAMATION GUIDELINES	9
ACKNOWLEDGMENTS	10

ABSTRACT

The project was implemented by student scientific associations from the University of Wrocław that decided to collaborate with each other. Field studies were designed to evaluate a biodiversity of the gravel pit area. For this purpose, a comprehensive inventory of Natura 2000 habitats, plants and the most important groups of animals was conducted. The field work began in early spring, and was completed in mid-September. This period of time allowed to identify species that appear at different times of the growing season and breeding time. All elements of the biodiversity of the area are mutually related. Therefore the project demanded an engagement of scientists dealing with different aspects of ecology and the natural sciences. This report is the result of an complex inventory of flora and fauna conducted in order to plan reclamation activities for the gravel pit "Szczytniki". The report contains information about an occurrence, distribution and preservation state of natural habitats. The report also includes the occurrence and distribution of rare, protected and endangered animal and plant species found within the mine as well as in its immediate vicinity. The most important element of the project was to determine the correlation between the different groups of organisms and to establish the presence of different species in different types of habitats. Obtained knowledge allowed us to determine which areas are the most valuable of the natural point of view. As it turned out the gravel pit area is very interesting in terms of habitat diversity. Alluvial meadows which are Natura 2000 habitat are extremely rich in species of host plants for a number of endangered species of butterflies. Refuges for this group of insects are also blackthorn scrubs that cover the periphery of forests and roads in the quarry. Reed beds that grow around the ponds are home to large numbers of amphibians and birds. The oak alley is not only a beautiful element of the landscape, but is also a potential habitat for rare on a European scale hermit beetle. The last part of the report include the reclamation guideline that will help protect natural habitats and associated with it plant and animal species. We carefully assessed all threats arising from the work of rehabilitation and established recommendations aimed at minimizing the negative impact on the environment. Restoration plan has been constructed in the way that all species of plants and animals could benefit.

1. INTRODUCTION

The development of civilization contributes to the unceasing decline in natural and semi-natural habitats, where many rare, protected animal and plant species exist. However human activity contributes to the creation of new habitats. This process commonly called synanthropisation provides to plants and animals new, often heavily transformed by man habitats. An example of such activity occurs in the "Szczytniki" mine. Undoubtedly, the extraction of gravel contributed in many cases to the destruction of natural or semi-natural ecosystems that were functioning well before human entered this areas. When the exploitation of gravel is terminated the gravel pits are put back into the hands of nature. Although, the area is still largely occupied by machinery and service staff the gravel pit is teeming with life. Ongoing natural processes results in the formation of new plant communities and creating new habitats for fauna. The management of "Szczytniki" mine is obligated by law to compensate the environmental damage. Reclamation has to be conducted properly to minimize and mitigate the environmental effects of mining. A strong correlation between different groups of organisms requires a broad insight into the processes occurring in nature. Therefore the young scientists belonging to different student associations and dealing with various aspects of ecology prepared a reclamation guidelines for the "Szczytniki" quarry. The reclamation plan is based on scientific research including comprehensive inventory of fauna and flora.

2. GOALS

The main aim of the project was to prepare a reclamation plan for a “Szczytniki” quarry. To achieve this goal we had to obtain a knowledge about a biodiversity of the entire area. We decided to determine an influence of gravel extraction on natural and semi-natural ecosystems that had existed here before human started exploitation. We also aimed to investigate the potential of newly created by human habitats as a refuge for various plant and animal species. This was done particularly for species considered as a rare or endangered on a scale of Lower Silesia, Poland or entire Europe. Briefly, we attempted to evaluate good practices for reclamation that could favour all living organism.

3. STUDY AREA

The “Szczytniki” gravel pit is located in the Southwestern part of the village Spalona (Kunice commune, district of Legnica, Lower Silesia Province). In terms of geographical position the study area is located in the “Kaczawa” valley. According to Kondracki it is classified to a region of Lower Silesia, mezo plain of Wrocław. Mining has been going here since the 70's of 20th century. An area of approximately 93 hectares is filled with sand and gravel deposits that were formed during the accumulation of the river sediments. The landscape is dominated by water reservoirs that constitute a place of recreation for residents of nearby towns and villages. It also attracts many fisherman. The area is still quite abundant in natural or semi-natural ecosystems such as meadows, alluvial forests or oak alleys that can be remnants of old forests.

4. RESULTS

4.1. BOTANICAL SURVEY

4.1.1. GOALS

The main aim of the conducted study was to provide information about: 1) habitat sites, 2) distribution of plant communities, 3) distribution of rare and protected plant species 4) distribution of invasive and expansive plant species. Collected information about a biodiversity of study area allowed us to prepare the plan of reclamation of gravel pit.

4.1.2. METHODS

The first step was to make a terrain reconnaissance that allowed to identify biotopes within the study area. Further field work was focused on floristic and vegetation surveys. Floristic and vegetation surveys were conducted during the growing season since March to September, 2012 and they were based on the several field trips. Plant development and thus phenological phases show great interannual variability. Therefore a floristic and vegetation surveys were conducted in different stages of individual plant development. It made possible to document species that show up in the early spring as well as species occurring in late stages of growing season. The study aimed at detecting: 1) natural habitats listed in Annex I of the Habitats Directive, 2) vascular plant species listed in Annex II of the Habitats Directive, 3) species of wild plants under protection in Poland, 4) rare plant species listed in the Polish Red Data Book of Plants (Kaźmierczakowa & Zarzycki, 2001), included in the Red list of the plants and fungi in Poland (Zarzycki & Szeląg, 2006) and Red List of Vascular Plants of Lower Silesia (Kącki, ed., 2003). In order to collect data about differentiation of vegetation phytosociological relevés were taken. In total, 140 phytosociological samples were collected using the Braun-Blanquet quantitative scale (Pawlowski 1977). Collected data was entered in the TURBOVEG database (Hennekens, Schaminée 2001) and then transferred to Polish Vegetation Database. Analysis were

performed using the Juice software package (Tichý, 2002) and Statistica (Statsoft 2010). Thereafter plant communities were distinguished. To identify particular plant species following keys were used: Rutkowski (2007), Szafer et al. (1986), Rothmaler (2010). Taxa nomenclature follows Mirek et al. (2002). Natural habitats were identified on the basis of key plant communities (Matuszkiewicz, 2001) and the Natura 2000 guides (Herbich, 2004 a, b, c).

4.1.3. RESULTS

4.1.3.1. RARE AND PROTECTED PLANT SPECIES

The search for rare and protected species have brought surprisingly positive results. At the gravel pit we found 2 strictly and 2 partially protected vascular plants species. We also recorded 3 species, which are included in Red list of plants in Poland and 5 species, which are included in Red list of vascular plants in Lower Silesia. The comprehensive list of rare and protected species with the information about their status in Poland is included in Annex 1. The number of the valuable plant species is low. They were usually distributed sparsely, often in a specific habitat conditions. It is highly recommended to preserve their habitat and allow their further reproduction, giving a chance for population to expand.

4.1.3.2. INVASIVE AND EXPANSIVE PLANT SPECIES

The result of inventory shows occurrence of 5 invasive (geographically alien) and 2 expansive (native) plant species. The list of species with short description is presented in Annex 4. The invasive plant species are infrequent element of flora in the studied area, but are still a potential threat to native flora. Therefore, during the restoration process, particular attention should be made to these species to not contribute their spread during transportation and ground leveling. On the other hand, there are more expansive species that are present in nearly all areas, not dangerous for the Polish flora but certainly not wanted, especially in habitats of high natural value.

4.1.3.3. HABITATS OF NATURA 2000 AND PLANT COMMUNITIES

The vegetation of the “Szczytniki” gravel pit area is diverse. During the botanical inventory we reported presence of up to 117 plant species. The phytosociological analysis using the Juice software package showed the 6 main types of plant communities (Annex 5). The first group of the highlighted communities comprises the semi-natural, abandoned meadows on the rivers alluvium. The phytosociological structure of those communities is mostly degenerated but in some cases they are well-preserved. The second and dominant group is strongly transformed, impoverished communities in habitats that were created due to exploitation activities. These include: 1) periodically flooded communities on wet surfaces, 2) communities of recultivated areas, 3) pioneer plant communities on uncovered sand, 4) a group of grassland dominated by *Elymus repens*. Studied area revealed the presence of 3 types of Natura 2000 habitats and one very rare community within the whole Europe. The Natura 2000 habitats within the study area include: 1) Alluvial meadows of river valleys of the *Cnidion dubii* (6440), 2) Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) (91E0), 3) Riparian mixed forest of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia* along the great rivers (*Ulmion minoris*) (91F0). The rare and valuable European plant communities are the spore-bearing plants communities. The crucial species in this communities are small plants of the genus *Anthoceros*. The valuable plant communities are very important element of the “Szczytniki” landscape, therefore, it is advisable to implement the recultivation plan to protect them. The following sections describe the exemplary outline of recultivation plan.

4.1.3.4. SUMMARY OF BOTANICAL SURVEY

The flora and vegetation of study area are a mosaic of various plant communities. There are mainly the ruderal and trampled plant communities. The small areas are occupied by meadows and degenerative forms of alluvial forests. Many parts of lakesides are covered with the initial reed beds and water plant communities. The high diversity of phytocoenosis has a positive effect on biodiversity in this area, making the gravel pit “Szczytniki” a valuable object. The study revealed occurrence of many rare and protected plant species and a small enclaves of forest protected by the European Habitats Directive, Natura 2000. The vegetation of the described area may be valuable example of biodiversity, shaping post-mining areas, but in require of deliberate recultivation treatments, aimed at protecting valuable natural and semi-natural ecosystems. It is particularly important to mow the meadows because of currently ongoing secondary succession process that will change the grassland into the forest.

4.2. ENTOMOLOGICAL SURVEY

4.2.1. GOALS

The main aim of the study was to find a protected species, described earlier in this area. According to the available information related to a nearby located area Natura 2000 we could expect to find following species: *Eriogaster catax*, *Lycaena dispar*, Dusky Large Blue *Maculinea nausithous*, Scarce Large Blue *Maculinea teleius*, Great Capricorn Beetle *Cerambyx cerdo* and Russian Leather Beetle *Osmoderma sp.*

4.2.2. METHODS

Collection of the invertebrates was conducted with a use of entomological nets and Barbers traps. We also tried to locate insects by looking for the traces of particular species (i.e. habitual prey, larvae, faeces). Entomological nets are helpful in catching flying insects in their natural habitat. It allow to identify a species without necessity of killing them. It is very helpful method in research conducted on the rare and protected butterflies. Another method - Barbers traps, is used by entomologists to research insects that live underground for all or much of the time. This method consist of putting jars or boxes in the holes in the ground. Every few hours traps are checked and insects which fall into traps are identified and released. This is very helpful method in catching beetles but in our research was useless. The traps were filled very fast by ants from genera of the *Myrmica* and *Formica*. This made impossible to record other species except ants. The last method that we used was based on visual searching and it was implemented in transects. We divided the area into several transects that were carefully examined for the presence of traces of rare and protected insects. We were looking for signs of feeding, faeces, residues development or alive specimens. We also were looking for the potential environments for these species, which were then subjected to additional observations. This method was found out to be the most helpful in our research.

4.2.3. RESULTS

As a result of this study we found 2 protected species Scarce Large Blue *Maculinea teleius* and Russian Leather Beetle *Osmoderma sp.* This species are included in the European Union's Habitat Directive and they are also called as an umbrella species. The presence of these two species is a reason to protect not only the species in the question and their habitat but also many other organisms living in the same environment. Russian Leather Beetle *Osmoderma sp.* is associated with another protected species *Proteatia aeruginosa* that occupy similar habitat. A presence of this species was helpful in finding specimens of *Osmoderma sp.*

4.2.4. SUMMARY OF ENTOMOLOGICAL SURVEY

In the period from April to September we had ten field trips to the quarry. We conducted a comprehensive inventory of oak alley, alluvial meadows and blackthorn bushes. We found there two species included in the European Union's Habitat Directive: Russian Leather Beetle *Osmoderma sp.* and Scarce Large Blue *Maculinea teleius*. A blackthorn bushes are typical habitat for *Eriogaster catax* which is confirmed in the surrounding areas. This year a weather conditions was not favorable for this butterfly. All species mentioned above are protected in Poland. They are also listed in The Red List of Threatened Species.

4.3. ORNITHOLOGICAL SURVEY

4.3.1. GOALS

The aim of this study was to prepare a list of bird species living in the quarry and its closest vicinity. We expected to find rare and protected bird species especially those listed in the Annex I of the Birds Directive.

4.3.2. METHODS

The inventory was based on the observation of flying, feeding and nesting bird species at the mine. Observations were made with binoculars and spotting scopes. In addition, some of the species were diagnosed on the basis of singing. To identify particular species we used a Collins Bird Guide (Svensson, Mullarney, Zetterstrom & Grant, 2010). The area of the mine has been visited once a month. The observations were made in the very early mornings in previously established transect around the ponds. During the months of March, April, August and September we also observed birds "flight" for the night

4.3.3. RESULTS

In total, 99 species of birds were identified of which 35 can be considered to be probably nesting species and 4 as nesting species. A detailed list is included in Annex 9. In Poland, most of the bird species are under protection. This explains the huge number of protected species (87) recorded at a the quarry. We found six bird species that are listed in the Annex I of the Birds Directive. It is a list that contains species covered by the special conservation measures, concerning their habitat, and which are aimed at ensuring the survival and reproduction in their area of distribution.

4.3.4. SUMMARY OF ORNITHOLOGICAL SURVEY

The Annex I of the Birds Directive contains rare species in the European Union, whose populations declined due to human activity. The protection of these species was strongly emphasized in recent years which caused an increase of their populations. The creation of suitable habitats for species found at the mine will surely develop their population, so it is important to know the biology of each of them. Within recorded species we noticed small share of waders. This is due to the very steep banks around the water bodies. Narrow coastal zone does not provide them sufficient feeding grounds as well. We recorded low number of breeding birds, which is surprising result taking into account the relatively big surface of studied area. The area is mainly occupied by water, so it should be attractive to bird from the order of the Anseriformes and to birds called as a "reed"- closely related with reed beds. But poorly developed water zone does not provide them adequate space for nesting and shelter. Depth of the water bodies also prevents the occurrence of a large number of diving ducks (pochards).

The oak alley and some parts of the forest are important for species such as woodpeckers and oriole that are associated with forest ecosystems.

4.4. HERPETOLOGICAL SURVEY

4.4.1. GOALS

The main purpose of the study was to make an inventory of amphibians and reptiles occurring in the “Szczytniki” mine. Additionally, we wanted to find out whether the species of amphibians and reptiles breed in the study area. We were particularly interested at finding the species listed in Habitat Directive of Natura 2000.

4.4.2. METHODS

The inventory began in March, 2012 and lasted to the end of August, 2012. The applied methods are following: observation and transition/patrolling the area - day and night, listening the sounds of mating (mainly in the evening along with the votes from the tape playback, the control of potential breeding sites). The occurrence of amphibians was determined by observing adults, identifying mating male voices and searching for spawn. Species were identified based on the field experience and with the use of key to identification of amphibians proposed by Berger (Berger, 2000).

4.4.3. RESULTS

The inventory of area showed the presence of the following species of herpetofauna: green frogs *Pelophylax esculentus* complex, brown frogs (common frog *Rana temporaria* and moon frog *Rana arvalis*), European Toad *Bufo bufo*, European Fire-bellied Toad *Bombina bombina*, grass snake *Natrix natrix* and sand lizard *Lacerta agilis*. All of these species are strictly protected in Poland. Two of them (European Fire-bellied Toad *Bombina bombina* and sand lizard *Lacerta agilis*) are included in Annex II and IV of the Habitats Directive.

4.4.4. SUMMARY OF HERPETOLOGICAL SURVEY

The habitats found at the quarry indicate for appropriate environmental conditions for our native amphibians such as green frog *Pelophylax esculentus* complex, moon frog *Rana arvalis*, common frog *Rana temporaria*, European Toad *Bufo bufo*, European Fire-bellied Toad *Bombina bombina* and reptiles such as grass snake *Natrix natrix*, sand lizard *Lacerta agilis*. A presence of European Fire-bellied Toad *Bombina bombina* seems to be very valuable discovery due to its status of threat. For this reason the species was listed in Habitat Directive of Natura 2000. The large number and variety of water bodies and aquatic vegetation in the “Szczytniki” mine constitute a great living and breeding place for many amphibians. The presence of large number of hiding places in the form of reed beds is suitable for reptiles. These valuable habitats for amphibians and reptiles should be protected. To do this we recommend to keep the status quo, to refrain from drainage the water bodies and to refrain from too intensive farming in the surrounding area that could contribute to eutrophication of water.

5. CORRELATION BETWEEN ORGANISMS

All of studied groups of animals and plants species are strongly correlated with each other. Other words, they are dependent on many relationships that enable them to survive. The studied area is rich in various habitats that enable existence and procreation of animals. A presence of alluvial meadows with abundantly distributed Great Burnet *Sanguisorba officinalis* is fundamental condition for occurrence of Scarce Large Blue *Maculinea teleius*. This butterfly is completely dependent on host

species because its caterpillars feed on inflorescence of this herbal. Another example are the oak alleys with old, hollow trees that promote an occurrence of Russian Leather Beetle *Osmoderma* sp. The old oak trees are the only habitat they can live in. Both *Maculinea telejus* and *Osmoderma* sp. are protected by Habitats Directive UE 92/43/EEG as a high priority species. Partly covered by vegetation water reservoirs, especially in the littoral zone favour existence of amphibians. That kind of habitat is especially important for European Fire-bellied Toad *Bombina orientalis* (a species included in Habitat Directive, Nature 2000) and European Toad *Bufo bufo*. Both species lay eggs around stems of plants submerged in water. Also water birds use reed beds as a breeding place. Good example of this behavior are Moor Buzzard *Circus aeruginosus* (species listed in Annex I of the Birds Directive), Great Reed Warbler *Acrocephalus arundinaceus*, Eurasian Reed Warbler *Acrocephalus scirpaceus* and the Common Crane *Grus grus*. A role of old trees is meaningful not only for insects but also for protected birds as Black Woodpecker *Dryocopus martius* (species listed in Annex I of the Birds Directive) or European Green Woodpecker *Picus viridis* – which is very willing to colonize alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) and riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmion minoris*) – both being Natura 2000 habitats. An existence of some species depends on presence of another one. For example an existence of Grass Snake *Natrix natrix* depends on presence of its delicacy - amphibians. Plenty of fishes favors occurrence of Kingfisher *Alcedo atthis*. On the other hand a huge amount of fishes is harmful for amphibians because they eat their spawn. Mature amphibians are food for Moor Buzzard *Circus aeruginosus*, White Stork *Ciconia ciconia*, Gray Heron *Ardea cinerea* and many others. A lot of species are strictly connected with human being. This species are often an invasive plants that come from other countries and now expand in Poland in very fast rate (Small-flowered Touch-me-not *Impatiens parviflora*, *Echinocystis lobata*, Canada goldenrod *Solidago canadensis*). There are also ruderal plant species that occupy habitats created by human being (Creeping Thistle *Cirsium arvense*, common wormwood *Artemisia vulgaris*, Common Tansy *Tanacetum vulgare*). The same refers to some bird species (Barn Swallow *Hirundo rustica*, Common House Martin *Delichon urbica*, Common Swift *Apus apus* or House Sparrow *Passer domesticus*). There are numerous correlations between particular groups of animals and plants. Therefore we cannot analyze any species without including correlation with another one existing in the same habitat. The environmental factors are very important in that kind of analysis. If we plan to research any kind of ecosystem without including a network of dependings between particular animal and plant species our results might be blurred.

6. RECLAMATION GUIDELINES

Obtained knowledge about biodiversity of the study area enabled us to prepare a reclamation guidelines for the quarry. The largest water body situated in the North and adjacent to the village Spalona is not that valuable in terms of the biodiversity as other parts of the quarry. This area is already occupied by human beings. A shore is divided in parcels of land devoted to building single-family houses (in the West shore), summer houses and other touristic investments (in the East shore). On the other hand the steep shore on the East side of the pond requires large amount of money to prevent slipping of the soil. The East side is designed for watering place with vacation resort. The nearest watering place is located in Kunice (5 km from Spalona) and every summer is overcrowded. It could be good idea to make a safe watering place in Spalona village because now local people use the ponds for recreation regardless health or threat to life. Additional attraction will be educational path created on the basis of results of our research. The path will promote biodiversity and increase a knowledge about quarry and its richness of flora and fauna. A project of educational path including routes and information about biodiversity at each stop is presented in Annex 11. This solution will

create an opportunity for touristic development of Spalona village and what is more important it will stop illegal use of a water bodies as watering places. In this case both people and nature benefit. One of the most important thing to do is to restore a continuity between forest in the North part of quarry and the oak alley. Water bodies should be separated with dike. The newly formed link should be planted with oaks so it can work as an ecological and migration corridor for animals such as Russian Leather Beetle *Osmoderma* sp. Dispersal ability of this beetle is very low so the restoration of connection between oak alley and forest will help in development of the population. It will also be a hiding place for bats and birds living in the tree trunks and crowns. In 2011 in North-East part of quarry planting of trees took a place. The plan was to restore oak-elm-ash forest which is typical for that kind of environmental. That would be a great idea taking into account the fact it is Natura 2000 habitat but this location is occupied by very rare plant Rock Cinquefoil *Potentilla rupestris*. This thermophilic species demands a great amounts of day light so it will be extinct from this area if trees will not be removed. Alluvial meadows located in the North-West and North-East part of the quarry are natural habitats of Natura 2000. The problem is that they are not mown for a several years. This contributed to the expansion of Wood Small-reed *Calamagrostis epigeios* and make meadows more poor in species. We propose the restoration of these valuable meadows by haymaking once a year which allow a regeneration of this habitat. Alluvial meadows are rich in Great Burnet *Sanguisorba officinalis* and Common Bistorta *Polygonum bistorta*. These are a host plants for some species of butterflies such as Scarce Large Blue *Maculinea teleius* which was found in the quarry area. A proper development of this kind of habitat and elimination of reed grass will contribute to maintenance and increase of protected butterflies population. Recultivated areas are usually sown with mix of grass but they also should be enriched with above mentioned host plants species for butterflies. Water bodies within the quarry are characterized by steep shores. An attempt to reduce steepness would be very costly. In return we propose creating a few „tongues” of soil reaching into middle of ponds. That will contribute to shallowing and subsequent slow entering of reed beds which are one of the best places for breeding of waders and water birds. Water level fluctuations which in 2012 were up to 20 cm cause periodical exposition of mud where rare and endangered plant species from class Isoëto-Nanojuncetea (such as species of the genus *Elatine*) develop. Any actions that could limit the water level fluctuations are not recommended. The last action we propose is to create an island in the middle of the water body. It can be easily done by separation some part of peninsula. It is recommended to plant tree species typical for *oak-elm-ash forests*. The island would be suitable nesting side for water birds that could be safe from predators and humans. Steep banks of the newly created island would be an excellent breeding place for kingfisher *Alcedo atthis*. Despite, the area is occupied by protected but very common plant species common centaury *Centaureum erythraea* it is worth to sacrifice a habitat of this species. Technical works related with creating the island will destroy habitat completely but there is always an option to move the population on other sites.

NOW THE NATURE WINS!

ACKNOWLEDGMENTS

We are deeply grateful to Dr. Zygmunt Dajdok for encouraging us in participation in the project and for his valuable advices and support during our research. We are also immensely thankful to Dr. Zygmunt Kącki for his engagement in this project, especially for his help in botanical field research and data analyses. We also would like to express our gratitude to Mgr. Aleksandra Kolanek for help in herpetological survey and to Mgr. Tomasz Maszkałko for help in ornithological survey.

REFERENCES:

Berger L. Płazy i gady Polski, 2000. Wydawnictwo Naukowe PWN, Warszawa – Poznań. ISBN 83-01-13139-X.

Buchholz L., Kubisz D., Gutowski J.M. 2000. Ochrona chrząszczy (Coleoptera) w Polsce - problemy i możliwości ich rozwiązania. W: Ochrona owadów w Polsce u progu integracji z Unią Europejską. Wiad. entomol. 18, Supl. 2: 155-163.

Buszko J. 1997b. Atlas rozmieszczenia motyli dziennych w Polsce (Lepidoptera: Papilionoidea, Hesperioidea) 1986-1995. Oficyna Wydawn. Turpress, Toruń, 170 ss.

Buszko J. 1993. Atlas motyli Polski. I. Motyle dzienne (Rhopalocera). Grupa IMAGE, Warszawa, 269 ss.

Dajdok Z. Pawlaczyk P. (red.). Wyd. Klubu przyrodników. Świebodzin, 2009. Inwazyjne gatunki roślin ekosystemów mokradłowych Polski

Dajdok Z., Śliwiński M. Polski klub ekologiczny – okręg dolnośląski. Wrocław, 2009. Rośliny inwazyjne Dolnego Śląska.

Głowaciński Z., Rafiński J. (red). Atlas płazów i gadów Polski. Status – rozmieszczenie – ochrona, 2003. GIOŚ, Warszawa. ISBN 83-7217-208-0.

Gutowski J.M., Buchholz L. 2000. Owady leśne - zagrożenia i propozycje ochrony. W: Ochrona owadów w Polsce u progu integracji z Unią Europejską. Wiad. entomol. 18, Supl. 2: 43-72.

Juszczyk W. Płazy i gady krajowe. Część 2: Płazy – Amphibia, 1987. Państwowe Wydawnictwo Naukowe, Warszawa. ISBN 83-01-05696-7.

Kącki Z.(red.). Instytut Biologii Roślin, Uniwersytet Wrocławski, Polskie towarzystwo przyjaciół przyrody „pro natura”. Wrocław, 2003. Zagrożone gatunki flory naczyniowej Dolnego Śląska.

Kulczyński S., Lilienfeldówna F., Raciborski M., Szafer W., Wierdak Sz. Akademia umiejętności. Kraków, 1919. Flora Polski. Rośliny naczyniowe polski i ziem ościennych. Tom I. Paprotniki, iglaste i jednoliścienne.

Matuszkiewicz W. Wydawnictwo Naukowe PWN. Warszawa, 2006. Przewodnik do oznaczania zbiorowisk roślinnych Polski.

Mirek Z., Zarzycki K. (red.). W. Szafer Institute of Botany, Polish Academy of Sciences.

Kraków, 2006. Red list of plants and fungi in Poland.

Oleksa A. 2002. Występowanie *Eriogaster catax* (Linnaeus, 1758) (Lepidoptera: Lasiocampidae) w Polsce. *Przegl. przyr.* 13 (1-2): 103-106.

Pawłowski J., Kubisz D., Mazur M. 2002. Coleoptera Chrząszcze. W: Czerwona lista zwierząt ginących i zagrożonych w Polsce. Z. Głowaciński (red.). Instytut Ochrony Przyrody PAN, Kraków. 155 ss. + supl. 74 ss.

Piękoś-Mirkowa H, Mirek Z. Oficyna Wydawnicza MULTICO. Warszawa, 2003. Atlas roślin chronionych.

Raciborski M., Szafer W. (red.). Polskie Wydawnictwo Naukowe. Warszawa, 1955. Flora Polski. Rośliny naczyniowe polski i ziem ościennych. Tom VII. Dwuliścienne wolnopłatkowe-dwuokwiatowe.

Raciborski M., Szafer W. (red.). Polskie Wydawnictwo Naukowe. Warszawa-Kraków, 1985. Flora Polski. Rośliny naczyniowe polski i ziem ościennych. Tom IV. Dwuliścienne wolnopłatkowe-dwuokwiatowe.

Ranius T., Aguado L.O., Antonsson K., Audisio P., Ballerio A., Carpaneto G.M., Chobot K., Gjurašin B., Hanssen O., Huijbregts H., Lakatos F., Martin O., Neculiseanu Z., Nikitsky N.B., Paill W., Pirnat A., Rizun V., Ruicănescu A., Stegner J., Süda I., Szwalko P., Tamutis V., Telnov D., Tsinkevich V., Versteirt V., Vignon V., Vögeli M., Zach P. (w druku). *Osmoderma eremita* (Coleoptera: Scarabaeidae) in Europe. *Animal Biodiversity and Conservation*.

Rutkowski L. Wydawnictwo Naukowe PWN. Warszawa, 2004. Klucz do oznaczania roślin Polski niżowej.

Sikora A., Rhode Z., Gromadzki M., Neubauer G., Chylarecki P. (red.) Bogucki Wydawnictwo Naukowe. Poznań, 2007. Atlas rozmieszczenia ptaków lęgowych Polski 1985-2004

Svensson L., Mullarney K., Zetterström D., Grant P.J. HarperCollins Publishers Ltd. Trento, 2010. Collins Bird Guide.

ANNEX 1

LIST OF RARE, ENDANGERED AND PROTECTED SPECIES FOUND IN QUARRY “SZCZYTNIKI”

English and scientific name	Directive, national protection, threat status	Localization and population size	
		Occupied habitat in the gravel (map in annex 2.)	Number of individuals / cover area
Common water crowfoot <i>Batrachium aquatile</i>	strict protection	water body	approx. 1 m ²
Grass Lily <i>Ornithogallum umbellatum</i>	strict protection LS (category LC)	fringe of the bushes and trees	approx. 0,25 m ²
Guelder Rose <i>Viburnum opulus</i>	partial protection	shrubs	2 shrubs
European centaury <i>Centaureum erythraea ssp. erythraea</i>	partial protection	commonest in wasteland on the peninsula of the largest water body	4 small populations that group of 2 to 4 individuals
Rock Cinquefoil <i>Potentilla rupestris</i>	PL (category V) LS (category EN)	discovered soil in the northern part of the quarry, now trees planting	concentrated population of approximately 20 individuals
Rye brome <i>Bromus secalinus</i>	PL (category V) LS (category VU)	roadside; reclaimed land in the western part of the mine	2 small populations that group of 2 to 5 individuals
Cut-leaved Cranesbill <i>Geranium dissectum</i>	LS (category LC)	reclaimed land in the western part of the mine	approx. 5 individuals
Mouse garlic <i>Allium angulosum</i>	PL (category V) LS (category NT)	alluvial meadow	dispersal of about 10 individuals

Abbreviations: PL- Red list of plants and fungi in Poland (categories of threat: V-Vulnerable);LS- Endangered Vascular Plants of Lower Silesia (categories of threat: LC- Least Concern, EN –Endangered; VU – Vulnerable,NT - Near Threatened)

ANNEX 2

MAP OF RARE AND PROTECTED PLANT SPECIES



dark blue- Common water crowfoot *Batrachium aquatile*; light blue- Mouse garlic *Allium angulosum*; green- Grass Lily *Ornithogallum umbellatum*; violet- Guelder Rose *Viburnum opulus*; pink- European centaury *Centaureum erythraea ssp. erythraea*; red- Rock Cinquefoil *Potentilla rupestris*; orange- Rye brome *Bromus secalinus*; black- Cut-leaved Cranesbill *Geranium dissectum*;

ANNEX 3

PHOTOGRAPHIC DOCUMENTATION OF RARE AND PROTECTED PLANT SPECIES



Guelder Rose

Viburnum opulus

Common water crowfoot

Batrachium aquatile





Rock Cinquefoil

Potentilla rupestris

Grass Lily
Ornithogallum umbellatum



European centaury
Centaurium erythraea



Mouse garlic *Allium angulosum*



Cut-leaved Cranesbill *Geranium dissectum*



Rye brome *Bromus secalinus*

ANNEX 4

LIST OF INVASIVE AND EXPANSIVE PLANT SPECIES FOUND IN THE QUARRY “SZCZYTNIKI”

English and scientificname	Status invasive/ expansive	Localization and size of population	
		Habitat	Number of individual/cover area
Wood Small-reed <i>Calamagrostis epigeios</i>	expansive	Abandoned alluvial meadows	population counted in hectares
Canadian Horsetweed <i>Conyza canadensis</i>	expansive	Ruderal areas, water body sides	dispersed, population up to 30 individuals
Devil's Beggarticks <i>Bidens frondosa</i>	invasive	Water body sides	dispersed, population up to 30 individuals
Small Balsam <i>Impatiens parviflora</i>	invasive	Shaded shrubs	dispersed, population up to 10 individuals
Wild Cucumber <i>Echinocystis lobata</i>	invasive	Water body sides	dispersed
Black locust <i>Robinia pseudoacacia</i>	invasive	Wood fringe	1 individual
Canadian goldenrod <i>Solidago canadensis</i>	invasive	All over the area: wastelands, water body sides	dispersed, population up to 5 individuals

ANNEX 5

PLANT COMMUNITIES AND THE HABITATS SITES OF NATURA 2000

In the study area distinguished 6 main types of plant communities. In the first group are semi-natural communities, including abandoned meadows occupied by *Calamagrostis epigejos* and typical meadow with *Deschampsia caespitosa* close to rivers. In the second group are strongly transformed communities as a result of mining activities:

- periodically flooded communities with the following species: *Ranunculus repens*, *Cirsium vulgare*, *Agrostis capillaris* observed along the ponds - especially in the eastern part of the mine;
- communities of rehabilitated areas with *Lolium multiflorum*, *Phleum pratense* and *Matricaria perforata* occurring in the western part of the area;
- plant communities on uncovered sand;
- plant communities with *Elymus repens*.

Characteristics of plant communities

Water vegetation and communities therophytes

Water vegetation has little relevance in the gravel vegetation. Zonal plant is difficult to see. On the banks of the ponds are pioneering community with *Myriophyllum spicatum*. On the small, periodically flooded areas are formed communities with *Isoetes-Nanojuncetea*, in which most species composition appears with *Plantago intermedia* and alien species - *Bidens frondosa*.

On the coastal slopes, we can see small patches of rare plant communities in Europe, where an important role is played by species of the genus *Anthoceros*. These communities are ephemeral and pioneer with species of the genus *Anthoceros* and *Peplis portula*, *Setaria glauca*, *Riccia glauca*, *Bryum argenteum*, *Polygonum aviculare*, *Arabidopsis thaliana*.

Rushes

Rushes occur in the coastal zone. They are represented by species-poor communities dominated by *Typha latifolia* or *Sparganium ramosum*. Only in the south-eastern part of the mine is a mosaic of rushes with *Phragmites australis*, *Sparganium ramosum*, *Typha latifolia*, *Glyceria maxima* and *Alisma plantago-aquatica*.

Along the edges of ponds we observed species prefer moist areas: *Rorippa palustris*, *Juncus articulatus*, *Typha angustifolia*, *Rumex crispus*, *Epilobium palustre*, *Spergula arvensis*, *Conyza canadensis*, *Polygonum hydropiper*, *Echinocystis lobata*, *Ranunculus sceleratus*.

Meadow vegetation

Grasslands were observed near the river Młynówka, which runs close to the mine. Grasslands are ecosystems with extensive type of use. In this area are well preserved floristic composition. These

communities are typical of river valleys. Species composition is dominated by *Alopecurus pratensis*. In addition, important are species from order *Molinietalia* with *Galium boreale*, *Silene silaus*, *Betonica officinalis*. These species are disappearing grassland flora elements and improve the natural value of the area. Grasslands are characterized by a compact structure. In the absence of cutting they are dominated by expansive species. The vegetation of these meadows is very valuable - we need to keep them as non-forest.

Another group are plant communities with grasses and segetal species. These communities belong to the class *Molinio -Arrhenatheretea* because of the high proportion of grassland species: *Festuca rubra* and *Lotus corniculatus*. In these communities there is a protected species - *Centaurea erythraea*. These kind of grasslands are located in the south part of the mine.

Reclaimed areas are included in the meadows. They are located in the eastern part of the mine. The area was planted a mixture of grass included: *Phleum pratense* and *Lolium multiflorum*. Species composition contains ruderal species and species associated with agricultural crops: *Bromus secalinus*, *Cichorium intybus* and *Artemisia vulgaris*, *Solidago altissima*, *Rumex crispus*. These communities are characterized by unstable structure, so it is difficult to give them the status of specific syntaxa.

In the wet depressions have developed a small patches of vegetation *Ranunculo-Alopecuretum geniculati* with *Agrostis stolonifera*, *Alopecurus geniculatus*, *Juncus effusus* and *Ranunculus repens*. The composition of these communities include species of abolishing flooding and oxygen deficiency in the soil.

Recreational use of the mine leads to the occurrence of trampled ground communities. These are low grasslands with species resistant to mechanical destruction. In their species composition occur *Polygonum aviculare*, *Plantago major*, *Trifolium hybridum* and *Poa annua*. Depending on the intensity of the trampling they are more or less compact.

Forest

Forest communities in the mine are transformed. They occupy small areas along streams. The most valuable community are scrub forest and riparian forests occur near Młynówka. They are protected, priority Natura 2000 habitats - code * 91E0 with: *Salix sp.*, *Calystegia sepium*, *Humulus lupulus*.

Small enclaves of communities with *Quercus robur* refer to alliance *Ficario-Ulmetum* and are relics of the forest. They are proof that in this place there were riverine forests with *Ulmus minor*, *Acer campestre*, *Padus avium*, *Fraxinus excelsior*, *Ulmus laevis*.

Valuable natural, especially for the presence of protected species of invertebrates, is an avenue with *Quercus robur*.

Valuable natural communities

Based on the inventory and analysis of collected data, we can determine the presence of 3 types of habitats protected under Natura 2000. To valuable natural habitats include:

- 6440 - Alluvial meadows of river valleys of the *Cnidion dubii*
- *91E0 - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*
- 91F0 - Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmion minoris*)

ANNEX 6

PHOTOGRAPHIC DOCUMENTATION OF NATURA 2000 HABITATS



6440 – Alluvial meadows of river valleys of the *Cnidion dubii*



*91E0 – Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*



91F0 – Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmenion minoris*)

ANNEX 7

HABITATS OF PROTECTED INSECTS SPECIES

Description of the Russian Leather Beetle *Osmoderma sp.* biology and typical habitat

The adults emerge in the spring, but remains in the shell, built by the larva waiting for warm days in the summer. Then just leave the hollows, sometimes flies on flowers and ripe fruit to get the food. Sexually mature individuals are reluctant to migrate and seek the development of a new generation in a radius of several hundred meters. Larvae, the development of which takes about three years, eat-out wood by fungi. The main host plant is oak, *Quercus spp.* Typical habitat: deciduous and mixed forests lowlands and foothills, as well as parks, roadside plantings and riparian. Everywhere, however, the possibility of *Osmoderma sp.* conditioned by the presence of old, reaching the appropriate size of the trees, where the hollows formed by the decomposition of wood by certain fungi.

Ways and purposes of protection

The beetle *Osmoderma sp.* is one of the species with the highest priority in the European Union's Habitat Directive. This paper include a list of species which can be a potential indicator and umbrella species for the endangered species of European fauna. To be useful as an indicator of a species-rich fauna species should be easy to inventory and be strongly correlated with the presence of other species. An umbrella species is a species which is so demanding that the protection of this species will automatically save many others. As *Osmoderma sp.* is easy to find and identify, it is useful as an indicator of stands with a rich beetle fauna in tree hollows. *Osmoderma sp.* can be used as an umbrella species, because if measures are taken to conserve *Osmoderma*, many other species in the same habitat are also conserved.

Description of the places in the quarry

During research have been found two places where *Osmoderma sp.* can exist. In two oaks occur a big hollows where adult forms can put eggs and larvae can grow up. Under this trees we found a faeces which remind *Osmoderma sp.* faeces by shape.

Description of the *Proteatia aeruginosa* biology and typical habitat

Fitosaprophage, imago stage found in July and August on the trunks (mostly oak) from the leaking juice, less on the flowers. Flights take place during the day, especially at high temperatures, usually in the trees. Eggs are few in number, rarely more than a dozen pieces, mostly wood inside hollow and located above the "pocket" formed under the bark of dying branches. The primary host plant is oak. Larval development period is 3, and our climatic conditions probably 4 years. Pupation takes place in late spring at the feeding larvae. Pupal stage lasts at most a few days, but the newly hatched beetle remains in the shell sometimes August. Typical habitat: extensive valleys in the lowlands, covered with oak-hornbeam forests and riparian forests loose with a high proportion of old trees. Living in the zone of crowns, but the development is possible in the lower elevations. Biotope sometimes associated with the places preferred by the *Cerambyx cerdo* or *Osmoderma sp.*. Sometimes, the beetles are the same trees dominate, both in the woods and in parks.

Ways and purposes of protection

Protection of habitats typical for this species. Especially old oaks with hollows and old trees in deciduous forests. For the conservation this species is essential to leave old growth oak and old hollow oaks growing on the edges of forests and afforestations

Description of the places in the quarry

We found adult form on the flower during nutrition.

Description of the Scarce Large Blue *Maculinea teleius*(*Phengaris teleius*) biology and typical habitat

Species have one generation per season. A butterfly appears in July and August, usually a little earlier than found in similar environments *M. nausithous* (Dusky Large Blue butterfly). In search of food, they often visit flowers of *Sanguisorba officinalis*, *Vicia cracca*, *Serratula tinctoria* and *Geranium palustre*. Caterpillar living initially in the *Sanguisorba officinalis* flowers. After a few molts, he leaves the plant, falling to the ground. At this time he releases chemicals (attractants), tempting ants of the genus *Myrmica* (for example *M. scabrinodis*, *M. rubra*, *M. gallienii*, *M. rugulosa*, *M. sabuleti*). Caterpillar is carried to the nest, where he leads a parasitic lifestyle feeding on larvae of ants. In the anthill the caterpillar lives about 11 months, and there also pupates. *Maculinea teleius* are obligatorily myrmecophilous butterflies. Molinian wet meadows, fens and bogs carbonate. Inhabits the foothills of the slope of the local water effusion. Range of the species is always dependent on the presence of suitable host plant and ants.

Ways and purposes of protection

Maculinea teleius in Poland, under the Regulation of the Minister of the Environment, is covered by strict protection. It is also protected against the background of the EU Habitats Directive 92/43/EEC and the Convention of Bern ratified by Poland.

As a result of complicated life histories *Maculinea* populations are highly sensitive to environmental changes. Threats to the species are both reclamation and associated with that intensification of the use of wet meadows, as well as natural succession, which leads to the replacement of meadows by thickets of willow, birch and alder. Care should be taken to maintain the environment at the appropriate stage of succession, which enables the development of caterpillar host plant and favors the presence of *Myrmica* ants. To do this, reduce mowing of meadows to once a year, preferably in August, and remove excessive sprawling shrubs. We should pay attention to mowing of meadows in appropriate period. It prevents ecological succession, but if performed at a wrong period with heavy machines in the whole area of a site, it might be highly destructive.

Description of the places in the quarry

We confirmed one molinian wet meadow in the quarry, where *Maculinea teleius* occur and one potential position, where he could be. They are both marked on the map.



Picture 1

This map show occurrence objects of our research:

dark green color sign confirmed habitat for Scarce Large Blue *Maculinea teleius*, and potential habitat for Dusky Large Blue *Maculinea nausithous* and Violet Copper *Lycaena helle*

light green color sign molinian wet meadow with *Sanguisorba officinalis*: potential habitat for Scarce Large Blue *Maculinea teleius* and Dusky Large Blue *M. nausithous*

dark red color sign old oak alley – confirmed habitat for Russian Leather Beetle *Osmoderma sp.* and *Protaetia aeruginosa*

ATTACHMENT 8

PHOTOGRAPHIC DOCUMENTATION OF ENTOMOLOGICAL PART



The Scarce Large Blue *Maculinea telejus* on the host plant Great Burnet *Sanguisorba officinalis*



Feeding *Protaetia aeruginosa*





Great Burnet *Sanguisorba officinalis* – a host plant of the Violet Copper *Lycaena helle*



Great Burnet *Sanguisorba officinalis* – a host plant of The Scarce Large Blue *Maculinea telejus*

ANNEX 9
LIST OF BIRDS FOUND IN THE QUARRY „SZCZYTNIKI”

Found species	Probably nesting species*	Nesting species	Species under protection in Poland	Species included in Annex I of the Birds Directive
99	35	4	87	6
Common Pheasant <i>Phasianus colchicus</i>				
Northern Wheatear <i>Oenanthe oenanthe</i>			+	
Western Marsh-harrier <i>Circus aeruginosus</i>			+	+
White Stork <i>Ciconia ciconia</i>			+	+
Great Tit <i>Parus major</i>	+		+	
Common Sandpiper <i>Actitis hypoleucos</i>			+	
Sand Martin <i>Riparia riparia</i>			+	
Common Whitethroat <i>Sylvia communis</i>	+		+	
Northern Lapwing <i>Vanellus vanellus</i>			+	
Grey Heron <i>Ardea cinerea</i>				
Tufted Duck <i>Aythya fuligula</i>				
Eurasian Siskin <i>Carduelis spinus</i>			+	

Barn Swallow <i>Hirundo rustica</i>			+	
Black Woodpecker <i>Dryocopus martius</i>	+		+	+
Great Spotted Woodpecker <i>Dendrocopos major</i>	+		+	
European Green Woodpecker <i>Picus viridis</i>	+		+	
Lesser Spotted Woodpecker <i>Dendrocopos minor</i>			+	
Rook <i>Corvus frugilegus</i>			during 15 March to 30 June	
Common Goldeneye <i>Bucephala clangula</i>			+	
Red-backed Shrike <i>Lanius collurio</i>		+	+	
Greylag Goose <i>Anser anser</i>				
Bean Goos <i>Anser fabalis</i>				
Bullfinch <i>Pyrrhula pyrrhula</i>			+	
Common Pochard <i>Aythya ferina</i>				
Rock Dove <i>Columba livia forma urbana</i>				
Hawfinch <i>Coccothraustes coccothraustes</i>			+	
Common Wood Pigeon <i>Columba palumbus</i>	+			
Common Swift <i>Apus apus</i>			+	+
Eurasian Blackcap <i>Sylvia atricapilla</i>	+		+	

Western Jackdaw <i>Corvus monedula</i>			+	
African Stonechat <i>Saxicola torquata</i>	+		+	
Common Moorhen <i>Gallinula chloropus</i>			+	
Black Redstart <i>Phoenicurus ochruros</i>			+	
Great Cormorant <i>Phalacrocorax carbo</i>			under protection are not birds that living at the fish ponds, recognized as breeding precincts within the meaning of the Inland Fisheries Act, from August to departure	
Common Blackbird <i>Turdus merula</i>	+		+	
Eurasian Nuthatch <i>Sitta europaea</i>	+		+	
Eurasian Wryneck <i>Jynx torquilla</i>			+	
Eurasian Sparrowhawk <i>Accipiter nisus</i>			+	
Common Raven <i>Corvus corax</i>			+	
Mallard <i>Anas platyrhynchos</i>		+		
Common Cuckoo <i>Cuculus canorus</i>			+	
European Serin <i>Serinus serinus</i>	+		+	
Fieldfare			+	

<i>Turdus pilaris</i>				
Mute Swan <i>Cygnus olor</i>			+	
Marsh Warbler <i>Acrocephalus palustris</i>			+	
Eurasian Coot <i>Fulica atra</i>		+		
Linnet <i>Carduelis cannabina</i>	+		+	
Eurasian Tree Sparrow <i>Passer montanus</i>	+		+	
Common Gull <i>Larus canus</i>				
Blue Tit <i>Parus caeruleus</i>	+		+	
Goldcrest <i>Regulus regulus</i>			+	
Common Buzzard <i>Buteo buteo</i>	+		+	
Common Merganser <i>Mergus merganser</i>			+	
Common House Martin <i>Delichon urbica</i>			+	
Short-toed Treecreeper <i>Certhia brachydactyla</i>			+	
Great Crested Grebe <i>Podiceps cristatus</i>		+	+	
Little Grebe <i>Tachybaptus ruficollis</i>	+		+	
Willow Warbler <i>Phylloscopus trochilus</i>	+		+	
Lesser Whitethroat <i>Sylvia curruca</i>	+		+	
Common Chiffchaff	+		+	

<i>Phylloscopus collybita</i>				
White Wagtail <i>Motacilla alba</i>	+		+	
Yellow Wagtail <i>Motacilla flava</i>	+		+	
Northern Shoveler <i>Anas clypeata</i>			+	
Whinchat <i>Saxicola rubetra</i>	+		+	
Corn Bunting <i>Miliaria calandra</i>	+		+	
Reed Bunting <i>Emberiza schoeniclus</i>	+		+	
Common Quail <i>Coturnix coturnix</i>	+		+	
Common Kestrel <i>Falco tinnunculus</i>			+	
Long-tailed Tit <i>Aegithalos caudatus</i>			+	
Eurasian Penduline Tit <i>Remiz pendulinus</i>			+	
European Robin <i>Erithacus rubecula</i>			+	
Black Tern <i>Chlidonias niger</i>			+	+
Common Tern <i>Sterna hirundo</i>			+	
Green Sandpiper <i>Tringa ochropus</i>			+	
Eurasian Collared Dove <i>Streptopelia decaocto</i>	+		+	
Little Ringed Plover <i>Charadrius dubius</i>	+		+	
Eurasian Skylark	+		+	

<i>Alauda arvensis</i>				
Common Nightingale <i>Luscinia megarhynchos</i>	+		+	
Eurasian Jay <i>Garrulus glandarius</i>			during 15 March to 30 June	
Eurasian Magpie <i>Pica pica</i>			+	
Great Grey Shrike <i>Lanius excubitor</i>			+	
Eurasian Wren <i>Troglodytes troglodytes</i>			+	
European Goldfinch <i>Carduelis carduelis</i>	+		+	
Common Starling <i>Sturnus vulgaris</i>			+	
Black-headed Gull <i>Larus ridibundus</i>			+	
Song Thrush <i>Turdus philomelos</i>	+		+	
Meadow Pipit <i>Anthus pratensis</i>			+	
Great Reed Warbler <i>Acrocephalus arundinaceus</i>	+		+	
Eurasian Reed Warbler <i>Acrocephalus scirpaceus</i>	+		+	
Yellowhammer <i>Emberiza citrinella</i>	+		+	
European Turtle Dove <i>Streptopelia turtur</i>			+	
Eurasian Golden Oriole <i>Oriolus oriolus</i>			+	
Carrion Crow <i>Corvus corone</i>			during 15 March to 30 June	
House Sparrow			+	

<i>Passer domesticus</i>				
Icterine Warbler <i>Hippolais icterina</i>			+	
Common Chaffinch <i>Fringilla coelebs</i>			+	
Common Kingfisher <i>Alcedo atthis</i>	+		+	+
Common Crane <i>Grus grus</i>			+	

probably breeding species evaluated on the basis of the classification of Polish Ornithological Atlas (Sikora, 2007)

Category B Nesting Probably:

- 1) A pair of birds observed in nesting habitat
- 2) Singing or held male mating flights, detected for at least two days in the same place or simultaneous finding many males in the breeding habitat of the species.
- 3) Copulation, courtship display
- 4) Visiting a places suitable for nest
- 5) Voices of anxiety suggesting proximity to nest or chicks
- 6) Brood patch (at a bird held in the hand)
- 7) Construction of nest or hollow drill

ANNEX 10

LIST OF AMPHIBIANS AND REPTILES SPECIES FOUND IN THE MINE “SZCZYTNIKI”

Species	Protection status	Acts
<i>Pelophylax esculentus</i> complex	strict protection	Nature Conservation Act of 2004
<i>Rana arvalis</i>	strict protection	Nature Conservation Act of 2004
<i>Rana temporaria</i>	strict protection	Nature Conservation Act of 2004
<i>Bufo bufo</i>	strict protection	Nature Conservation Act of 2004
<i>Bombina bombina</i>	strict protection	Annex II of the Habitats Directive, Nature Conservation Act of 2004
<i>Natrix natrix</i>	strict protection	Nature Conservation Act of 2004
<i>Lacerta agilis</i>	strict protection	Annex IV of the Habitats Directive, Nature Conservation Act of 2004

Pelophylax esculentus complex - a complex of green frogs with three taxa: *Pelophylax lessonae*, *Pelophylax ridibundus* and their natural hybrid - *Pelophylax esculentus*. This frog strongly associated with water, individuals residing in it not only for mating and procreation time, but practically the whole of the year in which they are active. Depending on the particular taxon, prefer different types of standing water tanks. *Pelophylax ridibundus* - large bodies of water, sometimes flow; *Pelophylax lessonae* - small tanks, closed to the flow of water. *Pelophylax esculentus* is a taxon which can live with both *Pelophylax lessonae*, *Pelophylax ridibundus*. This amphibians are common, inhabiting almost every tank, even tanks are subject to strong anthropogenic impact.

Rana arvalis and *Rana temporaria* - a group of brown frogs, green frogs less than associated with water - it just go down to the mating and reproduction, at other times they can be found mostly on the ground, with the *Rana temporaria* prefer drier habitats (forests, dry meadows), and *Rana arvalis* wetland habitats (bogs, wet meadows), sometimes there are side by side. Males have a mating during mating calluses. In addition, males in the spring morning arvalis become intensely blue.

Bufo bufo - the most common of toads, significant sexual dimorphism (except for mating calluses can see a clear difference of body size between males and females). In addition to mating season characterized by land and nocturnal. It occurs in forests, fields and gardens, wedding explosive, individuals are able to migrate long distances in order to serve the mating and egg laying. Due to the slow migration of mass die on the roads crossing their migration routes. Therefore, in the presence of traffic should be reduced, or protect migrating toads by creating passages for amphibians under roads.

Bombina bombina - a species of Natura 2000. Sexual dimorphism is marked by the presence of black males mating calluses. Species strongly associated with water, most of the activity resides in the tank all the time. Prefer small, shallow containers with clean water, rich in algae and vascular plants underwater. After laying eggs migrate to rich food, often contaminated tanks. In Poland, the species is

rather common, but because of the rarity of its occurrence in Europe, is set out in Annex II of the Habitats Directive.

Natrix natrix - snake, with its characteristic bright spots for the eyes. There is a variety of environments at the edge of forest in humid forests, wet meadows - in close proximity to bodies of water, eats mainly because amphibians and their larvae. Often, it can be seen flowing just below the surface of the water while hunting. Adults may have one meter in length. There is sexual dimorphism. Their protection is directly related to the protection of amphibians as their main food base. Eggs are laid in mounds of rotting leaves, manure, soft, plump land.

Lacerta agilis - prefers grasslands habitat, often found on railway embankments, the ruins of buildings, which has provided shelter between the stones and also plenty of space to soak up. Sexual dimorphism in mating - males have a green color.

ANNEX 11

MAP OF EDUCATIONAL PATHWAY



- P- parking
- I. Mine „Szczytniki”;
- II. Biodiversity definition;
- III. Biodiversity;
- IV. Oak avenue;
- V. Molinion meadow;
- VI. Reed beds;
- VII. Pond

ANNEX 12
MAP OF OAK ALLEY AND RIPARIAN MIXED FORESTS



I. MINE 'SZCZYTNIKI'

Dear visitors, you are in the former Szczytniki Mineral Resources Mine which belonged to the HeidelbergCement company. Due to sand and gravel extraction, large holes were created, which in favourable conditions have filled with water. These conditions were met thanks to Kaczawa river proximity and high level of underground water. Now we can observe the results.

Exploitation cause of mineral resources cause a total transformation of the ecosystem. After the deposit depletion and mine liquidation, new habitats are created for countless species of plants and animals. It is vital to properly prepare such areas for organisms migration, e.g align tank shores to provide space for higher number of species, or to sow different grass species before weeds or invasive plants appear there.

The Educational path was made within the scientific project of complex Szczytniki mine flora and fauna inventory and planed recultivation project by Wrocław University students science societies. The project was made due to concern for natural environment of HeidelbergCement group. The track presents discovered natural habitats on the former mine site and species living there now. Beside common plants and animals that are around us, we can find here rare and protected species from Polish Red List of Plants and Animals.



Fot. A. Mozanowicz

WASP SPIDER



Fot. K. Mielcarska

GRASS SNAKE



Fot. K. Ostrowski

GREAT CRESTED GREBE



Fot. M. Zboińska

COMMON CENTAURY

Fot. M. Zboińska

II. BIODIVERSITY - DEFINITION

Biodiversity is the variety of all living organisms in a given area. There are three levels of biodiversity: genetic diversity, species diversity and ecosystem diversity.

Genetic diversity are all genes contained in all individual organism. This kind of diversity describes the differences between species and between individuals of the same species, because each living creature has its own, unique set of genes. **Genetic diversity of individuals ensures stability of population.**

On the pictures below circles represent individuals of the same species; colours - different variants of the same gene (just as the different variants of the same gene encoding different eye colors in humans). If we imagine that the virus kills only individuals with a specific variant of the gene (in our example red), we will understand why the genetic diversity of the population is so important.



Species diversity describes two components of biodiversity: the number of different species that are represented in the environment and the population size of these species. Ecosystems with the greatest diversity of species are evergreen rainforests and coral reefs.

It is hard to predict how many species live on Earth. Only two million of them have been described, but estimates range from 3 to 10 million of species. The most probable value is 11 million. Sadly many of them will disappear before they are even found - scientists estimate that **every hour three species disappear!**

Ecosystem diversity describes the variety of ecosystems in a given place, so takes into account all living organisms connected by network of relationship between them and between them and the nonliving components of their environment. Diversity of ecosystems in Poland are presented on the photos below.



Photo M. Zbońska



Photo M. Zbońska



Photo M. Zbońska

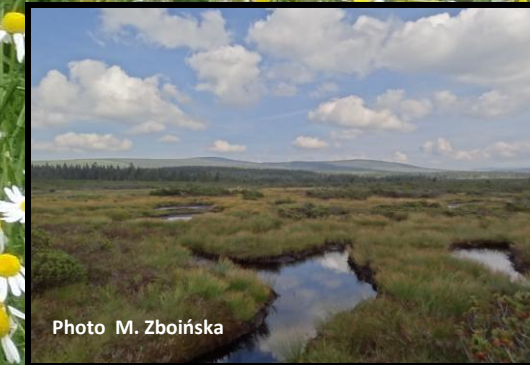


Photo M. Zbońska

From upper left corner: beech forest on the Wolin Island, the Baltic Sea, molinia meadow at the Mine 'Szczytniki', peatland in the Izerskie Mountains.

Photo M. Zbońska

III. BIODIVERSITY

Why is biodiversity so important?

Agriculture

- Human uses hundreds of plant and animal species as food. Furthermore, 75% of the crop plants is dependent on the animal pollinator like insects, birds or bats.

Medicines

- 50% of drugs derived from natural sources: plants, animals and microorganisms. Global value of these pharmaceutical products is worth hundreds milliards of dollars.

Industrial materials

- Ecosystems provide a great diversity of materials: wood, fiber, dyes, oils, paper...

Environmental stability

- Plants regulate the chemical composition of the atmosphere by removing carbon dioxide and locking it in their tissues.
- Microorganisms are involved in degradation of wastes and wastewater.
- Forests accumulate significant water reserves taking part in its circulation.
- Living organisms are involved in the nutrients circulation and soil formation.

Cultural services

- Biodiversity has aesthetic and cultural value, is important for development of tourism.

What threatens biodiversity?

Habitat destruction

- Deforestation.
- Development of cities, road-building.
- Mining activities.
- Regulation of rivers, drainage of wetlands.

Overexploitation

- Overfishing.
- Soil impoverishment.
- Illegal wildlife trade.

Invasive species

- Displace native species.

Climate changes

- Global warming.

Environmental pollution

- Excessive fertilization.

Invasive species are foreign origin (nonindigenous) plants and animals that displace native species of flora and fauna. This is possible because they grow and reproduce very fast, so they rapidly inhabit new places. Furthermore they are tolerant for wide range of environmental condition and effectively compete with native species for environmental resources (light, water, nutrients).

Some invasive plants occurring in Poland are shown in the photographs (from left): giant goldenrod (*Solidago gigantea*), small balsam (*Impatiens parviflora*), wild cucumber (*Echinocystis lobata*).



Photo M. Zboińska



Photo M. Zboińska



Photo G. Swacha

Photo M. Zboińska

IV. OAK AVENUE

The old trees avenues have a particular importance for maintaining the biological diversity. Because of their linear character they act as ecological passages for species that avoid open area such as **woodpeckers** or some of bats species. The old trees provide many ecological niches which allow many groups of animals and mushrooms to exist.. To give an example, in a tree hollow birds can nest or bats find shelter. On the bottom of such tree hollow live many insects like **hermit beetle** or **flower chafers**. What's more, on a tree trunk grow saprophytic and parasitic fungus or feed wood-eating insects. Finally, bark is a suitable habitat for mosses and **lichen**.



Fot. K. Mielcarska

HERMIT BEETLE



Fot. A. Mozanowicz

COMMON ORANGE LICHEN



Fot. K. Ostrowski

GREAT SPOTTED WOODPECKER



Fot. K. Mielcarska

FLOWER CHAFER

Fot. M. Zbońska

V. MOLINIA MEADOW

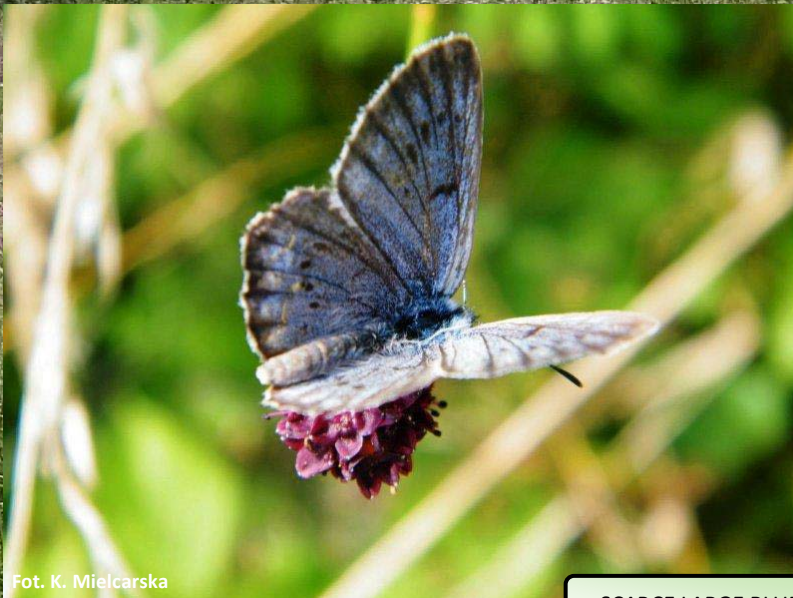
Molinion meadows are a meadow type where humidity can change during the year, which often are mowed once in late summer or autumn. They exist on mineral soils with different pH levels. They are very valuable because when left without mowing they turn into tall herb communities but mowed too often, they turn into marsh marigold meadows. In the past they served as hay source for cattle padding.

On a molinion meadow we can find many precious and protected species of plants and animals such as: **mouse garlic** (*Allium angulosum*), northern bedstraw (*Galium boreale*) or **scarce large blue** (*Phengaris teleius*) and **whinchat** (*Saxicola rubetra*). They are also ideal feeding grounds for storks and cranes.



Fot. K. Ostrowski

WHINCHAT



Fot. K. Mielcarska

SCARCE LARGE BLUE



Fot. M. Zbońska.

MOUSE GARLIC

VI. REED BEDS

Reed bed (rush) is a complex of aquatic and marsh plants that grow in the coastal zone of lakes and rivers. Reed beds are composed mainly of the common reed or reedmace (cattail) species but also include many other plants – sweet flag, **bur-reed**, **mad-dog weed**, arrowhead, yellow flag, sedges, and closer to the shore also: water mint, **purple loosestrife**, soft rush, water forget-me-not, cursed buttercup.



Photo M. Zboińska



Photo M. Zboińska



Photo M. Zboińska



Photo K. Mielcarska



Photo M. Zboińska

From the left: bur-reed (*Sparganium* sp.), mad-dog weed (*Alisma plantago-aquatica*), purple loosestrife (*Lythrum salicaria*), grass snake (*Natrix natrix*), water frogs (*Rana esculenta* complex).

Rushes are a habitat for many animals, providing them foods, shelter and quiet place for breeding and raise their young. In the reed beds **great reed warbler** and **great crested grebe** build their nests. We can meet there **water snake**, which swims very well and hunts for numerous **frogs** and fishes hiding in the bushes. Colourful **dragonflies** fly above the water. This insects lay their eggs into the water, mud or water plants tissue. If an inattentive dragonfly fell on the water surface, it would become the food for pond skater- bug, which is able to run on top of the water surface. If we are lucky we will meet here even otters. It is hard to deny that reed beds are the unique refuge of biodiversity.



Photo A. Sala



Photo M. Pietkiewicz



Photo K. Ostrowski

In the photos from left: dragonfly of the genus Eurasian bluets (*Coenagrion* sp.), great reed warbler (*Acrocephalus arundinaceus*) and great crested grebe (*Podiceps cristatus*).

Photo G. Swacha

VII. POND

Water and wetlands areas are very important for the preservation of biodiversity, because numerous birds live in such areas. Water provides them the abundance of food (fishes, aquatic plants, small invertebrates, plankton), while plants growing on the banks - shelter and protection from predators.



Photo A. Knychala

Common merganser (*Mergus merganser*) is an expert in diving- it can reach a depth up to 10 meters. Merganser feeds on fish, amphibians, rodents and even a small birds. Young birds, in the second day of their lives, have to jump out of the hollow tree, located dozen meters above the ground, in order to follow his mother to the nearest pond.



Photo K. Ostrowski

Mute swans (*Cygnus olor*) feed on aquatic plants. These animals cannot dive, but thanks to a long neck they can get the plants from a depth of even 1m. Despite the vegetarian diet swans achieve considerable size- the record holder weighed 22,5 kg! Another feature of the mute swans is their longevity - they can live up to 20 years.



Photo M. Pietkiewicz

Common kingfisher (*Alcedo atthis*) is one of the most colourful birds of Poland. This bird feeds on mostly fish, but sometimes catches also dragonfly larvae and water beetles. Kingfisher is watching for their prey sitting on a branch hanging over the water. If he perceives prey, dives very quickly, but only to small depth-to 25cm.

Ducks (*Anatinae*) is a subfamily of Anatidae birds (*Anatidae*). We can distinguish among them dabbling ducks and pochards (diving ducks). Dabbling ducks, such as mallard and northern shoveler, cannot dive, so they are looking for food at the water surface (plankton, plant fragments), while the pochards, e.g. common pochard, feed by diving beneath the water.

In the photos from left: mallard (*Anas platyrhynchos*), northern shoveler (*Anas clypeata*) and common pochard (*Aythya felina*).



Photo M. Pietkiewicz

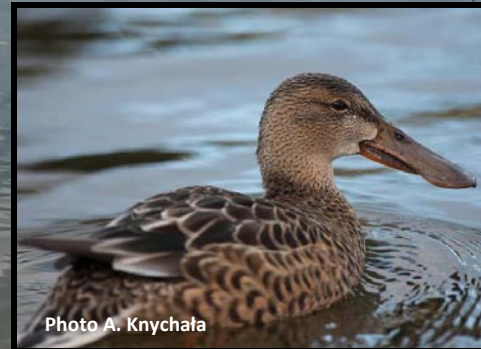


Photo A. Knychala



Photo M. Pietkiewicz

Photo M. Zbońska

REFERENCES:

Berger L. Płazy i gady Polski, 2000. Wydawnictwo Naukowe PWN, Warszawa – Poznań. ISBN 83-01-13139-X.

Buchholz L., Kubisz D., Gutowski J.M. 2000. Ochrona chrząszczy (Coleoptera) w Polsce - problemy i możliwości ich rozwiązania. W: Ochrona owadów w Polsce u progu integracji z Unią Europejską. Wiad. entomol. 18, Supl. 2: 155-163.

Buszko J. 1997b. Atlas rozmieszczenia motyli dziennych w Polsce (Lepidoptera: Papilionoidea, Hesperioidea) 1986-1995. Oficyna Wydawn. Turpress, Toruń, 170 ss.

Buszko J. 1993. Atlas motyli Polski. I. Motyle dzienne (Rhopalocera). Grupa IMAGE, Warszawa, 269 ss.

Dajdok Z. Pawlaczyk P. (red.). Wyd. Klubu przyrodników. Świebodzin, 2009. Inwazyjne gatunki roślin ekosystemów mokradłowych Polski

Dajdok Z., Śliwiński M. Polski klub ekologiczny – okręg dolnośląski. Wrocław, 2009. Rośliny inwazyjne Dolnego Śląska.

Głowaciński Z., Rafiński J. (red). Atlas płazów i gadów Polski. Status – rozmieszczenie – ochrona, 2003. GIOŚ, Warszawa. ISBN 83-7217-208-0.

Gutowski J.M., Buchholz L. 2000. Owady leśne - zagrożenia i propozycje ochrony. W: Ochrona owadów w Polsce u progu integracji z Unią Europejską. Wiad. entomol. 18, Supl. 2: 43-72.

Juszczyk W. Płazy i gady krajowe. Część 2: Płazy – Amphibia, 1987. Państwowe Wydawnictwo Naukowe, Warszawa. ISBN 83-01-05696-7.

Kącki Z.(red.). Instytut Biologii Roślin, Uniwersytet Wrocławski, Polskie towarzystwo przyjaciół przyrody „pro natura”. Wrocław, 2003. Zagrożone gatunki flory naczyniowej Dolnego Śląska.

Kulczyński S., Lilienfeldówna F., Raciborski M., Szafer W., Wierdak Sz. Akademia umiejętności. Kraków, 1919. Flora Polski. Rośliny naczyniowe polski i ziem ościennych. Tom I. Paprotniki, iglaste i jednoliścienne.

Matuszkiewicz W. Wydawnictwo Naukowe PWN. Warszawa, 2006. Przewodnik do oznaczania zbiorowisk roślinnych Polski.

Mirek Z., Zarzycki K. (red.). W. Szafer Institute of Botany, Polish Academy of Sciences.

Kraków, 2006. Red list of plants and fungi in Poland.

Oleksa A. 2002. Występowanie *Eriogaster catax* (Linnaeus, 1758) (Lepidoptera: Lasiocampidae) w Polsce. *Przegl. przyr.* 13 (1-2): 103-106.

Pawłowski J., Kubisz D., Mazur M. 2002. Coleoptera Chrząszcze. W: Czerwona lista zwierząt ginących i zagrożonych w Polsce. Z. Głowaciński (red.). Instytut Ochrony Przyrody PAN, Kraków. 155 ss. + supl. 74 ss.

Piękoś-Mirkowa H, Mirek Z. Oficyna Wydawnicza MULTICO. Warszawa, 2003. Atlas roślin chronionych.

Raciborski M., Szafer W. (red.). Polskie Wydawnictwo Naukowe. Warszawa, 1955. Flora Polski. Rośliny naczyniowe polski i ziem ościennych. Tom VII. Dwuliścienne wolnopłatkowe-dwuokwiatowe.

Raciborski M., Szafer W. (red.). Polskie Wydawnictwo Naukowe. Warszawa-Kraków, 1985. Flora Polski. Rośliny naczyniowe polski i ziem ościennych. Tom IV. Dwuliścienne wolnopłatkowe-dwuokwiatowe.

Ranius T., Aguado L.O., Antonsson K., Audisio P., Ballerio A., Carpaneto G.M., Chobot K., Gjurašin B., Hanssen O., Huijbregts H., Lakatos F., Martin O., Neculiseanu Z., Nikitsky N.B., Paill W., Pirnat A., Rizun V., Ruicănescu A., Stegner J., Süda I., Szwalko P., Tamutis V., Telnov D., Tsinkevich V., Versteirt V., Vignon V., Vögeli M., Zach P. (w druku). *Osmoderma eremita* (Coleoptera: Scarabaeidae) in Europe. *Animal Biodiversity and Conservation*.

Rutkowski L. Wydawnictwo Naukowe PWN. Warszawa, 2004. Klucz do oznaczania roślin Polski niżowej.

Sikora A., Rhode Z., Gromadzki M., Neubauer G., Chylarecki P. (red.) Bogucki Wydawnictwo Naukowe. Poznań, 2007. Atlas rozmieszczenia ptaków lęgowych Polski 1985-2004

Svensson L., Mullaney K., Zetterström D., Grant P.J. HarperCollins Publishers Ltd. Trento, 2010. Collins Bird Guide.