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REPORT FROM THE PROJECT
Conservation and restoration of xerothermic grasslands in Poland - theory and practice
LIFE08 NAT/PL/513

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REGIONALNA DYREKCJA OCHRONY ŚRODOWISKA W LUBLINIE
CHROŃMY MURAWY klub przyrodników

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WYDAWNICTWO KLUBU PRZYRODNIKÓW
ŚWIEBODZIN 2013

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Naturalists' Club Publisher (Wydawnictwo Klubu Przyrodników)
1 Maja 22 street, 66-200 Świebodzin

Recommended quoting method:
Barańska K., Żmihorski M., Pluciński P. 2013. Report from the project Conservation and restoration of xerothermic grasslands in Poland - theory and practice LIFE08 NAT/PL/513. .Naturalists' Club Publisher, Świebodzin.

Cover photograph: Joanna Antosik, Piotr Chmielewski, Katarzyna Barańska

Nr. ISBN 978-83-63426-09-5

Typest and printed by: Tondo Poligrafia Reklama, Okrzei 14/1 street, 44-100 Gliwice

Made as part of the project LIFE08NAT/PL/000513 'Conservation and restoration of xerothermic grasslands in Poland - theory and practice, realized by the Naturalists' Club and the Regional Directorate for Environmental Protection in Lublin, financed by the financial instrument of the European Commission LIFE+ and the National Fund for Environmental Protection and Water Management.

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1.1. General description of xerothermic grasslands

Xerothermic grasslands are semi-natural, non-forest plant assemblages. They occur in extremely warm, dry and sunny places. Normally they cover small areas of slopes with southern or south-western and south-eastern exposure; at the edges of river valleys, ice-marginal valleys, morainic hills, highland acclivities and rock outcrops and on slopes of anthropogenic origins. In very rare cases, due to advantageous microclimate conditions they are able to develop on flat terrains or on northern-sided slopes.
Alkaline or neutral surfaces rich in calcium carbonate are an additional, necessary factor which conditions the existence of xerothermic grasslands. These vegetation is found on various soils, most frequently on rendzinas, pararendzinas, black soils, brown soils, created from rocks rich in calcium-loess soils, clays and moraine sands, gypsums, chalks, serpentinites and other carbonate rocks.
Apart from soil factors and local climate factors the key impact on the appearance and maintenance of grasslands lies with the factors that limit natural succession towards associations of bushes and forests. Such factors may be natural, i.e. landslides or fires including anthropogenic ones: pasture, burning or periodic ploughing. Xerothermic grasslands are not thus climax vegetation. Large number of species that the xerothermic grasslands consist of are of post-glacial relicts which reached the areas of our country in the period of the climate warming and lack of forest formations after the last glacier had withdrawn. Xerothermic species migrated to the areas of our country through three routes: from Besarabia and Podola, from the Hungarian Plains and from Thuringia. The majority of xerothermic species which undertook post-glacier migration was preserved in subsequent times thanks to men. By clearing forests, burning, grazing animals and triggering erosion processes, despite the milder and more humid climate, men enabled the survival of xerothermic species in semi-natural communities - strongly overexposed by grazing thermophilous oakforests and regularly, extensively grazed and burnt xerothermic grasslands.

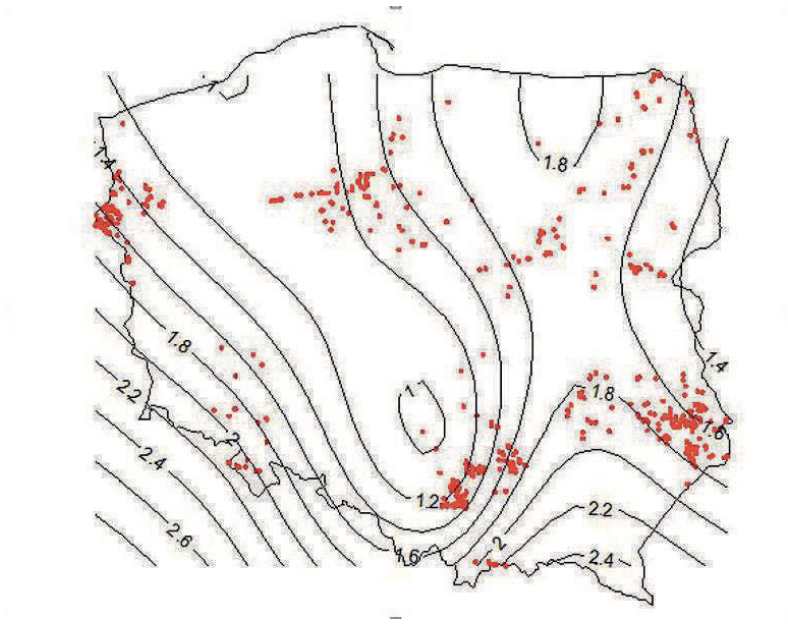
Photograph 1. Xerothermic stipoideae grassland on ecological site Laski II on the Ujście Warty Natura 2000 site, Lublin Voivodeship (by K. Barańska)

Despite extreme habitats which they are found on, xerothermic grasslands are characterized by particular species richness. Nearly a hundred of vascular plants' species may fall within one square meter of this habitat. In addition, xerothermic grasslands are home to many precious rare and endangered species. Among them the following deserve special attention: *Carlina onopordifolia*, *Thesium ebracteatum, Cyprypedium calceolus, Erysimum pieninicum, Galium cracoviense, Serratula lycopifolia* and *Echium russicum*. These species are rare, endangered in the entire Europe and for this reason they are listed in Annex II to the Habitats Directive. Apart from the plants, many rare and

protected species of animals may be found on xerothermic grasslands, mainly invertebrates that adjusted themselves to the extreme conditions of these habitats.
Vegetation of xerothermic grasslands is significantly diverse and is considered in Poland as class *Fetuco-Brometea.* Due to differences in species composition, structure and habitats they are found on, xerothermic grasslands in our country can be divided into three groups: flowery, stipas, rocky. Xerothermic rocky grasslands are loose pioneer vegetation associations, growing on limestone rocks. They inhabit steep or downright vertical blocks of Jurrasic Limestones using the cracks, depressions and ledges. The key structural element of such congeries and, at the same time, a unique species is clumpy xerothermic grass - *Festuca pallens* - accompanied by minor perennials: other minor clumpy grass species, *Thymus* sp.*, Jovibarba* sp.*, Sedum* sp. and other.

Photograph 2. Xerothermic flowery grassland in Stawska Góra Reserve, Lublin Voivodeship (by P. Chmielewski)

Xerothermic stipa grasslands are loose, extremely xerothermic grasslands, also formed by clumpy grass. Their physiognomy and species composition strongly relate to the real steppe of the continental region of south-eastern Europe. They are found in the most extreme xerothermic habitats in the country-dry, hot and very sunny and steep slopes. However, they may also be encountered on shallow, skeletal soils of rendzina type, as well as on deep brown or black earth types of soils. The main structural component of these grasslands are xerothermic clumpy grasses with narrow, bluish green leaves and often beautiful inflorescences, mainly *Stipa* sp. and fescues *Festuca* sp. Amongst grass clumps one may spot loosely scattered thermophilic, flamboyant and colourful dicotyledon perennials (salvias *Salvia* sp.*,* centaureas *Centaurea* sp., *Galium sp.* and other). Lower layer of the vegetation is made up of plants of pillow structured *Potentilla* sp., *Thymus* sp.*, Sedum* sp. and minor sedges *Carex* sp.
Flowery grasslands are the most diverse group of xerothermic grasslands. They cover large number of vegetation communities, differing both in terms of physiognomy, species composition, habitat and scope of occurrence. In spite of this, in comparison to all xerothermic grasslands found in Poland, they form a rather homogenous group which distinguishes itself with rich, flowery and often multicoloured grassland which overgrows the surface. Similar to the rest of the xerothermic grasslands they prefer dry, sunny and warm places. Exceptionally they are though found on such extreme habitats as stipas or rocky grasslands. In majority of cases they grow on mildly steep and richer in nutritional compounds. Hence, also the plants inhibiting these grasslands are more mesophilic and richer in species. They are built up mainly by remarkable dicotyledon and stolon perennials or loose-clumpy, broad-leaved grass. Their structure, in many cases, is more similar to meadows or tall herb communities.
Presently, the main areas of occurrence of xerothermic grasslands in Poland are central and lower parts of the Odra and Warta valleys and the Toruńsko-Eberswaldzka Ice-marginal Valley, Lower Silesia, Lesser Poland, Lublin Region, Valley of Bug, Suwalszczyzna Region and Pieniny.



Drawing 1. Occurence of xerothermic grasslands in Poland according to data from the Habitat Action Plan for the habitat 6210, conducted by the Naturalists' Club in the frame of the project LIFE08NAT/PL/000513

1.2. Key threats for the xerothermic grasslands in Poland

Xerothermic grasslands are one of the most threatened habitats in Europe. The intensification of agriculture caused massive abandonment of exploiting of these precious vegetation or their transformation into other, more productive uses, which in turn triggered the whole series of subsequent negative changes. Lack of any form of exploitation whatsoever resulted in, within a number of decades, many grasslands having turned into scrub and then forest communities. Significant part of the unexploited patches has been "productized" by forestation. Some more accessible areas have been ploughed and turned into farmlands, while other ones, strongly fertilized and seeded with a mixture of highly productive species were turned into intensively used pastures. Abandoned grasslands became also a place of exploitation of various types of aggregates (sand, clay, grit or chalk). Patches situated within the areas of intense urban development were subject to land development.

Photograph 3. Overgrown with shrubs (to the left) and ploughed (to the right) slopes with xerothermic grasslands near Zatoń in the Dolna Odra Natura 2000 site, Zachodniopomorskie Voivodeship (by K. Barańska)

Similar to many other habitats that are precious to the environment, xerothermic grasslands are threatened by invasive species. Through overgrowing the grasslands they supersede the precious xerothermic species and in extreme cases-they alert the habitat conditions making it impossible

for the xerothermic plants to return to the former habitat. An example of such negative impact of an alien species on the xerothermic habitats may be the change of soil fertility caused by *Robinia pseudoacacia*. Other known invasive species on grasslands include, among others: *Lycium barbarum*, *Mahonia aquifolium*, *Solidago canadensis* and *S. gigantea*, *Rosa rugosa*, *Ailanthus altissima*, and on less extreme grassland habitats also *Acer negundo* and *Heracleum sosnowkyi*.

Photograph 4. Ailanthus altissima - invasive species which overgrows xerothermic grasslands around Zatoń in the Dolna Odra Natura 2000 site, Zachodniopomorskie Voivodeship (by K. Barańska)

Xerothermic grasslands often undergo an expansion of native species. Aside from shrubs and trees bursting into the unused grassland parts, these might also include the expansive native for the Polish flora, but ecologically alien for the grasslands herbaceous plants. The expansion of i.e. *Calamagrostis epigejos*, *Arrhenatherum elatius* or *Vincetoxicum hirundinaria* is a significant issue for a large number of grasslands.

At present, agri-environment subsidies allowed for renewed maintaining of xerothermic grasslands. However, the funding does not always cover activities which are targeted at their proper preservation. Recently, apart from the payments for the extensive use of this type of habitats, also subsidies towards afforestation (which is one of the main threats of the so-called wastelands on which maintaining became unprofitable) were implemented. Subsidies for afforestation of land, from the perspective of users seem to be more beneficial financially than payments towards usufruct of grasslands for pasture or mowing. It is also worth noting that despite agri-environment subsidies, previous forms of grasslands maintaining have long been a holdover and the owners of lands are very reluctant to return to them, considering such activities as time-consuming and labor-intensive and, more importantly, not bringing any benefits apart from the payments themselves. The fact remains that EU subsidies towards Polish agriculture will not last forever, while extensive agriculture which favours maintenance among others of the grasslands must soon become a self-reliant branch of the economy.

Another factor that impacts the disappearance of the grasslands which is extremely difficult to counteract with the help of traditional forms of use is the global environment pollution. Development of economy, intensification of agriculture and industry, development of the built-up area significantly impacts the increase in number of chemicals, negatively influencing nature. Habitats, in some regard extreme, and this refers directly to the xerothermic grasslands, react most frequently to this type of factors. An example of such process may be the eutrophication of grasslands by the flow of manure from the farmlands or acidification of habitats by deposition of some chemicals together with precipitation. The latter phenomenon is already quite visible in the countries of Western Europe.

Xerothermic grasslands are the kind of habitat the existence of which depends on a number of corelated features of natural environment, economy and culture. Sadly, the majority of these features underwent irrevocable changes. Broad extensive landscape where islands of xerothermic grasslands were able to function thanks to large number of ecological corridors, strong gene pool of xerothermic species, traditional methods of maintenance and finally-various types of disturbances such as fires, local mining for natural resources or landslides has drastically changed. Furthermore, new factors appeared which had been of insignificant importance to the natural

environment before such as increase of air pollution, use of new technologies in agriculture and many others some of which we are not even fully aware of.

Photograph 5. Xerothermic grassland near Cedynia in the Dolna Odra Natura 2000 site (Zachodniopomorskie Voivodeship) covered with spruce (by K. Barańska)

In this reality, a return to old-fashioned methods of the use of grasslands as a form of active protection of the habitats may not always be effective. In the past single burning or ploughing of a plot of xerothermic grassland could positively impact the general state of xerothermic flora and fauna of the region - "refreshing" it by removing the felt and boosting the soil seed bank of a given habitat. Such seemingly destroyed fragment of vegetation was quickly regenerated by appropriate species which freely migrated through various sorts of ecological corridors (i.e. boundary strips) and other rich populations. Currently, such action could in many cases lead to the irrevocable disappearance of a given plot of xerothermic grassland, if not due to lack of connection with other patches of grassland (potentially the sources of propagules), then due to disruption of abiotic habitat (ie. eutrophication) or penetration of the invasive alien species.

Photograph 6. An isolated fragment of the xerothermic grassland near Nawodna in the Dolna Odra Natura 2000 site (Zachodniopomorskie Voivodeship), surrounded by intensively exploited farmlands (by K. Barańska)

Furthermore, the introduction of an extensive pasture is not such a simple thing nowadays. Regardless of the dilemmas related to the profitability of the animal husbandry of certain animals and exploitation of grasslands there are other problems that may be encountered. Patches of grasslands that have been preserved to date are the residue after former large pastures and are

often strongly isolated not only in ecological terms. Some of them are located in hardly accessible places, in the middle of forests or far from any developments. Other ones, on the other hand, are too small. Formerly field tracks on which cattle was led, they turned into fast traffic motorways. Moreover, this is joined by the human factor - the number of people possessing the appropriate knowledge on the traditional pasture, inbreeding of traditional animals and manufacture of traditional pasture related products has gradually decreased.
All this makes the former methods of farming be, undoubtedly, the best methods of protection of xerothermic grasslands, however, only on the condition that they will be modified in order to match the changes having taken place in the environment within the last few decades in the entire Europe.

1.3. Basic methods of protection of xerothermic grasslands

Despite numerous research conducted for many years, the factors that participate in the creation of an ecosystem of xerothermic grasslands have not yet been fully recognized. Formation and maintaining the grassland is a process which consists of many factors and their specific combinations for each object or even its part are of certain importance. Different results may be obtained on various types of surfaces not only through applying different forms of exploitation (burning, mowing, feeding, ploughing), but also through the term, frequency, intensity of activities performed, and even, types of animals fed and the applied tools.
The most efficient form of land use from the perspective of protection of xerothermic ecosystems which, in fact, is strongly related to the many centuries old traditional farming, is a diversified use, which consists in creating a mosaic of habitats both on the time scale and spatial scale. Such a patchwork form of land use in former times shaped the diversity of the majority of grasslands.
Putting aside all sorts of scientific dilemmas it is a well known fact that the basics of formation and functioning of the majority of grasslands is the pasture management.
In many regions the pasture on xerothermic grasslands was rather irregular. These types of vegetation, often less accessible and with poorer nourishment base, were not the most desired pastures. Farm animals were most frequently fed on flat and fertile terrains rich in good quality and full-bodied feed. Xerothermic grasslands were quite often grazed as the only alternative - in a situation where there were no other better pastures in vicinity, due to bad material conditions of the farmer who had no possibility of animal pasture on better fields but also in situations where the better pastures were unavailable.
Summer floods prevented the use of significant meadows in river valleys and at times for periods as long as several months in a year. This forced the farmers to bring the animals to the slopes of valleys which the flood water did not reach. The slopes, which were significantly smaller than large meadows, often covered by xerothermic grasslands had to shelter often entire herds of cows, horses, goats and sheep in possession of farmers in a given area. After the descent of waters the majority of animals returned to the fertile pastures while the grasslands had the entire year to regenerate after a short but intensive grazing. In other situations, in the face of availability of better pastures, grasslands were abandoned for periods of several years. Quite often their renewed use commenced with recovering pastures by burning down the grown thickets or cumulated felt. These are just a few examples which present the complicated and diverse nature of the processes which impacted the formation of grasslands. In many cases it is rather difficult to spot here any regularity and order. It seems however, that it is this seeming "mess" which was the main key to maintaining xerothermic grasslands. Drastic and fast happening events which most likely never covered the entire area of a plot, such as fire, ploughing, intensive pasture intertwined with longer periods during which there was no exploitation whatsoever or an extensive pasture was in place.
It must be remembered though that the area occupied by xerothermic grasslands in the past and the degree of isolation of individual patches differed significantly from the present situation. For this reason, what was once salutary for these habitats may nowadays become the harmful factor. Therefore, today for the majority of cases the safest and least invasive method of grassland usage is the extensive pasture. Experiences with burning, ploughing or intensive pasture are applied only solely in test areas and on a small scale.
Xerothermic grasslands may be used for grazing different farm animals, mainly those more resistant to bad conditions such as goats and some breeds of sheep as well as horses and cows.

Regardless of the grazed livestock it was established that its position in case of an extensive pasture on the discussed habitats should not exceed 0.5 LSU/ ha.
During the selection of animals to be grazed on xerothermic grasslands it is worth to reach for traditional native variety. They are far more resistant to local climate conditions and diseases than those imported. Moreover, when protecting xerothermic grasslands a good practice might be to maintain pastoral traditions and old farm animal breeds.
When selecting animals to be grazed on xerothermic grasslands it is worth remembering that individual species affect the habitat in different way and the long-term pasture effect of one of them may have an impact on degradation manifesting itself through elimination of some and excessive development of other population of species.
It is a known fact that goats are more suitable for more overgrown surfaces as they find it easy to crack even large shrubs. While on the other hand, sheep prefer more open spaces or they barely gnaw the leaves of young trees and bushes leaving naked twigs, goats tend to gnaw the entire shoots and bark, effectively restraining the growth of bushes. Areas significantly covered by herbs or shrubby-herbal (ie. *Calamagrostis epigejos*, oatgrass, blackberries), with large amount of felt are easier to handle large number of grazed animals such as horses and cows due to the fact that they cope more easily with high sward. Sheep systematically crack the lower parts of grasslands, treading at the same time the gathered felt and disrupting the surface. Goats on the other hand tend not to bend and often crack the selected bushes and upper parts of perennials-inflorescence, buds. Both types of animals crack the grass selectively, choosing the plants that grow on it - selecting in the first place species they prefer most, and then proceeding to eat the rest.
Cows and horses, most likely due to their larger sizes, do not have such abilities. Interestingly, according to research conducted in Western Europe asses, despite being related to horses, unlike the latter ones also gained the ability to selectively crack only those species they prefer. In addition, goats similar to sheep - apart of cracking plants, quite often pull out the entire clumps. Cattle and horses are similar - when cracking the plants they softly pull out some clumps and thus create a diverse turf structure. Therefore they are recommended for surfaces with rich and precious species composition of invertebrates. All these species, thanks to a different impact on the habitat, perfectly complement one another while protecting xerothermic grasslands. Cows and horses, due to their weight, impact the habitats far more significantly than goats or sheep. They trample down and sometimes tamp down the surface of grassland in a hard way and they require a greater amount of biomass. Furthermore, their droppings fertilize the surface to a much greater extent than the excrements of other animals. That is why keeping these species on one place for longer time is not recommended. Despite what's stated above, upon careful application they may have an excellent impact on the protected habitat. Horses joyfully crack rigid and sharp leaves of *Calamagrostis epigejos*, unlike sheep and goats which rather omit them.
Apart from the species of grazed animals the time of grazing is also critical. Animals may remain on grasslands practically throughout the entire year. Many resistant races (i.e. Polish Heath sheep, Hucul pony) successfully spend both cold winters and hot summers on pastures. The only thing necessary to be arranged in this case is basic roofing which might protect them against fallouts, strong wind and sun, as well as access to fresh water.
Throughout grazing on the grasslands it is important to leave fragments of uncracked grass (about 20% of the total area of pasture) - each year in a different place. Ungrazed patches allow for the full cycle of development to take place for at least some of the species. It is also a good practice solution to suspend the exploitation of pasture every couple of years entirely or just for the growing season. This solution is however not possible if there is no alternative pasture or other source of feed for the animals. Yet another solution is to decrease the number of animals on the pasture. In special situations a larger number of animals for a shorter period of grazing may be used. This concerns in particular the beginning of grazing on fields which had not been used for a long time, where a thick layer of felt was able to be formed and where expansive species (*Calamagrostis epigejos*, blackberries, coating of trees and bushes) reached a considerable level of covering. At this point, fast removal of the tier of the died out plant residual, allowing the light reach the lowest parts of vegetation and eliminating the intrusive species, is critical. Such effect may be obtained through short-term but more intensive than the recommended one method of pasture (i.e. 50 sheep/ha/week). In order to obtain better results and ensure the use of method on a specific fragment of grass that requires it, the use of rotational grazing is recommended (periodically fenced fields, i.e. 1 hectare small or even smaller). At first glance the effect of such a method may seem unsatisfactory. The plants located in the field of 1 ha size is completely eaten

out within a week by a herd of Polish Heath sheep. After several weeks the plants on this type of grassland pick up again, while the effect is far more satisfactory than that on grasslands pastured in smaller position. It ought to be indicated however that this method is recommended for use only at the beginning, in order to "prepare" the surface for further extensive exploitation. Annual complete eating out of the vegetation for a longer period of time will surely lead to the disappearance of many species necessary for xerothermic grasslands.

Photograph 7. Mixed herd of sheep and goats on xerothermic grasslands in the protected area of the Naturalists' Club "Owczary" on the Ujście Warty Natura 2000 site, Lubusz Voivodeship (by K.Barańska)

Some of the experts who specialize in xerothermic grasslands consider mowing as one of the methods of exploitation of these habitats. This is, most likely, due to the fact that in current conditions it is the simplest method in terms of realization to maintain grasslands. Also, agri-environmental programmes allowed for this type of management in the option "thermophilic grasslands".

The findings on former methods of exploitation of the xerothermic grasslands do not make any significant references about mowing. In most cases these areas used to be either grazed or burnt. Mowing was probably used sporadically on more mesophile flowery grasslands the structure of which resembled meadows. Mowing was used in order to obtain hay as source of feed for animals i.e. for the winter period. For this reason, in case of all stipa and rocky xerothermic grasslands and the majority of flowery xerothermic grasslands type, due to their specific structure and the unique xeromorphic layout of many species were practically not suitable for this type of exploitation.

Initial research and observation have shown that mowing promotes some species of grass, which are often the expansive species on the grasslands (i.e. *Arrhenatherum elatius*, *Calamagrostis epigejos, Brachypodium pinnatum*) and lead to the decrease of number of clumpy species (ie. *Stipa* sp.).

Furthermore, the complex phenology of the described phenomenon makes establishing of the correct term for mowing a difficult task.

An important factor that has an impact on xerothermic grasslands are natural and anthropogenic fires. According to the Polish tradition, the factor that ensured an open character of the grasslands was more or less systematic burning. In cases of relatively intensive pasture it did not concern most likely the entire areas, and above all, less intensively grazed due to certain reasons or for not accessible to animals, where the remaining part of vegetation cumulated in larger amounts or where trees and bushes grew. Burning the grasslands was probably the method of recovering abandoned for various reasons (wars, economic crises) and temporarily not used areas. The fire was also the factor which maintained grasslands on firing ranges and at their borders.

The opinions of many experts on the impact of fires on grasslands in Poland significantly vary. The prevailing view indicates that sporadic fires, once every 5-10 years may be the prothesis of pasture exploitation, effectively contributing to hampering the succession. Ash, usually blown out by the wind, does not contribute to eutrophication of habitats, unlike deteriorating organic matter. As mentioned before, this method is still insufficiently tested and it may have a significantly destructive impact on some types of soils. The use of controlled fires ought to be proceeded by

series of tests on a smaller scale, supervised by experts and covering no more than several dozen percent of less precious and strongly threatened by encroaching of shrubs fragments of grasslands. Moreover, it must be remembered that burning the grass is illegal in our country and any experiments related to this type of method of protection require special permission of the Ministry of Environment.

Due to the fact that many patches of xerothermic grasslands are strongly degenerated, mainly by an advanced secondary succession or afforestation, as well as they often have no conditions for pasture, it is necessary to cut down the shrubs and trees that grow on the grasslands. Contrary to the appearances, planning clearance is not a simple thing to do. Because of the mating and breeding season of birds the best time to remove expansive shrubs and trees is wintertime. On the other hand, though, many species that grow on grasslands, ie. blackthorn, *Lycium barbarum*, raspberries and blackberries, *Robinia pseudoacacia* are very expansive plants in case of which winter clearance will not be enough. These species will definitely pick up in summer with double strength from the remaining rootstocks and seeds, which thanks to the clearance received a shot of sunlight which mobilized them to sprout. In such case removing the unwanted plants in the period of their blooming and fructifying is helpful. At this time the plants are the most fragile and weak due to "production" of flowers and fruits and any mechanical damages (including cutting down) are automatically more harmful for them than those occurring outside the vegetative period. However, throughout the spring-summer period xerothermic grasslands which may be damaged during the clearance come into life also. Rather controversial though effective method of dealing with oppressive invasive species is spot application of chemicals, widely used in gardening and forestry for removal of the so called weeds. Too hasty application of this sort of solution may though be harmful to the grassland plants. One of the safer methods is the application of chemicals in i.e. knocks of trunks of invasive species in the period of their growth or i.e. covering trunks of cut off trees. The safest method of fight against shoots is however their systematic, repeated through the year mowing or following the logging directly after with animal pasture.

It must be remembered though that shrubs and forest communities, despite constituting a threat to grasslands, may also be distinguishable in particular due to environmental values. Thermophilic slope riparian forests or thermophilous oakforests on which habitats grasslands were formed are also rare and endangered communities in Europe. Presence of minor forest covers and shrubs, shelters, single trees have a significant importance for landscape biodiversity. Mosaic of grasslands, fringe vegetation, thermophilic shrubs and patches of wood is far more attractive for many thermophilic animals than an even surface of the grassland itself.

In many places logging may turn out to be insufficient. Seeds of xerothermic species are very short-lived. Should we cut off old shrubs of blackthorn on former grassland, wishing for the xerothermic species to appear here due to the existing soil seed bank of these species we may be quite disappointed. In case of strongly isolated grasslands (i.e. surrounded by forests) and degenerated, with a very small number of desired plants, an external supply of seeds from well-preserved grasslands will be necessary. An excellent means conveyor of seeds, unknowingly applied already for centuries is rotationally grazed herd of farm animals on several grasslands. Seeds of many grassland species attach perfectly to sheep's fur and many of them are carried by gastrointestinal track of animals - some are downright adjusted to this type of spreading - that is to the so called zoochory.

Photograph 8. Precious from the environmental perspective mosaic of thermophilic shrubs and xerothermic grasslands in the Pamięcin reserve in the Ujście Warty Natura 2000 site, Lubusz Voivodeship (by K. Barańska)

2. Basic information about the project

2.1. Basic information

Deadline for application submission: 2008
Project title: Conservation and restoration of xerothermic grasslands in Poland - theory and practice
Project acronym: XericGrasslandsPL
Project no.: LIFE08 NAT/PL/513
Project implementation date: January 2010 – March 2014
Project planed budget: EUR 1 284 314 (PLN 5 774 276)

Coordinating beneficiary: The Naturalists' Club
Established in 1993, The Naturalists' Club (NC) is an organisation engaged in wide-ranging nature conservation and environmental education. Formerly known as Lubuski Klub Przyrodników [Lubusz Naturalists' Club], in 2001 it expanded its activities, thus covering the entire country.
During its operation, NC has conducted dozens of major projects, mainly concerning the protection of natural habitats, e.g.: xerothermic grasslands in the Odra, Warta and Noteć regions, raised bogs and alkaline fens in Pomerania or the forest ecosystems of the Drawska Forest. The organisation has also been involved in projects concerning rare plant and animal species, including xerothermic plant species, snails (*Vertigo angustior* and *V. moulinsiana*), the European pond turtle and the smooth snake. Moreover, NC has led projects aimed at minimising the conflict between humans and beavers, as well as those consisting in preserving old varieties of fruit trees and rare species of segetal plants (the Club's Field Station in Owczary possesses a conservation collection of old varieties of fruit trees and a "weeds garden"). The Club was also the first institution in Poland to implement a venture funded under the EU LIFE+ programme - it was a project conducted in 2003-2007 under the title: "Conservation of Baltic Raised Bogs in Pomerania". The Naturalists' Club currently has several projects underway, including two supported by the EU LIFE+ programme: "Conservation and Restoration of Alkaline Fens (code 7230) in the Young-Glacial Landscape of Northern Poland" and "Conservation of Alkaline Fens (7230) in Southern Poland".
In addition, The Naturalists' Club is engaged in making nature inventories and collecting information for the purposes of documentation and conservation plans relating to nature reserves, ecological sites, national and landscape parks and Natura 2000 sites. Moreover, NC purchases lands for nature reserves and ecological sites. This has led to the creation of, among others, the Owczary private reserve in the Odra valley. The Naturalists' Club has 2 field stations: in Owczary and in Uniemyśl, and a permanent exhibition at the Museum of the Meadow in Owczary, as well

as its own publishing house, issuing around a dozen books a year. As part of the Club's educational activities it organises nature workshops, conferences, study sessions, as well as tours and competitions for children and teenagers. More information about The Naturalists' Club on: www.kp.org.pl.

Associated beneficiary: Regional Directorate for Environmental Protection in Lublin (RDOŚ in Lublin)
RDOŚ in Lublin is an organ of the non-combined government administration, operating in the Lublin Voivodeship. It was established under the Act of 3 October 2008 on providing information on the environment and its protection, public participation in environmental protection and on the environmental impact assessment (Dz. U. [Journal of Laws] No. 199, item 1227). The Directorate conducts activities in the field of nature protection (including the management of the Natura 2000 sites), environmental impact assessments, preventing damage to the environment and the Eco-Management and Audit Scheme (EMAS). It co-operates with scientific institutions, NGOs, local government units and the local community in respect to nature protection. It also implements and participates in nature conservation projects, training courses, conferences, exhibitions, and other activities related to environmental protection. More information about the Directorate on www.lublin.rdos.gov.pl.

Subsidising institutions:

the European Commission, LIFE+ programme, Nature and Biodiversity
LIFE+is a programme supporting environment and nature conservation projects in all Member States of the European Union. It is a continuation of LIFE I-III, which arose as a response to the need to support activities related to counteracting negative changes in the environment. Since 1992 – which is when LIFE I was established – to this day, LIFE has financed thousands of projects in various countries, with dozens of Polish ventures already among them.
The LIFE+ programme is targeted at all legal entities, both public and private, of commercial and non-commercial character, registered within the European Union.
It is divided into three components defining three main objectives of the activities funded by it:

- LIFE+ Nature and Biodiversity
- LIFE+ Environment Policy and Governance
- LIFE+ Information and Communication

More about the LIFE+ programme on: www.ec.europa.eu/environment/life/index.htm.

The National Fund for Environmental Protection and Water Management (NFOŚiGW)
Existing since 1990, NFOŚiGW is the most important state institution responsible for financing environmental protection in the country. Since Polish accession to the European Union the key task for the National Fund has been to effectively and efficiently use the EU funds earmarked for the expansion and modernisation of infrastructure, environmental protection and nature conservation in our country, including also the implementation and co-financing of LIFE+ projects. NFOŚiGW funds are primarily intended for the realisation of large supra-regional projects aimed at improving water, air and soil cleanliness. It also funds activities in the field of geology and mining, environmental monitoring, prevention of threats to the environment, nature and forest conservation, popularising ecological knowledge, preventive care of children, as well as of scientific research and expertise. In recent times, NFOŚiGW's priority are investments utilising renewable energy sources.
More information about NFOŚiGW can be found on www.nfosigw.gov.pl.

2.2. Main project objectives

During the past few decades the areas included in the project, like most patches of xerothermic grasslands in Poland and Europe, have been seriously threatened by the intensification of agriculture and related land use changes. The most damaging to grasslands are the abandonment of extensive grazing and ongoing natural succession, afforestation, ploughing and conversion to farmland. Other negative processes taking place within the grasslands are eutrophication and the penetration of alien species.

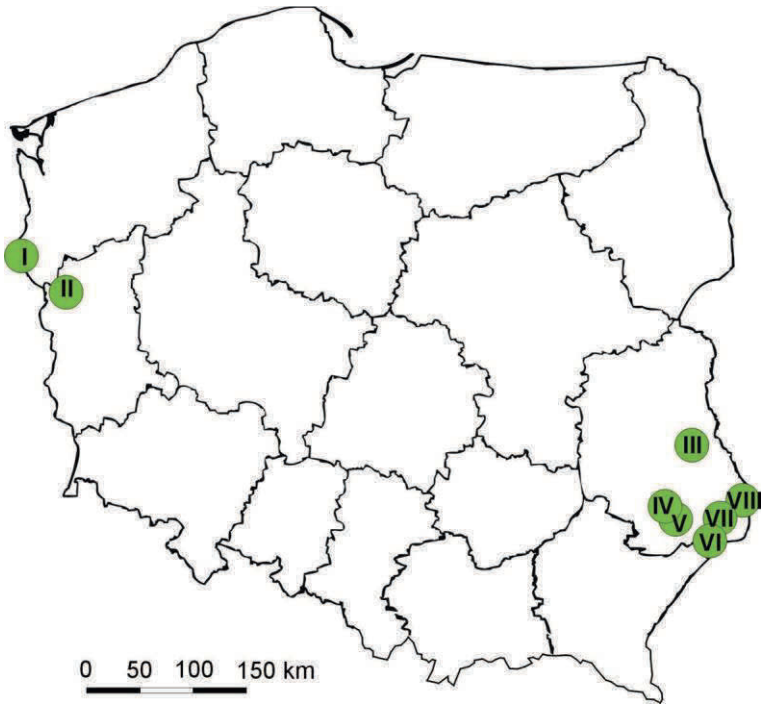
This project was aimed at stopping and preventing further negative changes resulting from the above-described processes. The main objective of the project was to provide comprehensive protection of the most valuable patches of xerothermic grasslands in north-western and south-eastern Poland, together with their precious flora and fauna. All activities were focused on preserving the valuable mosaic of thermophilic habitats – so important for maintaining high biodiversity and numerous plant and animal species with different habitat requirements (e.g. fringe and bush species).

Specific project objectives:

- Improving habitat conditions and limiting the succession of undesirable species on selected xerothermic grasslands through active conservation treatments.
- Restoring traditional farming methods (mainly extensive grazing) on parts of the grasslands included in the project in order to ensure their sustainable and effective protection.
- Increasing the biodiversity of the areas included in the project by shaping a dynamic mosaic of xerothermic habitats.
- Ensuring an adequate factual basis for comprehensive and complete conservation of xerothermic grasslands in Poland.
- Ensuring an adequate legal basis for effective conservation of the grassland patches included in the project.
- Promoting and broadening knowledge of the xerothermic grasslands and the need to protect them among different social groups.
- Developing/testing the methods for restoring and recreating xerothermic grasslands in degraded areas.
- Improving the population status of selected rare xerothermic species.

2.3. General location of the activities

The project was implemented in two regions of Poland, which constitute two of the main concentration centres of thermophilic plants in the country: the lower reaches of the Odra and Warta valleys (north-western part of the country) and the Lublin Region (south-eastern part of the country). Activities covered the area of three voivodeships (West Pomeranian, Lubusz and Lublin) and eight Natura 2000 sites: PLH320037 Dolna Odra, PLC080001 Ujście Warty, PLH060018 Stawska Góra, PLH060044 Niedzieliska, PLH060010 Kąty, PLH060029 Żurawce, PLH060039 Dobużek, PLH060035 Zachodniowołyńska Dolina Bugu.
Two of the above enumerated areas, i.e. Dolna Odra and Ujście Warty, were established for the protection of large sections of major river valleys, including a mosaic of aquatic, wetland and forest habitats, as well as wet meadow and xerothermic grassland habitats connected to dry valley edges. Consequently, they were divided into so-called sub-areas, i.e. areas covering particular grasslands subject to activities under the project. And so, the Dolna Odra area was divided into thirteen sub-areas, and the Ujście Warty area into four (a detailed description of the sub-areas can be found in Chapter 3. Areas Covered by the Project). The Stawska Góra, Niedzieliska, Kąty and Żurawce areas are of small size and were established almost entirely for the purpose of protecting xerothermic grasslands, due to which the whole area they cover was included in the project. The Dobużek and the Zachodniowołyńska Dolina Bugu – similarly to the Ujście Warty and Dolna Odra areas – cover not only grasslands, but also other habitats not included in the project. However, in the case of these areas only one object per each area was chosen to be covered by the protection activities, hence the division into sub-areas was not necessary.
In total, the project covered about 225 ha of various thermophilic habitats.



Drawing 2. Localisation of the Natura 2000 sites in Poland chosen for this project

2.4. Habitats and species included in the project

HABITATS

Xerothermic grasslands (*Festuco-Brometea* class) 6210

Conservation of xerothermic grasslands (6210) constituted the key objective of the project. It is estimated that in Poland there are still about 10 000 ha of this type of vegetation – in better or worse condition. All communities of xerothermic grasslands in Poland were classified to habitat 6210 – Xerothermic grasslands (*Festuco-Brometea* and thermophilic grasslands *Asplenium septentrionale-Festucion pallescentis*). Priority habitats include only grasslands with significant orchid sites. For the purposes of the project, the most valuable objects of the two chief (next to Lower Vistula, Małopolska, Silesia and the Suwałki Regions) regions containing xerothermic grasslands were selected; namely – the Lublin Region and lower and middle stretches of the Odra and Warta valleys. The communities of xerothermic grasslands in these two areas differ significantly, as they are located on opposite ends of the Polish map.

In the north-western part of the country, in the lower stretches of the Odra and Warta rivers, two basic types of xerothermic grasslands have developed. One of them – more extreme in terms of the habitat – is *Stipa* grasslands. They can usually be found on steep warm and very warm slopes made of clays or, less commonly, gravels or sands with high calcium carbonate content. They are made up of xerothermic tussock-grasses – *Stipa* and *Festuca*. These grasslands are represented in the Odra region by: the more common *Potentillo-Stipetum* association and the extremely rare and found only in the Lower Odra Valley – *Linosyridi-Stipetum* association. Despite the extreme conditions these grasslands are found in, they are home to numerous very rare plant and animal species (such as *Stipa pulcherrima*, *Anthericum liliago*, *Carex supina*, *Atypus muralis* or *Helicella striata*).

The gentler slopes of the Odra and Warta valleys are covered with flowery xerothermic grasslands *Adonido-Brachypodietum*. These more mesophilic communities structurally resemble meadows and are characterised by large contents of flowering perennial dicotyledons.

Photograph 9. Flowery xerothermic grasslands within the Naturalists' Club's Owczary protected area in the Natura 2000 site – Ujście Warty, the Lubusz Voivodeship (by K. Barańska)

The Lublin Region boasts a much greater variety of flowery xerothermic grasslands. They are represented here by three main communities: low and colourful grasslands *Inuletum ensifoliae* and lush flowery grasslands of *Thalictro-Salvietum* and *Origano-Brachypodietum*. The former are often found on initial rendzinas developed from limestone. The latter two are found mostly on black soils developed on loess formations.

The Lublin region is home to many rare species which are not to be found in the Odra and Warta valleys, e.g.: *Carlina onopordifolia*, *Echium russicum*, *Sicista subtilis* or *Spermophilus suslicus*. Unlike those in north-western Poland, the grasslands in the South of the country abound in orchid species, due to which many of them should be treated as priority habitats.

What these regions (xerothermic grasslands of the Lublin region and the Odra and Warta regions) share, however, is the condition the grasslands are in and the threats they face. Vast majority of the xerothermic grasslands in Poland are semi-natural habitats, conserved mainly thanks to extensive agriculture – grazing, mowing and burning, for the most part. Like in the rest of Europe, over the past few decades the economic development has made this type of land use unprofitable in Poland. This has brought about the discontinuation of grazing and the onset of natural succession on the grasslands, or their forestation or ploughing.

Photography 10. Flowery xerothermic grasslands in the Natura 2000 site – Dobużek, the Lublin Voivodeship (by P. Chmielewski)

Currently, the xerothermic grasslands in the Lublin, Odra and Warta regions, as well as all over the country, are mainly small isolated patches (usually a few hectares) of plants growing in the most extreme habitats in the landscape – steep slopes of river valleys and moraine hills, or limestone outcrops. A majority of these patches are not used in any way. Usually, they are out-of-reach 'islands' surrounded by arable land or pine monocultures.

Natural succession is one of the biggest threats to xerothermic grasslands not only in Poland, but also in other European countries. It is noteworthy, however, that the mosaic of thermophilic habitats found here – grasslands, fringe communities, shrublands and forests – is significantly more diverse biologically than homogeneous patches of xerothermic grasslands. Many thermophilic species associated with xerothermic grasslands in fact prefer ecotone habitats (e.g. transition areas between grasslands and shrublands). This is in the case of, for instance, *Cypripedium calceolus*.

Photograph 11. Xeric sand calcareous grasslands in the Pamięcin reserve in the Natura 2000 site – Ujście Warty, the Lubusz Voivodeship (by K. Barańska)

For that reason, the project aimed not only to conserve xerothermic grasslands themselves, but also the thermophilic communities accompanying them:

Xeric sand calcareous grasslands (*Koelerion glaucae*) 6120*
They are found only in northern Poland and represented in the Lower Odra and Warta regions by *Sileno-Festucetum* and *Festuco-Koelerietum* associations. They are located on rather flat sandy slopes rich in calcium carbonate. In some cases they accompany xerothermic grasslands as an earlier stage of succession. Similarly to those grasslands, they also require extensive use in order to survive. Some quite rare species, characteristic of such areas, and found near the Odra and Warta regions are *Stipa borysthenica, Dianthus arenarius*, *Festuca psammophila* and *Silene otites*.

***Juniperus communis* formations on heaths or calcareous grasslands 5130**
They are found mainly in southern Poland, including some sites covered by the project: Niedzieliska and Żurawce. Phytosociologically they are difficult to separate from xerothermic grasslands, as they constitute one of the stages of natural succession on these grasslands. In the onset they differ from grasslands by high juniper presence, in later stages they have more and more shade-tolerant and grazing-intolerant species. These formations are not climax communities, in a later stage they evolve into forest communities. They constitute perfect habitats for xerothermic fringe species, including *Cypripedium calceolus*.

Subcontinental peri-Pannonic scrub with *Prunus fruticosa* 40A0*
They can be found in both northern and southern Poland, but among the project sites only in the Lublin region (Stawska Góra, Kąty, Dobużek, Niedzieliska). Like juniper formations, they are a stage in the natural succession on xerothermic grasslands. They consist of rather low formations with significant presence of *Prunus fruticosa* and numerous fringe species. Typically, they do not cover such large areas as juniper formations.

Photograph 12. Juniperus communis formations in the Natura 2000 site – Żurawce, the Lublin Voivodeship (by P. Chmielewski)

Riparian mixed oak-elm-ash forests (*Ficario-Ulmetum*) 91F0.

Riparian mixed forests *Ficario-Ulmetum minoris violetosum odoratae* constitute one of the last stages of natural succession on some xerothermic grasslands in the Lower Odra and Warta areas. These forms of thermophilic forests are very rare in Poland and highly unique. They develop on steep slopes and are dependent on surface water flows. The body of their crop is chiefly elm *Ulmus*, sometimes ash *Fraxinus excelsior*, field maple *Acer campestre* and oak *Quercus* species. In earlier stages, large tree forms of some thermophilic shrubs can be found (e.g. hawthorn *Crataegus* species).

Drawing 13. Subcontinental peri-Pannonic scrub in the Horodysko ecological site, the Lublin Voivodeship (overall view and flowers – by A. Cwener, fruit – by P. Chmielewski)

Thermophilic shrub formations not listed in Annex I to the Habitats Directive

In addition to the above-listed habitats, also others, not listed in Annex I to the Habitats Directive complement the thermophilic vegetation formations on project sites: thickets with *Prunus spinosa*, different *Crataegus* species, *Berberis vulgaris*, *Ligustrum vulgare* and *Rosa* species. On the one hand, their excessive development threatens xerothermic grasslands, but on the other – their peripheries constitute perfect habitats for numerous species of xerothermic flora and fauna.

Another non-Natura 2000 habitat, but one that significantly increases the biodiversity of thermophilic vegetation complexes, is that created by thermophilic fringe communities. They constitute perfect habitats for various orchid species and other species sensitive to direct sunlight. It is worth noting that in many EU countries these have been included in the 6210 habitat. This approach is more and more frequently proposed also in Poland.

Drawing 14. Thermophilic forests and thickets accompanying xerothermic grasslands in The Naturalists' Club Owczary protected area in the Natura 2000 site – Ujście Warty, the Lubusz Voivodeship (by K. Barańska)

SPECIES

The main objective of the project is a comprehensive conservation of xerothermic habitats. For this reason, the attention is focused not only on the maintenance of good condition of habitats, but also on the population of specific species and, consequently, a high level of biodiversity.
Special attention has been paid to two species in particular:

Stipa borysthenica

Is a species protected in Poland and listed in the Polish Red Data Book of Plants (CR category - critically endangered). It is the rarest species in the genus of *Stipa* in the country. It had only four locations by the Dolna Odra. Only three of them are now confirmed, one of them being probably of anthropogenic origin. Polish population of *Stipa borysthenica* amounts to several hundred clumps. This grass can be found in the xerothermic *Stipa* grasslands (6210) or in the xeric sand calcareous grasslands (6120*). By the time the project was launched the locations of *Stipa* were practically unprotected. As few as several clumps were located in the area of one ecological site. Two existing natural locations of *Stipa* have been protected within the frameworks of this project (in the sub-areas of Rudnica, Trutwiniec and Siekierka). The main threat to *Stipa borysthenica* in Poland is afforestation with pine.

Photograph 15. Stipa borysthenica (by K. Barańska)

***Echium russicum* (4067)**

It is a species listed in Annex II of the Habitats Directive, protected in Poland and listed in the Polish Red Data Book of Plants with the CR category. It can be only found in the Lublin Region in its three locations. Despite the attempts of reintroduction, Polish population of *Echium*

amounted only to few blooming units by the time the project was launched. This species can be found in the xerothermic flowery grasslands (6210). Two of the known locations (Skarba Dobużańska Nature Reserve and Błonia Nadbużańskie ecological site) have been included into the project. The third location that has recently been discovered has not been a part of Natura 2000 site at the time the project was launched. It is currently protected as the Posadów Natura 2000 site. The main threat to *Echium* is the lack of utilization of the escarpments where it can be found.
Actions taken during the project had an indirect positive influence on populations of other species from the Annex II of the Habitats Directive, among other things: *Spermophilus suslicus, Sicista subtilis, Colias myrmidone, Maculinea teleius, Maculinea nausithous, Carlina onopordifolia* and *Cypripedium calceolus*.

Photograph 16. Echium russicum (by P. Chmielewski)

2.5 Main threats and problems of grasslands included in the project

The main factor that generates threats to the xerothermic grasslands in Poland is change in utilization of land which is caused by the intensification of agriculture that triggered a group of mutually interconnected processes and factors. The following are the basic processes and factors that affected the areas included into the project:

Natural succession
Abandonment of grazing and mowing or periodical burning causes commencement of natural succession which consists in reshaping of xerothermic grassland into shrub and trees assemblages. This problem occurred practically in every grassland included in the program. Of particular arduousness were thickets of *Prunus spinosa, Viburnum opulus, Ligustrum vulgare, Cornus sanguine* and *Rubus* sp., which are the species that have bluish sprouts growing on tree trunks and roots.

Afforestation of grassland areas
After grazing abandonment some areas of grasslands were made productive by afforestation and conversion into utility forests. The species that were used to afforestation the grasslands included in the project are mainly *Pinus sylvestris* (among others: sub-areas of Nawodna, Rudnica, Kostrzynek, Czarnów, Górzyca), *Pinus nigra* (area of Żurawce), *Picea abies* (sub-area of Cedynia), *Quercus* sp., *Ulmus* sp. and *Larix* sp. (sub-area of Raduń).

Photograph 17. Expansive blackthorn shrubs developing on the xerothermic grassland near Stary Kostrzynek, in the area of Dolna Odra Natura 2000 site, West Pomeranian Voivodship (by K. Barańska)

Ploughing of grassland areas

The unused grasslands located on gentle slopes were turned into poor quality arable land. Moreover, the grasslands bordering with arable lands were annually ploughed. This threat was the most troubling for the areas of Kąty, Niedzieliska, Żurawce, Raduń and Moczyły.

Photograph 18. Ploughed xerothermic areas of Niedzieliska Natura 2000 site, Lublin Voivodeship (by K. Barańska)

Natural Resources Extraction

Xerothermic grasslands often develop on the beds of sand, gravel or lime rocks that are precious mineral resources. In most of the cases the extraction is conducted illegally. Paradoxically, former post-mining pits became perfect substitutive habitat for thermophilous flora. Illegal extraction of aggregates had a negative impact on grasslands in the sub-areas of Krajnik and Nawodna and also Niedzieliska area.

Euthrophication

Grasslands that are located close to the intensively used arable lands are exposed to the influx of biogenes that excessively fertilize grassland's beds and lead to irreversible changes in the habitat. Euthrophication is also caused by expansion of *Robinia pseudoacacia* (see below). This problem

affected chiefly grasslands in the sub-areas of Kurów, Pamięcin, Owczary and Zachodniowołyńska Dolina Bugu area.

Photograph 19. Euthrophicated as a result of biogenes effluenting from the arable lands slope in the area of Natura 2000 site Zachodniowołyńska Dolina Bugu, Lublin Voivodeship (by K. Barańska)

Acidification

Owing to excessive chemical use in agriculture, forestation with coniferous trees (pine and spruce) or accumulation of dead vegetation, leaching of calcium carbonate from the soil may occur, which leads to the lowering of its pH value. This process was to be observed chiefly in grasslands on the Odra river located in the sub-areas of Rudnica, Trutwiniec, Siekierki and Kostrzynek.

Intrusion of ecologically alien species

Owing to a variety of disturbances (forestation, ploughing, trash dumping etc.) as well as changing abiotic conditions (eutrophication of the soil, lowering temperature, shading etc.) xerothermic grasslands become more accessible for many native but ecologically alien species – forest, meadow or ruderal species. A good example is the intrusion on the grasslands of a meadow species *Arrhenatherum elatius* (in the sub-areas of Kurów, Kostrzynek, Rudnica, Gozdowice and Czarnów), an ubiquitous sand species - *Calamagrostis epigejos* (in the sub-areas of Czelin, Gozdowice, Rudnica, Kostrzynek, Raduń and areas Stawska Góra and Żurawce) or a thermophilous fringe species - *Vincetoxicum hirundinaria* (grasslands in the sub-areas of Krajnik, Raduń and Kąty area).

Photograph 20. Thick field of Calamagrostis epigejos in xerothermic grasslands next to Zatoń in the Dolna Odra Natura 2000 site, West Pomeranian Voivodeship (by K. Barańska)

Intrusion of species non-native to Poland.

Apart from native species, disturbed xerothermic grasslands may provide good living conditions for non-native species. The best example is *Robinia pseudoacacia* which was a big threat for the

grasslands of the following areas, among others: Owczary, Pamięcin, Górzyca, Bleszyn, Trutwiniec, Gozdowice. Another instance are *Heracleum sosnowskyi* (area of Żurawce), *Lycium barbarum* (sub-areas of Owczary and Gozdowice), *Solidago canadensis* (area of Żurawce) and many others.

Photograph 21. Sprouts of Robinia pseudoacacia on the xerothermic grassland in Owczary, Ujście Warty Natura 200 site, Lubuskie Voivodeship (by K. Barańska)

Excessive tourism

Unchannelled tourism in attractive landscapes leads to numerous unfavorable changes in xerothermic grassland habitats: trampling, littering, picking and digging out plants, frightening animals. The problem was visible mainly in the area of Stawska Góra and sub-areas Owczary, Gozdowice and Bleszyn.

Trash dumping

Xerothermic grasslands, as unused areas, are viewed by the local inhabitants as something worthless and unworthy of being taken care of. In many such places household wastes are being thrown away or even wild dumps are created. Apart from the obvious, negative effects of such activity there are less obvious but equally dangerous, the functioning of the dumps as sources of non-native and invasive plants, among other things. This problem was present particularly in the grasslands in area of Niedzieliska and sub-areas Nawodna, Siekierki, Owczary and Pamięcin.

Photograph 22. Fragment of the illegal dumping site in the area of Natura 2000 site, Lubelskie Voivodeship (by K. Barańska)

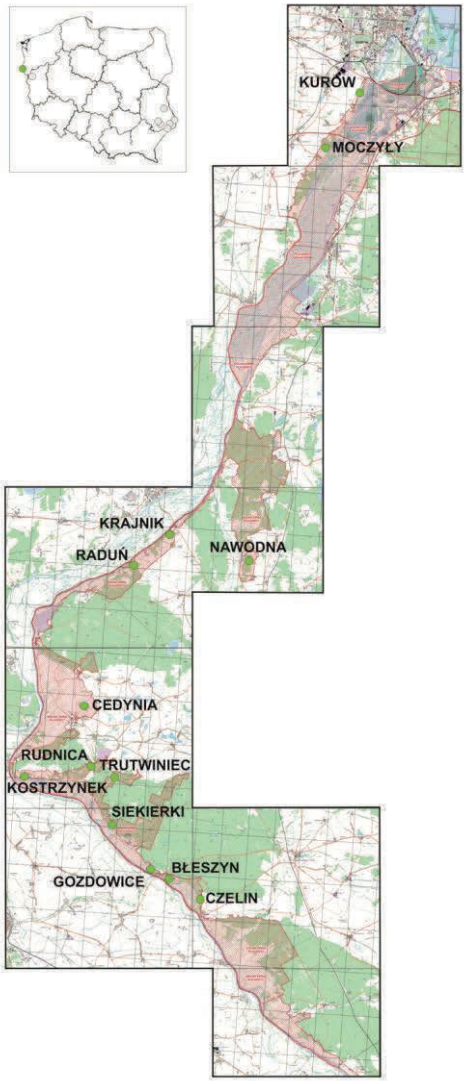
Lack of interest in grassland use
Extensive grazing on xerothermic grassland – a time- and labour-consuming endeavour – ceased to be profitable decades ago. Despite favorable financial support provided for Rural Development Program of UE, farmers are not interested in using grasslands. Furthermore, numerous entities responsible for conservation in Poland (landscape parks, national parks) still do not treat extensive grazing as a legitimate method of conserving these valuable ecosystems.

Difficult, costly and time-consuming conservation methods
Grassland conservation must surely be one of the most difficult areas in nature protection. It requires repeated activities linked to animal husbandry. In order to practice it, one needs not only the knowledge of ecology but also of agriculture. Its effects are not always satisfactory, but always far removed in time. The variety of threats coupled with poor condition of the grasslands require the application of numerous methods simultaneously: thinning out or cutting down shrubs, chemical treatment of stumps of invading species, grazing, mowing, burning, dislocation of non-tree invading species, transplanting plants, reintroducing plants and many more.

3. Objects included in the project

3.1 Dolna Odra

The Dolna Odra Natura 2000 site, with an area of nearly 30,000 hectares, has been created to protect almost 90 kilometer long section of the valley between Kostrzyn and Szczecin. The stretch has been naturalizing over the last couple of decades. It encompasses a broad area of flood plain with oxbows, stretches of riparian forests, reeds, lowland peat-bogs, wet and fresh meadows as well as *Molinia* meadows with variable moisture content, dunes and other precious habitats.
Conditions to sustain numerous pieces of xerophilous and thermophilous flora in the edge areas of the valley are provided by the peculiarly warm- for the Oder valley's latitude- climate, scarce rainfall and a lot of sunny days during the year. Azonal xerothermic vegetation has been growing on the steep, sunlit slopes of naturally meandering river which Oder was at that time. The escarpments and rock slides stretching along the river valley created natural ecological corridors, enabling the thermophilous species to migrate and exchange genes with other populations. After river flow regulation such habitats started to disappear gradually, succumbing to the natural succession that led to the creation of shrub and forest assemblages. At the same time, the hunger for land which troubled the inefficient agriculture from the turn of the century, led to cultivation and putting into production every scrap of land available. Every available piece of the flatter moraine upland together with the dried polders was plowed while the inaccessible slopes of escarpments were used as pasture.
Sheep and goats were put to graze because of steepness of the slopes and the poor quality nutrition base. The extensive grazing of the escarpments of Odra Valley has been hindering the ecological succession enabling xerothermic assemblages to grow on the slopes.
The rich and easily accessible deposits of sand, gravel and clay whose many mines were created on the Odra banks were made available to the economy by the river flow regulation and moving away its corridor from the foot of the escarpment. To this day, many former pits remain and, due to extremely dry conditions and good exposure to sunlight, became a perfect substitutive habitat for xerothermic vegetation on the Odra banks.



Drawing 3. Natura 2000 Dolna Odra area together with the location of the sub-areas included into the project

So paradoxically, it was human who stopped the natural dynamics of shaping of the landscape of the river valley and its escarpments and, on the other hand, contributed to the establishment of the substitute habitats that were ready to be settled by thermophilous plant populations.
After the World War II, the Odra Valley region became deserted, grazing practically ceased to exist and the xerothermic grasslands started to overgrow gradually. A significant part of xerothermic grasslands, often of a great value, was afforested. Among the remnants of the vegetation of the lower Odra Valley only a small part came into protection (among others: Bielinek Reserve and Wzgórze Widokowe Reserve).

13 most valuable locations of concentration of the xerothermic habitats have been determined within the frameworks of the project. These are in the most urgent need for protection and on their areas the protective actions have been planned: Kurów, Moczyły, Krajnik, Raduń, Nawodna, Cedynia, Kostrzynek, Rudnica, Trutwiniec, Siekierki, Gozdowice, Błeszyn, Czelin.

3.1.1 Kurów

Location
The northern-most xerothermic grassland on the lower Odra River. It is one of the last patches of the formerly rich complex of xerothermic flora on the western Oder escarpment, most of which underwent the process of afforestation or development of single family dwellings. The object is located on the left bank of the Odra Valley, between Kurów and Ustowo towns in the Kołbaskowo municipality. The grassland included in the project is located predominantly on the southern part of the plot of record no. 166 in the geodetic district of Ustowo, in the Kołbaskowo

municipality. It is in the possession of 32 entities (including 2 firms, the State Treasury and 29 private persons, including married couples) and a smaller part of it is located on the eastern edge of the plot with record no. 167 in the region of Ustowo, in the Kołbaskowo municipality, belonging to Gmina Kołbaskowo.

Photograph 23. Sub-area of Kurów (by P. Pluciński)

Brief characteristics of abiotic and biotic conditions

The slope in Kurów is a part of the slope of the lower Odra Valley. It is composed of sand and glacial till, having in places a high content of gravel. The initiall brown soil, rich in calcium carbonate, often called pararendzina, occurs hear. The longitudinal slope has an incline of 30°-40° and southern and south-western exposure.

The plot of the xerothermic grassland included in the project is relatively small (around 1 hectare) but it is rich in valuable xerothermic grasslands. It is also a perfect representation of thermophilous flora assemblages typical of this region.

A warm and heated-up slope was a good habitat for flowery xerothermic grasslands of *Adonido-Brachypodietum* association (6210) and xeric sand calcareous grasslands of *Sileno-Festucetum* (6120*) association. The second one can be found on the sandiest fragments of the slopes. Among interesting xerothermic species occurring in this area the following can be mentioned: *Campanula sibirica, Veronica spicata* or *Potentilla arenaria.*

The reason of including the object into the project

Dolna Odra was one of the main migration corridors for the xerothermic species in the postglacial period. Thus, until recently, its slopes abounded in broad patches of thermophilous flora which were of important cognitive meaning. Nowadays, many of the patches ceased to exist as a result of changes in human's economy and in natural environment. The grassland near to Kurów constitutes a model plot of habitat 6210 and a local refuge for xerothermic species, even though it does not concentrate a lot of rare species. It is one of few patches of xerothermic flora which preserved until present on the left bank of the Odrs River. Its existence reduces isolation and facilitates communication of the xerothermic species between particular species in the Odra Valley.

Threats

At a time of starting the project the main threats for the grasslands were the illegal extraction of sand and gravel from the slopes, euthrophication and the progressive natural succession. The first threat is directly related to the pit on the plot no. 167 neighboring with the grassland. The second one (euthrophication) is related to strongly degradated and euthrophicated industrial area and silo remnants neighboring from the north (patches no. 166 and 164). Natural succession is caused by the lack of utilization. At a time of starting the project 60 % of the slope was covered by the loose blackthorn *Prunus spinosa* and hawthorns *Crateaegus* sp.

Actions undertaken
A1, B1, C1, C8

3.1.2 Moczyły

Location

The object is located on the left bank of the Odra River, north of Moczyły and almost 10 km south of the grassland in Kurów.
The grassland included in the project, developed on the slope is located on the north-eastern edge of the plot of record no 262/5 in the geodetic district of Moczyły, in the Kołbaskowo municipality. The plot is owned by one private landowner.

Brief characteristics of abiotic and biotic conditions
The slopes in Moczyły, just like in the case of the previous object, are the fragment of the left slope of the lower Odra Valley. It is composed of sandy glacial till; the initial brown soil started developing on them. The slopes are gentle and their inclination is 30 ° at its maximum. The exposure of the slops is south or east.
The flowery xerothermic grasslands of the *Adonido-Brachypodietum* (6210) association, the *Stipa* xerothermic grasslands of the *Potentillo-Stipetum* (6210) association and xeric sand calcareous grasslands of the *Sileno-Festucetum* (6120*) association are the predominant type of vegetation.
The grassland preserved its rich and varied flora with rare and protected species like *Stipa capillata* and *Campanula sibirica* despite the lack of legal protection.

Photograph 24. Sub-area of Moczyły (by P.Pluciński)

The reason of including the object into the project
Just like in the case of Kurów, the grasslands of Moczyły are of importance as a model of a very rare thermophilous habitat on the left bank of the Odra River which is a local refuge for xerothermic species. They significantly increase the local biodiversity and they are also evidences of the past processes of the flora development that were going on in the Odra Valley.
The grassland in Moczyły is also a refuge of an interesting theromphilous flora. Out of the species occurring here the following are worth to be paid particular attention: *Stipa capillata, Primula veris, Scabiosa columbaria* and *Campanula sibirica.*

Threats
The main threat to the grasslands in Moczyły was natural succession. At a time of starting the project 80% of the surface of the slope was covered with the shrubs of *Prunus spinosa*, *Cratsaegus* and single young *Pinus sylvestris* trees.
The second threat to the object is ploughing of the valuable patches belonging to the habitat. Almost the whole plot of the *Stipa* grassland located in the southern and western part of the object

has been ploughed throughout several years preceding the project. A plot with an area of 2 hectares has been preserved until present.

Actions undertaken
A1, B1, C1, C8

3.1.3 Krajnik

Location
The object is composed of three patches of thermophilous flora having a total area of almost 7,5 hectares. It is located on the right bank of the Odra River, south of Krajnik Dolny town.
All three grasslands are located predominantly in the area of the parcel of reference no.58/4 in the region of Krajnik Dolny, in the Chojna municipality, belonging to the Agricultural Property Agency. Small parts of the grasslands are located within the area of the parcel no. 58/5 in the region of Krajnik Dolny, in the Chojna municipality, being also a property of the Agricultural Property Agency. The northern part of the object is located within the area of three small parcels of record (57/2, 72/5, 434 in the geodetic district of Krajnik Dolny, in the Chojna municipality) which were purchased by the Naturalists' Club within the framework of the project from the Chojna municipality.

Photograph 25. Sub-area of Krajnik (by K. Barańska)

Brief characteristics of abiotic and biotic conditions
The grasslands in Krajnik constitute a complex of slopes of the dried ravine which adjoins directly the Odra Valley. They are composed of sand and glacial till with a hint of gravel. The initial brown soil and pararendzina developed on this type of soil.
The flowery xerothermic grasslands of the *Adonido-Brachypodietum* (6210) association are the predominant type of flora in Krajnik. There are also *Stipa* xerothermic grasslands *Potentillo-Stipetum* (6210) and the flowery grasslands of the *Bromion erecti (*6210) association, together with the xeric sand calcareous grasslands *Sileno-Festucetum* (6120*) and dried heath rich in species (4030).
The mentioned non-arboreal habitats occur in a dynamic mosaic with the thermophilous shrubs of *Prunus spinosa, Ligustrum vulgare* and *Crataegus* sp. In the north-eastern part there is also a small patch of a thinned stand of pines. In its undergrowth the thermophilous species occur as well.
The grasslands in the area of Krajnik are rich in species despite a very small surface and an advanced process of overgrowing by shrubs. Among rare and protected plant species the following can be listed: *Platanthera bifolia, Stipa capillata, Oxytropis pilosa, Carex humilis, Prunella grandiflora* and *Scorzonera purpurea.*

The reason of including the object into the project

The grasslands in the sub-area of Krajnik are one of the most valuable habitats of thermophilous flora in the lower Odra Valley. They concentrate a lot of rare and protected species despite their small surface (see above).

Krajnik is surrounded by an intensively managed landscape of arable land and dwellings and constitutes a refuge for thermophilous flora, just like the other objects located in the area of Dolna Odra do. This is why it is extremely important as a factor increasing the biodiversity of the region.

Photograph 26. Scorzonera purpurea (by K. Barańska)

Threats

The main threat to the non-arboreal assemblages in the area of Krajnik was an intensive growth of the thermophilous shrubs that was caused by the lack of utilization. Approximately 50 % of the object was covered with the dense shrubs of *Prunus spinosa*, *Ligustrum vulgare* and *Crataegus* sp. before the project was launched.

The illegal extraction of sand from the pits located in the northern part of the object together with littering constituted another threats caused by the direct neighborhood of human dwellings.

Actions undertaken

A1, B1, C1, C6, C8

3.1.4 Raduń

Location

The object, with its area of almost 350 hectares, encompasses a big concentration of the patches of the valuable thermophilous flora stretched between Raduń and Zatoń Dolna- two small towns on the Odra River. The southern part of the object, with numerous small grasslands scattered among the rich deciduous forests (hornbeam and beech wood) has decidedly forest characteristics. This part is managed almost entirely by the Chojna Forest Inspectorate (Forest District of Piasecznik, Szczecin Regional Directorate of State Forests). The valuable xerothermic grasslands managed by the State Forests of Poland are located among others on the parcel of record no. 41/2, 42, 61 and 3/5 geodetic district of Zatoń Dolna, the municipality of Chojna. A significant part of these grasslands have been included in the "Słoneczne Wzgórza" Reserve, established within the frameworks of the project.

In the northern part, where big patches of grasslands are neighboring with intensively used arable lands, an agricultural landscape is predominant. The main administrators of the lands here are the Agricultural Property Agency (i.e. parcels 6/5, 120/1, 151/2 in the geodetic district of Zatoń Dolna, the municipality of Chojna) and the private landowners (i.e.parcels 32/1, 161/1, 150/3, 235, 238 in the geodetic district of Zatoń Dolna, the municipality of Chojna), including the

Naturalists' Club which, within the frameworks of the project, purchased one of the parcels containing the xerothermic grasslands and brought them under protection as an ecological site (parcel no. 175/3 in the geodetic district of Zatoń Dolna, the municipality of Chojna).

Photograph 27. The subarea of Raduń (by K.Barańska)

Brief characteristics of abiotic and biotic conditions

The object of Raduń encompasses steep slopes of the Odra Valley and the moraine hills which meet the river corridor almost perpendicularly here, between Raduń and Zatoń Dolna towns.

The area is known for its uniquely variable terrain. Numerous dried ravines and small streams valleys neighbor with hills and planes located on the upland. In some areas, the hills reach to almost 100 meters above sea level at inclines of even 50°. In some areas, the upright precipices occur (i.a. the remnants of the former brickworks in the vicinity of Zatoń Dolna). The hills are mostly made up of silty clay, rich in calcium carbonate.

A feature that attracts the attention is a big content of fractions floating in the ground (pollens) and a practical lack of the skeleton elements. Only in several areas the clay is mixed with gravel and here and there on the surface there are assemblages of big glacial erratic.

This kind of abiotic conditions gave the possibility of development to a peculiar combination of rare and often extreme habitats of flora assemblages. They occur on the slopes between Raduń and Zatoń Dolna as different stages of succession: xerothermic grasslands *Linosyridi-Stipetum pulcherrimae, Potentillo-Stipetum* and *Adonido-Brachypodietum* (6210), xerothermic shrubs rich in species *Querceto-Lithospermetum subboreale* and riparian woods on the slopes *Fraxino-Ulmetum* (91F0). In some areas, another habitats listed in the Annex I of the Habitats Directive occur: petrifying springs with tufa formation (7220), fresh meadows (6510), mixed oak-hornbeam forests (9160) and beech woods (9110 and 9130).

The reason of including the object into the project

The complex of the thermophilous flora stretched between Raduń and Zatoń Dolna constitutes one of the most precious habitats of xerothermic flora not only in the region, but also in the whole country.

The steep slopes of the hills in the vicinity of Raduń on the Odra River have been known and valued as a habitat of xerothermic flora, exceptional in the whole country. A forest-steppe reserve near Raduń was already proposed for this site about 50 years ago. At that time, this area was compared to the well-known steppe reserve in Bielinek.

This area is characterized by a unique natural abundance. Around 60 % of its subarea consists in diversified mosaics of at least 6 habitats listed in the Annex I of the Habitats Directive.

Stipa pulcherrima has been acknowledged as the most valuable flora element of this planned reserve. Nowadays, this is one of five existing sites of this rare grass in Poland. In 1960, this site was considered the country's largest uniform patch of xerothermic grassland dominated by *Stipa pulcherrima*. Other rare species found on the xerothermic slopes near Raduń are the following: *Anthericum liliago*, *Carex supina*, *Carex humilis*, *Oxytropis pilosa*, *Aster linosyris*, *Campanula sibirica*,

Campanula bononiensis, *Cephalanthera damasonium*, several species of broomrape (*Orobanche*), the spider *Atypus muralis*, the snail *Helicopsis striata*, eagle owl *Bubo bubo (*species from the Annex II of the Habitats Directive) and many other.

Photograph 28. Steep slopes with grasslands in the sub-area of Raduń (photo by K. Barańska)

Having its unique abundance in species and habitats, the hills between Zatoń and Raduń fulfill an important role in maintaining a high level of biodiversity not only on the regional and national scale but- due to the presence of Natura 2000 habitats and species- on the scale of the whole Europe.

Photograph 29. Mosaics of grasslands and thermophilous shrubs in the sub-area of Raduń (by K. Barańska)

Threats

The main threat to the slopes between Raduń and Zatoń Dolna is the natural succession caused by the lack of appropriate utilization and forest economy. Over last couple of decades, 60% of xerothermic grasslands on the said slopes have been afforested. A big part of the valuable non-arboreal habitats, located on the gentle slopes, has also been ploughed.
Another threat is the influx of the dangerous invasive species - *Robinia pseudoacacia*.

Actions undertaken

A1, A2, B1, C1, C4, C6, C7, C8

Photograph 30. Grasslands in the vicinity of Zatoń, in the sub-area of Raduń, purchased within the frameworks of the project (by K. Barańska)

3.1.5 Nawodna

Location

Nawodna, as the only object of the Odra River Natura 2000 site included in the project, is not situated in the direct proximity of the valley of the Odra river. It encompasses many ravines crisscrossing the eastern Rurzyca River's slope - the Odra tributary located nearby Nawodna town. This area of over 350 hectares comprising numerous pieces of sandy and xerothermic grasslands is surrounded by a monoculture of pine and farmlands neighbouring with the valley of Rurzyca.

The grasslands' proprietary situation is highly diversified. The majority of the patches is within an administration of the State Forests National Forest Holding (The Chojna Forestry Division, The Chojna Forest District, The Szczecin Regional Directorate of State Forests) and it is posted under the following plots of land: 57, 59/2,59/3,59/5, 59/4, 60, 61, 795/1, 859 – the Nawodna geodetic district, the community of Chojna.

The one of the most valuable and the biggest grasslands in the tract lying in the proximity of the former sandpit belongs to Treasury (the administrator's data are missing) and is registered under patches of land 815/1 and 815/2. Another part of that grassland (parcels 804-811) is administered by The Community of Chojna and The County Council Administration of Gryfino. The eastern edge of land is situated on the parcel numbered 802 being under administration of The Agricultural Property Agency. Moreover, remarkably species- rich grasslands belonging to a private sector are based on the following parcels of lands: 758/3, 758/4, 782, 783, 820 and 860 (the Nawodna geodetic district, the community of Chojna).

Photograph 31. The sub-area of Nawodna (by K. Barańska)

A short description of biotic and abiotic conditions

This site includes a fragment of the Rurzyca River slopes transected by numerous small dry valleys. The entire area's substratum is mainly comprised of sand and sandy till. The soils that developed on these formations are either podzolic or poor brown soils. Pararendzinas occur on the steep, sandy slopes rich in calcium.

The valley's slopes run north to south. They are, however, crisscrossed by many ravines and xerothermic grasslands being developed on the warmer slopes with a southern exposure. Most of the slopes were afforested in the 1970s. Currently, thermophilous non-forest plants occur in small, isolated but numerous patches surrounded by a monoculture of pine or fallow lands.

Xerothermic grasslands (6210) are mainly represented by the *Potentillo-Stipetum* and *Adonido-Brachypodietum* associations. In many places, xeric sand calcareous grasslands *Festuco-Koelerietum* and *Sileno-Festucetum* (6120*) are also found on the loose sands. In patches forested with pine, specific associations of *Pinus-Brachypodium pinnatum* have developed. Though xerothermic grasslands in Nawodna have not been utilized for ages and afforested in most area, the great diversity of species has been preserved. Among rare and protected species of plants the following might occur here: *Orchis militaris*, *Oxytropis pilosa*, *Anthericum liliago*, *Stipa capillata*, *Prunella grandiflora*, *Hieracium echioides*, *Gentiana cruciata*, *Campanula sibirica*, *Dianthus arenarius, Stachys recta*, *Orthanta lutea.*

Photograph 32. Dianthus arenarius on the slopes of the Nawodna sub-area (by K. Barańska)

The reason of including the object into the project

In the 1970s, the grasslands near Nawodna were still considered one of the largest, species-rich assemblages of xerothermic plants in Pomerania. Despite afforestation, well preserved patches of xerothermic grasslands have survived here, as well as sites with rare species that found a place for themselves in the undergrowth of the pine plantations and at the edges of fields. This shows the great natural potential that still exists in this area.

Threats

The main threats to the thermophilous plants near Nawodna are afforestation, illegal sand excavation, illegal trash disposal but also the abandonment of extensive grazing. The site is also threatened in places by the encroachment of *Robinia pseudoacacia.*

Actions Undertaken

A1,A2,C1, C3, C7, C8

Photograph 33. The horses grazing on the grasslands of the Nawodna sub-area (by K. Barańska)

3.1.6 Cedynia

Location

The grassland in this sub-area is based on the eastern slope of the valley of the Odra River and about 2 kilometers south of the Cedynia town. The object (about 10 ha) is located on the parcel number 74/2 (the Radostów geodetic district, the community of Cedynia) administrated by The Agricultural Property Agency. The land is leased but unused.

A short description of biotic and abiotic conditions

The area is on the side of a small ravine crossing the slope of the Odra valley. This southern-exposed slope has an incline of 30°-40° and is mainly built on sandy till and boulder clays with high gravel content. Initially, brown and, in places, pararendzina soils developed on this type of substratum. The slopes are mainly inhabited by very rare type of the xerothermic grassland with *Stipa pulcherrima - Linosyridi-Stipetum* association. Remaining part of an area is overgrown by the former grassland, now afforested by the spruce. In places where the seedlings of spruce have died, the valuable patches of the following grasslands have been preserved: *Linosyridi-Stipetum, Potentillo-Stipetum, Adonido-Brachypodietum*. In some parts termophilious shrubs of *Prunus spinosa* and *Crataegus* sp. ocures.

Photography 34. The sub-area of Cedynia (by K. Barańska)

The reason of including the object into the project
Despite their lack of use and small area, the grasslands near Cedynia are fairly well preserved. Additionally, they represent the rarest and most extreme habitat type of *Stipa* grassland – *Linosyridi-Stipetum* association. The following species, rare in Poland, also occur here: *Stipa capillata*, *Linosyris vulgaris, Stipa pulcherrima* (one from the five existing sites in Poland) and *Prunella grandiflora*.

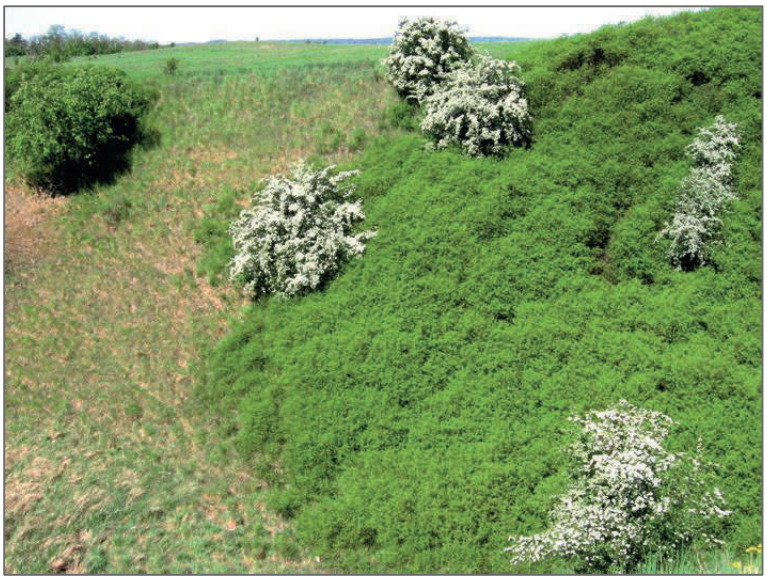
Threats
The main threat is the grassland afforestation by the spruce. Another threat concerns the fact that the grasslands have become largely overgrown, mainly with blackthorn bush.

Actions Undertaken
A1, B1, C1,C8

3.1.7 Kostrzynek

Location
The site with the surface area of about 80 ha covers a 3-km long fragment of the Odra River valley's slope lying in the proximity of Stary Kostrzynek town. Almost the whole terrain is the property of Treasury and is administered by State Forests National Forest Holding (The St.Rudnica Forestry Division, The Mieszkowice Forest District, The Szczecin Regional Directorate of State Forests). Remaining grounds belong to the private sector. The prevailing types inhabiting the area of State Forests are monocultures of pine with numerous grasslands among them (parcel numbers: 244/1, 333/3, 333/6, 333/8, 333/9, 333/10 – Stary Kostrzynek geodetic district, the community of Mieszkowice). There the planned forest economy has been kept (one grassland situated close to Kostrzynek is classified as the ecological site and therefore is excluded from using). The private grounds include mainly arable fields, outbuildings and wastelands.

A short description of biotic and abiotic conditions
Kostrzynek includes a fragment of the Odra River valley's slope that is transected by ravines of varying sizes. The majority of the site is surrounded by a monoculture of pine. However, extremely valuable patches of thermophilous vegetation have been preserved in the forests' light-gaps, at the edges of pine monocultures and on the slopes of mine excavations. The prevailing types of substrate are glacial sands and sandy till, with an admixture of small-grained gravel in places. Areas planted in pine have developed podzolic soils, with poor brown soils present in some areas, whereas pararendzinas occur on some of the slopes. *Stipa* grasslands of the *Potentillo-Stipetum* association have formed on the open, warm ravine slopes and abandoned pit sites found here, along with the xeric sand calcareous grasslands of *Sileno-Festucetum* and *Festuco-Koelerietum* associations. Patches of grassland reach a maximum size of 3 ha and are scattered over the entire area. They have become the habitats of many rare species of plants and animals: *Stipa capillata, Stachys recta, Orthanta lutea, Gentiana cruciata, Thesium linophyllon, Orobanche caryophyllacea, Helicella striata*, *Atypus murali* and many others.



Photograph 36. The mosaic of the grasslands and bushes in the sub-area of Kostrzynek (by K. Barańska)

The reason of including the object into the project

As with most of the Odra River valley areas included in the project, the grasslands around Kostrzynek are a refugium of xerothermic plants surrounded by agricultural fields and tree plantations. They significantly increase the region's biodiversity. Some of the patches are well preserved and exhibit a typical character of the xerothermic grasslands in northwestern Poland. They harbour many rare and protected species of plants and animals.

Threats

The main threats to the thermophilous open habitats of Kostrzynek are afforestation and natural succession. In places, littering of the grasslands becomes an equally serious threat. According to historical data from the beginning of the twentieth century, the whole Odra river escarpments based in the neighborhood of Stary Kostrzynek was non-forested place, excluding its western edge. There the gravel site excavations were grown by mixed forests. As it is shown in the maps from 1989, the post-war afforestation in the proximity of Kostrzynek, came gradually. Looking into the map, in the eastern and northern part of the site some coppices and single trees had been already visible whereas the central part was still non-forested. The afforestation in the area of Kostrzynek had been continued still in the nineties. The site is also threatened in places by the encroachment of *Robinia pseudoacacia*.

Actions undertaken

A1, C1, C3, C6, C7

3.1.8 Rudnica

Location

An area of nearly 150-hectare site encompasses the valley of a small tributary of the Odra River called Młynówka and some fragments of the Odra River slopes located near Stara Rudnica town. Almost the whole terrain is the property of Treasury and is administered by State Forests National Forest Holding (The St. Rudnica Forestry Division, The Mieszkowice Forest District, The Szczecin Regional Directorate of State Forests). The prevailing types inhabiting the area of State Forests are monocultures of pine. There the planned forest economy has been kept (some parts are classified as the ecological site and therefore they are excluded from using). The grasslands cover numerous forests' light-gaps (parcel numbers: 220, 72/4, 776/4, 229/1, 775, 774 – Stara Rudnica geodetic district, the community of Cedynia). Approximately 10 % of the grounds are in private hands. These include mainly the fish ponds and the surrounding meadows or wastelands. A little patch situated on the parcel numbered 281/4 (Golice geodetic district, the community of Cedynia) is the only one which is privately owned.

Photograph 37. The sub-area of Rudnica (by K. Barańska)

A short description of biotic and abiotic conditions

As far as the character of flora and the abiotic conditions are concerned, Rudnica and Kostrzynek sub-areas have a lot in common. However, instead being located on the slope of the valley of the Odra River, it is based in the valley of its small tributary. Młynówka's slopes are mainly comprised of glacial sands, on which podzolic soil developed, and on some areas richer in calcium carbonate the pararendzina soils were created. The slopes are generally not very high, with inclines varying from 20° to 40°, and their exposure is mainly southern and southwestern. Most of the slopes are forested with pine, but some of them still have patches of *Stipa* grasslands of the *Potentillo-Stipetum* association and the thermophilous *Festuco-Koelerietum* and *Sileno-Festucetum* sandy grasslands. They may be small, but are rich in rare species. In several cases, these assemblages have recolonized former mine excavations.

Despite their small size and extreme isolation, several of these patches harbour some very rare species for the country. The largest of four known sites of *Stipa borysthenica* in Poland (a species in the Polish Red Data Book of Plants) is found in the Rudnica sub-area. Other rare and protected plants also found here include: *Stipa capillata, Aster linosyris, Thesium linophyllon*, *Ononis spinosa*, *Primula veris* and *Orthanta lutea*. Of particular note is the thermophilous fauna that occurs here, with, among others, the following listed in the Polish Red Data Book of Animals: *Eresus cinnaberinus*, *Atypus murali*, *Helicella striata* and *Chondrula tridens*.

Photograph 38. Stipa borysthenica in the sub-area of Rudnica (by K. Barańska)

The reason of including the object into the project
A great concentration of grasslands in Rudnica, similarly to Kostrzynek, testifies to an enormous natural potential existing here. Additionally, it is the evidence of old times when sandy and xerothermic grasslands were covering huge area here. The patches of these valuable grasslands have become a refugium of thermophilous flora in the region. Despite their small size and extreme isolation, several of these patches contain some very rare species for the country, e.g.: *Stipa borysthenica*, *Eresus cinnaberinus* or *Helicella striata.*

Threats
The main threats for the grasslands in Rudnica are planned forest economy and associated with it isolation of the patches of valuable vegetation and rare species of plants. Looking into some historical maps, it has been noticed that at the beginning of the twentieth century this region was still non-forested. After the World War II, these places were gradually afforested with exclusion of some gaps thanks to which the thermophilous species and assemblages could survive. The southern part of the site was afforested only in the nineties. There, the most valuable patch of the grassland with *Stipa borysthenica* locality.
Among other threats, there also should be listed a natural succession resulting from improper utilization and littering. The site is also threatened in places by the encroachment of *Robinia pseudoacacia.*

Actions undertaken
A1,A2, C1, C3, C4, C6, C7

3.1.9 Trutwiniec

Location
An area of nearly 120-hectare site encompasses the northern slope of the small and nameless tributary of the Odra River located about 2.5 km for the north of Siekierki town. The biggest and the most valued assemblage of the grasslands is based in the neighborhood of an old, middle-forest settlement called Trutwiniec.
The majority of that terrain is administered by State Forests National Forest Holding (The Siekierki Forestry Division, The Mieszkowice Forest District, The Szczecin Regional Directorate of State Forests). Only the eastern edge of the region is under control of Polish State Railways and partially private investors. The prevailing types inhabiting the area of State Forests are monocultures of pine. There the planned forest economy has been kept (One area is classified as the ecological site and therefore they are excluded from using). In the central part of the sub-area the leased fish ponds play the main role. The grasslands are localized on the following parcels of land: 72/1, 41/1 - Siekierki geodetic district, the community of Cedynia. As far as the private grounds are concerned, they include meadows or wasteland (parcels 304 and 306/1, Żelichów geodetic district, the community of Mieszkowice). The grounds belonging to Polish State Railways are some inactive embankments overgrown by thermophilous flora (parcel numbered 310 - Żelichów geodetic district, the community of Mieszkowice).

Photograph 39. The sub-area of Trutwiniec (by K. Barańska)

A short description of biotic and abiotic conditions
As with Rudnica, Trutwiniec sub-area covers the valley of a small Odra tributary. Its slopes are mainly comprised of glacial sands with podzolic soils and some patches richer in calcium carbonate with pararendzina soils. The slopes are not very high, with inclines of 20° - 40° mainly facing south and southwest. Most of the slopes are forested with pine, but some still maintain patches of *Stipa* grasslands of the *Potentillo-Stipetum* association and the thermophilous *Festuco-Koelerietum* and *Sileno-Festucetum* sandy grasslands. They may be small, but are rich in rare species. In several cases, these assemblages have recolonized former excavated pits and the embankments constructed along railways and roads. Despite their small size and extreme isolation (as with Rudnica and Kostrzynek sub-areas), several of these patches contain some very rare species of plants and animals. Among species occurring here, the following ones can be listed: *Stipa borysthenica, Stipa capillata, Anthericum liliago, Carex supina, Scorzonera purpurea, Pulsatilla pratensis, Ononis spinosa*, *Avenula pratensis*, *Primula veris, Orthanta lutea*, *Atypus muralis* and *Helicella striata.*

The reason of including the object into the project
Similarly to Rudnica and Kostrzynek, the sub-area of Trutwiniec has been incorporated into the project because of its extraordinary value as refugium of xerothermic plants. Despite their small size and extreme isolation, some of these patches contain some species which are very rare in the country. The one of four known sites of *Stipa borysthenica*, *Anthericum liliago* and *Carex supine* (a species from the Polish Red Data Book of Plants) is found in the Trutwiniec sub-area. Apart from that, other rare and protected species can grow here (mentioned above).

Threats
The main threat for the grasslands in Trutwiniec is an isolation of the patches resulting from keeping here planned forest economy (mainly based on afforestation). Another risk is associated with the encroachment of *Robinia pseudoacacia.*

Actions undertaken
A1, A2, C1, C4, C6, C7

3.1.10 Siekierki

Location
The site comprises three small patches of thermophilous vegetation (with a total area of about 3 ha) deployed on the eastern edge of the valley of The Odra River and situated between Siekierki and Stare Łysogórki towns. The grasslands are based on the following parcels: no 147 with Siekierki geodetic district and the community of Mieszkowice, and no 176/6 - Stare Łysogórki geodetic district and the community of Cedynia. The whole area is administered by State Forests National Forest Holding (The Siekierki and Stare Łysogórki Forestry Divisions, The Mieszkowice

Forest District, The Szczecin Regional Directorate of State Forests). On two from above mentioned sites, nature monuments have been created – "Ciepłolubna Wydma" and "Ostnicowa Skarpa".

Photograph 40. The sub-area of Siekierki (by K. Barańska)

A short description of biotic and abiotic conditions
These three small patches are a fragment of the slope of the Odra River valley. Two of them have been created on steep slopes of the former sand pits and the third one is located on a small sandy hill. The site's substratum is made up of glacial sands rich in calcium carbonate. In places, pararendzina soils developed on this type of substratum. All patches are surrounded by monoculture of pine including xerothermic grasslands of *Potentillo-Stipetum* association and thermophilous sandy grasslands of *Sileno-Festucetum* and *Festuco- Koeleritum*. Despite a small area, these patches have become the habitats for many rare species of plants and animals: *Stipa capillata, Stipa borysthenica, Anthericum liliago, Carex supina, Chelicella strata, Atypus murali* and many others.

The reason of including the object into the project
This small area is highly significant in preserving the biodiversity, not only of the region, but of the entire country. It is one of four sites with the rarest *Stipa* in Poland - *Stipa borysthenica*. Additionally, many other rare and protected species can be found here (mentioned above). Disposed alongside the river valley, these patches constitute the valuable refugium of thermophilous plants, contribute to the decline of isolation of xerothermic species and facilitate its migration along the valley.

Threats
The main threat is the encroachment of *Robinia pseudoacacia*. Also, as with Rudnica, Kostrzynek and Trutwiniec sub-areas, planned forest economy and littering are also included to the list of serious threats.
As the maps show, the slopes on the beginning of the twentieth century were not forested. There are no tree symbols visible in these documents what may mean that this terrain was treeless and completely opened. Some maps from 1989 present these areas as already afforested so there have been assumptions stating that afforestation has been completed in the postwar years.

Actions undertaken
A1, A2, C1, C2

3.1.11 Gozdowice

Location
This little site (with a total area of about 3 ha) is localized on the steep slopes of The Odra River - about 1 km for the northern-east of Gozdowice town. The main part of the object lies below

the level of a well-known in the region view point. The whole area is administered by Treasury (The Gozdowice Forestry Divisions, The Mieszkowice Forest District, The Szczecin Regional Directorate of State Forests). An ecological site name "Murawa Ostnicowa" is set in on the surface of 0.95 ha (Plot No. 195/3- Gozdowice geodetic district and the community of Mieszkowice). On the remaining part (located within plot no. 199/2) some gaps in pine forest stands can be found.

Photograph 41. The sub-area of Gozdowice (by K. Barańska)

A short description of biotic and abiotic conditions

Here we have a high (about 40 m) and steep slope of the Odra River valley with a southwestern exposure. The slope was formerly an excavated pit site and has an incline of 40°, and even 50° in some places. It is built on sandy till. *Potentillo-Stipetum* association has become here the prevailing type of vegetation. Despite the lack of use, the grassland is in good condition, with individual shrubs and fruit trees found in only a few locations. Among the rare species occurring here are: *Stipa capillata*, *Orthanta lutea*, *Ononis spinosa*, *Carex supina* (a species in the Polish Red Data Book of Plants) and *Stachys recta*. This sub-area also has some species in the Polish Red Data Book of Animals: *Atypus muralis*, *Helicella striata* and *Chondrula tridens*.

Photography 42 Cocoon of Atypus Murali in the sub-area of Gozdowice (by K. Barańska)

The reason of including the object into the project

The slope near Gozdowice has one of the best preserved patches of xerothermic grasslands in the Odra River valley. It is a model site for this habitat. It also constitutes very valuable refugium of thermophilous flora which influences on the conservation of the ecological corridor for xerothermic species.

Threats
The main threat is the encroachment of *Robinia pseudoacacia* and *Calamagrostis epigejos*. The latter is a native species for Poland but an ecological intruder for the grasslands. Apart from that, littering is also a threat here - mainly because of the neighborhood of view point.

Actions undertaken
A1, C1, C6, C7

3.1.12 Błeszyn

Location
The patches of grasslands cover sandy slopes of The Odra River. This site is located about 0.5 km to the southern-west of Gozdowice and about 0.5 km to the west of Błeszyn town. The grassland is based on the following parcels: no 136/13 and 198/14 - Błeszyn geodetic district and the community of Mieszkowice. This area is owned by Treasury and administered by State Forests National Forest Holding (The Błeszyn Forestry Divisions, The Mieszkowice Forest District, The Szczecin Regional Directorate of State Forests). The whole site has been set up as an ecological site – "Murawa Błeszyńska".

Photograph 43. The sub-area of Błeszyn (by K. Barańska)

A short description of biotic and abiotic conditions
This high (about 40 m), steep and partly unstable slope of the Odra River valley has a southwestern exposure. Błeszyn has been an abandoned excavation pit, characterized by steeply inclined terrain. It is made up of glacial sands rich in calcium carbonate.
Błeszyn consists of the *Stipa* grassland *Potentillo-Stipetum* association, Xeric sand calcareous grasslands (6120) and thermophilous shrubs of the *Prunus spinosa, Ligustrum vulgare* and *Crataegus* sp.. Before the beginning of the project, *Robinia pseudoacacia* had grown on the part of the slope but then it was cut out.
Among the rare species occurring here are: *Anthericum liliago, Orthanta lutea, Stipa capillata*, *Ononis spinosa*, *Carex supina*, *Stachys recta* and *Plantago arenaria*. This sub-area also has some species which are listed in the Polish Red Data Book of Animals: *Atypus muralis*, *Helicella striata* and *Aporia crataegi*.

The reason of including the object into the project
The slope at Błeszyn is one of the most valuable patches of xerothermic grasslands in the lower Odra valley. It is a model example of habitats 6210 and 6120. It is also a place, where many rare species of plants and animals can be found including the types having been registered in the Polish Red Data Books - *Anthericum liliago, Carex supine, Atypus muralis* or *Helicella striata*. Błeszyn also constitutes very valuable refugium of thermophilous ecosystem which influences on the conservation of the ecological corridor.

Threats
The site's main threat is the expansion of shrubby and arboreal species, in particular of *Robinia pseudoacacia*. Furthemore, littering caused by fishermen being present on the slopes has become another threat for Bleszyn.

Actions Undertaken
A1, C1, C7

3.1.13 Czelin

Location
An area of nearly 15-hectare encompasses small ravine crisscrossing the eastern slope of the Odra River's valley. It is based about 1 km for the north of Czelin town.
The majority of the grasslands are located on the plot no. 366 being in the Czelin geodetic district, the community of Mieszkowice. That site belongs to The Agricultural Property Agency and now is being leased by the private company. Small fragments of the grasslands are also laying on the plot no 370 in the Czelin geodetic district (the property of Mieszkowice's community) and plot no 369 being in the Czelin geodetic district as well but owned by the parish of Czelin.

Photograph 44. The sub-area of Czelin (by K. Barańska)

A short description of biotic and abiotic conditions
The site covers the fragment of the eastern slope of The Odra River's valley and crisscrossing it small, naturally eroding ravine. The substratum is comprised of sandy till with impurity of grit. The slopes are not very high, with inclines of 30° mainly facing south and southeast and east. The whole complex offers a mosaic of various thermophilous habitats. The majority of the whole surface has been overgrown by the xerothermic grasslands of *Adonio-Brachypodieum* association (6210). The prevailing species of grass is *Brachypodium pinnatum* which is diversified by some richly flowerying perennials (*Scabiosa columbaria, Salvia pratensis, Prunella grandiflora* and *Campanula sibirica).* At the base of an embankment, flowery grassland is being smoothly transferred into meadows of assemblages rich in many species. In the central part of the area, the sandy slopes of the ravine with their southern exposure are covered by *Potentillo-Stipetum* grasslands dominated by *Stipa capillata* and *Potentilla arenaria* with many colorful flowering species, such as *Dianthus carthusianorum*, *Melampyrum arvense*, *Chondrilla juncea*, *Veronica spicata* or *Centaurea scabiosa* and *C. rhenana.*
The third part of Czelin grasslands is localized in the south and built on leftovers of gravel pit. This habitat is of anthropogenic character with initially grown flora. Patches of xeric sand calcareous grasslands (mainly *Sileno- Festucetum* association) have developed here and cover relatively steep excavations and gravel hills. Also at this part, the grasslands are enriched by numerous species of flowers including: *Sedum sexangulare, Potentilla recta, Senecio jacobaea, Helichrysum arenarium* or *Medicago minima.* On the top of that, the fragments of thermophilous type of *Fraxin-Ulmetum* (91F0) can be also found at this sector.

The reason of including the object into the project
As with other sites in the neighborhood of the Lower Odra River, the grasslands in Czelin are also refugium of xerothermic plants surrounded by agricultural fields and forests. They significantly increase the region's biodiversity. Some of the patches are still well preserved and present the typical character of xerothermic grasslands from the north-western Poland. They have become the habitats of rare and protected species: *Stipa capillata, Stachys recta, Campanula sibirica, Primula veris, Prunella grandiflora* and many others.

Photograph 45. Campanula sibirica in the sub-area of Czelin (by K. Barańska)

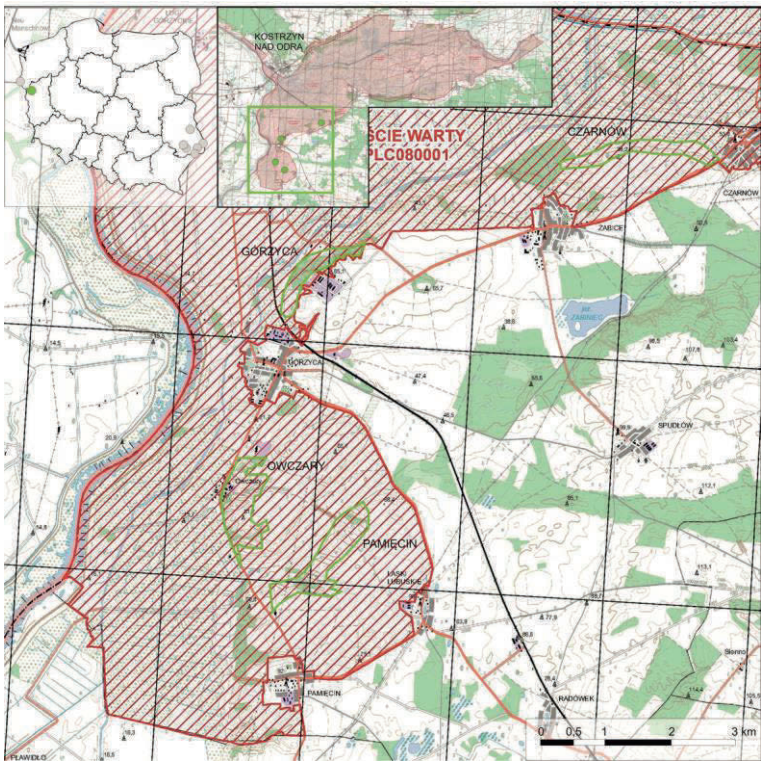
Threats
Before the beginning of the project, natural succession and expansion of *Calamagrostis epigejos* and *Arrhenatherum alatius* constituted the main threats for that site. This was mainly caused by lack of grazing.

Actions undertaken
A1, B1, C1, C8

3.2 Ujście Warty

The Ujście Warty Natura 2000 site is an area of 33297.35 hectares. It was established to protect both a bird site as well as the Natura 2000 habitats of the area. It encompasses broad floodplain formed by the confluence of three rivers: Warta, Odra and the smallest of them - Postomia. It is a huge complex of extensively utilized humid meadows, well-hydrated rushes, oxbows, ponds, willow scrub, various types of riparian forests, alder and oak-hornbeam woods. The Ujście Warty National Park, the former Słońsk Nature Reserve, that is part of the area of Ujście Warty, is one of the most valuable wetlands in central Europe. At least 35 species of birds listed in the Annex I of the Birds Directive are to be found here.
Among the many species inhabiting this area during breeding season there are: Shelduck, Greylag goose, Northern shoveler, Spotted crake, Gadwall, Great egret, Eurasian coot, Black-winged stilt, Eurasian oystercatcher, Common redshank, Tufted duck, Little gull, Little tern, White winged tern, Black tern, Aquatic warbler, Common pochard, Common snipe , Black-headed gull, White stork, Black stork, Corn crake ,Red-backed shrike, Barred warbler, Tawny pipit, Bluethroat, Wood lark, Ortolan bunting, Common crane, Mute swan, Grey heron and many others.

There are 11 natural habitats listed in the Annex II of the Habitats Directive in the site. Among them, the best represented include: natural eutrophic lakes and oxbows (3150); rivers with muddy bank that are flooded (3270); riverside hydrophilous tall herb fringe communities (6430); alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0), together with xerothermic grasslands (6210).
Apart from the Ujście Warty National Park there are other protected areas that form the refuge: part of the Ujście Warty Landscape Park, the "Lemierzyce", "Pamięcin" and "Dolina Postomil" Nature Reserves together with the Ramsar Słońsk and several environmental use areas. Apart from broad wetlands, the area encompasses many sites with thermophilous vegetation at the edges of the Odra and Warta River Valleys.
The best preserved complexes of xerothermic grasslands, fringe vegetation and thermophilous shrubs and forests can be found in the southern part of the area, in the vicinity of Górzyca, Owczary, Pamięcin and Laski Lubuskie towns.
4 main sub-areas of the concentration of xerothermic habitats have been determined, where the protection actions have been planned: Czarnów, Górzyca, Owczary and Pamięcin.



Drawing 4. The Ujście Warty Natura 2000 site with locations of the sub-areas included in the project

3.2.1 Czarnów

Location
This around 15 hectares area encompasses a one-kilometer long fragment of the southern part of the Warta Valley between Żabice and Czarnów towns. The grasslands in Czarnów are managed entirely by the State Forests of Poland (The Czarnów Forestry Divisions, The Ośno Lubuskie Forest District, The Zielona Góra Regional Directorate of State Forests). They are located on the parcels of record no. 516/13, 211/2, 365/1 in the geodetic district of Górzyca, the municipality of Górzyca. The grasslands are protected as environmental sites "Długa Murawa" and "Murawka". Since 2008, both objects are extensively used (mowing and grazing) on the basis of the agreement between the Forest District and the Naturalists' Club.

Brief characteristics of abiotic and biotic conditions
The area is a fragment of the Odra valley's gentle slopes that run between the villages of Żabice and Czarnów. The slopes face in a northerly direction with inclines of 20° - 30°. They are transected by ravines of small size, where xerothermic grassland developed (6210). Brown soils developed on a substratum of sandy till hear.

The slope is in 50 % covered by thermophilous shrubs and pine monocultures with the thermophilous species in the undergrowth. Open assemblages are represented by the flowery xerothermic grasslands *Adonido-Brachypodietum* (6210), xeric sand calcareous grasslands of *Sileno-Festucetum* association (6120*) and fresh meadows with a large index of xerothermic species (6520).

Photography 46. Chalkhill blue Polyommatus coridon in the sub-area of Czarnów (by K. Barańska)

The reason of including the object into the project
The sub-area of Czarnów is not rich in rare xerothermic species. However, it is a refuge for the natural thermophilous habitats in the valley of a big river. It significantly increases the biodiversity of the surrounding agricultural landscape and reduces the isolation of xerothermic species' populations. Of the more interesting species that occur here, there are: *Pulsatilla pratensis, Primula veris, Silene otites* and *Helichrysum arenarium*.

Threats
The main threat to this area is natural succession leading to conversion of open assemblages into shrubs and forests. Maps from the beginning of the 20th century show that the escarpment, on which the grasslands are predominantly located, used to be a woodless area.
Only in some areas single trees and bushes occur.

Actions undertaken
A1, C1

3.2.2 Górzyca

Location
This approximately 10-hectare area is situated on excurrent segment of the Warta river valley slope, and is linked in this place with the Odra river valley. Grasslands are located on the northern edge of the village of Górzyca. They border with kennel buildings and former state-owned collective farm's buildings in the north.
The area is almost in its entirety located under directorate of State Forests (The Czarnów Forestry Divisions, The Ośno Lubuskie Forest District, The Zielona Góra Regional Directorate of State Forests). Only their small fragment lies on the Polish State Railways land. They are located on patches with identification numbers 643, 206 (Polish State Railways plot), 66/20 and also partly 645 geodetic district Górzyca and Górzyca municipality. In the past, grasslands were protected as ecological site, which was subsequently abolited. Within a project the ecological site was constituted again.

Short characteristics of biotic and abiotic conditions
Górzyca site includes a fragment of Warta valley slope, linking here with the Odra valley. The slope has northern and western exposure at inclines of 20º - 40º. Small erosional ravines cut across the area. Brown soils developed on the slopes of sandy till.

Photograph 47. Górzyca sub-area (by K. Barańska)

Before the commencement of the project, the slope was in 60% occupied by thermophilous shrubs, pine plantations and deciduous forests with thermophilous species in the undergrowth. During the project part of the shrubs and entire *Robinia pseudoacacia* were cut down. Delay in succession process is caused also by periodical fires, illegally lit up by local inhabitants.
Open plant communities are represented by *Stipa* and flowery xerothermic grasslands of *Potentillo-Stpetum* and *Adonido-Brachypodietum* associations (6210) as well as xeric sand calcareous grasslands of *Sileno-Festucetum* association (6120*).
Among rare species, which can be found on grasslands near Górzyca the following should be mentioned: *Stipa capillata, Eryngium campestre, Prunella grandiflora, Melampyrum arvense* and *Campanula sibirica.*

Reason for including the object into the project
It is one of the most precious fragments of thermophilic vegetation in the region. It represents typical examples of Stipa and flowery xerothermic grasslands. Dynamic mosaic of grasslands, *Rhamno-Prunetea* shrubs and thermophilous type of forests significantly increase the biodiversity of the surrounding agricultural landscape. Moreover, there are many rare species of plants connected with xerothermic grasslands.
Threats
The main threats to grasslands near Górzyca are natural succession and penetration of dangerous invading species - *Robinia pseudoacacia.* Trash dumping by local inhabitants is also a problem.

Actions undertaken:
A1, A2, C1, C4, C6, C7

3.2.3 Owczary

Location
Owczary site is a regionally known, vast, nearly 70-hectare complex of thermophilic vegetation which has been under the care of Naturalists' Club for years. The site is located within the former state-owned collective farm in the village of Owczary and it borders directly with the Field Station and a farm owned by Naturalists' Club.
To a large extent, the area of grasslands in Owczary remains the property of Naturalists' Club (patches no: 635/18, 635/5, 635/32, 635/43 geodetic district of Górzyca, municipality Górzyca), other patches include grasslands (635/35, 635/36 Górzyca geodetic district and 1/7 of Pamięcin geodetic district, municipality Górzyca) are owned by Regional Directorate for Environmental Protection in Gorzów Wielkopolski.
In case of 75% of the total area, the Naturalists' Club has been conducting extensive pasturing of sheep, horses and goats for more than 10 years. 10 % of the area is covered by mowed meadows. A rather small fragment currently forms little farmland, destined for cultivation of rare species of

weeds. Patches 635/35, 635/36 and 1/7 are covered by ecological sites called "Owczary I" and "Owczary II".

Photograph 48. Owczary sub-area (by M. Matysiak)

Short characteristics of abiotic and biotic conditions

Owczary site forms a complex of ravines crossing eastern slopes of the Odra river valley. This place is characterized by diverse landform. The inclination of slopes ranges between 5º and 45º. Exposure is mainly southern and south-eastern.

On slopes built from till, rich in calcium carbonate, brown soil types have been formed.

Local flora consists of dynamic mosaic of thermophilous habitats which include: xerothermic grasslands represented by *Adonido-Brachypodietum* and *Potentillo-Stipetum* associations (6210), xeric sand calcareous grasslands *Sileno-Festucetum* (6120*), thermophilous fresh meadows (6510), *Rhamno-Prunetea* thickets and riparian forests located on slopes *Fraxino-Ulmetum* (91F0), thermophilic oakwoods (91I0) and *Pinus-Brachypodium pinnatum* communities.

Thanks to long-term pasturing and regular mowing, meadows and grasslands remain in perfect condition.

There are numerous rare species such as: *Stipa joannis, Anthericum liliago, Eryngium campestre*, *Orobanche caryophyllacea, Orobanche lutea, Campanula sibirica, Campanula bononiensis, Scorzonera purpurea, Stipa capillata, Thesium linophyllon, Oxytropis pilosa, Atypus murali, Helicella strata* and many others.

Reason of including the object into the project

Grasslands in Owczary are definitely one of the most valuable and one of the largest complexes of thermophilous flora in Poland. It forms a model example of habitats 6210 and 91F0. This is a place where many rare species of plants, in the whole country scale, exist, like: *Stipa joannis, Anthericum liliago* or *Atypus murali and Helicella strata.*

Threats

The main threat for grasslands in Owczary is expansion of dangerous invasive species - *Robinia pseudoacacia.* Another risk is also flowing down of biogenes from intensively exploited fields surrounding the complex. Trash dumping by local inhabitants is also problematic.

Actions undertaken

A1, C1, C3, C4, C7

Photograph 49. Stipa joannis in Owczary sub-area (by. K. Barańska)

Photograph 50. Pasturing of sheep and goats in Owczary sub-area (by. K. Barańska)

3.2.4 Pamięcin

Location

Pamięcin sub-area includes a few patches of grasslands in different sizes (from a few to several dozen hectares) located among intensively used farmlands among localities of Laski Lubuskie, Pamięcin and Owczary. A part of it is managed by Regional Directory of Environmental Protection in Gorzów Wielkopolski: ecological site "Laski I" (parcel no: 635/37 Górzyca geodetic district, municipality Górzyca) and "Laski II" (parcel no.: 635/38 Górzyca geodetic district, municipality Górzyca). Grasslands located on parcel no 635/16 belong to State Forests (The Czarnów Forestry Divisions, The Ośno Lubuskie Forest District, The Zielona Góra Regional Directorate of State Forests). Whereas on parcels 635/17, 635/44, 621 and Pamięcin reserve (parcel no. 1/3 Pamięcin geodetic district, municipality Górzyca) they are managed by Agricultural Property Agency.

Photograph 51. Pamięcin sub-area (photo by K. Barańska)

Short characteristics of abiotic and biotic conditions

Pamięcin sub-area includes the lower stretch of an extensive dry valley directly connected to the Odra River valley. The valley is transected by many ravines running east to west. Xerothermic vegetation often covers these fairly steep and high slopes. The remaining, flatter area is used mainly as agricultural fields. The territory consists of a few "islands" of thermophilic islands surrounded by crops.

Thermophilic vegetation is represented above all by various: Stipas and flowery xerothermic grasslands like *Potentillo-Stipetum* and *Adonido-Brachypodietum* associations (6210), and to a lesser degree by xeric sand calcareous grasslands *Sileno-Festucetum* and *Festuco-Koelerietum* (6120*) and also thermophilous shrubs and riparian forest on slopes *Fraxino-U lmetum* (91F0).

Patches of grasslands, located in the area, abound in precious xerothermic species, e.g.: *Stipa joannis, Anthericum liliago*, *Eryngium campestre*, *Orobanche caryophyllacea, Campanula sibirica, Campanula bononiensis, Stipa capillata, Thesium linophyllon, Oxytropis pilosa, Helicella strata, Chondrula tridens, Atypus murali, Aporia crataegi* and many others.

Reason of including the object into the project

Other than Owczary, it is the second most precious object in the region which contains xerothermic grasslands. It comprises of model and outstandingly rich in various species patches of habitat 6210, forming part of reserve and two ecological sites. The grasslands found here are home to numerous and nationwide rare species.

Threats

Main threats for grasslands in Pamięcin sub-area are natural succession and expansion by dangerous invasive species - *Robinia pseudoacacia.* The next risk is also flowing down of biogenes from intensively exploited fields surrounding the complex. Trash dumping by local inhabitants is also a problem.

Actions undertaken

A1, C1, C3, C4, C7

Photograph 52. xeric sand calcareous grasslands in Pamięcin sub-area (by K. Barańska)

3.3 Stawska Góra

Location

The object is Natura 2000 site and at the same time, the natural reserve with the same name – Stawska Góra, located within the same borders (4,98 ha). It is situated on the top of the hill called Góra Czubatka, less than 2,5 km north from the town of Staw in Chełm municipality in Lublin vovoidship.

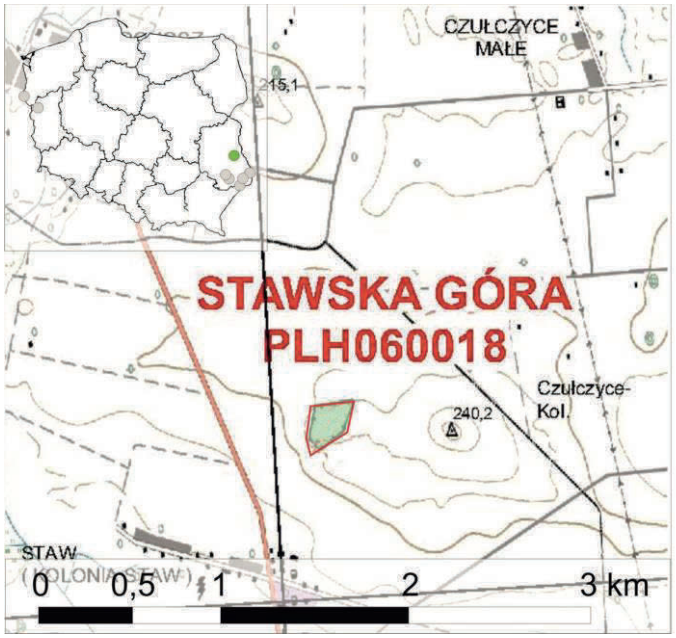
The area belongs to Chełm municipality and according to the soil classification it constitutes in its entirety arable land. In reality, it is peak of chalk hill, unexploited for a long time and surrounded by arable fields. The object occupies the whole area of plot no. 381, Staw geodetic district, Chełm municipality.

Short characteristics of abiotic and biotic conditions

Stawska Góra is a quite small area occupying a peak of Góra Czubatka, surrounded by farmlands and a little watercourse rising over the valley – Garka river. It is a fragment of Pagóry Chełmskie region, lying in eastern part of Lubelska Upland. The subsoil constitutes a skeletal initial soil made of chalk marl (rendzina). Slopes' inclination does not exceed 10°.

Vegetation forms a floral mosaic of xerothermic grasslands (6210) and different stadia of successive thermophilic shrubs. Open plant communities are mainly represented by a complex of *Inuletum ensifoliae* association, *Brachypodium pinnatum* and *Teucrium chamaedrys* communities as well as initial *Anemone sylvestris* and *Aster amellus* communities formated on former fallow lands. Well developed xerothermic grasslands exist in forms of little and difficult to access patches among the shrubs, mainly in western and southern part of the area. Larger patches of grasslands, but initial and formed on the fallow lands, occur in eastern and northern part of the area. The layer of non-forest xerothermic vegetation is decreasing every year due to intensive natural succession. Before the commencement of the project shrubs constituted 70% of the area.

Nevertheless, the area includes unusual variety of flora and fauna, among the most precious species the following should be mentioned i.e.: *Carlina onopordifolia, Cerasus fruticosa, Senecio macrophyllus, Anemone sylvestris*, *Asperula tinctoria*, *Aster amellus, Campanula sibirica, Carex humilis*, *Carex michelii, Gentiana cruciata*, *Inula ensifolia, Adonis vernalis*, *Carlina acaulis, Polygala comosa, Teucrium chamaedrys, Thesium linophyllon* and many other.



Drawing 5. Location of Stawska Góra area

Reason of including the object into the project

Despite relatively small area and advanced processes of natural succession, Stawska Góra is one of the most precious sites of xerothermic grasslands in Lublin region. There are 210 species of vascular plants. It is a large amount, considering the fact, that the area is only a little fragment with relatively homogeneous vegetation.

In nothern part of the reserve, on former fallow land one of two known populations of *Carlina onopordifolia* (2249) in Lublin region may be found. This is the only species of flora of Stawska Góra from Annex II of the Habitats Directive.

Photograph 53. Grassland with Carlina onopordifolia in Stawska Góra area. (by P. Chmielewski)

Apart from that, there are also species from the Polish Red Data Book of Plants, such as: *Cerasus fruticosa* and *Senecio macrophyllus,* as well as many other rare and protected species in Poland (see above).

Xerothermic grasslands are accompanied by diverse fauna. This tiny area is home to 600 species from different taxonomic groups. Among them there are 27, which have been listed in The Red List of Threatened Species. Invertebrates are the group which is the richest in terms of number of species, among which butterflies have been the most explored. Within the reserve, more than 300 species of butterflies have been identified. Two of them are protected: *Papilio machaon* and *Proserpinus proserpina*; numerous belong to the group of rare species with only a few spots of occurence in Poland. Stawska Góra, despite far-moved natural succession, is still a model example of habitat 6210. Thanks to this, and due to the variety of xerothermic flora and fauna, this terrain has gained cross-regional meaning in terms of the maintained biodiversity. On the local level, it forms a unique refugium for xerothermic species among large-areas of farmlands.

Photograph 54. Panorama of the Stawska Góra area (by P. Chmielewski)

Threats

The main threat for the area is the succession of expansive species of shrubs, mainly *Cornus sanguinea, Prunus spinosa, Rhamnus catharticus, Frangula alnus* and *Viburnum opulus*, as well as expansive species of herbaceous plants, mainly *Calamagrostis epigejos* and weeds coming from neighbouring fields. Before the commencement of the project another threat was also the lack of hiking trails, resulting in treading out illegal paths by tourists and trash dumping.

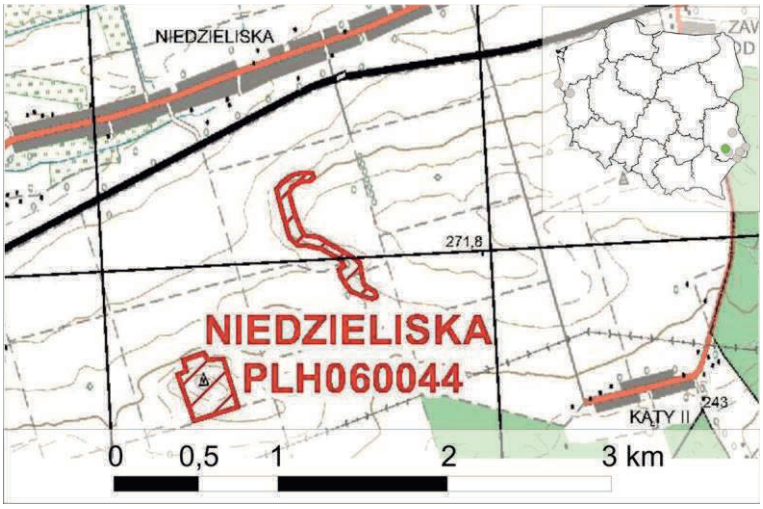
Actions undertaken

A1, A2, C1, C3, C4, C7

3.4 Niedzieliska

Location

The refugium Niedzieliska, with area of 7,39 ha, includes patches of grasslands and xerothermic shrubs on two calcareous hills and is located about 1 km to the south of Niedzieliska village in Szczebrzeszyn municipality, Lublin voivodeship. A small layer of greenery on one of the hills, called Dziewcza Góra, with the area of 0,16 ha, has been protected as nature monument since 1990s. The ownership structure of this area is diversified. The grasslands are located on several dozen of private patches.



Drawing 6. Location of Niedzieliska area

Short characteristics of abiotic and biotic conditions

The area consists of two fragments including incline of northern edge of Central Roztocze region between Szczebrzeszyn and Zamość towns, to the south of Niedzieliska village.

On the shallow soils, shrubs and xerothermic floral grasslands were formed with significant orchids sites (6210*). Thermophilic shrubs belong to a plant community, rarely met in the country - with *Juniperus communis* (5130). Xerothermic grasslands have an initial character and tend to appear on terrains formerly used as farmlands. There are many colorful plant species i.e.: *Salvia verticillata, Agrimonia eupatoria*, *Centaurea scabiosa*, *Lathyrus tuberosus, Medicago falcata*, *Picris hieracioides*, *Scabiosa ochroleuca* and many others. Within the mainstay 12 species of plants under legal protection were recorded. Among them the most numerous are: *Anemone sylvestri* and *Aster amellus*. Considerably less numerous are local populations of *Listera ovata, Cerasus fruticosa* or *Rosa gallica.*

Photograph 55. Niedzieliska area (by K. Barańska)

Reason for including the object into the project

Niedzieliska is the most numerous in the Lublin region and one of the most numerous on the territory of Poland locations of species from Annex II of the Habitats Directive - *Cypripedium calceolus* (1902). Its population consists of almost 2500 specimens.

Apart from that, within the area, one can meet species listed in the Polish Red Book of Plants: *Cerasus fruticosa* and other rare and protected species in Poland: *Adonis aestivalis*, *Adonis vernalis, Allium scorodoprasum*, *Anemone sylvestris, Aster amellus*, *Gentiana cruciata*, *Listera ovata* and *Primula veris.* It should be noted that Niedzieliska includes grasslands with important orchid locations; therefore, it is the priority habitat.

Similar to Stawska Góra, Niedzieliska area is located among intensively developed landscapes, where farmlands and rural buildings are predominant. In this case, it constitutes one of non-numerous biodiversity mainstays in this region.

Threats

The main threat for this site is the change of ground usage. Currently, a significant part of the object is undergoing continuous process of overgrowing by expansive thermophilous shrubs. Thick thicket and deserted excavations of limestone are sometimes used as illegal landfill sites. Some patches of grasslands are afforested or used for ploughing, in spite of bad quality of soil. In some places aggregate is illegally extracted. One of the main threats is penetration of fertilizers and herbicides from the nearby farmlands. Dziewcza Góra is a popular view point. That is why, it is very often visited by tourists, who pick or dig out decorative plants growing there.

Undertaken actions

A1, A2, B1, C1, C3, C7

Photograph 56. Anemone sylvestris (by P. Chmielewski)

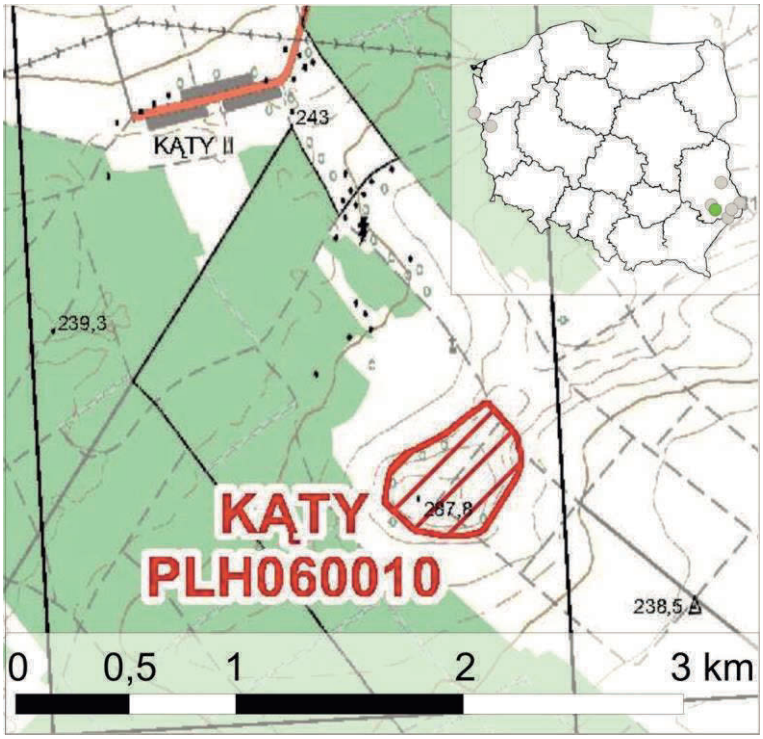
3.5 Kąty

Location

The Kąty site covers an area of about 20 ha and includes a hill called Wieprzecka Góra, situated near Kąty II village in municipality Zamość. Since 1950s the authorities planned to create here a nature reserve, but due to a complicated ownership structure, only a part of xerothermic grasslands covering an area of about 2 ha has been preserved as natural monument.
The area which is included in the project is located within 29 parcels, being in the vast majority a private property, and according to the ground classification, it constitutes arable land.

Short characteristics of abiotic and biotic conditions

Wieprzecka Góra is located within the Zamojski Vale, mesoregion of Lublin Upland. The ground is constituted by rendzinas, formed from chalk marl, covered by a thin layer of loess.



Drawing 7. Location of Kąty area

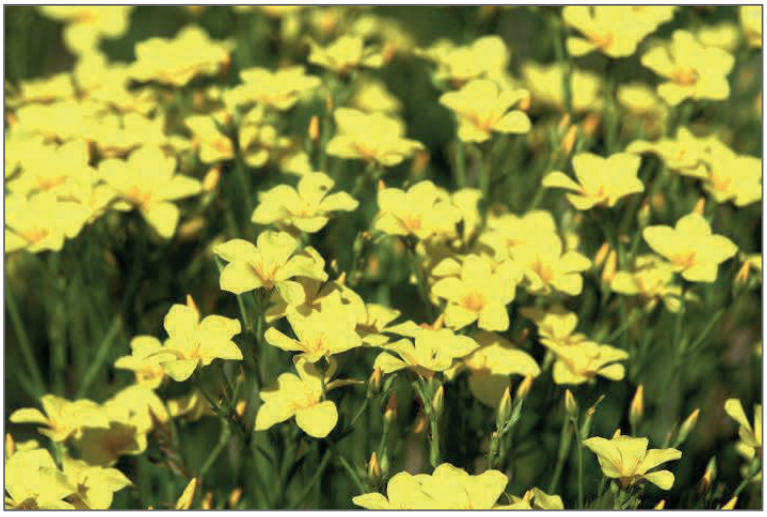
Xerothermic floral grasslands, with an important orchid species localities (6210*), were created on warm and stony slopes. In Kąty one may encounter assemblages of thermophilous plants,

belonging to *Inuletum ensifoliae* association and community with *Brachypodium pinnatum*. Grasslands on Wieprzecka Góra, due to being home to a large variety of rare and protected plant species are probably the most valuable in Poland. Here we can encounter as many as 26 species under protection. *Hypericum elegans, Veratrum nigrum, Muscari comosum* and *Gentianella lutescens* belong to the most precious species. Xerothermic species like: *Inula ensifolia, Prunella grandiflora*, *Campanula sibirica, Aster amellus*, *Astragalus onobrychis* and many others, grow here on a massive scale. Inverbrates from Kąty area are also very well known. *Papilio machaon* can be spotted here very often. There are records of the occurence of *Colias myrmidone* and *Polyommatus thersites*. On northern slopes of the hill, weakly exposed to sun during the day, pine coppices and *Prunus spinosa* shrubs were formed.

Photograph 57. Kąty area (by K. Barańska)

Reason of including the object into the project

Kąty site is one of the most valuable locations, and by some botanists it is considered the most precious place where xerothermic flora exists within the entire Lublin region. It is the place where 2 species from Annex II to the Habitats Directive: *Cypripedium calceolus* (1902) and *Colias myrmidone* (4030), as well as many species listed in the Polish Red Data Book of Plants occur. Owing to the presence of orchids, xerothermic grasslands existing in this area are the priority habitat.



Photograph 58. Linum flavum (by P. Chmielewski)

Threats

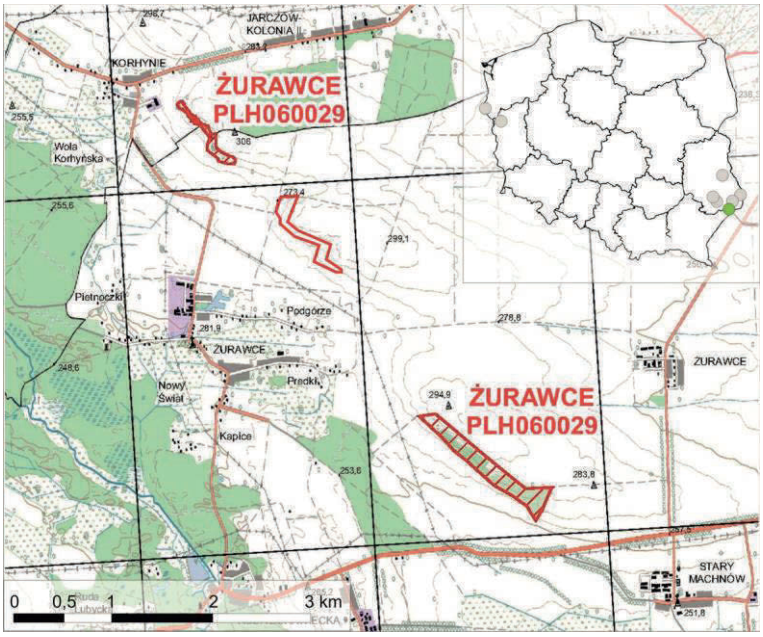
The main threats for this area are natural succession, unregulated tourist movements (trash dumping, treading, as well as picking up and replanting rare species of plants), intensive farming with the use of agrochemicals and annual ploughing of grassland fragments which border with

farmlands. Some fragments are threatened by spring burning that leads to invasion of plants like *Vincetoxicum hirundinaria* and *Anthericum ramosum.*

Undertaken actions
A1, A2, B1, C1, C3, C7, C8

3.6 Żurawce

Location
Żurawce area occupies 3 slopes within arable land in close neighbourhood of Korhynie, Żurawce and Machnów Stary localities in Lubycza Królewska municipality. The project covered the area of about 38,5 ha. Within the object there are: 2 ecological sites: Korhynie (5,74 ha) and Żurawce (3,45 ha), Machnowska Góra nature reserve (25,3 ha) and adjoining fragments of xerothermic grasslands with total surface of about 4 h.
The largest patch (Machnowska Góra reserve, whole located within plot no. 51, Żurawce geodetic district, Lubycza Królewska municipality) is owned by State Forests (The Tomaszów Lubelski Forest District, The Regional Directory of State Forests in Lublin). The other objects are crossed by numerous parcels in possession of private owners and partly by Agricultural Produce Cooperative in Żurawce (parcels no. 501/3 and 26, Żurawce geodetic district, Lubycza Królewska municipality).
Grounds which are ecological sites called Korhynie and Żurawce are classified as wastelands.
These layers were practically not used for years, only in some places they were ploughed farmlands to a small extent, local inhabitants picked up juniper there and beehives were placed. Machnowska Góra reserve was classified as a forest, while in 1980s it was afforested with *Pinus sylvestris* and *Pinus nigra*. Forest management was conducted within this area. In the past the whole area of Żurawce area was exploited by farmers and precious xerothermic species survived in bounds of wide balks.



Drawing 8. Locality of Żurawce area

Short characteristics of abiotic and biotic conditions
Żurawce area connects Roztocze Środkowe with Małe Polesie region. This area is characterized by the presence of chalk humps deprived of loess cover. On the three hills, on the edge of the Sołokija river valley, precious thermophilous plant communities joined to the area were formed.
The ground consists of rendzinas developed to various degree - skeletal soils formed from limestone and chalk marl. On hilltops there is a strong humus rendzina, similar to black soil.
In majority, gentle slopes have south-western exposure and are surrounded by farmlands.
On most of the steep slopes, with southern and south-western exposure, unique communities of xerothermic plants were formed, like: xerothermic grasslands (6210), fringe vegetation,

thermophilous shrubs, patches of *Pinus-Brachypodium pinnatum* association – pine forests with large volume of thermophilous species in undergrowth.
From the phytosociological perspective, there can be found xerothermic grasslands, which belong to *Origano-Brachypodietum pinnati, Thalictro-Salvietum pratensis* and *Inuletum ensifoliae* associations. fringe vegetation consist mainly of *Geranio-Peucedanetum cervariae* association.
Part of the area is covered by second after xerothermic grasslands Natura 2000 habitat - *Juniperus communis* formations (5130). The other shrubby vegetation are mainly extremely thermophilous patches of *Ligustro-Prunetum* association.
Part of the area consists of the abovementioned 20 to 25-year-old pine monocultures with *Brachypodium pinnatum* in the undergrowth and segetal associations.

Photograph 59. Juniperus communis formations in Żurawce area (by P. Chmielewski)

In the Żurawce site there are large numbers of plants under legal protection, e.g. *Anemone sylvestris, Orobanche lutea* and others. On the whole, in the area there are 20 species of protected plants. In the past, in Machnowska Góra reserve the presence of *Sicista subtilis* was recorded - a species of rodents, under special European Union legal protection. Unfortunately, fauna research that was led as a part of the project, did not confirm the existence of this species within the refugium. Moreover, the whole refugium area is a place where rare invertebrates like: *Colias myrmidone*, *Polyommatus thersites, Maculinea rebeli, Papilio machaon, Thymelicus acteon* and *Satyrium acaciae* can be found. There are also other rare species of insects and numerous spiders. A unique feature of the hill in Żurawce is a bunker from the times of the Second World War, which belonged to so called Molotov Line. Similar bunkers are found near Teniatyska and Mosty Małe.

Photograph 60. Initial xerothermic grasslands in Żurawce area (by K. Barańska)

Reason of including the object into the project

Żurawce is one of the most precious places where one can find xerothermic flora in the Lublin region. Within the whole area there are more than 200 species of vascular plants. It is characterized not only by its large area of model habitats from Annex II of the Habitats Directive, but also by its outstandingly rich flora and fauna. Among the species from Annex II of Habitat Directive the following can be found: *Sicista subtilis, Colias myrmidone* and *Cypripedium calceolus.*

Furthermore, numerous orchids are noteworthy. Apart from *Cypripedium* there are i.e.: *Orchis purpurea*, *Orchis militaris, Platanthera bifolia, Listera ovata, Epipactis helleborine* and *Epipactis palustris*.

Other species listed in the Polish Red Data Book of Plants, which can be found in there are: *Muscari comosum* and *Orobanche picridis.* Apart from that there are also other species rare and protected in the country.

In Żurawce, an unusual variety of entomofauna can be noticed. It is also possible to encounter rare species of invertebrates, like abovementioned *Colias myrmidone* and species from the Polish Red List: *Maculinea rebeli, Polyommatus thersites* and *Thymelicus acteon.*

The area plays a significant role in biodiversity preserve, not only regionally, but also at the country level, and in case of some species – for the entire Europe.

Photograph 61. Cyprypedium calceolus (by P. Chmielewski)

Threats

The most significant threat for the refugium is overgrowing of the grasslands and juniper forests by expansive shrubs, like *Prunus spinosa*, *Cornus sanguinea*, *Ligustrum vulgare* and different species of *Rosa* sp. During realisation of the project a rather small concentration of *Robinia pseudoacacia* was found. The serious threat for xerothermic grasslands are also the plantations of *Pinus nigra* and *Pinus sylvestris* in Machnowska Góra reserve, which were, in great measure, removed as a part of the project. In some places the area is penetrated by *Calamagrostis epigejos*. Another threat is also penetration of biogenes and pesticides from the neighbouring fields. The next serious danger is located near Machnowska Mountain population of *Heracleum sosnowskyi*, invasive and difficult to overcome herbaceous perennial. Decorative species of protected plants which grow here are often dug out or picked up in order to create bouquets.

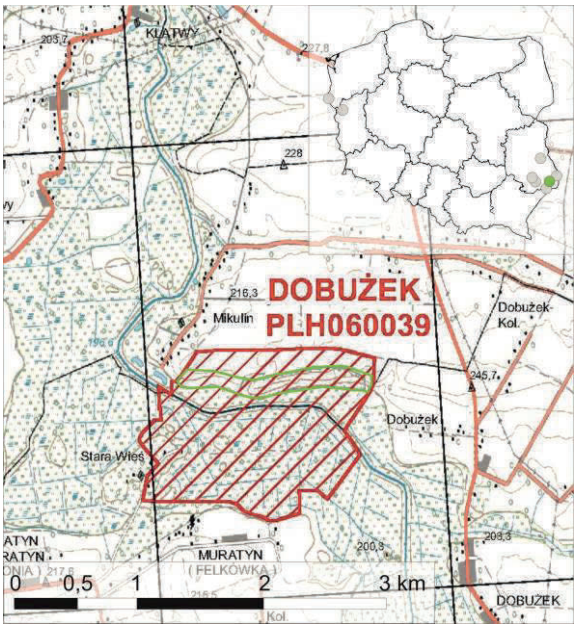
Undertaken actions

A1, A2, B1, C1, C2, C3, C4, C7, C8

3.7 Dobużek

Location

Dobużek Natura 2000 site (area of 199.3 hectares) covers the fragment of the Huczwa valley together with its high and steep slopes, which are located between the villages of Mikulin and Dobużek (near Tyszowce town, Łaszczów municipality). The project encompasses only a fragment of the site with xerothermic grasslands which developed on the abovementioned slopes. Since 1989 some of them have been under protection as Skarpa Dobużańska nature reserve with the area of 5.07 hectares. All xerothermic grasslands are privately owned.



Drawing 9. Location of the Dobużek site

Short description of abiotic and biotic conditions

Refuge Dobużek is situated in the Zachodniowołyńska Upland in the Grzęda Sokalska meso-region. The soils which one can find here are fertile chernozem, and in deeper layers it is chalk. On the southern exposed slopes, flowery grasslands of *Festuco-Brometea* (6210) developed belonging to the assemblage of *Thalictro-Salvietum pratensis,* which is rarely found in the Lublin region, as well as the community of *Brachypodium pinnatum*. The site is also overgrown with *Anthericum ramosum, Stachys recta, Dianthus carthusianorum, Salvia pratensis* and many more. Several plants among those taken under protection deserve particular attention: *Echium russicum, Aster amellus, Campanula sibirica, Aneme sylvestris, Cerasus fruticosa, Carex humilis*, several species of parasitic plants belonging to Orobanchaceae family, and many others. In total, in the Dobużek area there are 7 protected species.

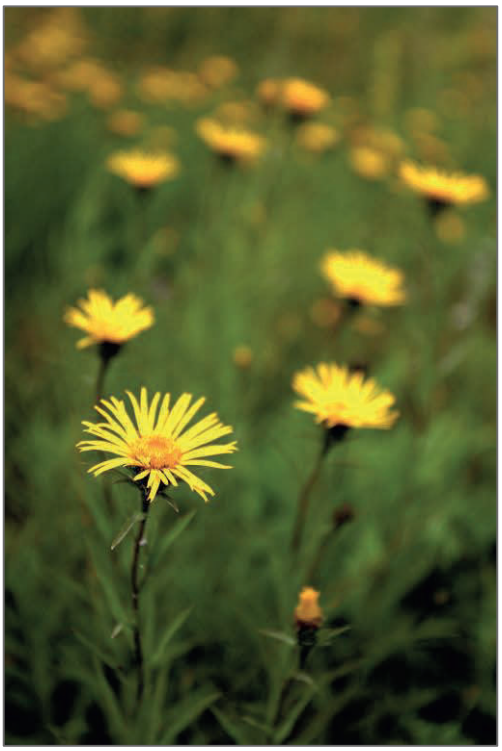
The fauna at this site is equally diverse. Formerly, *Mustela eversmannii* (no longer exists in Poland) and *Spermophilus suslicus* were observed. We may encounter here numerous butterflies, such as *Vanessa cardui* and *Papilio machaon*. Moreover, the whole area is characterized by attractive landscapes.

Photography 62. The Dobużek site (by P. Chmielewski)

The reason for including the object into the project

Xerothermic grasslands in Dobużek are one of the best preserved sites of this type in Lublin region. Skarpa Dobużańska natural reserve is one of the three sites where *Echium russicum* occurs

– a species from Annex II of the Habitats Directive. Besides, some of Poland's rarest xerothermic species may be spotted on the slope: *Cerasus fruticosa* (listed in the Polish Red Data Book of Plants), *Carex humilis, Inula ensifolia, Anemone sylvestris, Chamaecytisus ruthenicus.*
The slopes are places where also a diverse fauna occurs. At this site 3 species of inverterbates from Annex II of the Habitats Directive exist: *Maculinea teleius, Lycaena dispar, Maculinea nausithous*. Skarpa Dobużańska is also famous for the occurrence of two nature species: *Mustela eversmannii* and *Spermophilus suslicus*. However, none of these species has been seen there recently.
Dobużek covers a fragment of a small river valley which is a local ecological corridor stretching for the intensively managed farmlands.



Photograph 63. Inula ensifolia (by P. Chmielewski)

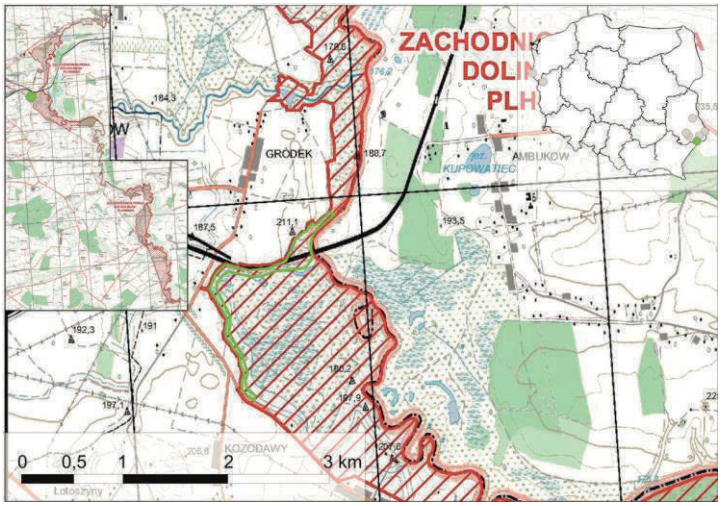
Threats
Due to specific geological and thermal conditions in Dobużek, the natural succession, which is the overgrowth of shrubs and trees, is not strong. Some large clusters of *Prunus spinosa* and single-seeded hawthorn *Crataegus monogyna* occur only in several ravines of the area. In some fragments of the slopes a negative phenomenon occurs of tight tissue of plant remnants (mainly grasses) which makes sprouting of the plants growing here harder. Due to the proximity of villages, the Dobużek area is excessively penetrated by people who pick the ornamental plants or dig them out. Unfortunalely, this is what happened to *Iris aphylla*, which once occurred here, similarly to *Echium russicum* specimen.

Actions undertaken
A1, A2, B1, C1, C5, C7, C8

3.8 Zachodniowołyńska Dolina Bugu

Location
Zachodniowołyńska Dolina Bugu site covers app. 25 kilometers of the Bug River valley between Husynne village in the North and Gołębie village in the South. The project embraces the steep slopes of the valley which are located in the vicinity of the villages of Gródek and Czumów (Hrubieszów municipality). Xerothermic grasslands on the slopes of the Bug river were placed under protection in the 1990s in the form of Błonia Nadbużańskie ecological site. Earlier, the only form of protection of the local xerothermic grasslands were 3 natural monuments of a small surface.

All land grounds located in the site included in the project are a private or joint property. Recently, several of the most valuable grounds were taken over by the Regional Directorate for Environmental Protection in Lublin.



Drawing 10. Zachodniowołyńska Dolina Bugu site with location of the area, on which the project was accomplished.

Short description of abiotic and biotic conditions

The site is located in Hrubieszowska Basin in the Zachodniowołyńska Upland. On both the steep slopes of the Bug river valley near Gródek and Czumów, and on the nearby roads and railway embankments, xerothermic grasslands of *Thalictro-Salvietum pratensis* association developed (6210). They are accompanied among others by small patches of *Brachypodium pinnatum* communities. A variety of xerothermic plants also appear there: *Thalictrum minus, Libanotis pyrenaica* and *Peucedanum alsaticum* (very rarely occuring in Lublin region), *Salvia pratensis, Centaurea scabiosa*, and other. In the Zachodniowołyńska Dolina Bugu area there are approximately 15 species which are under protection in Poland. Special attention is to be paid to *Echium russicum* and *Chamaecytisus albus*, which are listed in the Polish Red Data Book of Plants. Moreover, one can come across *Anemone sylvestris, Campanula bononiesis, Scorzonera purpurea, Gypsophila paniculata, Gentiana cruciata*, and other here.

In the past, *Spermophilus suslicus* occurred in the neighberhood of steep slopes. Nowadays, its scattered colonies can be encountered on the fields in the vicinity of Gródek. Another unique feature of Gródek is a medieval mound which belongs to Cherven Towns.

The reason for including the object into the project

Xerothermic grasslands near Hrubieszów are famous and one of the best preserved localities of this type in Lublin region. It is one of the three habitats of the species from Annex II of the Habitats Directive – *Echium russicum*. Besides, some of Poland's rarest xerothermic species occur on the slope: *Scorzonera purpurea, Cerasus frucicosa, Gentiana cruciata, Peucedanum alsaticum, Campanula bononiensis, Aster amellus, Chamaecytisus albus*, species from *Orobanchaceae* family and many other.

The slopes near Hrubieszów are a fragment of a crucial ecological corridor – the Bug river.

Photograph 64. Grasslands in Zachodniowołyńska Dolina Bugu included in the project (by P. Chmielewski)

Photograph 65. Echium russicum (by K. Barańska)

Threats

Due to the presence of croplands in the upper areas, the run-off of nutrients and plant protection substances is observed. They cause eutrophication of the top soil and getting the nitrophilous species and expansive species in the xerothermic grasslands. Because the slopes have not been used to date a tight tissue of plant remnants appeared. It has a negative impact on the population of xerothermic species. Paradoxically, a dense sward hinders or even makes it impossible for the shrub species to grow on the most of the Bug river's grasslands. Due to the proximity of villages, ornamental plants are often picked or dug out.

Actions undertaken

A1, A2, B1, C1, C5, C7, C8

4 Actions taken in the project and their effects

4.1. Description of actions and their effects

4.1.1. A1a – Gathering information about land ownership in the project's areas, determining boundaries of property.

Description of the action
Due to a complicated ownership structure of protected areas, it was crucial to acquire information concerning the owners, administrators, exact boundaries, land management records and other basic information in order to plan and carry out the actions included in the project (purchasing the grounds and establishing cooperation in reestablishing extensive grazing).
The action included above all: purchasing topographic maps from different years and obtaining extracts from land management records and excerpts from zoning plans.

Areas on which the task was completed
All areas included in the project.

Final effect of the action
For all areas covered by the project a kind of technical documentation has been prepared. The documents include information about locality, number of parcels and their owners/administrators, area, detailed description of boundaries and also type of usage nowadays and in the past.

4.1.2. A1b – Securing permits from appropriate institutions for the application of planned actions.

Description of action
In accordance with the provisions of Polish law, many actions concerning protected habitats, species and areas included in the project required obtaining permits from the landowners, local government institutions and administrators of protected areas in Poland.
The action included obtaining permits for: staying in the territory of natural reserves and active conservation works, collecting the seeds and ex situ multiplying of *Echium russicum* – a protected species, restoring the grazing in State Forests etc.

Areas on which the action was completed
Most of areas included in the project, but in particular the ones within natural reserves and on the territory of State Forests.

Final effect of the action
Several dozen permits were obtained from different institutions (The Ministry of Environment, Regional Directorates for Environmental Protection, State Forests etc.) which enabled the implementation of further activities included in the project.

4.1.3. A1c – Negotiating with landowners and managers their participation in project and then the methods, dates and scale of planned actions.

Description of action
It was necessary to establish which owners or administrators are interested in cooperation in terms of the project, and to what extent. One of the main aims concerned negotiations with private owners of grasslands, on which the extensive grazing or purchase was planned. Meetings with local communities were organized in order to inform them about the activities within the project and principles of cooperation between The Naturalists' Club and property owners. Moreover, meetings with administrators were held: State Forests, local institutions, Regional Directorate for Environmental Protection, etc. Meetings were a source of information concerning the public

feelings in a given region and attitude towards nature conservation and restoring the former farming methods on precious natural areas.

Photograph 66. Meeting with the local community in Niedzieliska area (by K. Barańska)

Areas on which the action was completed
All areas included in the project, especially private properties.

Final effect of the action
In total, in terms of the project 32 different meetings were held, including 7 group meetings (open meetings for all residents, property owners of a given area included in the project) and 25 direct meetings (meetings with individual property owners or administrators). In sum, 183 persons took part in the meetings.

4.1.4. A1d – Determining on-site, together with local experts, the methods, dates and scale of planned actions.

Description of actions
This action was necessary because of the need to take specific features of each area into consideration and establish the scope and methods of actions. Accurate and honest planning of particular actions in respect to individual areas was vital. It helped in systematizing actions and planning them in time properly. The task was accomplished with the active involvement of local experts who were employed in terms of the project. After getting to know the area, taking measurements and establishments with local experts for each area included in the project the basic action plan was defined.

Areas on which the task was completed
All areas included in the project.

Final effect of the action
The final effect of the action was the preparation of so called 'action plan' for each area included in the project. The action plan consists of a map with areas and dates of the conservation activities marked on it. During the term of the project the plans were modified on an ongoing basis, so that they were fully adjusted to changing conditions are the project realities.

Drawing 11. An example of action plan for Pamiecin natural reserve in Pamicin sub-area (Ujście Warty site) (source of background: http://www.geoportal.gov.pl/)

4.1.5. A1e – Preparing scientific documentation for 14 new protected sites.

Description of actions

In terms of the task, a full natural documentation for a number of precious areas, which had not been the subject of any form of protection, was created. The documentations were based on detailed terrain inventorying concerning plants, vegetation and the most important species of fauna. They provided the arguments for creating environmental protection forms, such as natural reserves, ecological sites and natural monuments. This activity was aimed at providing an effective and long-term protection of areas included in the project. Parts of the documentation were created by employed specialists. Documentation was sent to institutions responsible for the establishment of legal protection forms (Municipal Councils, Regional Directorates for Environmental Protection).

Areas on which the action was completed

Dolna Odra area (sub-areas: Krajnik, Nawodna, Raduń, Cedynia, Rudnica, Trutwiniec, Siekierki), Niedzieliska, Kąty, Żurawce, Zachodniowołyńska Dolina Bugu areas.

Final effect of the action

In terms of the action 15 natural documentations were created for the following forms of protection:

1. Natural monument „Storczykowa Skarpa" (Dolna Odra area, Nawodna sub-area)
2. Natural monument „Ciepłolubna Wydma" (Dolna Odra area, Siekierki sub-area)
3. Natural monument „Ostnicowa Skarpa" (Dolna Odra area, Siekierki sub-area)
4. Ecological site „Górki Krajnickie" (Dolna Odra area, Krajnik sub-area,)
5. Ecological site „Murawka w Nawodnej" (Dolna Odra area, Nawodna sub-area)
6. Ecological site „Skarpy w Zatoni" (Dolna Odra area, Raduń sub-area,)
7. Ecological site „Góra Ewy" (Dolna Odra area, Raduń sub-area)
8. Ecological site „Szawin" (Dolna Odra area, Cedynia sub-area)
9. Ecological site „Niedzieliska" (Niedzieliska area)
10. Ecological site „Kąty" (Kąty area)
11. Ecological site „Żurawce" (Żurawce area)
12. Ecological site „Korhynie" (Żurawce area)
13. Ecological site „Błonia Nadbużańskie" (Zachodniowołyńska Dolina Bugu area)
14. Natural reserve „Ostnice pod Rudnicą" (Dolna Odra area, Rudnica sub-area)
15. Natural reserve „Ostnice nad Kruszarnią" (Dolna Odra area, Trutwiniec sub-area)

4.1.6. A2 Preparation of conservation plans for 10 objects.

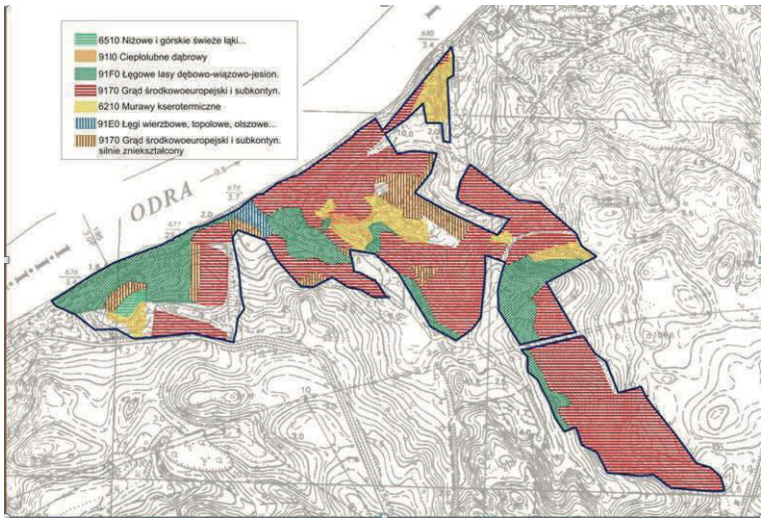
Description of actions
The action was aimed at creating plans for the protection of already existing or planned forms of protection, encompassing the most valuable areas included in the project – Natura 2000 sites, natural reserves, ecological sites or natural monuments. The creation of such plans is necessary to provide a proper and long-term protection of valuable natural habitat sites. Apart from plans preparation, the action was aimed at making efforts to establish the planned protection forms, and approving the already created documents by proper institutions. The task was partly the continuation of task A1e, in terms of which natural documentation for the planned protection forms was being prepared.

Areas on which the action was completed
Dolna Odra area (sub-areas: Raduń, Nawodna, Siekierki, Rudnica, Trutwiniec), Ujście Warty area (Górzyca sub-area), Stawska Góra, Żurawce, Kąty, Niedzieliska areas

Final effect of the action
In terms of the action the new 8 forms of protection were created (including 6 for which documentation in terms of task A1e was prepared):

1. Natural reserve „Słoneczne Wzgórza" (Dolna Odra area, Raduń sub-area)
2. Ecological site „Skarpy w Zatoni" (Dolna Odra area, Raduń sub-area)
3. Ecological site „Ostnice pod Rudnicą" (Dolna Odra area, Rudnica sub-area)
4. Ecological site „Ostnice nad Kruszarnią" (Dolna Odra area, Trutwiniec sub-area)
5. Ecological site „Murawy w Górzycy" (Ujście Warty area, Górzyca sub-area)
6. Natural monument „Storczykowa Skarpa" (Dolna Odra area, Nawodna sub-area)
7. Natural monument „Ciepłolubna Wydma" (Dolna Odra area, Siekierki sub-area)
8. Natural monument „Ostnicowa Skarpa" (Dolna Odra area, Siekierki sub-area)

For the above mentioned areas and for four Natura 2000 sites included in the project (Stawska Góra, Kąty, Żurawce and Niedzieliska) protection plans or conservations measures plans were made and approved. In total 12 documents were created.



Drawing 12. An example map from protection plan for Słoneczne Wzgórza natural reserve

4.1.7. A3 – Preparation of Habitat Action Plan for xerothermic grasslands in Poland.

Description of actions
For full and comprehensive protection of 6210 habitat in the country, the uniform plan of action is necessary – the so called Habitat Action Plan. This plan supports the main documents concerning the protection of habitats in the country, among others Habitats Directive. The task of HAP is to present the guidelines, methods and vital actions, which have to be taken into

account in order to protect xerothermic grasslands in a full and comprehensive way in the whole country.
It is a pretext for summing up and ordering the knowledge concerning the protection of xerothermic grasslands in Poland, as well as it allows to supplement the lacking information and to discuss the problems.

Areas on which the task was completed
All areas included in the project.

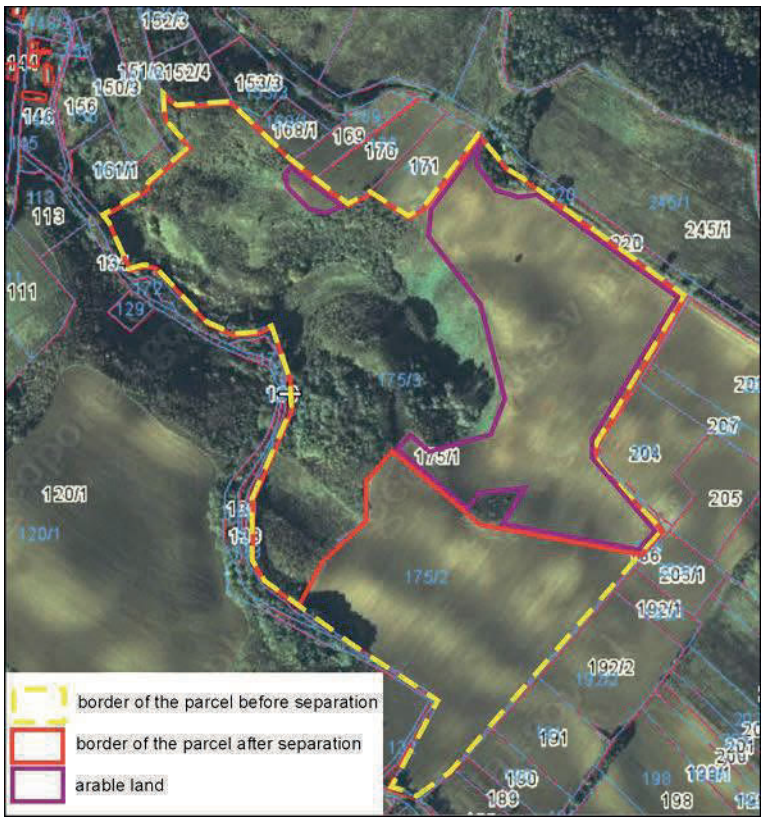
Final effect of the action
As a result of the action the professional plan of the protection of xerothermic grassland in Poland was created. The document was sent to the General Directorate for Environmental Protection.

4.1.8. B1 – Purchase of land with precious patches of xerothermic grasslands

Description of actions
In terms of the project the purchase of land, in case of which their owners refrained from starting extensive grazing (task C8 – description below), was planned. The project included ca. 90 hectares of land for potential repurchase. Due to the risk concerning the repurchase of land, beneficiaries assumed repurchasing of ca. 30 hectares.
The price of the land was established based on average land prices in Poland. To the price of grounds handling fees were applied (notarial fees and geodetic division of patches fees).
Firstly, repurchase included the most valuable grounds containing xerothermic grasses. The taking over by organisations which specialise in taking care of protected areas provides the grounds with professional and long-term care. Grounds on which grazing is not carried out overgo natural succession quickly or they are used improperly – afforestated, ploughed or become a place of aggregate mining. The Naturalists' Club as an organisation experienced in the protection of xerothermic grasslands and having a proper economic support (farm with a flock of Polish heath sheep) will ensure the professional protection of repurchased grounds.

Areas on which the task was completed
Dolna Odra area (Raduń and Krajnik sub-areas), Kąty area

Final effect of the action
During the project 6 areas (total area of 25.62 hectares) were repurchased, including one of the most valuable sites of xerothermic grasslands by the Odra river – grasslands near Zatoń Dolna (in terms of the project it was included in the scope of ecological site "Skarby w Zatoni").
The repurchased grounds became a property of The Naturalists' Club and will serve only as objects under protection.



Drawing 13. Plan of ground division near Zatoń in Dolna Odra area, for repurchase (red line) from a bigger site encompassing croplands (yellow broken line), purple line – area of croplands included in the repurchases ground. (source of background: http://www.geoportal.gov.pl/)

4.1.9. C1 – Cutting out or thinning expansive thickets of shrubs and trees

Description of actions

As an action preparatory to the implementation of other methods of protection (described in the tasks C4, C5, C6, C7 and C8), all areas included within the project were subjected to the removal of expansively invading shrubs and trees. Such actions constitute a basic method of protection of open semi-natural habitats, necessary to the improvement of sunlight exposure and thermic conditions for the vegetation, plants and fauna.

The removal was carried out in such a way as to simultaneously uncover the xerothermic grassland surface, and maintain the dynamic mosaic of habitats (shrubs, fringe and open spaces). The oldest and thickest vegetation was left, while most of the loose, young and expansively encroaching shrubs, with grassland plants still surviving in their undergrowth, were removed. Moreover, the natural boundaries between open habitats and shrubs or tree stands were shaped during the clearing wherever possible.

The shrubs of *Prunus fruticosa*, and the well-developed shrubs of the *Juniperus communis* were always left untouched.

Where possible, strips of shrubs were left on the boundaries between xerothermic grasslands and cultivated fields, so as to protect the former from biogenic inflow from the neighbouring farms.

Some of the shrubs were thinned, and not completely removed. This method was employed mostly in the case of juniper formations and stands of orchids, which prefer partial shade (e.g. *Cyprypedium calceolus*).

All non-native species (*Robinia pseudoacacia*, *Lycium barbarum*, *Mahonia aquifolium*, *Pinus nigra*, *Acer negundo* etc.) were always removed unconditionally.

The action was performed in the autumn/winter season (from September to March), so as to minimize the interference into the protected ecosystems.

In the case of those species which do not produce strong shoots from their cut trunks or roots, the removal was carried out only once. In the case of shrubs and trees with strong offshoots, it was followed by the elimination of shoots.

Photograph 67. Removal of the Pinus sylvestris on the grasslands near Nawodna, in the Dolna Odra area (by K. Barańska)

Areas on which the task was completed
Dolna Odra area (sub-areas: Kurów, Moczyły, Krajnik, Raduń, Nawodna, Kostrzynek, Rudnica, Trutwiniec, Siekierki, Gozdowice, Błeszyn, Czelin), Ujście Warty area (sub-areas: Czarnów, Górzyca, Owczary, Pamięcin), Stawska Góra, Niedzieliska, Kąty, Żurawce, Dobużek areas.

Final effect of the action
Removals were carried out in 3 stages (I – the turn of 2010/2011, II – the turn of 2011/2012, III – the turn of 2012/2013), on the total area of 76.34 ha. The action, apart from uncovering tens of hectares of xerothermic grasslands and successfully constraining the natural succession process, allowed for implementing further methods of protection: mostly grazing, grassland restoration, and channelling of tourist traffic.

4.1.10 C2 – Removal of non-native invasive species – *Heracleum sosnowskyi*

Description of actions
A large population of one of the most dangerous invasive species – *Heracleum sosnowskyi* – was identified in the Żurawce site and in its immediate vicinity. The aim of the project was to remove its main stronghold – an extensive, thick patch on the sides of a road running near the site, as well as all single specimens of the hogweed, scattered across the Żurawce area and along balks and dirt roads leading to it.
Heracleum sosnowskyi is a highly expansive and viable species, producing large quantities of seeds which survive long in the soil. As a big plant capable of rapid colonisation of new places, it presents a direct threat to the valuable vegetation of xerothermic grasslands in the Żurawce site. Its spread may be also detrimental to the natural merits of other areas outside. It should be emphasised that *Heracleum sosnowskyi* being a strongly stinging plant, poses a threat to humans.
It was decided that – within the framework of the project – the hogweed would be removed by repeated mowing of its denser patches throughout a year, so as to prevent the plant from blooming and producing seeds. The mowing was carried out on the total area of 2.5 ha, in the months of May, June, July and August, in the years 2010-2013. Single specimens, particularly those found within the limits of the Żurawce site, were cut manually beneath the root collar, so as to avoid offshoots.

Photograph 68. Manual removal of the Heracleum sosnowskyi (by K. Barańska)

Areas on which the task was completed
Żurawce area

Final effect of the action
During the four years of the project duration, 4 series of mowing of the densest hogweed patches were regularly carried out on the total area of 2.5 ha. Although this procedure did not result in a complete eradication of the hogweed, it significantly reduced the plant's population (we note ca. 50% decrease of the species cover) and prevented it from blooming and producing new seeds. Since the method has proved effective so far, this action will be continued also after the project's termination.
Another outcome was the elimination (by cutting the plants beneath the root collar) of all single specimens of the hogweed in the Żurawce site and in its immediate vicinity.

4.1.11 C3 – Removal of illegal landfills

Description of actions
Illegal trash dumps are the source of various kinds of pollution, toxic substances and biogenes, as well as of seeds of plants which are foreign to the grasslands (organic household waste) and present a threat to protected habitats. Besides, dumping trash on the grasslands inflicts direct mechanical damage on the habitats, and diminishes the grasslands' aesthetic merits.
Therefore, it was decided that all the largest known illegal trash dumps on the sites selected for the project would be removed. Wherever possible, the waste was sorted. The action was backed by ecological education, which involved, e.g., putting up information boards about the harmful influence of trash on the natural environment in the areas of removed dumps.

Areas on which the task was completed
Dolna Odra area (sub-areas: Nawodna, Kostrzynek, Rudnica, Siekierki), Ujście Warty area (sub-aras: Owczary, Pamięcin), Niedzieliska, Kąty, Żurawce, Stawska Góra areas

Final effect of the action
10 illegal trash dumps were removed as a result of this task. Specialist companies were hired to clear the six largest ones (in Nawodna, Sierkierki, Owczary, Pamięcin sub-areas; Niedzieliska and Kąty areas), with the remaining dumps being cleared by the project workers. Wherever possible, the waste was sorted into recyclable materials. From the largest dumps in Nawodna and Niedzieliska, tens of tons of trash were eventually transported.

Photograph 69. Removal of trash in the Niedzieliska site (by P. Chmielewski)

4.1.12 C4 – Restoration of degenerated xerothermic grassland patches

Description of actions

This is one of the most innovative and, at the same time, most controversial tasks included in the project. Its aim was to restore the grasslands in places where, for various reasons, they were completely damaged. Such areas of the habitat, due to their far-advanced degradation and, sometimes, extreme isolation, do not have the natural potential necessary to restore the complete species' composition.

Most of the areas selected for the experiment were overgrown with *Robinia pseudoacacia*. This invasive plant, apart from overgrowing the grasslands and pushing out xerothermic species, has a very detrimental influence on the habitat's substrate. Belonging to the *Fabaceae* family, the locust lives in symbiosis with rhizobia and enriches the grasslands' substrate with nitrogen. Moreover, the species has negative allelopathic effect on other plants. The locust is also highly viable. It sends up strong offshoots from its trunk, and even from small fragments of roots which are left in the soil. *Robinia pseudoacacia* issues large numbers of seeds, which retain their capacity for sprouting for a very long time.

In light of the above, conventional methods such as cutting or grazing do not produce the desired effect on the locust. In order to restore the grasslands in such places, the invasive species had to be entirely removed.

Photograph 70. Offshoots of Robinia pseudoacacia from a root left on a grassland (by K. Barańska)

Removal of the top layer of soil

In the areas overgrown by black locust, the process of restoration started with the rooting up of all specimens of this invasive species, and then with the removal of the top layer of soil, reaching 40 cm deep. What was thus removed was the upper layer of soil, 'polluted' by the locust's seeds and remains of its roots, and overly rich in nitrogen. Simultaneously, the lower layer of soil was exposed, containing more calcium carbonate and less nitrogen. Greater availability of calcium carbonate is conducive to the growth of xerothermic plants, which prefer alkaline soil. The next step was to carefully rake the surface and search through it for any potential remains of the locust roots.

A total of 3.1 ha of locust formations in Trutwiniec, Pamięcin, Owczary and Górzyca sub-areas were subjected to this procedure.

Soil samples were collected before and after the experiment, in order to examine the effect of the removal of the top layer on the chemical composition of the substrate. 18 samples were collected from each of the areas, every one containing around 200 g of the substrate. They were subsequently subjected to an analysis of pH (measured in KCl and H_2O), calcium carbonate content ($CaCO_3$, mg/1 kg of dry weight), percentage of organic nitrogen (N) and carbon (C), and mutual proportion of carbon and nitrogen (C:N).

Photograph 71. Removal of the top layer of soil in the Trutwiniec sub-area (Dolna Odra site) (by K. Barańska)

Photograph 72. Removal of the top layer of soil in the Pamięcin sub-area (Ujście Warty site) (by P. Pluciński)

Restoration of grasslands by sowing and transplantation of implants

Thus prepared surface was covered with a grid of cells of side length of 15 m, and two methods of grassland restoration were practised on it: the sowing of seeds, and transplantation of grassland implants. Some of the cells were left out as testing spaces, with the grassland restoration taking place in a natural way – through the succession of species from the neighbouring grasslands. Where possible, the cells were designated in such a way so as not to apply the same restoration method on any adjacent spaces.

The seeds were collected by two different methods in the closest possible areas of well-preserved grasslands, so that the local gene pool of xerothermic species would not be disturbed. Seeds sown in some of the cells were collected selectively (only the seeds of xerothermic species, desirable in the grasslands, were included in this mix), while those sown in the others were collected unselectively, belonging to all grassland species.

The implants was also sourced from well-preserved grasslands in the immediate neighbourhood of the areas subjected to transplantation. The extracted fragments had the average size of 40 cm x 60 cm x 30 cm, with the latter dimension representing the implant's volume. 4 implants were placed in every of the 15-metre side length cell. In this way it was possible to transfer whole plants and the seed pool present in the soil. There were no foreign species in the transplanted fragments.

Photograph 73 and 74. Extracting and transplanting grassland implants (by K. Barańska)

Covering the shoots of shrubs with black foil

Another experiment aimed at the restoration of degraded grassland patch was to cover the expansive shoots of shrubs with black foil. The lack of sunlight was expected to cause their decay. This method was implemented on the total area of 0.5 ha in the Stawska Góra nature reserve. On the selected fragment of grasslands, the shoots of previously cut out shrubs overgrew almost the entire area. No xerothermic species were identified on the site. Before the foil was spread, the area had been carefully searched for potential burrows, nests and other places of animal habitation. Where any of these were found, the surface intended for covering was moved elsewhere.

The thick, black, opaque construction foil was spread and then secured with metal rods driven into the ground, and stones and earth placed around the edges. The experiment was launched in June 2012, and finished in July 2013. During that time the state of the foil was examined every month, and all necessary repairs were carried out. Once removed, the foil was used again on the farm of the Naturalists' Club in Owczary.

Restoration of grasslands by the spreading of hay

Some of the grounds bought for the project's purposes were once grasslands, turned into cultivated fields within the last few decades. In order to accelerate the regeneration of these valuable habitats, yet another form of restoration was employed on the 8.7 ha of ploughed grasslands in the Kąty area and the Raduń sub-area (Dolna Odra area) – namely, the spreading of hay from the neighbouring patches of thermophilous grasslands. In the spring, the surface of the field was ploughed, in order to facilitate the sprouting of corn seeds remaining after the times of cultivation. Once the corn seedlings appeared, the surface was disked and harrowed. Thus prepared substrate was covered with hay containing the desired thermophilous species. The hay was collected from the grasslands in August, then dried, and spread on the surfaces selected for restoration.

Photograph 75. Expansive shoots of shrubs covered with black foil in the Stawska Góra site (by P. Chmielewski)

Manually removing of invasive plant species

Where the invasive plant and shrub species had already encroached, but the grasslands vegetation was still visible, attempts were made at the manual removal of undesirable species. The uprooted species were mostly: *Mahonia aquifolia*, *Solidago canadensis*, and seedlings of *Lycium barbarum* and *Robinia pseudoacacia*. The procedure was further extended over the native expansive species, such as *Vincetoxicum hirundinaria*, *Calamagrostis epigejos*, *Rubus* sp. and seedlings of expansive shrubs.

This action was performed in the Żurawce sites (the Machnowska Góra reserve), Dolna Odra site (sub-areas: Kostrzynek, Rudnica, Bleszyn, Trutwiniec, Krajnik) and Ujście Warty site (Czarnów sub-area), on the total area of 7.1 ha.

Raking out felt and needle cover

One of the most negative effects of the lack of grazing on the grasslands is the accumulation of the so-called 'felt' - a layer of plant remnants. It prevents the light-demanding seeds from sprouting, and consequently modifies the abiotic conditions of the xerothermic grassland habitats.

The raking out of typical felt was carried out partly to strengthen the population of *Echium russicum* (see the description of task C5), and partly in those areas selected for restoration where a thick needle cover remained after the removal of a monoculture of pine.

Photograph 76. Ploughed grasslands near Zatoń Dolna, Dolna Odra area, selected for restoration (by K. Barańska)

During a 2-day stay in the Machnowska Góra reserve (Żurawce site), the Naturalists' Club workers and around 15 volunteers from the Zamojskie Naturalist Society raked 0.6 ha of grasslands which were once forested with *Pinus nigra*. Thus collected material was moved out of the reserve and composted by a local farmer. A similar action took place in the sub-area of Rudnica (Dolna Odra site) where 0.2 ha of land was raked after the removal of a monoculture of *Pinus sylvestris*. The needle cover and a layer of moss were carefully raked out, reaching down as deep as the mineral substrate. The work was done manually, by means of light wooden (or, less frequently, metal) hay rakes. It was quite easy to perform, but took a relatively great physical effort. Difficult terrain conditions and natural merits of the grasslands made it often impossible to enter the raked surface with heavy machines, so the material had to be moved out manually. This purpose was served perfectly by large, steady sheets.

Photograph 77. Raking out of needle cover in the Żurawce site (by P. Chmielewski)

Areas on which the task was completed

Ujście Warty area (sub-areas: Owczary, Pamięcin, Górzyca, Czarnów), Dolna Odra area (sub-areas: Trutwiniec, Rudnica, Bleszyn, Kostrzynek, Raduń), Stawska Góra, Żurawce, Kąty areas.

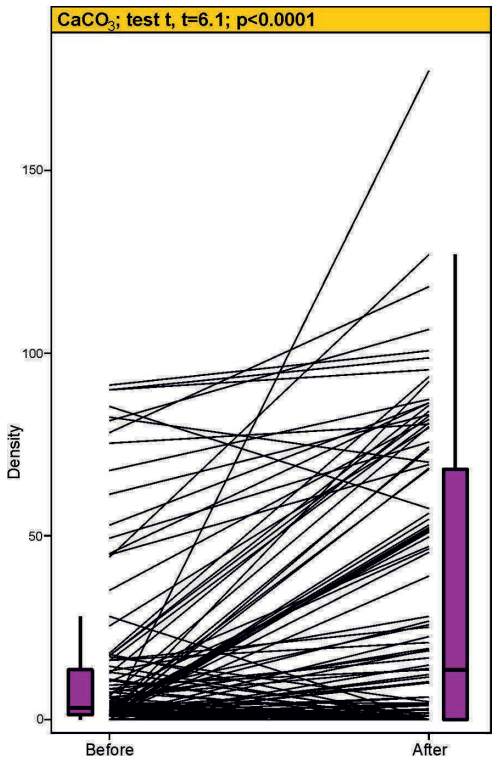
Final effect of the action

Protective actions specified in task C4 were carried out on the total area of 20.2 ha. They include the initiation of the process of the habitat's regeneration from the state of complete damage (caused by total overgrowth, afforestation, ploughing) on the total surface of 13.1 ha. On the 7.1

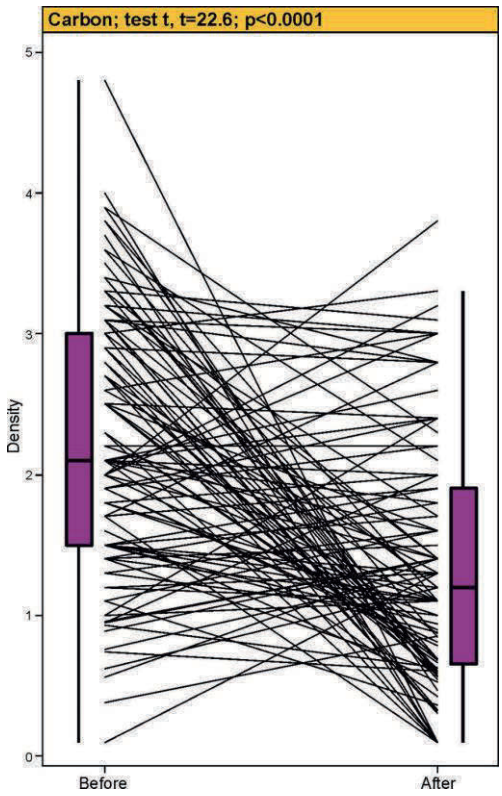
ha of land where the xerothermic vegetation was still visible, uprooting of invasive and expansive species was performed.

The restoration of species-rich and stable xerothermic grasslands is a very long-lasting process. At least 5-10 years will surely have to pass before the actions described above bring any results. However, the Naturalists' Club has observed some early positive effects of the experiments already after a year. First seedlings of xerothermic species have appeared on the restored surfaces, including rare plants strictly associated with this type of habitats, such as *Stipa capillata*. Moreover, after a year the following species have been identified on the surfaces restored through the removal of the top layer of soil: *Salvia pratensis*, *Origanum vulgare, Festuca psammophila, Festuca trachyphylla*, *Achillea pannonica*, *Brachypodium pinnatum*, *Centaurea stoebe* and *Centaurea scabiosa*. High percentage of the flora on the restored surfaces is still constituted by segetal and ruderal species, but their population is steadily declining with every passing year.

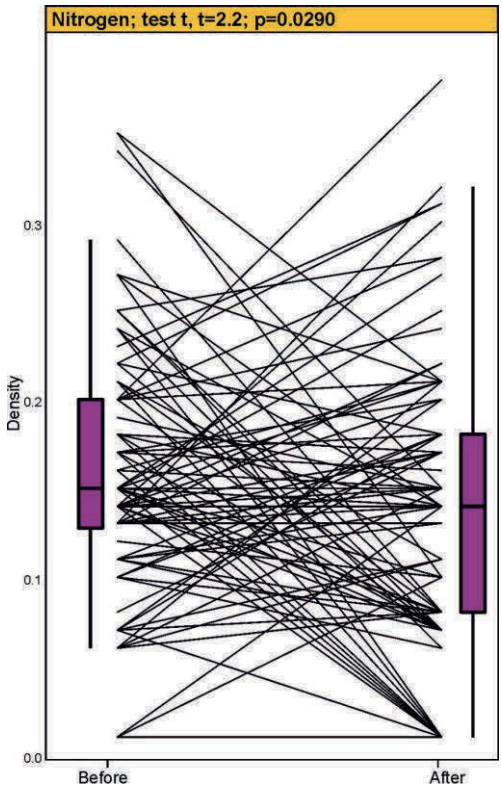
The analyses of soil have also confirmed the positive effect of the removal of its top layer. A significant increase in the calcium carbonate content has been noted, as has consequently been the rise of the substrate's pH, which is definitely favourable for the grasslands. At the same time, the carbon and nitrogen content has diminished, which is also conducive to the development of xerothermic vegetation.



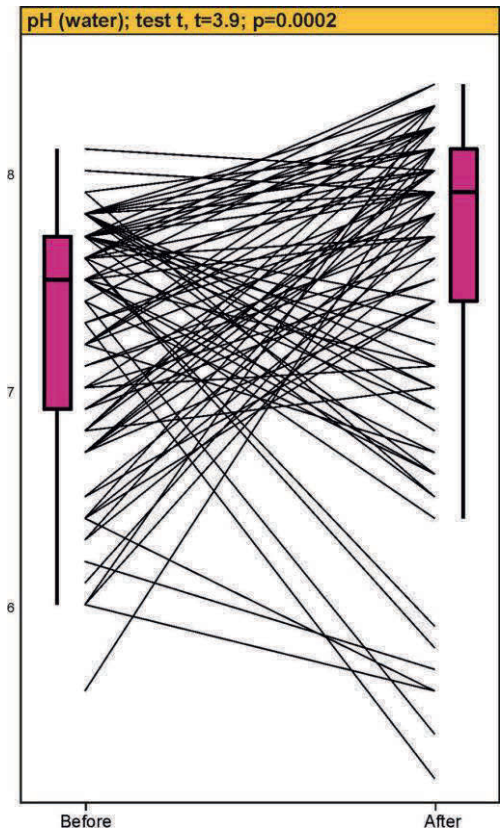
Drawing 14. Amount of $CaCO_3$ in the top soil layer before and after the soil removal action. Vertical lines inside the boxes indicate median, boxes cover 50% of observations, vertical lines indicate all observations excluding outliers. Skewed lines in the middle of the chart shows values before and after at particular paired plots. Result of t-test for paired samples is given in the top.



Drawing 15. Amount of carbon in the top soil layer before and after the soil removal action. Vertical lines inside the boxes indicate median, boxes cover 50% of observations, vertical lines indicate all observations excluding outliers. Skewed lines in the middle of the chart shows values before and after at particular paired plots. Result of t-test for paired samples is given in the top.

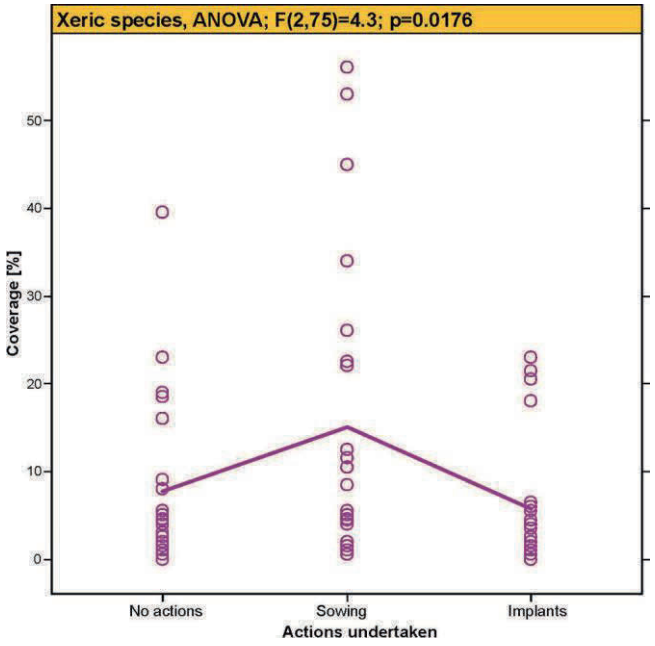


Drawing 16. Amount of nitrogen in the top soil layer before and after the soil removal action. Vertical lines inside the boxes indicate median, boxes cover 50% of observations, vertical lines indicate all observations excluding outliers. Skewed lines in the middle of the chart shows values before and after at particular paired plots. Result of t-test for paired samples is given in the top.

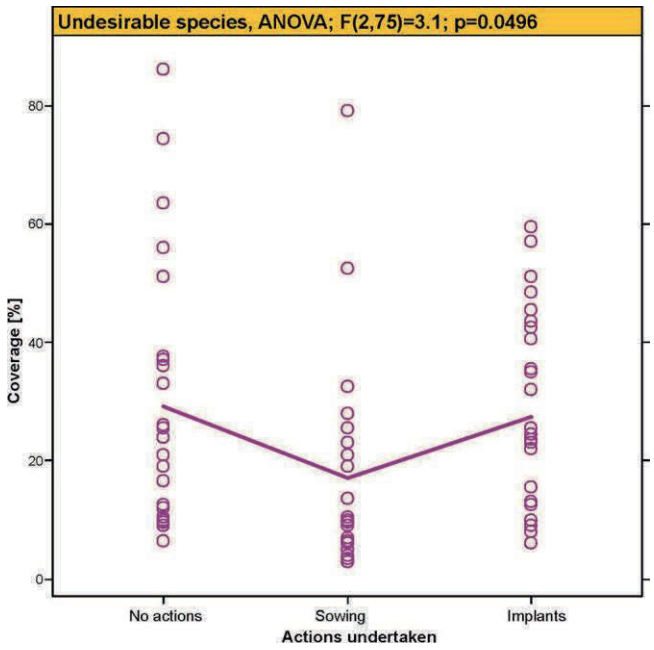


Drawing 17. Variability of pH in the top soil layer before and after the soil removal action. Vertical lines inside the boxes indicate median, boxes cover 50% of observations, vertical lines indicate all observations excluding outliers. Skewed lines in the middle of the chart shows values before and after at particular paired plots. Result of t-test for paired samples is given in the top.

Of the three applied methods of grassland restoration in areas where the top layer of soil was removed (seed sowing, transplantation and natural succession), the seed sowing was judged the most effective one.

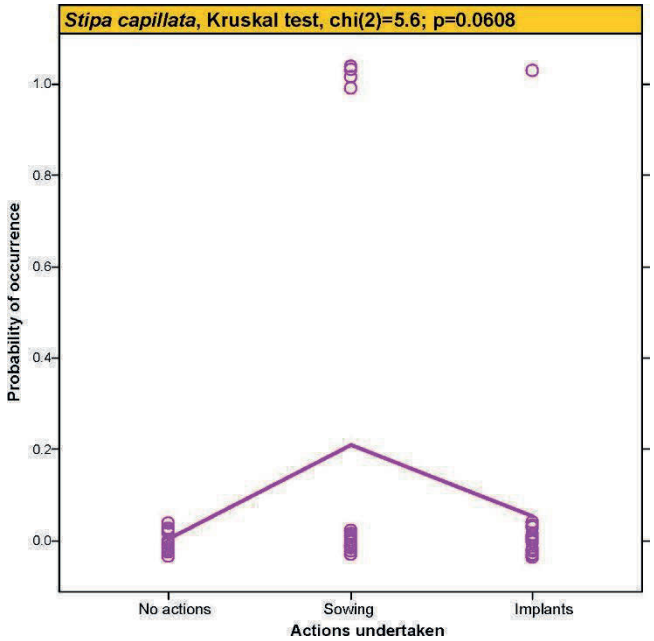


Drawing 18. Mean cumulative plot coverage by all xerothermic plant species in relation to actions undertaken on the xeric grasslands. The line indicates mean coverage, dots indicate observations (coverage) from particular grasslands. Results of ANOVA test is given on the top.

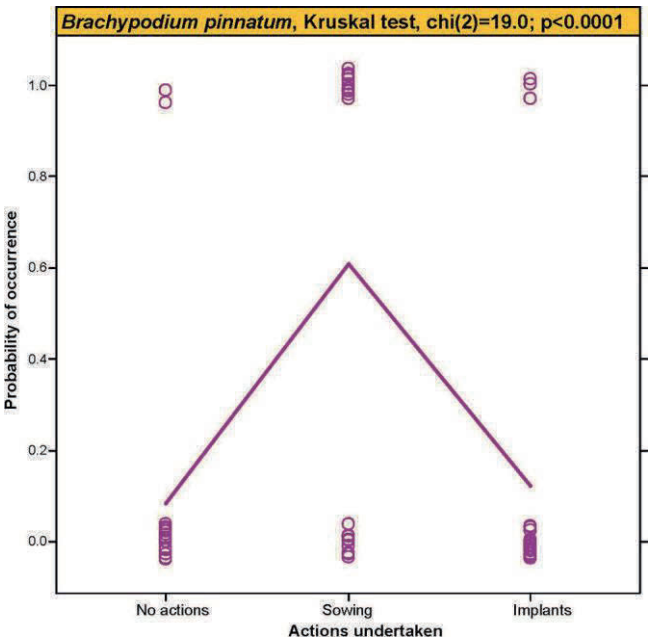


Drawing 19. Mean cumulative plot coverage by all undesirable plant species in relation to actions undertaken on the xeric grasslands. The line indicates mean coverage, dots indicate observations (coverage) from particular grasslands. Results of ANOVA test is given on the top.

Positive effects of the actions undertaken within the framework of this project have also been observed in the case of main species forming xerothermic grasslands in the northwestern Poland, where these habitats were restored – *Stipa capillata* and tor-grass *Brachypodium pinnatum*.
Covering with black foil has also brought positive results. It has been observed that over 95 % of offshoots of expansive shrubs have died.



Drawing 20. Probability of occurrence of Stipa capillata in the controlled plot (releve) in relation to actions undertaken on the xeric grasslands. The line indicates mean probability, dots indicate observations (presence/absence) from particular grasslands. The result of Kruskal-Wallis test is given on the top, slight random noise along the y-axis was added to avoid symbol overplotting.



Drawing 21. Probability of occurrence of Brachypodium pinnatum in the controlled plot (releve) in relation to actions undertaken on the xeric grasslands. The line indicates mean probability, dots indicate observations (presence/ absence) from particular grasslands. The result of Kruskal-Wallis test is given on the top, slight random noise along the y-axis was added to avoid symbol overplotting.

The removal of felt and needle cover has also produced positive effects already in the first year after the procedure. Seedlings of xerothermic plants have appeared on the raked grasslands. In the area of Machnowska Góra, due to the closeness of cultivated fields, a large number of seedlings of segetal and ruderal species have been observed as well. However, it has to be emphasised that this is a natural phenomenon in a regenerating habitat. In time, the unwanted species shall be driven out by typical grassland species.

Simultaneously, besides the direct effects in the form of restoration and extension of the habitat's area, several indirect effects have been achieved as well. The populations of rare species, such as *Stipa borysthenica*, have been strengthened. On larger sites (e.g., Górzyca, Owczary), the strongholds of black locust were eradicated. Moreover, different methods of grassland restoration which had hitherto never been used in Poland were now tested and compared.

4.1.13 C5 – Strengthening the population of *Echium russicum*

Description of actions

One of the project's objectives was to strengthen the population of one of the rarest xerothermic grasslands species in Poland – *Echium russicum*. At present, this species has 3 sites in Poland, and is extremely sparse in all of them. All 3 are located in the Lublin voivodeship: 1) Skarpa Dobużańska reserve (Dobużek site), 2) grasslands on the slopes of the Bug river valley near Czumów (Zachodniowołyńska Dolina Bugu site), and 3) Posadów Natura 2000 site (eventually not included in the project). At the project's inauguration, four single specimens were identified in the Skarpa Dobużańska reserve (and only one of them blooming!), also four in Posadów, and already none on the slopes near Czumów. The aim of this task was to grow the *Echium russicum* seedlings ex situ, from seeds collected on its natural sites. Since the number of seeds found on the surface in Skarpa Dobużańska and Posadowo was very scanty, the seeds were finally procured from the Botanical Garden in Lublin, which keeps *Echium russicum* specimens from the slopes near Czumów. While the project lasted, the best specimens of the grown seedlings were selected every year, and then planted on natural sites. This was done in groups of 10-20 plants, as the experience of the Lublin Botanical Garden's employees was that such a system grants the seedlings greater survivability. The planting was carried out every year in autumn. During the first few years the land around the newly planted specimens was carefully plowed, and the entire grassland is mowed every year in late autumn.

On the natural site of *Echium russicum* in Dobużek, the flat was additionally raked out. Since 2011, around 20 ares of the reserve's area have been manually raked. At first, the surface was strongly overgrown with tor-grass *Brachypodium pinnatum* – grass species typical for xerothermic grasslands, yet sometimes, due to the lack of grazing, acquiring the features of expansive species. The dense layer of dry tor-grass leaves is carefully raked out once every autumn (in September or October, depending on the weather), when the seeds of xerothermic species are already issued. Light wooden hay rakes are the best tool for this job. It is quite easy to perform, but takes a relatively great physical effort. A large part of dead leaves is still connected to the living plants and during the raking must be pulled away from the root system. Besides, in this kind of areas a relatively thick layer of moss is usually produced apart from the flat, and also has to be removed by raking. Moreover, the Dobużek grasslands are subjected to grazing, as part of the action C8 (see the description below).

Photograph 78. Planting of Echium russicum on the Zachodniowołyńska Dolina Bugu site (by K. Barańska)

Areas on which the task was completed
Dobużek and Zachodniowołyńska Dolina Bugu areas

Final effect of the action
In this way the population of *Echium russicum* was increased to 160 plants in the Skarpa Dobużańska site, and to 120 plants on the slopes near Czumów.
The area of 3 ha has been subjected to regular mowing, and the area of 0.2 ha to the raking out of flat.

Photograph 79. Participants in an international conference, organized as part of the project, admire the effects of the reintroduction of Echium russicum on the Zachodniowołyńska Dolina Bugu site (by K. Barańska)

4.1.14 C6 – Testing of the mobile pasturage method

Description of actions

As part of the project, the Naturalists' Club tested the new method of the so-called 'mobile pasturage'. It is a perfect solution for small and isolated grassland patches which are far removed from human dwellings, and where the traditional form of pasturage is impossible. It creates an opportunity to save little fragments of grasslands, which frequently comprise a valuable refugium of xerothermic vegetation, and whose protection by regular methods is too complicated or completely unprofitable to the owners.

In this light, the perfect trial grounds for this method were small, yet extremely valuable patches of xerothermic grasslands in the Mieszkowice, Chojna and Ośno Lubuskie Forest Districts in the Dolna Odra and Ujście Warty sites. The Naturalists' Club selected 21 separate patches of grasslands for this purpose, of total area of 15.87 ha. In subsequent years, two other areas located outside the State Forests were added to the experiment – a plot in Zatonia Dolna (Raduń sub-area, Dolna Odra site) purchased within the project's framework, and a plot in the Krajnik sub-area (Dolna Odra site) which is intended for purchase. Owing to that, the grazed surface has been extended by another 12.92 ha.

The essence of the method was to transport or lead a flock of Polish heath sheep and goats from one area to another. The sheep and goats were chosen because, firstly, these were the animals originally put to pasture on the xerothermic grasslands in this region, and secondly, because they are small and easy to transport. The pasturage was taking place only in the growing seasons – from (April) May to September (October), in a rotary way, subsequently on different areas, for the several years of the project's duration. At first the animals were put out to graze only on the best-preserved surfaces, and later on the more degraded ones. This was done in order to facilitate the dispersal of xerothermic species' seeds through endo- and exozoochory.

Every grazed area was enclosed with wooden posts (black locust or oak posts, 1.5 metre-high, at least 10 cm in diameter, secured at the point of contact with ground, spaced by around 5 m). An electric fence would be put up on them during grazing. A special kind of electric fence for small animals was used, in the form of a net 110 cm high. It was powered by an energiser connected to an accumulator charged on the spot by a solar battery. The fence was relatively light and easy to dismantle. When the grazing of one grassland patch was completed, the fence was taken down and moved to the next area. Owing to that, wild animals had access to the grasslands after grazing, which would have been limited in the case of permanent fencing. A wooden shelter for animals was also erected in each of the grasslands. Areas of around 1 ha were enclosed with the fence, and every one of them was used as a pasture for no longer than 1-2 weeks at a time.

Photograph 80. Fence put up in an area selected for grazing (by K. Barańska)

Photograph 81. Putting up fences in areas selected for grazing (by P. Pluciński)

The flock was being monitored all day and all night by two employees hired for a pasture season, and sometimes by volunteers. The animals were transported in the Naturalists' Club's truck, specially adapted for the purpose. The shepherds lived in a trailer, moved from one grassland patch to another along with the sheep.

Photograph 82. In the foreground – Polish heath sheep grazing; in the background – the shepherds' camp (by K. Barańska)

Photograph 83. Sheep shelter erected on a grassland selected for grazing for task C6's purposes (photo by K. Barańska)

Beside transporting and monitoring the sheep, the shepherds were obliged to regularly provide the animals with fresh drinking water, and to carry out minor jobs for the active protection of grasslands (removing the shrubs with shears, mowing the surface, uprooting invasive species, etc.).

Areas on which the task was completed
Dolna Odra area (sub-areas: Krajnik, Raduń, Kostrzynek, Rudnica, Trutwiniec, Gozdowice), Ujście Warty area (sub-area: Górzyca).

Final effect of the action
During the project's 4-year term, 23 patches of xerothermic grasslands, of total area of 28,79 ha, were subjected to regular mobile pasture. The new method of grazing on small and extremely isolated grassland patches was tested and improved.

Photograph 84. Sheep put out to graze (by K. Barańska)

4.1.15 C7 – Chanelling tourist

Description of actions
Unchanelled tourist traffic in different areas included in the project resulted in mechanical damage to the sensitive xerothermic vegetation, in tramping down and littering of grasslands, and in people riding cross bicycles and quads over them. Wild paths, often running near rare sites and

impressive species, created opportunities for digging out and plucking such plants. In many cases, such behaviour was probably due to the tourists' lack of awareness and knowledge.
The essence of this action was to install items of outdoor furniture which would channel the tourist traffic in areas threatened by a strong tourist pressure, and minimize the negative effects of human presence on the grasslands which were described above.
The planned infrastructure was to include educational trails, viewing points, information boards, and various shelters and resting places, which would all entice the tourists into less vulnerable, yet aesthetically exceptional grasslands.

Photograph 85. Construction of a viewing point in the Raduń sub-area (Dolna Odra site) (by P. Pluciński)

Areas on which the task was completed
Dolna Odra area (sub-areas: Raduń, Nawodna, Rudnica, Kostrzynek, Trutwiniec, Siekierki, Gozdowice, Błeszyn), Ujście Warty area (subareas: Górzyca, Owczary, Pamięcin), Stawska Góra, Niedzieliska, Kąty, Żurawce, Dobużek, Zachodniowołyńska Dolina Bugu areas

Final effect of the action
The outcome of this task was the creation of:
3 educational trails – one in every of the 3 sits of Żurawce, Dolna Odra (Kostrzynek sub-area) and Ujście Warty (Owczary sub-area).
4 viewing points – two in the Dolna Odra site (sub-areas: Kostrzynek and Raduń), one in the Ujście Warty site (Owczary sub-area), one in the Żurawce site.
65 information boards of various sizes – in all sites included in the project.
6 silt fences for controlling erosion – all in the Ujście Warty site (sub-areas: Pamięcin and Owczary).
22 benches – all in the Ujście Warty and Dolna Odra sites.
3 shelters – one in the Dolna Odra site (Gozdowice sub-area), two in the Ujście Warty site (Owczary sub-area).
The facilities listed above increased the accessibility and attractiveness of the grasslands, characterised by outstanding aesthetic merits and, at the same time, by relatively high resistance to anthropomorphic pressure. Consequently, the sites of rare species or vulnerable patches of naturally valuable habitats were relieved.
The action has certainly not solved the problem completely, but it has definitely improved it in a significant degree. It has also made it possible to use the areas for educational and didactic purposes.

Drawing 22. Example of an information board created for the project

4.1.16 C8 – Reinstating extensive grazing on xerothermic grasslands

Description of actions

As part of the project, the restoration of extensive animal grazing was implemented also in co-operation with local communities, and particularly with the private owners of patches on which the grasslands are located.

Beside organizing many informative meetings and courses, and distributing educational materials, it was necessary to offer the locals some material enticement into the return to the old shepherding traditions, and to help them organize the pasturage on the grasslands.

Around 90 hectares of land were selected for the project, all located within the sites of Dolna Odra, Niedzieliska, Kąty, Żurawce, Dobużek and Zachodniowołyńska Dolina Bugu Natura 2000 sites. Next, throughout the whole period of the project's lasting, there were talks with the owners of these patches about the potential co-operation. In return for using their land as pastures again, the farmers would get animals, trailers for their transportation, fences, animal shelters and other equipment necessary for the restoration of grazing. Additionally, the Naturalists' Club offered to remove the shrubs on their patches while preparing them for pasturage. Those farmers who entered into co-operation had to agree to graze the animals on conditions of the Naturalists' Club, throughout the whole period of the project's lasting, and for at least 5 more years after its termination.

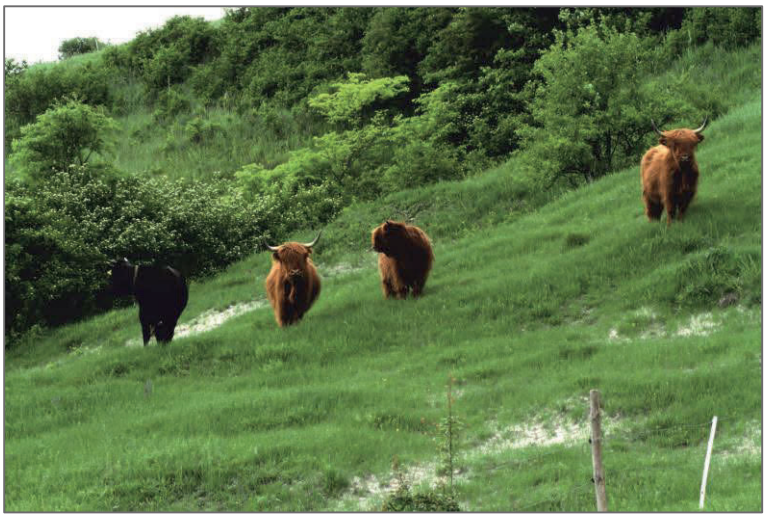
The final decision on the choice of grazing animals depended on the local tradition and the characteristic features of particular areas (species composition, degree of degradation, abiotic conditions, etc.), as well as on the owners' preference. In this way, the co-operation with the Club was meant to be more attractive to the landowners, and therefore to potentially improve the chances of the restoration of extensive grazing on the grasslands.

Areas on which the task was completed

Dolna Odra area (sub-areas: Czelin, Nawodna, Raduń), Żurawce, Dobużek areas.

Final effect of the action

Contracts were signed with six landowners. Owing to that, the extensive maintaining of the grasslands was restored on the total area of 38.6 ha.



Photograph 86. Highland cattle grazing on grasslands in the Dobużek site, as part of the task C8 (by K. Barańska)

4.1.17 D1 – Preparing, publishing and dissemination of educational materials

Description of actions

The aim of this task was to spread the information about the project, and to educate social groups which are directly or indirectly associated with xerothermic grasslands. Particular social groups may be interested in various aspects of grassland preservation or use, and may derive different benefits from both. Accordingly, there is a need to create different materials, which would reach different recipients.

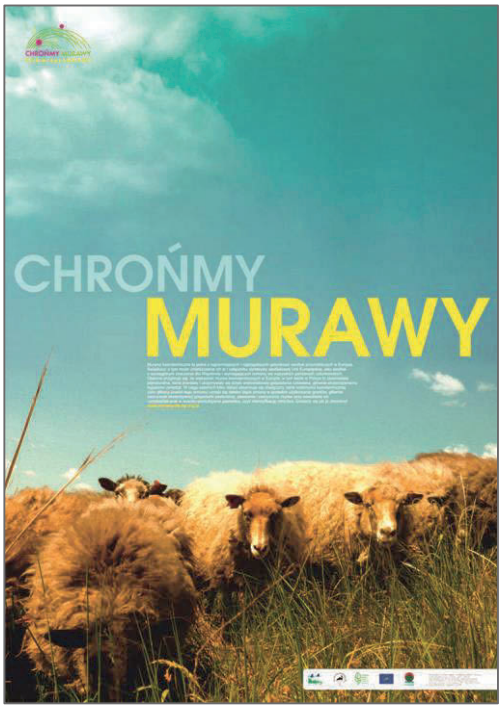
Various folders, brochures, posters and information boards were planned to be created as part of this project.

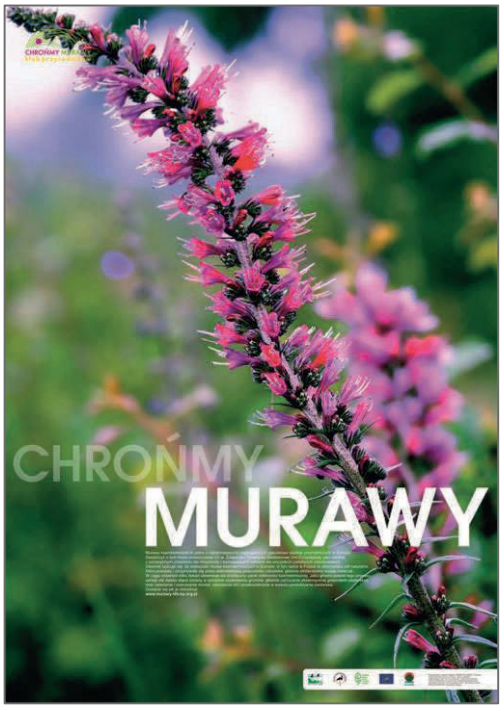
Final effect of the action

In result of this task, the following educational materials were created and widely distributed among different social groups throughout the whole period of the project's lasting:

- A folder, in two language versions (Polish and English, with summaries in German and Ukrainian), containing basic information about the project (2500 copies were printed in total).
- A set of brochures about xerothermic grasslands, their problems and methods of protection, for three different social groups – farmers, foresters, and children and teenagers (1500 copies were printed in total).
- Eight kinds of posters promoting xerothermic grasslands (4000 copies were printed in total).
- Two kinds of information boards about xerothermic grasslands for schools (a total of 24 copies were printed and sent to schools).
- A CD with grassland sounds (1000 copies were issued).

Drawing 23. Information board for schools, created as part of the project





Drawing 24 and 25. Examples of posters, created as part of the project

4.1.18 D2 – Creation, publishing and distribution of an album about xerothermic grasslands in Poland

Description of actions

The important element of protection of xerthermic grasslands is to make the society aware of their wide values not only natural but also cultural and aesthetic ones. The album's aim is to fulfill this task. It is mainly addressed to the people who are not directly associated with grasslands protection and laymen in the field of environment protection.

The photos which were taken on grasslands included in the project, among others by the participants of outdoor photography, arranged within the task and by the workers of the project have been placed within the album.

Photograph 87 Thanks to open-air photography in Owczary most of the photos used in the album could be taken (by K. Barańska)

Final effect of the action

148-pages album with the photos presenting xerothermic grasslands was prepared and published, in volume of 500 pieces. There are 144 photos in the album presenting the landscape of grasslands as well as species occurring on them along with genre scenes from sheep and goats grazing.

4.1.19 D3 – Organizing a series of workshops and conferences on xerothermic grasslands and their conservation

Description of actions

Effective ecological education and information flow about xerothermic grasslands are one of the main conditions of prosperity of protection of these valuable habitats.

Two kinds of meetings were being realized during the project:

The courses and workshops for different social groups of exclusively educational character. They were conducted mainly during the growing season so that part of the activities could be run in the field. The meetings were arranged especially for children and the youth and they concerned groups consisting of 15 -30 persons.

The conferences targeted at summing up and updating along with information flow about xerothermic grasslands protection. They were directed to the wide circle of the interested people, mainly to the persons, institutions and organizations engaged or interested in xerothermic grasslands and their protection.

Final effect of the action

There were 8 workshops organized within the project, participated by the total of 168 persons. They were, among others:

Two-days workshops for the youth groups consisting of 20 persons in Owczary (Ujście Warty area).

One-day workshops for the youngest children groups of 21 persons from the elementary schools from the communes where the project was realized in the Lower Oder Valley (Dolna Odra area).

Five-days, 13-person open air photography in Owczary for the adults who are interested in photography (Ujście Warty area).

One-day activity for three children groups from groups of schools in Lubycza Królewska (Żurawce area), in which 69 persons participated.

Two workshops for children from schools in Tomaszów Lubelski (Żurawce area), in which 45 persons participated.

Moreover, two conferences were organized:

International conference entitled "When theory meets practice: Conservation and restoration of grasslands" was organized in the cooperation with European Dry Grassland Group, the organization comprising persons and institutions interested in xerothermic grasslands in Europe. The meeting took place in Zamość (Lublin Region) and lasted from 24th to 31th of May, 2013. At the same time it performed the function of the annual EDGG congress, called European Dry

Grassland Meeting which is held every year. During the congress 86 participants were invited to attend from 25 different countries. One of the participants was Mrs. Simona Bacchereti, the representative of LIFE fund. The conference was preceded by two-day trip through the Mazowieckie Voivodeship and Podlaskie Voivodeship which was conducted by the employees of the University of Warsaw. Open air sessions took place at the historic hotel Mercure, located in the area of Great Market Square in Zamość, the heart of old town. The conference participants could admire the exhibition 'Natura 2000/Lubelskie/PL', provided by Society for Nature and

Photograph 88. Practical activities on grasslands for the youngest (by P. Pluciński)

Man from Lublin in the breaks between debates. The conference participants' readings referred to protection related issues and xerothermic grasslands reconstruction fight against invasive plant species and ways for the local society engagement in grasslands protection by the examples of different projects, funded by the European Union. The lecturers also presented the existing results of the project "Conservation and restoration of xerothermic grasslands in Poland - theory and practice". Within the frames of the conference a number of poster sessions were conducted. Three-days post conference trips directed the congress participants toward the most interesting areas of Natura 2000 that protect thermophilous habitats in Lublin Region, among others, included in the project. The visitors had also the opportunity to taste regional cuisine.

Photograph 89. The internacional conference participants in the area of Dobużek (by K. Barańska)

The conference which summed up the project took place on December 2th, 2013 at the hotel Klasztor in Cedynia, the medieval object, located on the top of the beautiful escarpment of the Odra valley. Beneficiaries of other LIFE projects realized in Poland were invited to the meeting,

as well as representatives of local government, State Forests, non-government organizations on nature protection as well as the performers of particular works, farmers and shepherds cooperating within the project, and all the other persons engaged in the project. There were about 50 persons from the whole Poland at the conference. The first part of the meeting was devoted to the particular introduction of assumptions and results of the project "Conservation and restoration of xerothermic grasslands in Poland - theory and practice". During the second oral session other LIFE projects realized in Poland were presented. After dinner the participants could watch the movie which was made within the project, and after the screening they had an opportunity to debate about chances, possibilities and difficulties in semi-natural ecosystems protection.

4.1.20 D4 - Shooting and distribution of a documentary on xerothermic grasslands

Description of actions

This is yet another element of ecological education included in the project which would be simple and clear also for laymen. The movie aim was to document the taken actions within the project. Thanks to this the movie CD serves as an ideal training material.

The making of the film commenced at the very beginning of the realization of hard protection actions on grasslands (C1-C8 actions), therefore, in the second quarter of the first year of the project, and it ended in the final year of the project. A film crew accompanied the project performers in every important event in the project.

Final effect of the action

As a result, a 38-minute movie was made, which clearly presented the problems of xerothermic grasslands faced in the project and the ways to solve them. The main emphasis was put on the methods of active protection. The film presented, among others, the clearance, grassland restoration, *Heracleum sosnowskyi* removal, population of *Echium russicum* enhancement and grazing. The film is in Polish version with English subtitles. It was issued in 500 copies on the DVD.

Photograph 90. The making of the film about grasslands in the Odra valley (by K.Barańska)

4.1.21 D5 – Project website

Description of actions

Project website was created in the first year of the project, in Polish and English languages. It is the basic instrument presenting the process and progress of the project. During the project duration the website was regularly completed with all the most significant events. It contains the basic information about the project: actions, location, information about the objects under protection, actions description, information about beneficiaries and financial institutions.

Final effect of the action
The website address http://www.murawy-life.kp.org.

4.1.22 D6 – Information boards

Description of actions
In every area included in the project an information board was placed about the project realization. The boards were put in the strategic points in order for every visitor to notice them immediately. These boards contain information that within each particular area the LIFE+ project is being realized, which is funded by the European Union resources. The boards also contain the basic information about the project, its title along with the beneficiaries and financial institutions logo.

Final effect of the action
55 information boards about the realization of the LIFE + project were placed in every object included in the project.

Photograph 91. Example project board (by K. Barańska)

4.1.23 D7 – Preparation and publication of a layman's report and scientific report

Description of actions
The report is a kind of substantive summary of the project, its aim is to inform about the taken actions and their results. It contains also the reflection about applied methods and opportunities of their further use and possible modifications.
The report has not only the basic information about the project, explaining the main assumptions and the methods of actions which are clear for average recipient, but also specialized scientific and technical description devoted to the more informed readers.

Final effect of the action
This report was prepared as a brochure (volume: 2000 copies) and script in digital version put on the Internet, in English and Polish versions.

4.1.24 D8 – Supporting the international flow of information about xerothermic grasslands conservation.

Description of actions
The main goal of the task was the information flow about the methods of grasslands protection and its benefits for people and the institutions engaged in similar issues in the other states of Europe. This action's aim was to organize a few international trips for the workers of the project and the workers of the institutions and organizations taking part in the project.

Due to the fact that the workers of Naturalists' Club established earlier cooperation with European Dry Grassland Group (international organization comprising persons and institutions interested in grasslands in Europe), intended to connect trips within the task with regular EDGG meetings taking place every year, each time in different place of Europe, known for the occurence of valuable xerothermic habitats.

Final effect of the action

Three, several days' long international trips were organized within the project at the EDGG conference in Slovakia, Ukraine and Greece. Moreover, one trip was organized at the international conference of European Congress of Conservation Biology in Glasgow. Finally, there were 16 persons taking part in the trips. At every meeting the workers of the project presented the information about the project "Conservation and restoration of xerothermic grasslands in Poland - theory and practice". It is worth mentioning that the last EDGG meeting took place in Poland and it was organized within the project.

Photograph 92 and 93. The EDGM conferences' participants in Poland (top) and in Greece (down) (by K.Barańska)

4.1.25 E1 - The management of the project

Description of actions

Management project group consisted of Project Manager, Technical Assistant, 5-person group of the Local Experts, RDOŚ representative in Lublin, IT specialist and persons responsible for project accounts.

Project Manager was responsible for the general project performance. His work was associated with coordination and planned actions.

Technical Assistant was engaged in the organization at the lower level and technical side of the actions. He substituted the Project Manager during his absence. 5-person group of the Experts was responsible for substantive side of the project. They mainly participated in the task

performance (A1, A2, A3, D1, D3) and were the general body responsible for preparation and realization of monitoring (E2 task). The number of experts was associated with great dispersion of planned actions in Poland. There was two experts per large areas of Dolna Odra and Ujście Warty and two expert for all Lublin region areas, the areas that are smaller than those in the northern and western Poland.
RDOŚ representative in Lublin was responsible for actions performed, coordinated and funded by the Directorate. Project accounting was conducted by the person who had already been employed by the Naturalists' Club. An IT specialist was engaged in running the website and possible assistance in the materials preparation in technical programs, such as GIS.

Final effect of the action
A result of the action was the professional project arrangement and performance.

4.1. 26 E2 - Monitoring of project's results

Description of actions
Monitoring of results of the taken actions in the project was planned and performed from the beginning of the field works realization. Monitoring in the main part was based on phytosociological photos repeated every year, taken with the use of the method of Braun-Blanqueta's on the areas of 25 square meters, placed on several dozen pieces of xerothermic grasslands. Within the monitoring the floristic composition and number of plants was controlled (expressed by covering) in the areas undergoing different preservation measures, including above all clearance of trees and shrubs (task C1), grazing (tasks C6 and C8) and both these tasks implemented at the same time. The control areas were also marked, on which measures were taken. As a part of monitoring of grasslands' restoration effects on the degraded areas (task C4), the independent system of trial areas and testing methods was applied.
The system consisted of two elements. Firstly, in the grasslands areas, localized next to each other, reconstructed by two methods (seeding and transplanted fragments of grasslands) and in the control areas the phytosociological photos were being taken – one photo in every area, one year and two years after measures. The series of the phytosociological photos enabled the assessment of the pace of grasslands regeneration and difference in the dynamic of this process depending on the measures or lack of them. The second element of monitoring of the grasslands restoration effects was soil testing. It depended on soil sampling, taken from the degraded grassland before and after removal of the higher soil layer. There were 18 samples from each area. The soil samples were tested in the specialized laboratory in terms of the basic physiochemical parameters which determine abiotic conditions of xerothermic grasslands' development: the soil pH (it is the measure of KC1 and H_20), calcium carbonate content ($CaCO_3$ mg/kg of dry weight) percentage organic nitrogen (N) and carbon (C) contents and carbon to nitrogen ratio (C:N).
Both chosen monitoring programs generated significant number of data, first of all, as a list of species and phytosociological tables being the object of statistical analyses which enable the assessment of efficiency of the taken tasks and preservation measures for keeping the proper state of protection of xerothermic grasslands habitats. Monitoring of the other actions in the project was more simplified and based on the control of chosen indicators that characterize each task, for example, the number of reintroduced individuals of *Echium russicum*, clean area from *Heracleum sosnowskyi* and etc.

Final effect of the action
As a result of monitoring significant numbers of data were obtained concerning flora, primarily the phytosociological photos and a list of species assigned to particular places which are marked with geographical coordinates, repeated every year during this project. In addition to part of area data of basic physiochemical parameters of soil was obtained. These information pieces were collected in some databases which served to conduct the statistical analyses, in the context of the assessment of natural results of taking protection actions in the project.

4.1.27 E3 – Preparing "After-LIFE Conservation Plan"

Task description
At the end of the project the so called "After-LIFE Conservation Plan" was elaborated, containing information concerning the necessary actions which will be taken after the finalization of the

project. This information concerns also the estimated financial sources of the actions and persons who are responsible for them. At the same time it is a part of the final report. Its basic assumptions are put in the final, fifth chapter of this paper.

The final outcome of the task
This action allowed for making of the plan of vital actions in order to sustain the undertaken actions in the project.

4.2 Best practices along with demonstrational and innovative actions used in the project

Best practices

Some specific and checked actions of nature protection were used in the project. However, both of them deserve the particular distinction. These are: extensive animals grazing and removal of shrubs and trees – the actions which are particularly linked with semi-natural non-forest habitats protection, as they are xerothermic grasslands.

Extensive animals grazing (action C6 and C8)
Extensive animals grazing is a way of the management in the poor quality of pastures which has been used for hundreds of years. Its characteristic way of influence on flora and its structure, species as well as ground in combination with specific natural conditions impacted on occurring and keeping many valuable natural habitats such as xerothermic grasslands. It was treated for a few decades as the basic, well-known and widely used method of protection in the whole of Europe. Apart from numerous, today's studies on the impact of grazing on protected habitats and tested practices, this method has centuries-old tradition and experience. On that basis, one gained the great knowledge about appropriate ways and grazing date along with stocking density and type of animals adjusted to particular habitats.
There are particular and proven practices in the case of xerothermic grasslands, which were implemented within the project as they took actions associated with grazing. But basically, on the extreme habitats like xerothermic grasslands with poor quality of food base it used the most original, resistant variety of livestock. In Poland these include: different variety of sheep (for example Polish heath sheep and Świniarka sheep), goats as well as Polish primitive horses, and cattle in the thicker grasslands. That is why old local breeds of animals were used in the project (mainly Polish heath sheep and goats adjusted to poor quality of grazing lands).

The great and known advantage of grazing is selective cracking of plants by animals. Especially sheep choose soft-leaves plants, avoiding those with xeromorphic structure, leading to regulate species composition of xerothermic grasslands – getting rid of the expansive meadow and ruderal species and leaving xerothermic ones. However, the goats limit in a natural way the spread of shrubs and trees. Livestock, leaving the densest and older shrubs and biting open areas of grasslands, lead to occurence of a dynamic mosaic, or the greater diversity of xerothermic habitats. Moreover, animals during grazing move grounds, destroying the dense layer of felt and exposing fragments of the bare earth. It makes it easier for the sunlight to access the lower parts of undergrowth and for the heliotrophic seedlings to develop within the grasslands plants as well as to mobilize soil seed bank. In order to take advantage of grazing' asset, it is preferable to jointly use a few type of animals which in different way influence the habitat. This practice is also implemented in the project through grazing of a mixed flock of goats and sheep as a part of task C6.
Another advantage of grazing in the multiple grasslands used in the project is the spread of diaspora of xerothermic spiecies between isolated pieces of grasslands by zoochory. It is vital to remember that grazing influences positively on grassland, provided that it is extensive. Too large flock in the small area may lead to destroying valuable xerothermic flora. The optimal number of sheep and goats, grazing in an extensive way during the growing season on grasslands is the maximum of 5 animals per hectare, and in case of cows- about one animal per hectare.
There are many advantages of the management method. It is related not only to reconstruction of natural values, but also cultural and aesthetic ones. Traditions related to grazing in many regions of Poland are very precious and forgotten element of agricultural landscape.

Photograph 94. Goats grazing on grasslands included in the project (by K. Barańska)

Removal of shrubs and trees (action C1)

This kind of action is one of the most frequently used methods of protection of non-forest semi-natural habitats such as xerothermic grasslands. This method usually makes sense as an initial action, preparing areas to introduce other protection methods that ensure the permanent result (for example, grazing or mowing). Naturalists' Club, based on its long-term experience of nature protection and other experiences, created a few basic principles which are necessary to be respected when cutting shrubs and trees within valuable natural habitats. These principles were used in the project:

- In terms of mating and breeding season of birds, if possible you cut during autumn-winter season (from October to March).
- On specific occasions, in case of species with strong sprouts, it is advisable to perform clearance during the growing season in order to reduce these plants. In such cases cuts should not be made in the larger areas and should concern single individuals or small shrubs, and it is necessary to check them before cutting in order to eliminate possibilities of destruction of bird's nests or animals species' shelters.
- During cutting it is absolutely vital to remove all the invasive species (alien to our flora), including *Robinia pseudoacacia, Padus serotina, Lycium barbarum, Acer negundo*, *Rosa rugosa, Mahonia aqufolia, Pinus nigra.*
- During remove of expansive shrubs it is necessary to cut mainly new, strong growing pieces, leaving the oldest shrubs.
- In case of grassland borders with intensive exploited farmlands, at the border of field and grassland it is worth to leave shrubs' zone that forms buffer, at least partly protecting valuable habitats against biogenic substance flow and herbicide.
- During cuts it is important to create the dynamic mosaic of open areas and shrubs.
- If possible, one should link cuts in grasslands with grazing. The animals which are grazed regularly bite systematically new sprouts, thus not allowing the shrubs to develop.
- In case of species that are remarkably alive and form many sprouts, it is necessary to mow sprouts many times a year.
- In case of part of shrubs or tree seedlings, forming sprouts, if possible it is worth to remove them with roots. This method is very slow and expensive (species are usually removed by hand); moreover, if certain species are carelessly removed, they will grow from the roots that are left in soil.
- In case of a part of cut trees and shrubs it is worth it to stock them on the outside of grasslands to create convenient hiding-place for small fauna, living in xerothermic grasslands.

Photograph 95. The cut of Robinia pseudoacacia in Błeszyn sub-area (Dolna Odra area) (by K. Barańska)

Demonstrational and innovative actions

Mobile grazing (action C6)

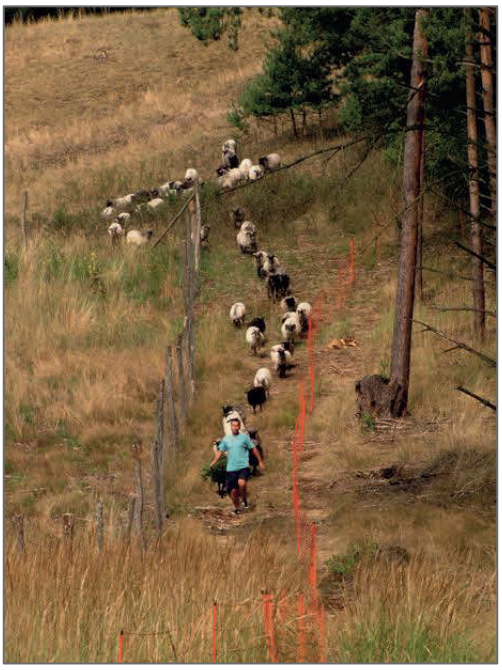
Extensive grazing of livestock has been a known and used practice on grasslands in Poland for a very long time. However, mobile pasturage is a decisively new practice. This method is not common in Europe, but in some countries neighboring with Poland, for example in Germany, it was used. During this project this method was used in Poland for the first time.

It is vital to use it due to strong isolation from large parts of pieces of xerothermic grasslands, its small area, usually large distance from farms and lack of interest of pasturage exploitation of the local society.

Grazing was carried out only during the growing season in a rotational way, subsequent on different areas. Firstly, the animals were grazed on the best maintained areas, and then on those most degraded, which leads to the spread of diaspora of xerothermic grasslands by zoochory.

Sheep were chased, and in the case of objects further situated they were transported from one object to another. Each grazed area was enclosed with easy disassembly electric fence, transported along with a flock to the next area. In terms of distance from human dwellings and sources of electricity, electric fence was powered with the composition of energizer, accumulator and solar battery. A part of fence (wooden pillars) and animal shelters were permanently put. Thanks to the fence, quarters of maximum 1 hectare were made, grazed on one place no longer than one-two weeks.

A flock was controlled by the workers employed in the pasture season for 24 hours. The animals were transported by truck owned by the Naturalists' Club, and shepherds lived in trailer, carrying it along with sheep from one grassland to another.



Photograph 95. Mobile sheep grazing in Dolna Odra area (by K. Barańska)

Restoration of strongly degenerated xerothermic grasslands (action C4)
The method related to saving strongly degenerated xerothermic grasslands consists in engrafting well preserved patches of xerothermic vegetation onto the designated areas - the so called transplantation. The research conducted to date on the effects of this method in the various European countries have brought various results. For this reason, it was a good idea to test this method in Polish reality.

The method assumed replanting fragments of well preserved grassland, together with the rhizosphere and soil layer with the seed soil bank within it, to the formerly prepared degenerated areas.
The alternative method, also applied within the project, was sowing the seeds of species from the well-preserved grasslands onto the restored areas. In both cases the material was taken from the closest possible areas and populations of species.
Preparing of most degenerated xerothermic grasslands (i.e. overgrown by *Robinia pseudoacacia*) consisted in tearing off the top layer of soil in order to remove seed bank and roots of the unwanted species, and related to *Robinia* extensive volume of azote and rhizoms of expansive herbal species. In case of the protected grasslands this method assisted also in reaching deeper layers of soil which are richer in calcium carbonate than the alerted surface layer. Larger accessibility of calcium carbonate supports the development of alkaline xerothermic vegetation.
Tearing off the surface layer of degenerated habitats has been increasingly popular method of protection. In Poland it was applied however solely in case of protection of peat bog, where the surface, demineralized layer of peat had been torn off. This method has not been tested in case of xerothermic grasslands or other habitats of mineral nature.

In order to delete the unwanted shoots of shrubs the areas of former xerothermic grasslands designated for restoration were covered with black foil. This activity was applied in gardening in order to remove the unwanted weeds. It triggers lack of access to sunlight for plants and consequently-their death. In Poland, prior to commencement of the project, it was not applied in environment protection.

4.3. Summary of effects of the project

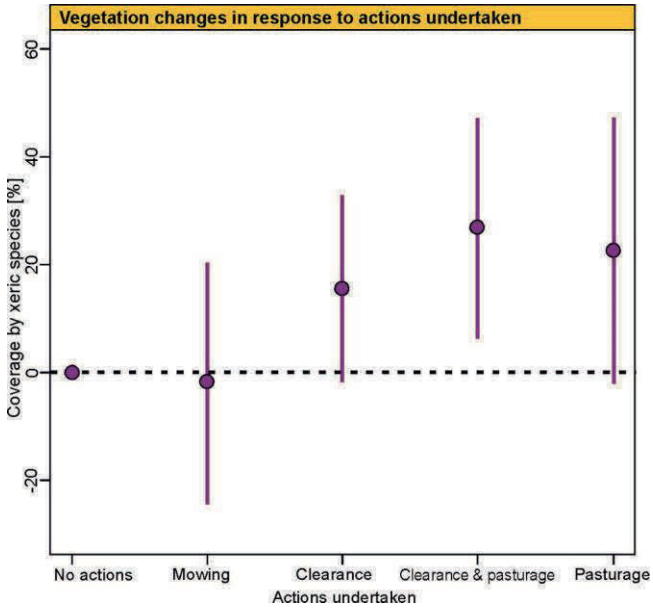
Overall effects in numbers
In total, throughout the project protective actions covered ca. 225 ha of precious natural habitats within 8 Natura 2000 sites. On this area ha of habitats negative processes were successfully ended, such as natural succession, eutrophication, degeneration related to anthrophogenic impact

(littering, irregular tourist traffic). On 20.2 ha the process of regeneration xerothermic grasslands was initiated. On further 61,19 ha extensive animal grazing was reinstated. The state of population and of locations of several dozen of protected species was improved, including also the rare species of: *Echium russicum*, *Cyprypedium calceolus*, *Carlina onopordifolia*, *Achillea setacea*, *Stipa borysthenica*, *Stipa pulcherrima*, *Anthericum liliago*, *Orchis purpurea*, *Helicopsis strata*, *Atypus murali*, *Colias myrmidone*. Furthermore, on 8 sites of Natura 2000 the expansion of several dangerous invasive species such as *Robinia pseudoacacia*, *Heracleum sosnowskyi* or *Mahonia aquifolia* was significantly limited. Through creating new reserves, ecological sites and natural monuments and detailed protection plans, permanent and professional protection for 12 objects was provided. In addition, solid basis for the protection of habitat 6210 was created in the entire country in the form of Habitat Action Plan.

Impact of undertaken actions on the vegetation of grasslands covered by the project

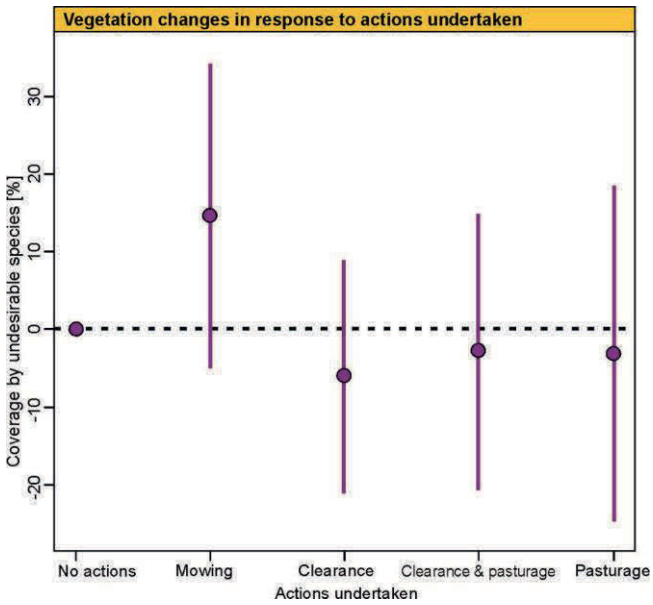
The actions that were undertaken gave measurable effects already at the stage of project realization in the form of an increase in number and occurrence of xerothermic species of plants and a decrease of share of unwanted species in the objects included in the venture. Proof for that is within the professional completion of statistical analysis of data from the monitoring of actions, conducted at all times throughout the realization of the project.

Thanks to these analysis series knowledge was also obtained on which of the applied methods were the most effective. Graph within the Drawing 26 presents an increase of occurrence of xerothermic species on grasslands which underwent various actions (mowing, cutting down shrubs and trees, pasture and clearance and pasture together).Connecting clearance of shrubs and trees and pasturing turned out to be the most effective method of protection which led to the largest increase of occurrence of the desirable species on the grasslands covered by the project.



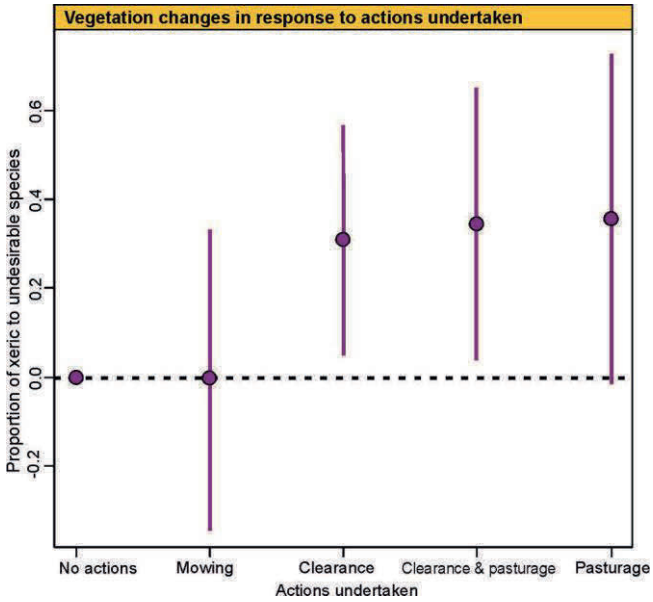
Drawing 26. Mean coverage by xerothermic plant species in relation to the actions undertaken. Dots indicate means change in coverage, vertical lines indicate 95% confidence intervals for the means. Lack of action was used as a reference level and effect size for this category denotes zero (no change). Dashed horizontal line indicates zero (no effect). For instance, on the plots where shrub and tree removal was conducted the mean coverage by xerothermic species was by ca. 18% higher as compared to plots without any action undertaken.

Graph on the Drawing 27 presents an impact of the same methods on the occurrence of unwanted species. Pasture and clearance of shrubs and trees as well as combining these methods significantly impacts the decrease of their occurrence. The analysis confirmed also the assumptions of many people who specialize in xerothermic grasslands, that mowing is not the best protection method for these habitats, since it increases the occurrence of the unwanted species, including in the case of mainly large, broad grasses, such as *Arrhenatherum elatius*.



Drawing 27. Mean coverage by undesirable plant species in relation to the actions undertaken. Dots indicate means change in coverage, vertical lines indicate 95% confidence intervals for the means. Lack of action was used as a reference level and effect size for this category denotes zero (no change). Dashed horizontal line indicates zero (no effect). For instance, on the plots where shrub and tree removal was conducted the mean coverage by undesirable species was by ca. 5% lower as compared to plots without any action undertaken.

Last graph on the Drawing 28 presents the change in proportion of xerothermic species in comparison to unwanted species. What arises from it is the fact that clearance, pasture and combining of these two methods works for the benefit of xerothermic grasslands and increases the coverage of xerothermic plants against the unwanted ones.



Drawing 28. Mean proportion of coverage by xerothermic to coverage by undesirable plant species in relation to the actions undertaken. Dots indicate means change in the proportion, vertical lines indicate 95% confidence intervals for the means. Lack of action was used as a reference level and effect size for this category denotes zero (no change). Dashed horizontal line indicates zero (no effect). For instance, on the plots where shrub and tree removal was conducted the mean proportion increased by ca. 35% as compared to plots without any action undertaken.

New possibilities for protection of habitats

Measurable effect of the project is also the application of new methods of protection of xerothermic grasslands in Poland. Testing and elaborating such actions as mobile sheep pasture, restoration of grasslands by tearing off the surface layer of soil or covering with black foil throughout the four years of the project realization opened new possibilities of saving strongly degenerated and "inaccessible" previously for protection patches of habitat.

Invasive species

Within the frames of project actions (ie. C1, C4, C6) also various methods of dealing with strongly invasive, dangerous for many habitats species such as, above all, *Robinia pseudoacacia* were applied, tested and observed. In order to eliminate it the following were used, among others:

- Standard cutting outside the growing season, in the autumn-winter period
- Cutting during the growing period
- Clearance with cutting down the trunk at the height of 120 cm
- Covering trunks of cut trees with opaque bags
- Clearance combined with several series of mowing of shoots throughout the year
- Cracking the shoots by animals
- Pulling out seedlings
- Pulling out trees with roots
- Removing surface layer of soil together with rootstock, roots and seeds

Elimination of invasive species was only one of the project tasks and not its main objective. For this reason, as mentioned above, all observations and tests of efficiency of applied methods were conducted upon realization of other tasks. One might though be tempted to state several conclusions which will surely be useful during the subsequent protection of xerothermic grasslands and other threatened by invasive species habitats:

- One-off „classic" clearance of *Robinia pseudoacacia* is inefficient and often leads to massive occurrence of shoots which may be far more troublesome than single trees.
- One-off clearance during the growing season which on one hand weakens *Robinia pseudoacacia*, but is significantly ineffective as it does not result in dying of this plant.
- Cutting out *Robinia* at the height of 120 cm from the ground level does not cause an immediate dying of it but it does bring some positive effects. Contrary to cutting the trunk at the ground level it causes the shoots not to reappear on a massive scale from the roots (by this taking over the surface of precious grassland plants), but they grow out of the left trunk. Thanks to this removing shoots is much easier - unlignified they would break off from the trunk easily even with bare hand. Systematic breaking off of the unlignified shoots from the cut off trunks may lead to gradual weakening of *Robinia* and in the end-to its death. During clearance one should though be careful so that the roots of Robinia that are located straight under the surface of the soil are not damaged - their damages cause immediate appearance of roots shoots. This laborious but so far one of the best methods of coping with *Robinia*, useful on surfaces with single trees of *Robinia* or small areas covered by this species, where it is possible to conduct a manual tearing down of the shoots.

Photograph 97. Robinia pseudoacacia cut out at the height of 120 cm (by K. Barańska)

- Covering the trunks of cut down trees with opaque bags caused death of trunk shoots but it did not stop the strong shoot from the roots.

- Clearance combined with mowing the shoots conducted several times within a year turned out to be the time-consuming and costly method, though an effective one. Mowing was performed between 4 and 6 times during the growing season, from approx. mid-May (when the shoots normally start to appear) to the first ground frosts (end of September - beginning of October) with the use of a strimmer. In warmer and more humid periods shoots were visible much faster and the mowing was conducted more frequently so that the total lignification of the cut off shoots was prevented. The method is recommended for use in case of large patches where shoots cover a significant area. The downside of this method is the cutting, together with the plants of the xerothermic vegetation, which does not benefit from such frequent mowing. A certain solution might be omitting where possible the patches without the shoots.
- Eliminating shoots (manual pulling out, mowing etc.) ought to be conducted rather early when the growing shoots are not yet lignified. Clearance, damaging and pulling out the shoots boosts the plant to produce new shoots. Removing them still when they are not yet producing enough chlorophyll and thus-are developing thanks to the energy stored within the plants makes the plant weaker and as a result-causes its death.
- Cracking the shoots by animals and their trampling gives a positive result; however, when the shoots are widely spread it does not eliminate entirely the invasive species. When accompanied by rich feed base (prolific grasslands, presence of soft-leaved species etc.) sheep omit the young, non-lignified shoots of *Robinia* as they possess a large number of poisonous alkaloids.
- Pulling out the plants together with their underground part is effective only in case of careful removal of all fragments of roots from the soil. *Robinia pseudoacacia* grows back even from tiny fragments abandoned within the soil.

Key encountered problems

During the four years of the project realization 23 very diverse tasks, requiring engagement of many persons and funds were realized. There were many factors that impacted the success of this realization, starting with good project organization, availability of funds and methods, possessed expert knowledge, through to abiotic conditions and state of preservation of the protected patches and a degree of danger of local society and goodwill of the local authorities and of institutions managing the lands on which the project was realized.

In line with the expectations one of the main obstacles within the project was the human factor. Frequent delayed procedures and indolence and lack of knowledge of local authorities significantly delayed the realization of tasks, damaging through this the initially established schedule of the project. Innovative, experimental and rarely applied in nature protection in Poland actions met with large misunderstanding and negligence. Eliminating *Robinia pseudoacacia,* generally considered as „useful" tree, producer of honey, supplying good quality wood and with attractive, scented flowers also met with huge resistance of the society (also among persons involved in nature protection!). This proves how significant the role of ecological education is within the nature protection and the reaction of the right image of organizations or institutions who are engaged in nature protection and activities conducted by them. Quite often the factor that is insignificant from the point of view of the protection of species or habitats has an outstanding significance for the realization of protective actions. An example of this might be *Heracleum sosnowskyi*, which similarly to *Robinia* is an invasive species and equally damages nature. Its harmful properties for humans (its juice causes serious burning) accelerate the social acceptance of their removal, often through the use of drastic measures.

4.4. Impact of the project on social education and strengthening the information flow on the LIFE programme and Natura 2000 network

Significant focus in the project was placed on ecological education, especially for children and the youth. As many as 9 tasks were directly and indirectly linked to broadening the knowledge on the project, actions undertaken within its frames, generally perceived nature protection and protected habitats and species (tasks: C7 and D1-D8).

In the framework of the project the total of 12 000 copies of various kinds of knowledge carriers (posters, leaflets, folders, albums, CD discs, boards), which were presented to various social

groups countrywide, and part of them abroad. All the materials were labeled with the logo of Natura 2000 and logos of institutions realizing and financing the project.
Furthermore, 42 different types of meetings, workshops and conferences were organized in which over 470 persons took part.
Throughout the entire period of project duration the project website was in place (http://www.murawy-life.kp.org.pl/).
Several dozen of articles were issued in press and in various magazines regarding the project and the actions undertaken within its frames throughout the realization of the project. Moreover, the employees of the project presented the effects of the venture during many conferences which were held in the country and abroad.