




Poland belongs to the group of countries with a relatively large area of wetlands. They occupy about 4% of the country's territory and are concentrated mainly in its northern part. The Biebrza Marshes are among the largest and best known. The size of the mires in the Narew valley and the diversity and outstanding values of fens in the Rospuda river valley - impress. The countless lakes and peatlands of Kaszuby and Bory Tucholskie form part of an extraordinary landscape of poor forests. The beautiful, picturesque landscape of the glades in Gorce mountains is emphasized by the white fields of the cottongrass growing on the flush fens. Regardless of the region, all these swamps, mires and flush fens require protection! For centuries, they have been drained, exploited, turned into meadows and fields, and finally abandoned - they are overgrown with forest. They are dying! Together with them numerous, unique species of plants and animals. The disappearing swamps emit enormous amounts of carbon dioxide responsible for climate change, which is so much to blame for mankind. That's why we try to protect them. Especially one of them - alkaline fens. Unique in every way! Mowing and cutting trees, blocking drainage ditches, are activities that at first glance have little to do with nature conservation, and which we have been dealing with for the last 6 years. Just for the protection of alkaline fens. Where, how and how effective? We invite you to read our book!

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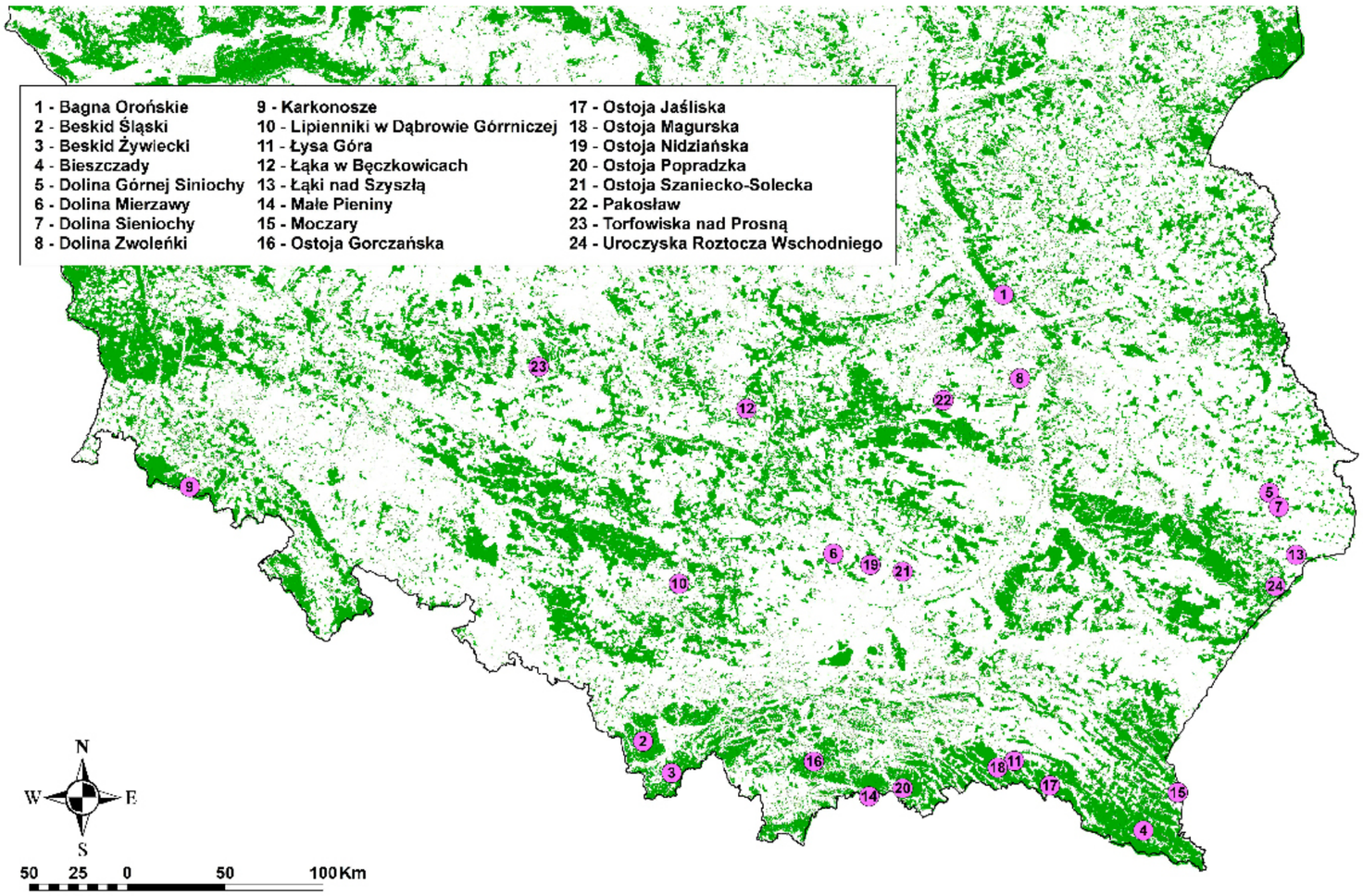
Layman's Report from realization of the projects
Conservation of alkaline fens (7230) in young-glacial landscape of northern Poland (LIFE11 NAT/PL/423)
Conservation of alkaline fens (7230) in southern Poland (LIFE13 NAT/PL/000024)

VOLUME II

Conservation of alkaline fens (7230) in Poland

Localisation of Natura 2000 sites, where project activities were implemented



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VOLUME II
Conservation of alkaline fens (7230) in southern Poland (LIFE13 NAT/PL/000024) and experiences of alkaline fens conservation in northern and southern Poland

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Photo on front page: Spring-fed cupola fen in Śniatycze (photo R. Stańko).

VOLUME II

1. LIFE13 NAT/PL/000024 Project „Protection of alkaline fens in southern Poland" – planned actions and achieved results

Dorota Horabik, Robert Stańko, Magdalena Makowska

The project „Protection of alkaline fens of southern Poland" was based on the results of the national inventory of habitat 7230 carried out within the framework of the completed project „Conservation programs for: alkaline fens (7230) and endangered species related to them – yellow marsh saxifrage, fen orchid, musk orchid, and fleshy starwort" (POIŚ.05.03.00-00-47/08). In principle it was aimed at inhibiting the degradation process and improving or maintaining the proper condition of alkaline fens in 24 Natura 2000 areas in southern Poland, as a habitat for many rare, protected, and extremely endangered plant species including, in particular, species from Annex II of the Habitats Directive.

The project was implemented in the period 09/2014 – 12/2018[1] from the funds of LIFE+ financial instrument (50%), National Fund for Environmental Protection and Water Management (45%), its Beneficiaries - the Naturalists' Club (Beneficiary), Gorce National Park (Co-Beneficiary), and additional co-financing entity for the activities in the Podkarpackie Voivodeship – Regional Directorate for Environmental Protection in Rzeszów. The project covered 8 Voivodeships: Małopolskie, Śląskie, Podkarpackie, Lubelskie, Dolnośląskie, Łódzkie, Mazowieckie, and Świętokrzyskie. Among 97 selected "sites" (patches of habitats) constituting the most valuable and best preserved alkaline fens in the southern and central part of the country, there were both mountain flush mires in Beskid Żywiecki, Gorce, Pieniny, as well as alkaline fens located in the central part of Poland.

The main task of the project was:

- inhibiting excessive outflow and raising the level of groundwater in the area of alkaline fens,
- inhibiting the process of mineralization and eutrophication of the surface layer of alkaline fens,
- inhibiting the process of decline in the biodiversity of alkaline fens caused by the expansion of species characteristic for habitats with lower moisture content, e.g., grasses, trees, and shrubs,
- popularizing methods for the protection of alkaline fens based on good management plans based on a sound scientific basis, with a particular focus on hydro-ecological aspects,
- promoting the protection of alkaline fens as sanctuaries for rare and endangered species, which are also regional and local natural attractions,
- gathering a group of people interested in the protection of alkaline fens, undertaking future maintenance activities for the results achieved within the framework of the project,
- encouraging as many individuals (farmers) as possible to use the sites for hay production extensively in the future.

The project created an opportunity to maintain or improve the condition of most of the alkaline fens of southern and central Poland, which constitute about 70% of the resources of this part of the country by surface area. The implementation of the project contributed to the preservation of the full geographical and regional diversity of the 7230 habitat, its unique nature – from particularly small fens and the flush mires in the Carpathians to the extremely alkaline fens of the Lublin region.

The implementation of the project contributed to the preservation of a few percent (on a national scale) of *Liparis loeselii* sites and other rare species strongly associated with alkaline fens, e.g., *Ligularia sibirica, Pinguicula vulgaris ssp. bicolor, Schoenus ferrugineus, Schoenus nigricans, Tofieldia calyculata, Swertia perennis ssp. perennis, Gymnadenia conopsea ssp. densiflora, Malaxis monophyllos, Carex dioica, Hamatocaulis vernicosus, Pseudocalliergon trifarium,* and *Tomentypnum nitens.*

1.1. Activities

The following activities were carried out as part of the project:

1 Initially, the Project was completed in June 2018. Due to the prolonged arrangements for the C1 measure, the European Commission agreed, at the request of the Naturalists' Club, to extend the project until the end of December 2018.

A1. Preparation of design and technical documentation, agreement on the purchase of land, and obtaining necessary permits and administrative decisions permitting the construction of gates and other non-technical solutions to improve water conditions in the area of fens and flush mires.

A2. Preparation of documentation and site management plans, including protection plans for Natura 2000 areas within the boundaries of the sites (where they have not been executed and are not planned to be executed during the project), including plans of protective tasks for Natura 2000 areas where habitat 7230 was the main subject of protection.

B1. Purchase of land for nature conservation purposes. The aim of the buy-outs was to prevent the destruction of the most valuable patches of the habitat but, above all, to guarantee its long-term conservation. This activity was carried out by the Project Partner – Gorce National Park – purchasing land located on its territory from private owners.

C1. Improvement of water conditions through construction of gates, dams and/or local elimination of „concentrated water flow areas" inhibiting erosion (especially within mountainous areas). In order to improve the disturbed water conditions, critical for the existence of fens, especially alkaline fens, a number of different technical solutions have been constructed, adapted to the needs of the individual sites.

C2. Improvement of light and water conditions (open brown moss and low sedge communities) by removing trees and shrubs. The aim of this measure was also to stop adverse changes in water conditions caused by increased evapotranspiration of trees, as well as to stop the degradation of peat deposits and the surface layer of the fens due to penetration with tree and shrub roots. This treatment was also one of the elements of activities restoring extensive hay production for some fens.

C3. Preparatory mowing. This measure constitutes the first step towards restoring extensive hay production on fens abandoned several years ago, and sometimes several decades ago. Due to the changes taking place, mowing again after a dozen or so years requires much more work and, consequently, financial resources.

C4. Changing the attitudes of the local community by organizing a series of workshops. This activity originally assumed a number of small meetings. However, experience from the first of the organized meetings showed that private owners prefer individual meetings, therefore this form of communication was selected. Further information regarding the meetings can be found in the publication "The Guidebook on Good Practices in alkaline fens conservation" (Stańko et al. ed. 2018).

D1. Phytosociological and hydrological monitoring in selected model sites. During the project, phytosociological and hydrological monitoring was carried out in order to monitor the effects of the activities.

D2. Monitoring of socio-economic effects. As part of this measure, a short survey was conducted with private owners regarding their knowledge of habitat 7230, management practices within this valuable habitat, and the willingness to continue conservation activities on their land.

E1./E2. Information and publicity measures. They included, among others, development of the project website (www.alkfens.kp.org.pl), promotional materials, organization of a series of workshops/seminars and preparation of The Guidebook on Good Practices in alkaline fens conservation, or the Monograph of habitat 7230.

1.2. Results

During projects realisation we managed to complete above mentioned actions:

A2 - In all the areas where the activities were carried out, studies were prepared to form a „compendium of knowledge" about individual patches of the habitat in the areas, as well as containing a comprehensive description of the protection of habitat 7230 within the Natura 2000 area. These documents were handed over to the land managers, owners and, above all, to nature conservation institutions.

B1 – app. 3 ha of land was purchased in Gorce National Park.

C1 – so far 49 gates and other facilities meant to foster hydrological conditions improvement. We hope that till the end of end of the project we will built next 16 facilities on State Tresury lands.

C2 – conservation measures was conducted on 69,76 ha.

C3 – conservation measures was conducted on 100,36 ha.

Detailed results description the Reader can find at the end of this book and in full version of the Report Volume II.

2. Example of the characteristics of alkaline fens protected by the project and the results of conservation measures and monitoring

Filip Jarzombkowski, Ewa Gutowska, Katarzyna Kotowska

Natura 2000 site Łąki nad Szyszłą PLH060042

The fens of the Szyszła Valley (two preserved patches with moss fen vegetation and the related vegetation) are soligenous low fens with moss-sedge and meadow vegetation, related to moss fen vegetation. They represent habitat subtype 7230-2: alkaline fens of southern Poland (excluding mountains) and central Poland.

Patches of habitat 7230 are located between Dyniska Stare in the east and Jarczów in the west (see Fig. 1).

The fens have developed in the middle of the Szyszła Valley (a tributary of the Rzeczyca River, which then flows into the Bug) and are significantly influenced by groundwater. The river channel is regulated and the land in the vicinity of the fens is partly used for hay production or grazing and partly unused (abandoned meadows, pastures, and former peat excavations overgrown with shrubby vegetation). The area is heavily drained (apart from the dams made as part of the project, there are no facilities for limiting the outflow of water) and relatively intensively used for agriculture – cultivated fields prevail in the higher-lying areas. In the past, the fens of the Szyszła Valley were used for hay production, as pasture meadows, and as a source of peat for fuel.

Fig. 1. Location of the fens of the Szyszła Valley against the background of an orthophoto map.

The vegetation of the segde-moss fens of the Szyszła Valley has survived in the form of meadows with the occurrence of numerous rare and endangered species of flora, such as *Liparis loeselii*, *Epipactis palustris*, and *Dactylorhiza incarnata*. In loose turf patches built mainly by low sedges, in places more hydrated together with *Eleocharis quinqueflora*, the following can be found: *Pinguicula vulgaris* ssp. *bicolor, Drosera rotundifolia*, and *D. anglica*. In small hollows filled with water or in exploited peatland hollows, one can find: *Utricularia minor, Chara* spp., *Sparganium minimum*, and *Cladium mariscus*. Among the rare sedges, *Carex davalliana* and *C. hostiana*, *Schoenus ferrugineus* were recorded, locally with *Menyanthes trifoliata*. In addition, there are the very rare, only found in south-eastern Poland species: *Senecio macrophyllus*, *Tofieldia calyculata*, *Phyteuma orbiculare*, and *Dianthus superbus*. In the moss layer, the following were confirmed: *Drepanocladus sendtnerii* and *Limprichtia cossonii*.

The vegetation has a heterogeneous character and is formed by the communities of the *Caricion davallianae* alliance in a mosaic with patches with characteristics of meadows of the order *Molinietalia* and of the *Molinion caeruleae* association, and of the communities related to *Magnocaricion* high sedge rushes. The fen vegetation is concentrated mainly in the area of the old exploited peatland hollows of different depths that are numerous throughout the area. The herbaceous layer is mainly composed of sedges with variable presence in the individual patches – *Carex appropinquata*, *C. rostrata*, *C. panicea*, *C. lepidocarpa*, *C. flava*, *C. flacca*, *C. davalliana, C. acutiformis* as well as *Schoenus ferrugineus*, *Equisetum palustre*, *Mentha* sp., *Eriophorum angustifolium* and *E. latifolium*, *Valeriana simplicifolia*, *Ranunculus lingua*, *Lysimachia vulgaris*, *Menyanthes trifoliata*, *Pinguicula vulgaris* ssp. *bicolor*, *Epipactis palustris*, *Potentilla erecta*, and in the water – *Utricularia minor* and *Chara* sp. In drier locations, the proportion of wet meadow species increase, such as *Cirsium rivulare*, *C. canum*, *C. palustre*, *Caltha palustris*, *Valeriana officinalis, Valeriana simplicifolia*; locally, one can observe the penetration of *Eupatorium cannabinum*

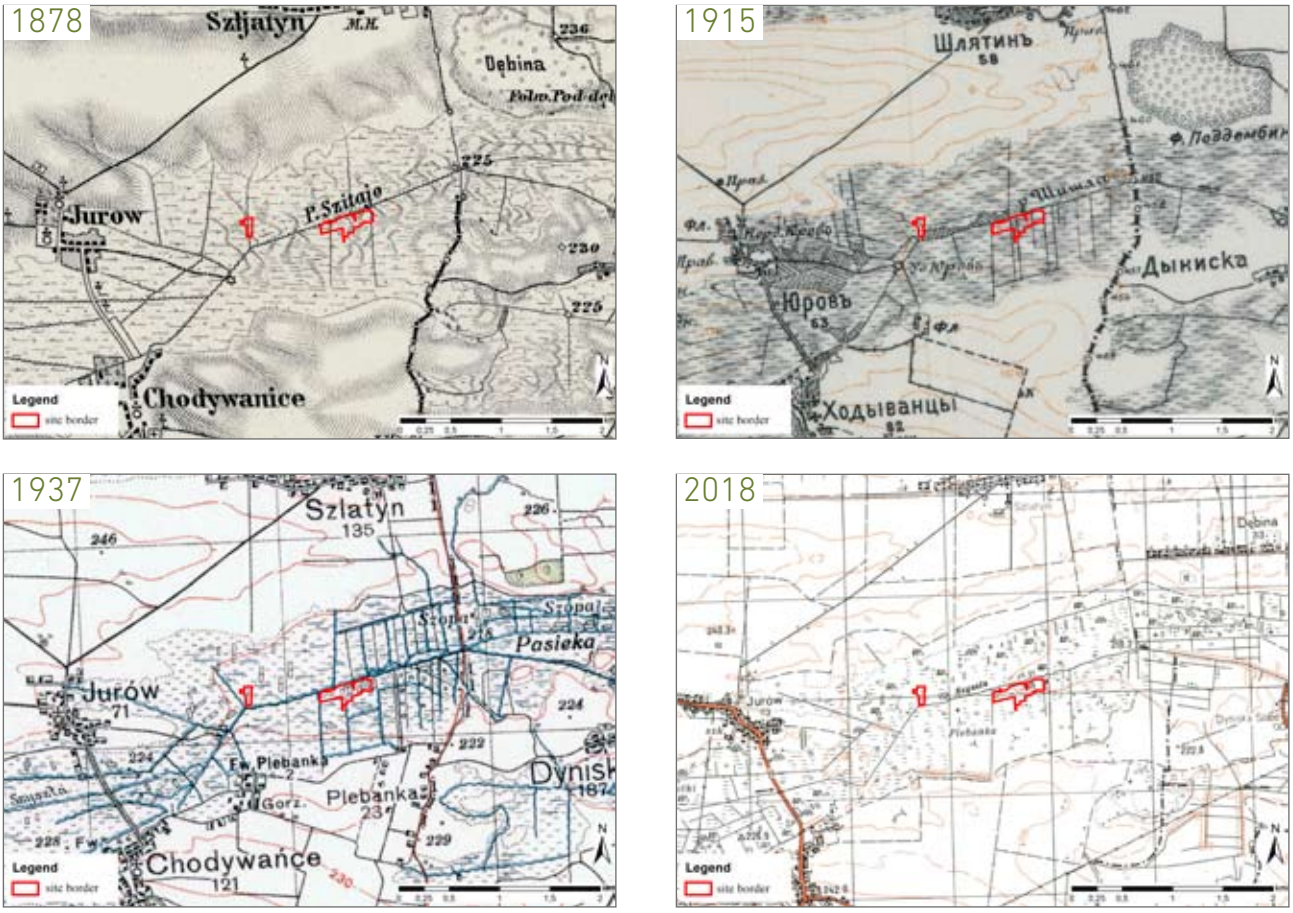

Fig. 2. Fragments of historic topographical maps from 1878, 1915 and 1937, as well as present maps showing how the valley was changed in terms of peat extraction, as well as the development of the drainage network, where all existing ditches have not been marked on the contemporary map. It should be noted that the preserved patches of habitat 7230 survived only in the former peat post-mine.

Photo 1. Fen complex of Szyszła valley (photo R. Stańko).

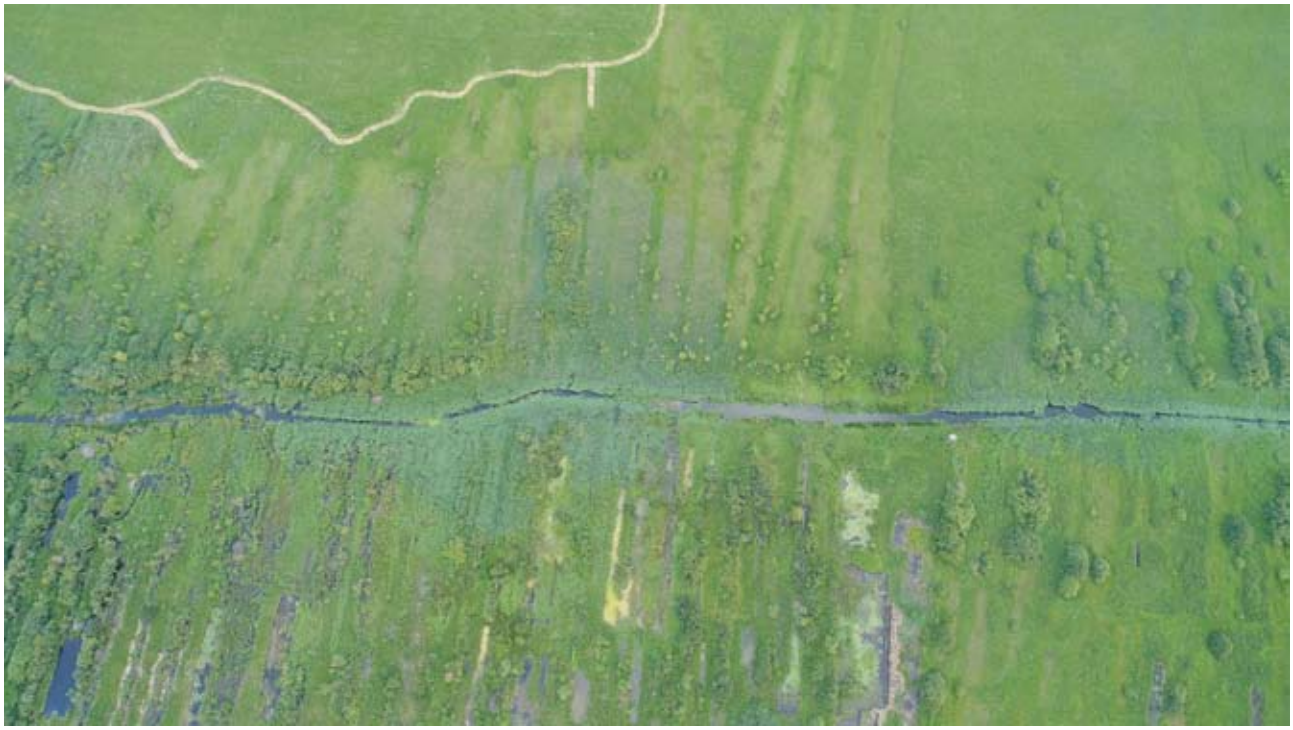

Photo 2. Fen complex of Szyszła valley – close up (photo R. Stańko).

and the variable-hydration meadow species – *Molinia caerulea*, *Succisa pratensis*, *Pimpinella saxifraga*, *Galium album*, *Sanguisirba officinalis*, and others. The moss layer is varied, with the presence of *Scorpidium scorpioides*, *Limprichtia revolvens* and *L. cossonii*, *Palustriella* sp., *Campylium stellatum*, *Bryum pseudotriquetrum*, *Fissidens adianthoides*, *Plagiomnium ellipticum*, *Calliergonella cuspidata*, *Drepanocladus sendtnerii* and *D. aduncus*, *Warnstorfia exannulata*, as well as *Calliergon giganteum*.

Some of the exploited peatland hollows are occupied by *Carex acutiformis* rushes, and in some places secondary succession is observed: the shrubs of *Salix myrsinifolia*, *Betula pubescens* and *B. pendula*, *Populus tremula*, as well as *Pinus sylvestris* penetrate the site. There is also a noticeable expansion of *Phragmites australis* and *Molinia caerulea* and, to a lesser extent, of *Calamagrostis epigejos*.

Active protection activities focused mainly on removing shrubs and mowing open patches of the moss fen (c.f. Chapter 1.2). Within Plebanka fen – on surronding ditches (from Estern and Western side and on transverse ditches) 11 throtlling culverts were installed, which serve lowering the water outflow from the mire. Furthermore, hydrological monitoring was carried out here by means of an automatic recorder, together with phytosociological monitoring.

The surface of fens in the Szyszła Valley was characterized by variable water content during the period of several years of observation (see Fig. 4). In 2016, the Plebanka Fen was relatively well hydrated (the water level ranged from approx. -10 cm to approx. a few cm above the ground surface), while in 2017 the removal of beaver dams on the Szyszła River was observed, which is probably reflected in the drop in the water table also on the fen. By spring 2018 the dams were completely removed, which resulted in significant drops in water levels and drying out of habitat already before the vegetation period. Persistently low groundwater levels altered the proper functioning of the ecosystem; however, the construction of throttling culverts in the summer of 2018 should reduce these adverse phenomena.

Stratigraphic studies confirmed the presence of relatively well-preserved peat deposits built by various types of moss-sedge and sedge peat. The peat profile for the Plebanka Fen (Fig. 5) confirms the long-term development of the fen. For technical reasons drilling was made only up to a depth of 2 m, but the peat deposit is much thicker. The two most important phases of its development can be observed on the fen. Until about 1,000 years ago, the fen developed in the form of sedge reeds with a significant share of reeds, overgrowing a terrestrializing water reservoir, as evidenced by the elements of shells and wood. After this period, moss-sedge vegetation with a reduced share of reed can be observed. The relatively high degree of peat decomposition to a depth of approx. 30 cm indicates that the top layers of the fen are drying out and that peat-forming processes are likely to be limited nowadays.

Photo 3. Throttling culvert (1 of 11 pcs.) on Plebanka fen (photo D. Horabik).

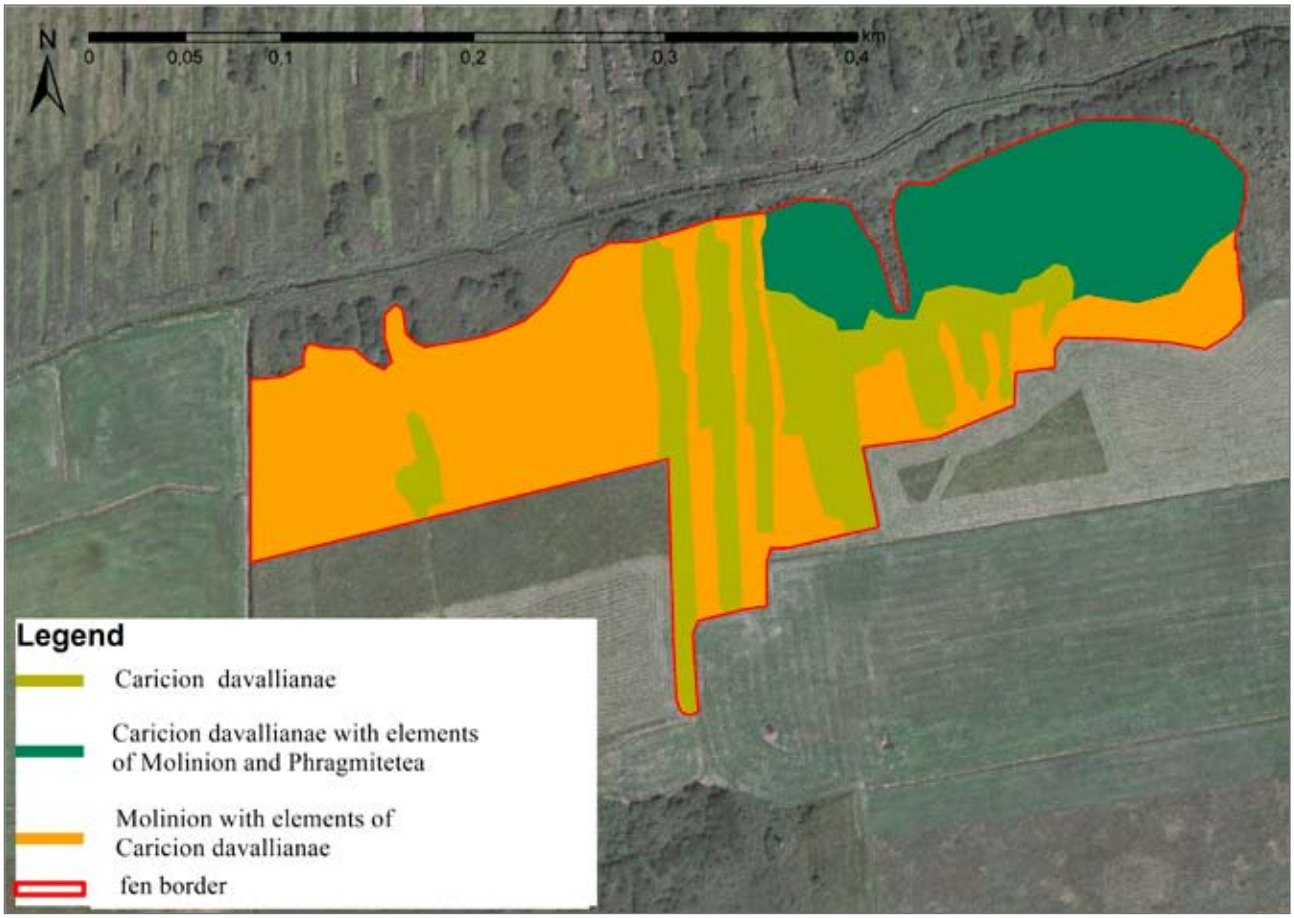

Fig. 3. Actual vegetation of the Plebanka Fen.

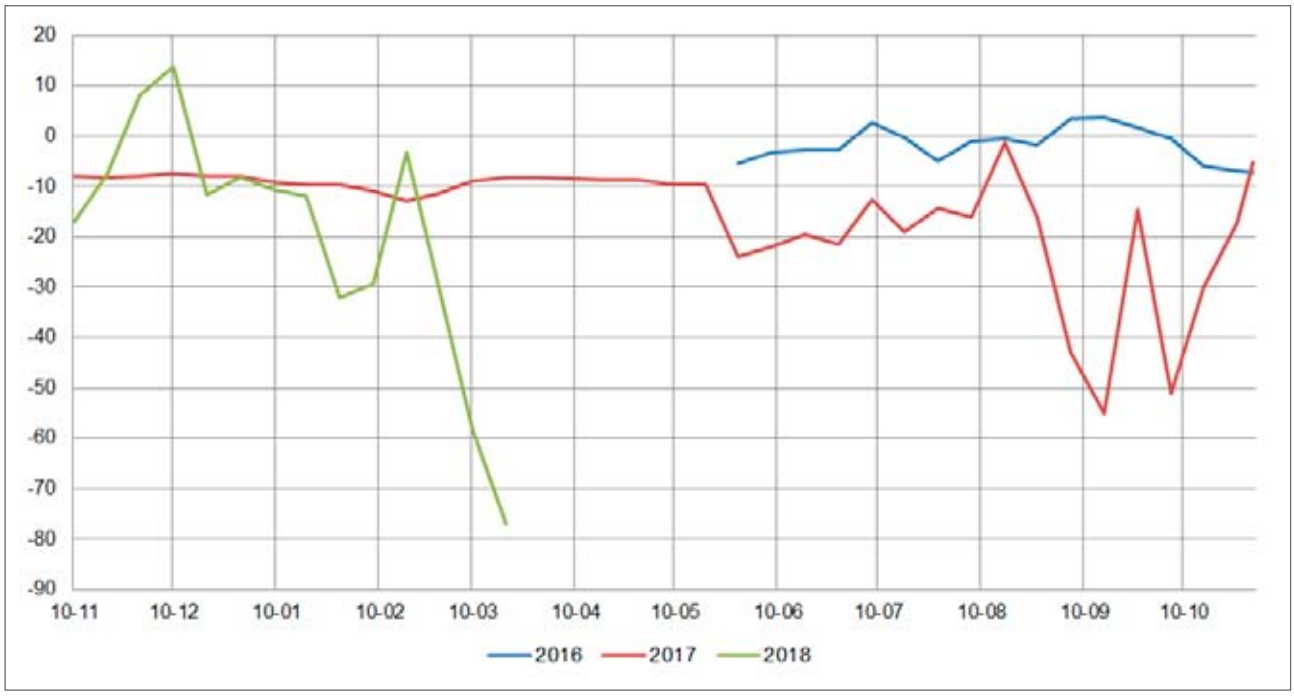

Fig. 4. Changes of the groundwater table on the Plebanka Fen in the hydrological years 2016 – 2018.

The natural values of the area were mentioned only in the studies by Michalczuk (2005), Michalczuk and Stachyra (2002), Jarzombkowski and Pawlikowski (2012), and Wołejko et al. (2012).

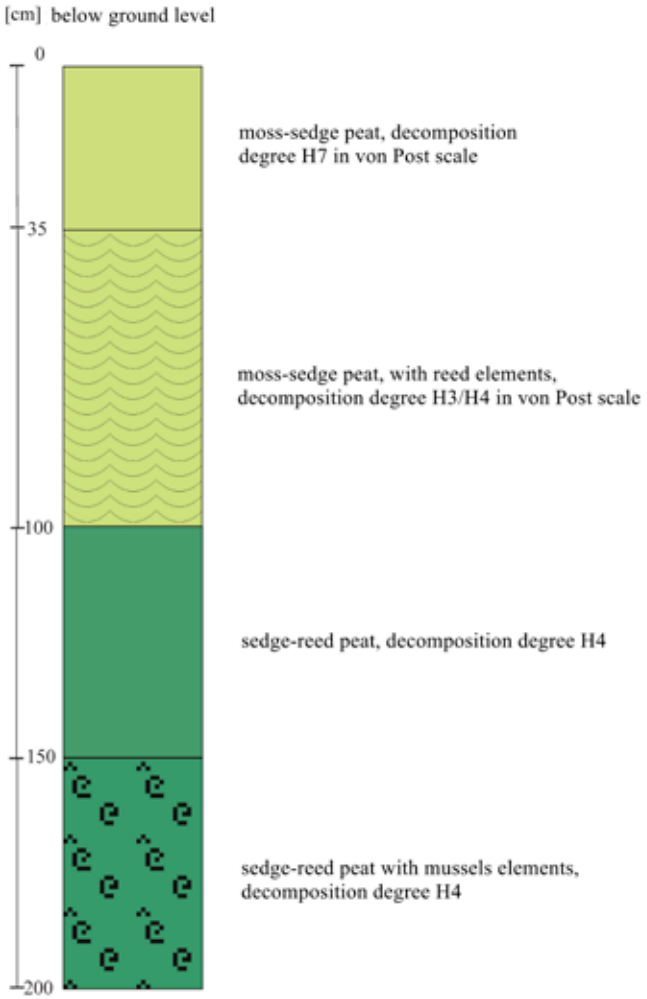

Fig. 5. Peat profile of the Plebanka Fen.

Photo 4. Plebanka fen (photo K. Kotowska).

Photo 5. Plebanka fen (photo K. Kotowska).

3. Practical experience in the actions taken to protect alkaline fens

3.1. Optimization of water conditions

Robert Stańko

As has been emphasized many times, the most important factor determining the formation and maintenance of alkaline fens is appropriate water conditions. This means that only undisturbed flow rate, appropriate level, and constant inflow of groundwater with specific physical and chemical parameters guarantee the development and proper conservation status of alkaline fens in the long term. Disturbed water conditions are the most frequent and the most important cause of degradation of habitat 7230. Currently in Poland, with the exception of some sites (probably just single instances), there are no fens located beyond the negative impact of hydrological conditions disturbed by human activity. The most frequent and easily noticeable element of these disturbances are the numerous drainage ditches (in Poland there are about 140 thousand km of them on all the fens!). In Poland, they are generally dug for drainage purposes only, without any means to inhibit excessive drainage or to block them during periods of drought. Due to the existing drainage systems, the drained fens are periodically or permanently dried out.

It is no coincidence that the activities consisting in inhibiting excessive outflow of water or raising the groundwater level occupy the majority of all the activities planned for the protection of fens. Over the last several years, when active protection of fens has become a very popular part of the activities of various organizations and institutions, many technical solutions for the improvement of the hydration of various types of wetlands, including fens, have appeared (Pawlaczyk et al. 2002, Pawlaczyk et al. 2005, Herbichowa et al. 2007, Makles et al. 2014). From the point of view of protection of all mires, including alkaline fens, the improvement of hydrological conditions – optimally, restoration of their original character – should be based on complete elimination of the ditches. The material used for this purpose should be the same as, or very similar to, the soil in which the ditch has been dug. In reality, unfortunately, such solutions do not exist on a larger scale. This is due to a number of factors (ownership and impact of such projects on the neighborhood, limited access to appropriate materials, e.g., poorly decomposed peat, technical capacity, etc.), the most important of which is the economic factor. For this reason, the vast majority of activities improving the water conditions boil down to individual blocking of water outflow from the drainage ditches. It is a compromise that is acceptable in terms of the effects achieved in relation to the required investment.

There is a wide range of technical solutions that effectively inhibit the outflow of water through drainage ditches and raise the groundwater level. The most important of these are:

- the size of the drainage ditch and, consequently, the water flow rate,
- the terrain, especially the gradient of the bottom of the ditch, which determines the number of dams required to maintain the proper water content for specific fragments of the fen, and not only of those closest to the buildings,
- accessibility of the terrain and the distance to be covered when transporting the required materials (taking into account the possibility of using machines or the lack of such a possibility),
- the type of substrate on which the gate (or other structures) are to be built.

In our opinion, legal and formal-administrative conditions are also an important factor in the selection of technical solutions. It is worth bearing in mind that the simplest solutions (which obviously meet the requirement of effectiveness) requiring the shortest and least complicated legal procedures are the best ones since they save time and considerable financial resources.

On the basis of the experience gained during the project implementation, it seems that one of the most effective and relatively least expensive solutions for improving the water conditions of the fens was the construction of various types of wooden gates. They are easy to build and install and they easily integrate into the landscape. Most often, these gates consist of one or two watertight walls made of oak boards (or other hard wood that can maintain its integrity in water for several decades) supported by a stone or earth-stone filling. They can be built even in the

most inaccessible areas of the fens (all the necessary material and equipment can be moved without the use of transport vehicles!). Depending on the local conditions, the gates (wooden walls) were subject to various modifications (see photographs below) to prevent bed erosion in the case of dams higher than several dozen cm, or to enable the migration of water fauna. The advantage of simple wooden gates is that it is also possible to adjust the water level without any real additional cost.

When selecting technical solutions it is worth remembering to choose those which will not require special care and attention in the future or frequent repairs. Optimal solutions are those that will not require any maintenance for the assumed period of time, i.e., about 20 – 25 years. The technical solutions adopted in the project seem to meet this requirement and only errors made during their construction may cause a repair to be necessary. The most common cause of various defects is a misidentified elevation of overflows resulting in washing out the edges of the ditch at the ends of the gate. Unfortunately, even a perfectly made gate requires checking from time to time. The cause of its malfunction can be, e.g., beavers taking advantage of the opportunity to raise the water level even higher. During the period of „use" of the gate, taking care of its tightness, as opposed to taking care of the protected fen, is unnecessary. Problems can arise when beavers leave a dam the a formed on the gate, which in such situations is usually destroyed. The problems may also be caused by local residents looking for a non-existent connection between a flooded basement of their own house and a gate located 10 km away or simply random persons, for example, checking the strength of the structure. For this reason, simple and inexpensive solutions also seem to be advantageous in this situation as deliberate or unintentional damage caused can be easily and cheaply alleviated.. Numerous examples of technical solutions are presented in the book entitled "The Guidebook on Good Practices in alkaline fens conservation" (Stanko et al 2018). The improvement of the water conditions in fens is not always connected with raising the water level. Due to the increasingly common activity of beavers, some of the fens are permanently flooded. In this situation, the solution used in the project was dedicated perforated PVC pipes, protected in such a way as to prevent their clogging by beavers, placed in a dam at a height ensuring optimum water level in the fen.

3.2. Inhibition of vegetation succession

Robert Stańko

Inhibiting the succession of forest vegetation in fens entails removing tree and bush wildings as well as mowing. It is worth mentioning here that not all alkaline fens (the best preserved ones) require the removal of trees and especially mowing! It should also be remembered that the frequency of these activities and their timing should be individually adjusted to each area; this usually depends on the degree of transformation of the fen and its vegetation (the most intensive mowing is needed by the sites that are most deeply transformed).

The equipment currently available on the market significantly improves the efficiency of these works, but still does not make them easy. An important fac-

Photo 6. One of the gates built as part of the project in a relatively wide and deep ditch. The use of a double wall with earth filling ensures full watertightness and excludes the possibility of any washing out of the structure (photo R. Stańko).

Photo 7. Throttling culvert built in a frame of LIFE13 NAT/PL/000024 project, which serves halting the water outflow from the fen. The excess of water is passed through the culvert pipes (photo D. Horabik).

Photo 8. Single-axle tractor – a rubber track reel mower, perfect for coping with the most difficult conditions on a strongly hydrated fen, is a very good and effective technical solution. It enables mowing about 4 – 5 times as much area as a brushcutter in the same time, using about 2/3 less fuel while not damaging the vegetation (photo R. Stańko).

tor determining the amount of work is the size of the fen. Large areas (several hundred hectares) make it possible to use specialist equipment that is a part of the extensive infrastructure allowing for the self-financing of the project. In these situations, the technical equipment used is worth making to custom order to meet all the requirements for use in difficult terrain (e.g., special continuous tracks designed to run on extremely muddy ground. Conducting the activities in the form of mowing alkaline fens is particularly difficult in the case of medium and small-sized sites. Depending on the possibility of access by vehicles or only on foot (mountains sites), objects with a small surface area (a few, a dozen ares) most often use ordinary gas-powered brushcutters. Where the surface area is larger (several, over a dozen hectares) and at the same time there is a relatively easy access by a vehicle, small single-axle tractors can be used (their weight is about 120 – 200 kg). Regardless of the water content, the best tractors for this purpose are those moving on rubber tracks with little contact pressure, which do not damage vegetation, especially the moss layer (see photo 8).

However, the biggest problem in the course of mowing operations is the removal of the mown biomass. Biomass is usually only partially dried and cannot be compressed and harvested mechanically. This part of work is sometimes the hardest (manual removal of biomass to the remote mineral edge of the fen) and the most expensive. Another issue worthy of attention is the problem with the use of the mown biomass, which is usually unsuitable for animal feed.

Photo 9. Preparing for the harvesting of the mown biomass with light horticultural tractors, – even with wide or double wheels – is possible only for some of the fens, while manual harvesting remains the only option for the remainder (photo R. Stańko).

Harvesting, preparation for transport (e.g., the need to compress biomass which is not sufficiently dried), the transport itself, in practice, in all conditions of small, distributed areas, incurs a cost that far exceeds any potential revenue.

3.3. Creation of nature reserves, land purchases

Magdalena Makowska, Dorota Horabik, Paweł Pawlaczyk

One of the important elements of the projects was the purchase of land and the creation of nature reserves. Both these activities are perceived by the Naturalists' Club as tools permanently protecting areas of high natural value and additionally sanctioning the priority of nature conservation in a specific area, in contrast to Natura 2000 sites where human economic activity is treated mostly as equal to nature protection by definition.

In Poland, in the last 20 years, on private land (excluding land belonging to non-governmental organizations) practically no reserves were created, and the only two cases from the entire country seem to confirm this rule (Jermaczek 2016). The negative attitude of private owners towards creating reserves on their land results from the obvious loss of full control over the area and serious restrictions on the use of the area, with the absence of any system of compensation by the state. Therefore, one of the main tasks of the project LIFE11 NAT/PL/423 was to buy out the land which would allow the inclusion of a valuable part of the fen in reserve protection.

Reserve protection is particularly necessary where not only species or natural habitats protected by the Natura 2000 network but also other values are worth securing and protecting. These values occurring in the areas proposed by us for establishing reserve protection include, among others: the entire natural and landscape complex; landscape, particularly being the result and expression of natural processes; strong populations of endangered (at least regionally) species not listed in Annex II of the Habitats Directive and therefore not directly protected within a Natura 2000 area; ecosystems/biogeocoenoses not directly protected within Natura 2000 areas; ecological or geomorphological processes; natural values preserved in a natural state or with little change that should be excluded from the economy and shaped by natural processes. It should also not be overlooked that scientific and cultural values which are not taken into account in any way during the protection planning of a Natura 2000 area may be protected as part of the reserve protection. The social perception of the site as a protected area is also important.

It is not without reason that the art of nature protection widely recognizes, uses, and recommends the tool of internal zoning of the sites and methods of protection of larger protected areas, in particular the existence of „core zones" with increased protection requirements. The creation of nature reserves within a Natura 2000 area is the simplest way to achieve precisely this internal zoning of a Natura 2000 site, which will prove very useful for the protection of natural habitats and species in the area – in particular, for the preservation of the full biodiversity supported by natural habitats. At the same time, it is worth emphasizing that such protection often requires that certain patches of a natural habitat – more than the rest of the resources of that habitat in the same area – should be protected above the general standard (Pawlaczyk 2016).

The establishment of a reserve is a clear message to the public that nature is protected and that the relevant authorities are concerned. Nature reserves are valuable because they identify a place with its specific natural and landscape values, both on the map and in the collective consciousness of the society. Reserves are commonly (and not without reason) seen as the *crème de la crème* of nature. For some communes and forest inspectorates, the local presence of a nature reserve(s) is a reason to be particularly proud and a confirmation of the outstanding, unique values of a given location and the efforts of these authorities to preserve it. Reserves are displayed in publications, on the Internet, on maps, etc., saturating them with natural content; their existence stimulates and concentrates scientific research, advanced natural education, obtaining necessary funds for protection, etc. The status of a nature reserve provides a unique brand to a given location, which no other formula can replace (Pawlaczyk 2016).

The long experience of the Naturalists' Club shows that the nature reserve form is more noticeable for the society, and more valued and respected than the Natura 2000 areas, which in our country are still young and unknown to a wider audience. As a result, the valuable area is better protected against negative factors related to human activities.

The resistance exhibited by various institutions, including some representatives of the State Forests NFH, is not primarily due to the possibility of losing potential benefits, including financial profit, but rather to the awareness of the loss of full control over

Photo 10. Fens of Rospuda valley – one of the most precious alkaline fens of Europe – now, partially are owned by Klub Przyrodników (photo R. Stańko).

the area, or the possibility for employees to pursue their hobbies in the form of hunting.

Also, not all employees of the authorities responsible for the establishment of nature reserves share the enthusiasm of naturalists for their establishment, as it is connected with the necessity of drawing up conservation plans, supervising the protective activities carried out, and most importantly – efforts to collect funds to implemnt them.

During the implementation of those and the previous projects, we were also met with an extremely favorable disposition of the owners/managers of the area (both private persons and forest inspectorates or employees of the nature protection administration), who considered the natural values of their areas to be the greatest and most important asset. Cooperation with an environmental non-governmental organization was perceived in positive light. We have also often met with actively seeking support from the Naturalists' Club in the implementation of nature protection (e.g., in the form of establishing a reserve) by the Forest Inspectorate or the communes. However, frequent meetings and discussions have almost always been the basis for this cooperation. This was particularly the case for the land purchase efforts. Finding the owners involved, firstly, obtaining their personal data (name, address etc.), which is not a simple matter at present, and undertaking discussions and negotiations on the possible sale of land. These conversations are usually not easy due to emotions connected with for example family history, memories, as well as different attitudes towards nature protection and environmental non-governmental organizations (NGOs) (which are also private entities often perceived as a threat to the region's traditionally understood economic development). Conducting negotiations requires considerable skills, sensitivity, knowledge of regional conditions and, above all, time – usually several months.

In the projects, the purchases were planned as one of the types of measures aimed at protecting the most valuable patches (i.e., the best preserved) of the habitat in the places where it occurs in Poland. Only areas remaining privately owned were purchased – i.e., under Polish law they were to a limited extent protected from the negative impact of human activity, especially in the context of low environmental awareness and the perception of bog areas as being useless.

As part of the it was eventually bought out approx 65 ha in 6 Natura 2000 sites: Dolina Pliszki, Puszcza Augustowska, Poszeszupie, Sulęczyno, Uroczyska Kujańskie and Ostoja Gorczańska. More information about those lands and established reserves Reader can find in full version of the Report, Volume II.

3.4. Monitoring of procedures for preparation of conservation measures plans and conservation plans for reserves and Natura 2000 areas

Magdalena Makowska, Dorota Horabik

Like most long-term projects, the conservation of fens requires good planning based on extensive knowledge. Reality indicates that this is not an easy task – not necessarily because of the lack of knowledge of the planners, but often because of the unpredictability of nature. An additional difficulty in planning is the difficulty of reconciling the often contradictory interests of nature conservation and various aspects of human activity. The lack of appropriate measures included in the plans does not have to be the result of substantive conclusions drawn during the preparation of a given planning document. This is often the result of strong pressure at the planning stage to minimize the scope and scale of planned activities, especially those that are more costly or carried out on private land, to which no one is likely to officially admit. It is also a result of the fears of the administration responsible for the implementation of the tasks scheduled in the plan that it will encounter a problem with obtaining funds for their implementation in the future.

Nature reserve conservation plans

According to the Act on Nature Conservation, the conservation plan is prepared for national parks, landscape parks, and nature reserves within 5 years from the date of establishment of a given protected area. Conservation plans are drawn up on the basis of complete knowledge of the area, gained by detailed field inventories conducted usually for a period of at least two years.

The conservation plan itself must, among other things, take into account the characteristics and assessment of the natural environment, social and economic conditions, spatial development, and identification of the internal and external risks. A detailed field survey is a key and most labor-intensive element of properly planned protection measures, often requiring the involvement of a large group of experts over a long period of time. Unfortunately, in Polish conditions we often encounter situations in which this key element is performed unreliably – sometimes as a result of work performed by unprepared contractors, sometimes erroneous financial planning by the administration body that commissioned the preparation of the plan (too short deadlines for providing the documentation due to the need to settle funds with external donors, too low fees for contractors resulting in poor quality of the documentation itself), or a reduction of the scope and scale of the protection activities due to the interests of local communities.

In practice, the most necessary provisions in the scope of active protection measures (which in many cases are also the most expensive measures) are often not approved by the group of stakeholders/manager or owner of the land. During these public consultations, they are significantly modified (to the detriment of the protection needs of the reserve), as a result of which their implementation does not bring the desired effect. In Polish conditions, in situations where the area of the planned reserve is owned by natural persons, the best solution, unfortunately, usually only possible in the case of granted funds from EU projects, is to buy out the most valuable natural areas with the intention of establishing a nature reserve. As mentioned earlier, the creation of the reserve is the first (although crucial) stage in the process of ensuring the long-term protection of the area. The experience of the Naturalists' Club from this and other projects shows that conservation plans for well researched and relatively small areas are approved more quickly, and their provisions are successively implemented. Unfortunately, conservation plans for large areas, such as national parks or Natura 2000 areas, are often not successful because the long-term process of their preparation does not keep pace with the changing legal basis and practice of nature protection, and above all with nature itself, which is not waiting for the plan to be approved.

Conservation measures plans for Natura 2000 sites

Conservation Measures Plan (CMP) for Natura 2000 areas are prepared for a period of 10 years, within 6 years from the date of approval of the area by the European Commission as a site of Community importance. Contrary to conservation plans, they are often drawn up on the basis of existing, sometimes incomplete or outdated knowledge and basic identification of the conservation status of the protected sites. Unfortunately, in many cases such an approach – where at the stage of drawing up the plans of protection tasks no detailed inventory of the existing habitats and species was provided – makes it impossible to carry out effective protection.

The aim of the CMP is to develop a list of the most crucial actions from the point of view of preservation of the sites. It is necessary to ensure the participation of interested individuals and entities carrying out business activities within the scope of the occurrence of natural habitats and species in the entire process.

It is crucial to win the support of the local community for the planned measures, especially in the case of areas where the natural habitats are private property, and to allow the effective implementation of particular provisions of the document.

Both before and during the project, the Naturalists' Club was constantly monitoring the process of developing new and revision of the approved CMP for Natura 2000 areas. The aim of this activity was to ensure that plans for those areas where habitat 7230 is protected ultimately included appropriate provisions for its conservation. Often, we prepared the entire documentation of the plan ourselves as a contractor and if this failed, we took part in the public consultation and actively sought to introduce appropriate content to protect the habitat. At the end of projects implementation, two-thirds of the plans for Natura 2000 sites had appropriate provisions in the part concerning the recommended measures. The remaining one-third are Natura 2000 areas of relatively small size for which no CMP had been developed by the time the project was completed.

3.5. Raising of environmental awareness

Magdalena Makowska, Dorota Horabik

The main objective of the projects was to stop the rapid pace of degradation of the country's alkaline fens through a series of planned active protection measures. In the original assumptions of the projects, forming the environmental awareness of the society was a complementary element, implemented „in addition" to the main goals. Subsequent stages of the projects gradually made the people involved in its implementation aware of the importance of this issue in relation to other tasks. This process did not result from an erroneous belief in the low importance of the problem, but from an underestimation of the necessary time for its implementation and an underestimation of the number of stakeholders with an impact on the achievement of the assumed projects' objectives. The number of persons (employees of various stages of administration, authorities issuing various types of decisions, permits, etc., land managers and owners) with whom it was necessary to conduct a series of direct discussions providing detailed information on the projects and theirs objectives in the context of the Natura 2000 network, was finally estimated at well over 1,000. These contacts were of a various nature and took place within the framework of the previously planned activities listed below.

3.5.1. Preparation of natural and planning documentation

Within the projects, four different types of natural documentation were created – conservation measures plans for Natura 2000 areas, reserve conservation plans, plans of habitat management, and agri-environmental (and agro-environmental-climatic) documentation. Each of them contains a different scope of content and performs different functions.

Conservation measures plan Natura 2000 sites (CMP) – the procedure for its preparation usually includes 2 – 3 meetings within the so-called local co-operation team, i.e., all those interested due to being an owner, civil servant, local environmental activist, etc. The purpose of these meetings is not to discuss the idea of the Natura 2000 network or the appropriateness of establishing a Natura 2000 area on a given land. In practice, however, these topics are still frequently addressed and invoke a great deal of emotion, especially if the area is entirely privately owned. A new explanation of the principles of management within Natura 2000 areas generally dispels the doubts and myths accumulated over the years about Natura 2000 areas. At the same time, it is conducive to building positive attitudes towards this form of nature protection.

Conservation plan of the reserve – apart from the entities executing the plan, representatives of various levels of nature protection administration, water management, State Forests, local governments, advisory bodies of nature protection administration and land managers, as well as other interested parties take part in the process of establishing the plan during public consultations.

The public participation is much lower during the development of the reserve conservation plans as most of the reserves are located on the land owned by the State Treasury.

Habitat management plan – equivalent to a conservation plan, but on a much smaller scale – refers only to the patches of habitat 7230 within a given site. Its function is to include knowledge about the habitat in a single document, enabling its use in many areas and circumstances (local spatial development plans, environmental impact reports, forest management plans, agri-environmental documentation, as well as future CMPs, reserve conservation plans, etc.). The document is handed over to the land managers or owners.

Agro-environmental documentation (currently agro-environmental-climatic) – created as a

result of expressing the will of the owner/manager of the land to join the agro-environmental-climatic program and to use the habitat in accordance with its requirements.

The common element connecting the above-mentioned documents is providing knowledge about the habitat and its protection methods to a relatively wide group of persons of key importance for the protection of a given natural habitat or species. The advantage of the procedures described above is the opportunity to meet in a wider group and discuss various problems and to learn more about the local historical conditions which are important for the protection of specific habitats or species. Different types of meetings in a wider group allow for the owners of valuable natural areas to feel appreciated, and to some extent also induce a sense of special responsibility for the protection of areas and a form of pride of ownership. Unfortunately, high turnout and wider interest among local communities is a rather rare occurrence.

3.5.2. Press articles, publications, conferences and workshops

As part of the project, a total of 25 popular-scientific articles were published in the national press and in the publications of the Naturalists' Club; 13 posters presented at international conferences in Poland and abroad; many presentations were also given at meetings organized by the Naturalists' Club or other institutions. A total of 16 meetings of various scales were organized, ranging from small meetings for several people to international study tours and conferences. The representatives of the project took part in nearly 30 meetings organized outside the scope of the project by other entities or by the Club itself. In all these manifestations of educational activity, the objectives and assumptions of the project were repeatedly presented, and the numbers presented above did not include meetings within the framework of the preparation of the CMPs or conservation plans, nor the direct meetings referred to below.

This type of activity, which provides key knowledge on the functioning and effectiveness of the applied conservation methods, seems (according to the experience of the Naturalists' Club – gathered both during and outside the projects implementation) to be the least measurable, but – although underestimated – extremely important for the protection of habitats in the future.

3.5.3. Direct meetings

The number of individual meetings conducted with private owners, forest officials, village heads, employees of forest inspectorates, parks, communes and regional directorates cannot be counted precisely. There were hundreds or more of them. During each of such meetings, a very wide range of topics was discussed with a small group of 2 – 3 persons, and often even with one person – from the awareness of the presence of a habitat (sometimes a Natura 2000 area) within a given site and education on its protection, through negotiations on the conditions for the implementation of conservation measures, to the binding legal conditions.

In the case of private persons, individual meetings are more difficult and time-consuming. Starting from the very fact of finding the owner, sparking interest in the problem of nature conservation, through gaining a minimum level of trust, and ending with convincing the owner about the protection of a valuable natural habitat on their land. The entire process – in the case of an amenable owner – may consist of one meeting. Sometimes, however, it is necessary to hold several meetings with the owner as well as with other persons (other family members, the village head, local mayor, local activists), to whom the owner looks for assistance in the decision. Because alkaline fens are often wastelands (from an agricultural point of view), where farming had been abandoned for a long time, it is unusual (and sometimes suspicious) for the owner that this land is a valuable area to be protected. In such cases, the arrangements last a little longer, but often have beneficial effects from the point of view of building responsibility for the natural values of the area they own. The surprise of having valuable habitats in their care and the growing pride in ownership are frequent observations during the presentation of the natural values of specific sites.

In practice, such meetings brought about the most visible effect, and thus – despite the fact that they were long and labor-intensive – they seemed to be the most effective form of education for a wide range of people in the field of values, risks, and the needs of protection of alkaline fens. The detailed experience of the meetings with private owners and managers was described in The Guidebook on Good Practices in alkaline fens conservation (Stańko et al. 2018).

4. Selected elements of nature monitoring

Robert Stańko, Lesław Wołejko, Filip Jarzombkowski

4.1. Hydrological monitoring, methodology and conclusions

The presented conclusions resulting from the conducted groundwater monitoring pertain to the observations carried out in selected areas of alkaline fens, both in the period of the implementation of the projects and before their commencement. The period of monitoring varies greatly due to limited access to appropriate technical devices (automatic recorders), occasional permanent damage resulting in the loss of some data, and theft.

Groundwater levels were measured with the use of automatic recorders of Diver and Baro-Diver type, placed in so-called piezometers (wells made of perforated pipes with filters) installed in the fen. The recorders were placed at a depth of 1 or 2 m. The measurements were made with a frequency of 4 records per day. In addition to the water column pressure, the devices also measured water temperature.

As a complementary element of hydrological monitoring, 3 fens in Poland were provided with hydrometeorological stations measuring rainfall, temperature, evapotranspiration, wind speed, sunshine, and water flow rate in the ground.

Records of groundwater level changes show that:

- alkaline fens in lowland Poland are characterized by a moderate amplitude of fluctuations from 15 cm (e.g., the Bagno Stawek Reserve) to about 50 cm per year (the Kijewo site in the Pliszka valley in 2010);
- the largest decreases observed in groundwater levels during the growing season due to capillary rising still provide water available to plants (including species typical of alkaline fens);
- the amplitude of water level fluctuation in individual sites, both where active protection ac-

Photo 11. Hydrometeorological station in Sarnetki (photo E. Gutowska).

tivities were carried out, consisting in inhibiting excessive outflow, and where such activities were not carried out, gradually decreased;
– within the selected alkaline fens, the hydrological conditions have been relatively stable over the decade.

Interesting correlations were found in the Mechowisko Kosobudki Reserve, where numerous dams were built under the LIFE11 NAT/PL/423 project. In the last 5 years a gradual increase in groundwater levels has been observed, despite the exceptionally low rainfall. Undoubtedly this was due to the high water level in the Pliszka River which was maintained until spring 2015 thanks to the beaver dam, whose backwater was approaching the measurement site to a distance of only 30 – 40 m, with an almost flat surface of the fen. In 2015, after the construction of the gates on drainage ditches, a further slight increase in the water level was recorded that lasted until May 2018. It should be noted at this point that as a result of the destruction of the damming in 2016, the water level in the river significantly decreased, which in turn did not significantly affect the change of the groundwater level in the fen. High groundwater level in the moss fen was maintained partly due to high precipitation in 2017, but mainly due to the dams built on the drainage ditches.

The observations carried out during the project implementation within the hydrological monitoring regime therefore indicate that the water conditions of the studied alkaline fens, despite unfavorable climate changes – mainly changes in rainfall structure, i.e., the occurrence of heavy rains in the growing season and lack of snow cover in winter – do not deteriorate and, with protective measures, they improve.

4.2. Phytosociological monitoring, methodologies and conclusions

The areas covered by the projects were of interest to the Naturalists' Club several, and sometimes over a dozen years before the start of the project (especially sites located in north-western Poland). Part of the data, including data on vegetation, was collected systematically in accordance with the previously planned methodology and was used for the purposes of the project preparation. At the same time, they are excellent comparative material for many sites, allowing conclusions to be drawn regarding the effectiveness of the adopted methods of protection of alkaline fens, which are impossible to formulate in the short term of the project implementation. A short period (1 – 2 years), which usually elapses between the completion of the treatments and the end of the projects, does not give the possibility to observe and fully analyze the changes in vegetation, except for obvious elements such as the lack of removed trees and shrubs.

Phytosociological monitoring within the individual sites included mainly studies of vegetation on designated, representative research transects. Stratigraphic analyses were carried out on the transects in order to reconstruct the history of the fens development and to assess the conservation status of the peat deposit. The results of the conducted vegetation monitoring studies are presented in detail in chapter 2 of Volume I and II together with the descriptions of individual sites. Detailed phytosociological observations were carried out mainly in the hydrological monitoring places, however, in the absence of automatic groundwater level recorders in the past it has not been possible to collect complete data on vegetation and hydrology at the same time. The most important conclusion observed on the majority of the studied fens is that their lighting conditions have significantly improved due to the removal of trees and shrubs, as well as reeds.

Mowing the sward together with removal of basal offshoots is particularly important when the weather conditions favor increased penetration by trees and shrubs (long dry periods alternating with heavy rainfall). Given that the climate is currently unfavorable to the conservation of these ecosystems, it is therefore extremely important not to allow an increase in tree cover density and the development of forest communities, even though there is no clear change in flora composition in favor of moss fen species. Often, therefore, the beneficial effect of the project – despite the vegetation being transformed already before the commencement of protective measures – is the lack of significant changes in the flora and species composition of the plant communities.

Conclusions

1. Protective measures consisting in regulation of groundwater level, removal of forest and rush vegetation, as well as mowing may result in various effects.
2. Protective measures, limited only to raising the water level within alkaline fens with altered hydrological conditions, contribute little to inhibiting the expansion of forest vegetation.
3. Raising the water level in sites where the top layer of peat is mineralized contributes to the expansion of rush vegetation.
4. Maintaining or restoring vegetation characteristic for alkaline fens in strongly transformed sites is possible by raising the water level combined with simultaneous intensive removal of biomass, but sometimes for unknown reasons the implementation of this measure – even for many years – does not bring the desired effects.
5. Occasional (every 3 – 5 years) removal of tree wildings ensures that the characteristic vegetation of the least transformed alkaline fens is maintained.
6. A significant influence on the changes in vegetation of alkaline fens, especially the altered ones, is the level of habitat hydration – in the case of the so-called „wet years", the vegetation may transform towards rush communities, while during the „dry years" – towards meadows.
7. The use of moss fens with heavy mechanical equipment, such as groomers, has a negative impact on the ecosystem by homogenizing the structure of the fen and affecting its biodiversity.
8. In the case of removal of bushes from alkaline fens, it is necessary to remove the root offshoots for several consecutive years.
9. Alkaline fens are distinguished by many specific features, depending on the local hydro-ecological conditions, and require highly individual treatment in the selection of protection methods.

Photo 12. Torfowisko Pliszka – one of the few fen complexes where the dynamics of the fen vegetation is relatively slow, which can be associated with natural or only slightly altered hydrological conditions. The degree of naturalness of the complex somehow reflects the natural system of surface watercourses, i.e., an unregulated meandering river and the lack of traces of drainage ditches (photo R. Stańko).

5. Prospects for the protection of alkaline fens

Robert Stańko, Lesław Wołejko, Paweł Pawlaczyk

Alkaline fens are a habitat distinguished mainly by the abundance of rare and endangered plant species and protected species, including several from Annex I of the Habitats Directive. For this reason, they should be of particular concern not only to the national authorities responsible for nature conservation but also to the European Community.

In Poland, most of the well known alkaline fens are protected under some kind of nature protection form. This statement itself doesn't thogh mean that the are protected enough. Even in nature reserves happens that in the conservation plan of the reserve the alkaline fen in it remains unnoticed and incorrectly counted among others, common types of peat ecosystems, mostly to transitional mires. As a consequence of such errors may be misunderstanding of ecohydrological determinants of functioning of those peatland, imperceptible to all its needs protection and, consequently, insufficient design of it's protection.

Despite its high natural values, the surface area of alkaline fens, as has been shown earlier, decreased dramatically over the last several decades as a result of drainage works. The state of preservation of the sites which have survived to this day is also a cause for concern. It is estimated that fens in good condition cover less than 10% of their total area.

Due to the unique water conditions that determine the development of alkaline fens, these areas are particularly sensitive to any modification of the natural hydrological systems, which are extremely difficult to identify and remedy. As habitats under past agricultural pressure, alkaline fens require in most cases continuation or restoration of extensive use for their further development.

As shown in the full version of the Report alkaline fens require individual approach, because in seemingly similar areas applying the same methods not always bring the expected results. Well preserved peatlands can and should be protected passively, however, peatlands in the past with agricultural pressures for their protection in most cases require continuation or restoration of their extensive use. The continuation of mowing of those hard to reach areas, ussually against the economic sense, must then be financed as a protective measure, or co-financed as an agri-environmental-climate measure within the framework of the agricultural economy. Fitting optimal means of protection in the possibility of obtaining such financing becomes an additional challenge, not easy and sometimes difficult which leads to far-reaching compromises.

Nevertheless**, the preservation of Polish resources of alkaline fens in their present state, and even their improvement, although very difficult, seems possible. Postulates of actions and solutions that in implementation such a goal could help:**

- **Recognition of funding for habitat 7230 protection activities as priority under the Priority Action Framework for Natura 2000. Granting for the fastest dying habitats in the European Union (to which habitat 7230 belongs), the same rank and privileged funding rules that are currently available to habitats, for which the EU has a special responsibility for biogeographic reasons (so-called 'priority habitats').**
- **Set as priority financing from national funds the protection of habitat 7230. Restore applicant's friendly (all types of them - not only to State Tresury entities), terms and conditions.**
- **Covering with protection under nature reserves further alkaline fens in Natura 2000 sites, and especially beyond them. Practice indicates that the very existence of the Natura 2000 site, and even landscape park or protected landscape sites, is not always enough for correct diagnosis of occurrence, not to mention the effective protection of alkaline fens.**
- **A broad and ambitious nationwide buy-out program of the most valuable alkaline fens from private owners, together with the provision of financing.**
- **More ambitious support for operations, including experimental ones, on the field of restoration of peatlands, in particular, restoring natural hydrological conditions in areas of concentration of alkaline fens.**
- **Ensure that all - even minor – water management investments, including above all modernisation and maintenance of ditches and small ones watercourses, as well as the construction of any water-based facilities, planned**

and implemented in areas with the possible occurrence of alkaline fens – have always been subjected to meticulous impact assessment procedures and approval by the nature protection authority. Sufficient for that are currently functioning legal provisions (including Article 118 of the Nature Protection Act), but it would have to be significantly improved in practice of using them.

- **Reforming and improving the quality of environmental impact assessment procedures together with impact assessment on Natura 2000 sites, so as to exclude any activities that could potentially disrupt local and regional hydrological conditions, especially regarding groundwater flow in areas where alkaline fens occur. Full application in these procedures the precautionary principle; taking into account also the pressure distant in space and the effects of distant in time causes.**
- **Execution of the requirement of good recognition natural values of the area, including inventory, classification and diagnosis of peatlands, before drawing up plans or studies of spatial development and before publishing decisions on land development conditions. Properly aking into account the needs of peatlands in strategic impact assessment on peatlands.**
- **Providing all drainage systems on peatlands with functional equipment enabling closing of the water flow and working out such water management patterns, which, among others, guarantee proper water conditions for peatlands.**
- **Make, existing and future agri-environmental schemes or their equivalents, more flexible. Program requirements should assume the possibility of an individual mode of use for each patch of habitat, allowing both intensification as well as extensification of conservation measures matched to a specific fen. An effective system of sanctions in payments is also necessary in the event of a breach of requirements - both general and individualy set by the expert for a specific fen. In parallel, it would be necessary an intense education of habitat experts and agro-environmental advisers in the specific needs of alkaline fens so that they knew correctly and for the benefit of the fen how to adjust the detailed usage requirements.**
- **Ultimately, changing support from agro-environmental-climate programs recompensation of lost benefits, to the payment system which amount depends on the achieved effects (preserved occurring on the farmer's plot natural values) and not methods of use.**
- **Promotion, through the use of agricultural policy mechanisms, maintenance of grassland in the neighborhood of alkaline fens. Preventing transformation of grassland and wasteland for arable land, ponds, etc.**
- **Extension and methodical improvement of the conducted monitoring of the natural habitat 7230 on a national scale, in particular a supplement for a component of good hydrological monitoring. Establishment of good local monitoring systems of specially protected peatlands, especially in reserves, national parks and Natura 2000 sites. This requires investment but usually obtained in this way knowledge of exact, often specific conditions of protectio, is worth spending.**
- **Seriously treating by the State Forest Holding its statutory obligation of „conservation of natural wetlands and peatlands in forests", understood as an obligation to act on behalf of or restoration of the favourable conservation status of peatlands located in forest managed by SFH - implemented by SFH alone or as eased to a large degree the protection of peatlands on State Forests' land to others interested entities.**
- **In the forest management, adaptation of breeding methods to stabilize water conditions within the basin of individual peatland, in particular non-use of total cuts in the vicinity of peatlands and springs.**

Table 1. List of the most important planned and implemented conservation measures during the project LIFE13 NAT/PL/000024

No.	Name of LIFE project site	Site name	Name and code of Natura 2000 site	Dams, gates and other facilities to improve hydrological conditions Action C1			Trees and shrubs removal [ha] Action C2				Preparatory mowing [ha] Action C3				Buyouts [ha] Action B1	
				P	R	R+	P	R	other	No consent	P	R	other	no consent	P	R
1	Karkonosze	Niedamirów	Karkonosze PLH020006				0,23	0,70			0,20	0,70				
2		Niedamirów 1					0,20		0,20		0,80		0,20			
3		Niedamirów 2									0,20		0,20			
4		Niedamirów 3									0,07		0,07			
5		Niedamirów 4									0,10		0,10			
6	Beskid Śląski	Polana Przysłop	Beskid Śląski PLH240005									0,06				
7		Twardorzeczka						0,04				0,04				
8		Hala Barania 1									0,05		0,05			
9		Hala Barania 2									0,15		0,15			
10		Hala Radziechowska 2					0,08		0,08		0,08		0,08			
11		Polana Cebula 1									0,19			0,19		
12		Hala Rysianka						0,55				0,55				
13		Pod Halą Rysianką						0,25				0,25				
14		Pod Rycerzową 1						0,71				0,71				
15		Pod Rycerzową 2						0,24				0,24				
16		Złatna Huta						0,50				0,50				
17		Dolina Ciapków					0,07	0,07			0,07	0,07				
18		Hala Bułkowa 1					0,08	0,08			0,08	0,08				
19		Hala Boracza		1							0,09		0,09			

20	Beskid	Hala Cebulowa	Beskid Żywiecki				0,10		0,10		0,10		0,10			
21	Żywiecki	Hala Cudzichowa 1	PLH240006				0,13		0,13		0,13		0,13			
22		Hala Górowa 1					0,08		0,08		0,08		0,08			
23		Hala Jodłowcowa 1					0,04		0,04		0,04		0,04			
24		Hala Krawcula					0,10		0,10		0,10		0,10			
25		Hala Miziowa					0,08		0,08		0,08		0,08			
26		Hala Bułkowa 2					0,10			0,10	0,10			0,10		
27		Hala Jodłowcowa 2					0,05			0,05	0,05			0,05		
28		Hala Jodłowcowa 3					0,07			0,07	0,07			0,07		
29		Mała Racza								0,10				0,10		
30		Pod Halą Miziową									0,07			0,07		
31	Lipienniki w Dąbrowie Górniczej	Torfowisko Antoniów i piaskownia Kuźnica Warżyńska	Lipienniki w Dąbrowie Górniczej PLH240037	9			3,75			3,75	6,00			6,00		
32		Borysówka						0,00			0,18	0,15			0,175	
33		Hala Długa/Wierchy Zarębskie		2	25		0,55	1,00			0,55	1,95	4,10		0,66	
34		Hala Nowa						0,64				0,50				0,7829
35	Ostoja	Jonkówki	Ostoja				1,10	0,35			1,10	1,00			1,353	1,3534
36	Gorczańska	Polana Bernadowa	Gorczańska					0,09			0,09	0,09				
37		Polana Rożnowa	PLH120018				0,07	0,07			0,07	0,07				
38		Średniak						0,21				0,21				
39		Polana Śmierdząca										0,48				
40		Ludwikowa										0,14				
41		Jasinkowa										0,42				
42	Ostoja	Gronie Chowańcowe	Ostoja									0,11				

43	Gorczańska	Gronie Drożdżowe	Gorczańska									0,04					
44		Przysłopy	PLH120018				0,60	0,77			0,60						0,4172
45		Stawieniec					1,33	0,00			1,10	1,00			0,723		
46		Skole Jędrasowe															0,3700
47		Gabrowska Mała					0,25			0,25	0,25			0,25	0,264		
48		Hala Filasowa		1			2,20			2,20	2,20			2,20			
49		Czerwona Skała						0,06				0,06					
50		Góra Homole						0,10				0,10					
51		Homole						0,01				0,01					
52		Homole 2						0,06				0,06					
53		Homole 2						0,03				0,03					
54		Huściawa 1						0,27			0,12	0,27					
55		Huściawa 2						0,00			0,07	0,05					
56		Huściawa 3						0,04			0,00	0,04					
57		Kociubylska Skała 2						0,03				0,03					
58		Kociubylska Skała						0,06				0,06					
59		Pod Durbaszką 5						0,01				0,01					
60		Pod Durbaszką 1					0,05	0,06			0,05	0,06					
61	Małe	Pod Durbaszką 2	Małe Pieniny				0,08	0,73			0,08	0,73					
62	Pieniny	Pod Durbaszką 3	PLH120025					0,03				0,03					
63		Pod Durbaszką 4a						0,04				0,04					
64		Pod Durbaszką 4b						0,02				0,02					
65		Pod Durbaszką 5						0,04				0,04					
66		Pod Dziurawą Skałą 2						0,02				0,02					
67		Pod Dziurawą Skałą 3						0,00				0,01					
68		Pod Dziurawą Skałą					0,06	0,03			0,06	0,03					

69		Pod Przełęczą Rozdziela 2						0,00			0,10	0,12					
70		Pod Przełęczą Rozdziela						0,15				0,15					
71		Pod Smrekową 1				0,12	0,03				0,12	0,03					
72		Pod Smrekową 2					0,00					0,02					
73		Pod Wierchliczką				0,07	0,07				0,07	0,07					
74		Pod Wysoką, źródła Kamionki					0,09				0,07	0,09					
75		Bukowina					0,13				0,08	0,13					
76		Długie Młaki 2				0,07	0,07				0,07	0,07					
77		Dolina Potaszni				0,11	0,11				0,11	0,11					
78		Dolina Sopotnickiego Potoku				0,16	0,69				0,16	0,69					
79		Dolina Sopotnickiego Potoku 2					0,12					0,12					
80		Jaworzynka 2									0,05		0,05				
81		Liskowa									0,07		0,07				
82	Ostoja	Łomniczanka	Ostoja					0,06			0,06	0,06					
83	Popradzka	Nad Wierchomlą 1	Popradzka								0,12		0,12				
84		Nad Wierchomlą 2	PLH120019			0,11			0,11		0,11		0,11				
85		Obidza					0,09				0,09	0,09					
86		Pokrywisko				0,07	0,07				0,07	0,07					
87		Polana Gwiaździsta									0,06		0,06				
88		Przełęcz Krzyżowa 1									0,16		0,16				
89		Przełęcz Krzyżowa 2									0,07		0,07				
90		Wyżnie Młaki									0,15		0,19				
91		Torfowisko Pastwa	Torfowisko nad			0,90	1,50				11,30	4,80					

92	Pastwa	Torfowisko Pastwa 1	Prosną PLH100037					0,10				0,10					
93		Torfowisko Pastwa 2										1,30					
94		Torfowisko Pastwa 3						0,10				0,10					
95	Łąka w Bęczkowicach	Łąka w Bęczkowicach	Łąka w Bęczkowicach PLH100004				11,10	10,83			18,40	10,83					
96	Dolina Mierzawy	Sędowice	Dolina Mierzawy PLH260020				1,04	1,47			2,76	1,47					
97	Ostoja Nidziańska	Torfowisko Bełk	Ostoja Nidziańska PLH260003				2,10	1,81			5,00	1,81					
98	Ostoja Szaniecko - Solecka	Torfowisko Zwierzyniec	Ostoja Szaniecko - Solecka PLH260034	5			0,45	0,70			2,90	0,70					
99		Śladków Duzy					1,10		1,10		1,20		1,20				
100	Torfy Orońskie	Torfy Orońskie	Bagna Orońskie PLH140023				0,30	2,40			1,80	2,40					
101	Pakosław	Pakosław PLH140015	Pakosław PLH140015	3			6,63	3,16			6,63	3,16					
102	Dolina Zwoleńki	Dolina Zwoleńki koło wsi Stara Siekierka	Dolina Zwoleńki PLH1400006				0,70	0,64			0,70	0,64					
103		Dolina Zwoleńki koło wsi Mierziączka					1,13			0,40	1,23			0,20			
104	Dolina Górnej Siniochy	Miączyn	Dolina Górnej Siniochy PLH060086	2							0,24		0,24				
105		Kolonia Niewirków		8			3,00			2,70	0,88			2,70			
106	Dolina Sieniochy	Perespa	Dolina Sieniochy PLH060025	6	5	1	0,75	10,00			12,53	12,54	1,68				
107		Rudka		11		6		9,29			10,27	14,59	0,83				
108		Śniatycze-Swaryczów		10		4	7,58	5,89	6,98		43,02	10,92	31,62				
109		Kopuła Śniatycze		11		2		4,22			4,70	8,34					
110		Komarów		2							1,35		1,35				

111		Antoniówka		5		3				0,70	0,44			5,10		
112	Łąki nad	Jurów	Łąki nad Szyszłą	1			0,00	1,29			0,25	1,29				
113	Szyszłą	Plebanka	PLH060042	3	11		0,14	3,19			3,29	6,38	2,34			
114	Siedliska	Siedliska	Uroczyska Roztocza Wschodniego PLH060093	4	8		0,23	1,20			1,30	1,20				
115		Ciechan					0,14	0,17			0,43	0,43				
116		Ciechan														
117	Ostoja	Grab					0,03	0,08			0,04	0,10				
118	Magurska	Świerzowa Ruska	Ostoja Magurska				0,05	0,05			0,15	0,15				
119		Świerzowa Ruska	PLH180001													
120		Wilsznia		1			0,15	0,15			0,39	0,39				
121		Łysa Góra 1					0,55	0,55			0,55	0,55				
122	Łysa Góra	Łysa Góra 3	Łysa Góra PLH180015								0,02		0,02			
123		Łysa Góra 2									0,02		0,02			
124	Ostoja Jaśliska	Jasiel 2	Ostoja Jaśliska PLH180014				0,11	0,11			0,11	0,11				
125	Bieszczady	Młaki za cmentarzem w Wołosatym	Bieszczady PLC180001								1,50	1,50				
126		Ostry 3						0,13				0,13				
127		Ostry 2					0,11	0,11			0,11	0,11				
128		Bandrów I						0,93				0,93				
129		Bandrów II						0,06			0,15	0,42				
130		Bandrów III						0,04			0,00	0,09				
131		Bandrów 3					0,40		0,00		0,40		0,14			
132		Bandrów 7					0,07		0,03		0,07		0,06			
133		Bandrów 8					0,07		0,06		0,07		0,38			
134	Moczary	Bandrów x	Moczary				0,07		0,28		0,07		1,55			

135		Bandrów y	PLH180026				0,06		0,92		0,06		0,92			
136		Bandrów z							0,00				0,05			
137		Bandrów 10					0,10		0,18		0,10		0,62			
138		Bandrów i							0,03				0,25			
139		Bandrów ii							0,05				0,07			
140		Bandrów 9							0,01		0,11		0,04			
141		Moczary 1					0,30		0,32		0,30		0,32			
142		Moczary 2					0,10		0,13		0,10		0,13			
TOTAL				**85**	**49**	**16**	**51,62**	**69,76**	**11,01**	**10,32**	**152,14**	**100,36**	**50,23**	**17,03**	**3,17**	**2,92**

Explanations:
P – planned scope
R – realized scope
R+ - planned realisation till the end of 2018
Other – actions undertaken by owners by themselves or within other projects.
No consent – lack of consent of private owner, lack of possibility to identify the owner etc.

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