INSPECTION OF ENVIRONMENTAL PROTECTION

Monitoring of natural habitats

Methodological guide

for 5 natural habitats: 3110, 6210, 6520, 7230 and 9180

LIBRARY OF ENVIRONMENTAL MONITORING

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Joint pubication edited by
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The presented publication is the choice of selected texts from three volumes of methodological guides (published in Polish): therein the general description, and the detailed methodologies:
for habitat types 6210 and 9180 were published in Volume 1 in 2010, for 3110 – in Volume 2 in 2012, for 6520 and 7230 – in Volume 3 also in 2012.

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Contents

Introduction

The presented publication is the collection of selected texts from the series of methodological guides entitled *Monitoring of Natural Habitats*, issued in the framework of the Library of Environmental Monitoring. Part I, covering the monitoring methodologies of 20 types of natural habitats, was published in 2010. Parts II and III, based on the same methodological principles, concerning 40 more types of natural habitats, were published in 2012. The introductory chapter below is – to much of an extent – a repetition of the Introduction included in Part I. The changes introduced in the text consist principally of reordering the layout of the text describing the methodology of monitoring and adding to it, among other things, recommendations concerning monitoring in Natura 2000 sites, and information on the use of monitoring results from monitored locations and sites for the purpose of reporting on the conservation status of natural habitats at the scale of biogeographical regions.

Definition and legal basis for monitoring

Monitoring of nature consists of regular observations and measurements of selected elements of living nature (species, ecosystems), conducted for the purpose of obtaining information on changes occurring in them at a specific time, as well as gathering and updating information about other important elements of nature, and on directions and rates of these changes. The data collected should help to prevent future adverse changes and encourage specific protection measures to be undertaken as well as to predict the responses of the studied elements of nature to further changes in the environment.

The obligation to carry out such monitoring was imposed by the Law of 16 April 2004 on nature conservation with later amendments (J. of Laws of 2004, No. 92, item 880 with later amendments). In accordance with Article 112 para 1: *Within the framework of the state environmental monitoring, the monitoring of nature, biological and landscape diversity are performed.* The scope of the monitoring was specified in para 2: *Monitoring of nature consists of observations and assessments of the status and the changes occurring in the components of biological and landscape diversity, on selected sites, as well as in the assessment of the effectiveness of applied nature conservation methods, including the observation of natural habitats and plant and animal species for which a Natura 2000 area was established , and in Article* 28 para 10, point 4 c: *The plan of conservation tasks for a Natura 2000 area includes a definition of measures pertaining to the monitoring of items subject to conservation.*

Article 29 para 8 provides: *The plan of conservation for a Natura 2000 area includes definitions of the methods for monitoring of the conservation status of natural habitats and species of plants and animals and their habitats which are subjects to conservation.*

Pursuant to the Regulation of 30 March 2010 by the Minister of the Environment on preparing a draft plan of conservation for Natura 2000 area (J. of Laws of 2010, No. 64, item 401, with later amendments), the monitoring of habitats and species is one of the indispensable elements in plans of conservation tasks and plans for Natura 2000 protection areas. Para 3.1 point 10 of this regulation defines this as *establishing the methods for the monitoring of the conservation status of the subjects of conservation by indicating ways, methods, frequency and scope of the observations, and recording data.*

Analogically, pursuant to the Regulation of 17 February 2010 by the Minister of the Environment on preparing a plan of conservation tasks for a Natura 2000 area (J. of Laws of 2010, No. 34, item 186, with later amendments): *the plan of conservation tasks for a Natura 2000 area provides [...] definitions of conservation measures [...] including, in particular, the measures pertaining to [...]monitoring of the conservation status of the subjects of conservation.*

The Annexes to both these regulations provide that: *In assessment of the natural character or disturbance of features of a population as well as the size and quality of habitat, for each species a separate set of indices, adopted on the basis of scientific knowledge for the purpose of monitoring referred to in Article 112 para 2 of the Act.*

There is also an obligation to perform monitoring results from the legislation of the European Union, and a number of international conventions, in particular the Convention on Biological Diversity (CBD). Pursuant to Article 7 of the Convention, the contracting states are obliged to identify and monitor the components of biological diversity important for its conservation and sustainable use, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use. The provisions of the Convention were elaborated in Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) which determined legal framework for creating the European ecological network Natura 2000, a main instrument for maintaining biological diversity in the EU territory. Article 11 of the Habitats Directive provides that: *Member States shall undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with particular regard to priority natural habitat types and priority species. Also, in accordance with Article 17 of the Directive: Every six years [...], Member States shall draw up a report on the implementation of the measures taken under this Directive. This report shall include, in particular, information concerning conservation measures [...] as well as an evaluation of the impact of those measures on the conservation status of the natural habitat types of Annex I and the species in Annex II and the main results of the surveillance referred to in Article 11. The report, in accordance with the format established by the committee, shall be forwarded to the Commission and made accessible to the public.*

Scope of the monitoring of nature and relevant publications

Because of the requirements under EU law, the monitoring performed should, above all, enable the assessment of the nature conservation status of natural habitats and species of Community importance and help to evaluate the effectiveness of measures applied to

protect them. On account of this, all types of natural habitats, occurring in Poland, listed in Annex I to the Habitats Directive (81 types) and species listed in Annexes II, IV and V of the Habitats Directive, including 140 animal species, and 54 taxa of plants (including the entire groups of plants, such as: club mosses, peat mosses, and cladonia fungi). Particularly important is the monitoring of natural habitats and species under the Natura 2000 system (Annexes I and II of the Habitats Directive) which were described in 9 volumes of *The guides of the Natura 2000 habitats and species conservation – A methodological textbook*, published by the Ministry of Environment in 2004.

From the viewpoint of the needs of nature protection in Poland, the scope of monitoring should be still broader and also cover habitats and species from outside the annexes to the Habitats Directive which are endangered in Poland. This concerns such habitats as alder swamp forests or the associations of segetal weeds, and species placed in Polish Red Data Books with CR and EN categories, rare species (including endemic species) outside of these categories, as well as other species of economic importance (e.g. taken from the wild) or alien (invasive) species.

In 2010, the first three volumes of methodological guides were published, covering the monitoring of 20 types of natural habitats, 18 animal species, and 16 plant species. Among these there were all types of habitats and species of so-called priority importance to the European Community (17 types of habitats, 14 animal species, and 10 plant species) as well as several other, important from the viewpoint of nature conservation in our country. The volumes of guides drafted in subsequent years, present methodologies of monitoring studies for the types of natural habitats, and the plant and animal species listed in Annexes to the Habitats Directive, which were covered by monitoring in 2009–2011 under the State Environmental Monitoring scheme entitled *Monitoring of species and habitat types with particular regard to the special areas of conservation of the Natura 2000 network*, commissioned by the Chief Inspectorate of Environmental Protection Management (hereinafter abbreviated as CIEP). These are both species and habitats widely distributed in Poland, numerous and known from many Natura 2000 localities and areas, as well as rare species whose occurrence is limited to single localities and areas. Among them there were also selected plants species from outside the lists in the Habitats Directive, deemed to be critically endangered in Poland, which have not been previously monitored under the State Environmental Monitoring.

Premises and organisation of monitoring

The premises of the monitoring system implemented are as follows:

- Adjusting the scope and recording information collected within the monitoring framework for the purposes of reporting required by the Habitats Directive (the collection of data which permits the evaluation of the conservation status of natural habitats and species at the level of biogeographical regions).
- Developing and applying a uniform organisational-methodological system of monitoring for particular types of habitats and species.
- Applying a common standard of data recording and gathering the data in a single database.

- Linking the monitoring of the conservation status of natural habitats and species at a national level to the monitoring at Natura 2000* sites where the obligation of monitoring stems from national law.
- Incorporating the monitoring activities concerning natural habitats and species carried out to date by various institutions into the system adopted by the CIEP.
- Combining the monitoring of habitats and species with other types of monitoring (e.g. monitoring carried out under the Water Framework Directive, State Forest Administration Monitoring, and the like).

* The Nature Conservation Act requires that monitoring should be carried out under the State Environmental Monitoring (Article 112), and also in all Natura 2000 sites (Article 28) which are subject to conservation in these sites. In accordance with the requirements of the Habitats Directive, the locations selected for monitoring should be representative for the entire range of occurrence of a given natural habitat or species. Thus, the monitoring under the State Environmental Monitoring is carried out in locations situated within the Natura 2000 network as well as outside. If the required uniform methodology is maintained then the results obtained will be coherent.

The detailed assumptions concerning the organisation and the way of implementing the monitoring (including fieldwork), coordination of activities and flow of data, are prepared individually by each EU state. The only one common (all-European) formal premise of the monitoring of natural habitats and species of European importance is that it has to provide data allowing the assessment of their conservation status at the level of biogeographical region and the method of this assessment has been formalised and described in the document entitled *Explanatory Notes & Guidelines for Assessment, monitoring and reporting under Article 17 of the Habitats Directive Final draft*; *October 2006* (http://www.bfn.de/fileadmin/MDB/documents/themen/natura2000/ec_guidance_2006_art17.pdf).

During the work on organising the monitoring of natural habitats and species in Poland *(Monitoring of species and habitat types with particular regard to the special areas of conservation of the Natura 2000 network) these guidelines were adapted to the assessment of conservation status of species and natural habitats at the level of monitoring locations and Natura 2000 sites. Recently, a new, amended version of these guidelines was approved by the Habitats Committee: Assessment and reporting under Article 17 of the Habitats Directive. Explanatory Notes & Guidelines for the period 2007-2012. Final draft July 2011* (http://circa.europa.eu/Public/irc/env/monnat/library?l=/habitats_reporting/reporting_2007-2012&vm=detailed&sb=Title).

The monitoring of natural habitats and species of plants and animals is organised hierarchically, on three levels: co-ordinating institution (one on the national level), national coordinators (experts, managing the monitoring of particular types of habitats and species), and local experts (contractors doing fieldwork: both scientist-biologists, members of nature conservation services, staff of the State Forest Administration, non-governmental organisations, students of natural history studies).

A database, common for all EU states, gathers information, including chiefly the monitoring results, in the form of reports on the state of populations and their habitats at the level of the biogeographical region. Every six years, each EU state is obliged to submit a report (the first reports were drafted in 2007). The method of gathering data resulting

from monitoring at the level of monitoring locations and Natura 2000 sites in Poland was drafted in 2006–2008 by the Institute of Nature Conservation of the Polish Academy of Sciences in Krak—wupon commission from the Chief Inspectorate of Environmental Protection (CIEP), under the framework of the above-mentioned task: *Monitoring of species and habitat types with particular regard to the special areas of conservation of the Natura 2000 network – Phase one and two.*

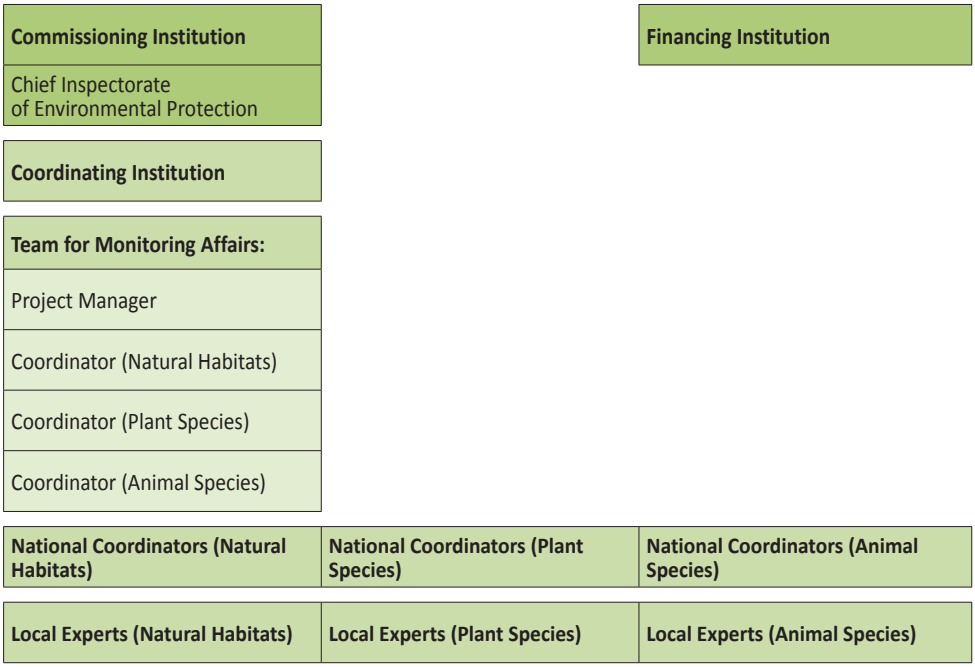

Fig. 1. The organisation chart of the monitoring of natural habitats and species at the national level.

Description of the procedure for the monitoring of natural habitats at the national level

Selection of monitoring locations

The monitoring of each natural habitat is carried out on so-called monitoring locations, which constitute a continuous fragment of natural space indicated on a topographic map. The monitoring/monitored location is a relatively uniform area of the examined natural habitat, clearly demarcated and easy to describe in the field. The size of monitoring location is very diverse, from several hectares in the case of large habitats (e.g. forest of meadow habitats) to several m2 in the case of epilithic mountain swards or petrifying springs with tufa formation. Depending on the specificity of the natural habitat studied, the way of marking monitoring locations may differ significantly, as it is elaborated in the description of research methodologies.

Some monitoring locations are treated as reference. These are model monitoring locations, with very good conditions, and with typically developed, non-endangered natural

habitats. The initial selection of reference locations is made by local experts after the first research cycle. This selection is then approved by national coordinators and by the coordinator for habitats.

The selection of monitoring locations is performed in a way ensuring proper representation of the places of occurrence of a natural habitat as to the number, distribution and degree of threat. The field studies carried out on these selected locations allow conclusions to be drawn on the conservation status of a natural habitat at the levels of biogeographical regions as well as of the whole country. The monitoring locations should be situated both in the centre of the range of habitat, and on its edge, on protected areas (e.g. Natura 2000 special areas) as well outside of them. However, rare and endangered habitats which occur in just a few places in Poland, should all be monitored, without exception. In the description of the methodology of monitoring of each habitat, the number and geographical position of all locations proposed for monitoring (performed under commission from CIEP under the framework of the State Environmental Monitoring) are given.

The procedure used to date for the determination of monitoring locations is as follows: Depending on financial capabilities, the coordinator for habitats makes the initial selection of the Natura 2000 sites and other places of occurrence of a given natural habitat ensuring that, on the one hand, geographical diversity is taken into account, and on the other hand, making sure that the monitoring covers the greatest possible portion of resources of a given natural habitat. This proposal is next verified and supplemented by the national coordinator. The precise position of monitoring locations within the selected areas is established in discussions between the national coordinator and local experts.

In order to begin the monitoring of a natural habitat in Natura 2000 sites designated for their protection, or outside of these, a survey of the whole area should be performed, and its results used to estimate resources and ecological diversity of the area's habitat. This initial stage of the monitoring exercise is essential for the proper distribution of monitoring locations as well as to formulate the correct overall conclusions describing the local variability of the studied natural habitat, and also the diversity of its conservation. For this reason, the local expert should possess a good knowledge of local natural conditions. It is difficult to give detailed principles for such field exploration because it is conditioned by both the specific features of a given habitat as well as the size and diversity of the investigated area. Beyond any doubt, after searching reference publications and identifying all available sources of information, a possibly detailed on-site visit should be planned, well in advance and in a suitable part of the vegetation season, in order to make a preliminary comparison of key-features of the inspected locations. Next, on this basis one should select several (3-4 on average) locations within each of the inspected sites, diversified in terms of development and preservation, where detailed observations will be made.

During the process of drafting the list of areas where monitoring will be performed, an attempt is made to include primarily these special Natura 2000 areas of habitat conservation which are the most important to a given natural habitat. Information from the standard data form (SDF) for Natura 2000 areas is used for selecting all areas whose importance for this habitat are graded as "A" and "B" while among the areas graded in the SDF as "C" those with the largest areas are selected. It should be emphasised that good knowledge of distribution and sizes of habitat resources, using the most current data is the best basis for

the proper selection of monitoring locations. Apart from the database containing data from SDF, the most important sources of data concerning natural habitats may include:

- data collected by the State Forest Administration (e.g. INVENT database);
- data taken from the protection plans of national parks, Natura 2000 areas, landscape parks, and nature reserves, as well as from plans for conservation tasks of Natura 2000 areas;
- data gathered in connection with the implementation of agri-environmental programmes, expert reports, and with the monitoring of implementation of programmes;
- major projects associated with the protection of natural habitats (for example, the projects implemented under the framework of the Life-Nature Fund, Financial Mechanism of the European Economic Area, Norwegian Financial Mechanism, Swiss-Polish Cooperation Programme, and the Operational Programme Infrastructure and Environment);
- inventories made within the framework of the Environmental Impact Assessments (EIS);
- other research and projects implemented by scientific institutions, Regional Directorates for Environmental Protection, and non-governmental organisations.

The target locations of permanent areas for the described natural habitats within the State Environmental Monitoring system will be conditioned mostly by the distribution of already existing monitoring locations. It is assumed that the number of monitored sites and locations should be at least kept at the current level, and in some cases (where only pilot studies were carried out) should be significantly increased.

The scope of monitoring activities on a monitored location

The scope and the recording format of information gathered for a natural habitat on a monitored location have been adapted to the needs of reporting provided in Article 17 of the Habitats Directive, so that the results of monitoring on the level of locations facilitate the assessment of the conservation status of the habitat on the level of biogeographical regions of Poland. For this reason, also at the level of monitoring locations, the conservation status is evaluated based on three parameters: surface area of the habitat, specific structure and function of the habitat, and the perspectives of conservation. The parameters of the natural habitat status as well as the system of assessments are discussed in detail in the further part of the Introduction.

The methodology of monitoring in the majority of the described natural habitats consists of marking on each monitoring location a 200 m long and 10 m wide transect (covering an area of 2000 m2). The beginning, centre, and end of the transect are places where phytosociological relevŽ samples are taken. RelevŽs (that is standard descriptions of vegetation applied in phytosociology) enable more profound analysis of species composition of the vegetation in the studied areas and provide the possibility of later floristic comparisons between locations throughout the whole country. A detailed analysis of relevŽs also helps to clear doubts on the correct identification of the natural habitat under study. Additionally, the status of the natural habitat is evaluated on the whole surface area of the transect (i.e. also between the places where relevŽs were taken), based on the system of parameters and indices described below, and on detailed methodology of research.

In the case of small-area habitats which create a mosaic with other habitats, when marking a transect of the envisaged dimensions is not possible in a single patch of the habitat, several separate patches of the habitat should be selected and their summary area determined. An optimum solution (although it is not always possible) would be that the summary area is equal to the area of the transect.

Parameters and indices of conservation status

The current conservation status ('condition') of a natural habitat is assessed on the basis of three parameters:

- surface area of the habitat within the conservation area,
- specific structure and functions,
- conservation prospects of the habitat.

These names were borrowed from the forms prepared by the European Commission for the reports on the conservation status of habitats and species in biogeographical regions of particular countries. Generally, it can be stated that each of the parameters of status of a habitat presents a synthetic description of a group of the characteristics of natural habitats as well as factors affecting them.

The way of evaluating the "surface area" and "conservation prospects" parameters is the same for all natural habitats whereas the third parameter "specific structure and functions" describes primarily these features which distinguish a given natural habitat and decide about its unique nature. Taking this into account, during the pilot project implemented in Poland, it has been envisaged that the coordinators of particular natural habitats will indicate the most essential features of the studied habitats or the phenomena affecting the ecological processes of key importance for the conservation of a given habitat. Such features or phenomena were called the indices of specific structure and functions of a natural habitat (also in this study called indices of habitat status).

The "surface area of the habitat" parameter is a numerical value most often given in square metres or in hectares. It may be determined as estimated value, or on the basis of existing phytosociological maps, forest maps or other cartographic materials. The assessment of this parameter is affected primarily by data on the changes of the area occupied by the natural habitat as well as by information on the spatial structure (fragmentation) and the degree of isolation of the studied patches of vegetation.

The "specific structure and functions" parameter serves to define the typical nature of habitat development and its conformity with its specific species composition, as well as to distinguish other elements indirectly affecting its structure and functions. A number of indices, matched individually to each type of natural habitat is used to determine this parameter with required precision. Obviously, many of them are the same for various types of habitats, particularly those with resembling characteristics or these which develop under similar climatic, edaphic or other conditions. In all, several dozen of such indices were proposed. The selection of indices is primarily based on the knowledge of conditions for the occurrence and dynamics of natural habitats. The characteristics of structure and functions of the natural habitat which are sensitive to the impact of various natural and anthropogenic factors, and – at the same time – relatively easy to measure,

are primarily selected for studies. These can be indices pertaining to both biotic features of a habitat (e.g. density and height of individual layers of vegetation, presence of characteristic species, alien species, and invasive species, fragmentation) and abiotic features (e.g. water saturation, purity of waters). Apart from great indicative value and objectivity, such indices should be, above all, characterized by simplicity and easy application in the practice of fieldwork with the assumption of the least cost-consuming. Additionally, the way of determining the values of such indices should take into account the limited access of future contractors to specialised equipment, and, whenever possible, be based on simple and proven research methods. The scope and methods of measuring the indices are given in tables included in the description of particular habitats. Certain indices are distinguished as so-called cardinal indices that is the key indices for the assessment of structure or functions of the natural habitat.

The „conservation prospects of the natural habitat" parameter is the forecast of changes occurring in a given location and in its surroundings which can affect the perpetuation of a proper status of the conservation of natural habitat over the following 10-15 years. This is an expert evaluation taking into account, among other things, information of known impacts and predicted threats, capital investment plans, and the current and planned conservation regime as well as on the effectiveness of the conservation measures applied to date (if there have been any).

Overall assessment is the final assessment including the evaluations of three parameters mentioned above, as well as information about the rarity of occurrence of the habitat in Poland, the features of its formation which distinguish it, the particular abundance of species composition and the like. It is a mean value of all three parameters described above.

It is worth mentioning that the process of evaluating the status of a given habitat should consider the current state of vegetation rather than the potential state of vegetation. For

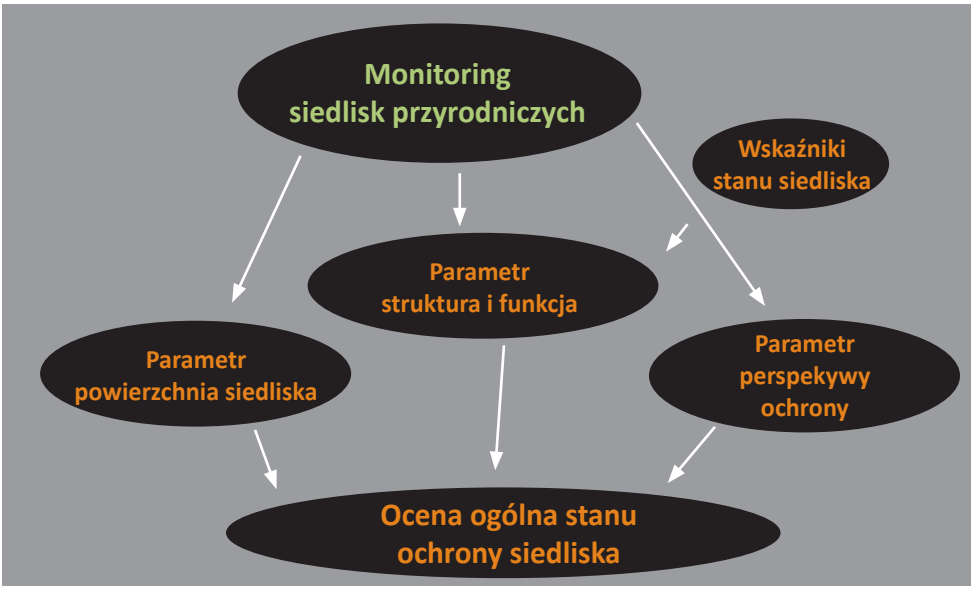

Fig. 2. Organisation chart of the monitoring of natural habitats.

example, if no vegetation typical for a given natural habitat is found on a monitoring location, it should be simply assumed that the habitat has either not developed there or has been completely transformed, therefore further monitoring of this patch of habitat does not make sense, and the results of field monitoring obtained in such a case may only be an indication of how to attempt the restoration of natural habitat in the given location.

Evaluation of the studied indices

The values of the indices for the status of natural habitats, expressed numerically or descriptively, are evaluated similarly as parameters of the conservation status, in a three-level scale: FV favourable status; U1 unfavourable inadequate; U2 unfavourable bad (or could be XX unknown). The scale of assessments is the same as adopted by the European Commission for the purposes of preparing reports on the conservation status of habitats and species in biogeographical regions. Applying the scale to evaluate indices, and then three parameters of the conservation status at the level of locations will facilitate using the results of national monitoring for the purposes of drafting reports for the European Commission.

On account of this, definite assessments are ascribed to certain values (or range of values) of indices (expressed in numbers or descriptively). The 'guides' to evaluate indices, presented in accounts of particular habitats, have been formulated on the basis of knowledge and experience of the authors, and based on the results of initial monitoring studies. As for many habitats, they will still require discussions and modifications owing to, among other things, their specific features in various parts of Poland.

Assessment of the conservation status parameters on the basis of studied indices

The assessment of the 'specific structure and functions' of a habitat is composed of several to more than ten indices. The method of deriving the assessment of this parameter based on the assessment of particular indices is described in detail in the methodology for each of the natural habitats. The cardinal indices are of particular significance for the assessment. Considering the fact that they describe the most important features of structure and functions of a natural habitat which have a relatively narrow optimum range, the lowered assessment of any of the cardinal indices should result in the lowered assessment of the whole parameter.

The assessment of habitat conservation status at the level of a monitored location

The assessment of the structure and function of a natural habitat in combination with the assessments of its surface area and conservation prospects allow the state of conservation of the habitat at the given location to be assessed. The 'overall assessment' should be derived in accordance with the rule adopted in the guidelines for reporting the conservation status of species and natural habitats in biogeographical regions (Explanatory Notes & Guidelines... 2006, 2011). This rule provides that the overall assessment is equal to the lowest of component assessments (that is the assessments of particular parameters):

- three FV assessments (or possibly two FV assessments and one XX assessment) -> overall assessment FV
- one or more U1 assessments -> overall assessment U1
- one or more U2 assessments -> overall assessment U2

Forms for field observations on a monitored location

Maintaining the standard recording of collected data is ensured by uniform forms for the observation of habitats in a monitored location. The information contained in the form presented below reflects the scope of information entered into the monitoring database. The form consists of several parts: a natural habitat observation sheet for the monitored location, assessment of habitat conservation status at the site, list current impacts and threats (future foreseeable impacts), other information.

The first part of the form, being a specific 'display window' of the monitored location, includes information allowing its identification, describing its geographical position and short characteristics, pertaining to the previous observations of the habitat in the monitored location, and also technical data such as time and date of making the observation, the name of the observer and the like.

Natural habitat observation sheet for the monitored location	
Code and name of the natural habitat	*Code of the habitat as in Annex I of the Habitats Directive*; *name based on guides of habitat conservation (J. Herbich 2004)*, *available in Internet at :* http://natura2000.mos.gov.pl/natura2000/pl/poradnik.php
Site name	*Name of the monitored area – only applicable for locations within the Natura 2000 sites*
Code of monitored location	*Filled in by coordinating institution*
Name of monitored location	*Name of the monitored location. In giving a name to the monitored site, the best solution is to relate to the names presented in topographical maps with 1:10000 scale whereas in forested areas – the names of forest complexes and the numbers of forest subdivisions taken from forest management maps. If there is no possibility to create an easily recognizable, unambiguous name, the serial numbers of subsequent locations may be added to the name of the area (or its part).*
Protected areas where the monitored location is situated	*Protected areas where the monitoring location is situated: nature reserves, national and landscape parks, sites of ecological interest, documentation sites etc.*
Geographical coordinates	*Fill in the geographical coordinates of the beginning, centre, and the end of the transect.*
Elevation a.s.l.	*The minimum and maximum elevation a.s.l. within the entire monitored area. It may be taken from topographic maps supported with GPS measurements*
Description of the natural habitat	*Synthetic information on distribution, diversity as well as on topography and relief of the terrain.*
Plant communities	*List all plant communities characterizing the natural habitat on the monitored location.*
Surface area of the habitat patches	*The combined surface area (in hectares) of patch/patches of the habitat where the transect is located.*
Dimensions of the transect	*Standard dimensions: 10x200 m. Exceptionally, when resulting from point, discontinuous distribution of the habitat, the transect may be replaced by a rectangular area of any dimensions (in that case, they should be given) equal to 200 m^2 (0.2 hectare).*
Observer	*Full name of the local expert responsible for this monitoring location (according to the contract).*
Dates of observations	*Dates of all observations (as in partial forms).*
Date of filling	*Date of filling in the form by the expert.*
Date of entering	*Date of entering into the database (filled in by the coordinating institution).*
Date of approval	*Date of approval by the authorised person (filled in by the coordinating institution).*

The principal part of the form provides for the recording of results of investigation, that is the values (given either numerically or descriptively) of the studied indices of the conservation status of the habitat, and the values of these indices, and next the assessments of particular indices, and an overall assessment of the habitat conservation status on the monitored location. For particular habitats, this portion of the sheet differs only in the number and names of indices. Examples of filled forms for 'conservation status of the natural habitat on the monitored location are included in the detailed part of each described habitat.

Conservation status of a natural habitat at the monitored location					
Parameters and indices		**Value of the index**	**Assessment of the index**		
Area of the habitat			FV/U1/U2		
Specific structure and function	Index 1		FV/U1/U2/XX		FV/U1/U2
	Index 2		FV/U1/U2/XX		
	Index ...		FV/U1/U2/XX		
Conservation prospects					FV/U1/U2
Overall assessment					FV/U1/U2
Proportion of the habitat area representing different conservation status within the monitored location			FV	x%	FV/U1/U2
			U1	x%	
			U2	x%	

Additionally, for the majority of the studied natural habitats, the forms for the relevés are also filled (as in the table below). Detailed information on the methodology of performing the phytosociological relevŽs can be found in textbooks of plant sociology (Dzwonko 2007, Wysocki, Sikorski 2002).

Relevé I	
Geographical coordinates of the centre, elevation a.s.l. Area covered be the relevé, inclination, exposure. Density of layers a, b, c, d. Height of layers a, b, c, d. Phytosociological unit.	**Species: alphabetical order, Braun-Blaquet scale: +, 1, 2, 3, 4, 5; (report only coverage)** Geographical coordinates: N degrees minutes..." E degrees minutes..." e.g.. N 51° 22'..." E19° 23'..." Area covered by the relevé: for non-forest natural habitats – 5x5 m, for forest natural habitats 10x10 m, possibly in the case of smaller patches = the area of the patch Plant species with their numbers in the relevé. It is recommended that all species of vascular plants and terrestrial bryophytes be identified, and – for the types of natural habitats where it is of essential importance – also of lichens. The names of vascular plant species should follow Mirek et al. (2002), and those of bryophytes – Ochyra et al. (2003). Important: in some cases, the transect will go across vegetation patches of the transitional type, with non-typical vegetation (predominating in the monitored area). In such cases we do not try to search for a typical patch but describe the vegetation directly in three points of the transect. Attempts should be made, however, to locate the transect in such a way that it suitably represents the vegetation of the monitored location, and to avoid making relevés in patches which are not spatially uniform. In cases, when – for instance – a path goes through the middle of the transect (which is the case in a Swiss mountain pine brush), the relevés should be performed in the nearest possible place to the left or right of the side of the point marking the transect (the coordinates to the left or right of the transect should be noted).

Relevé II	
Geographical coordinates of the centre, elevation a.s.l. Area covered by the relevé, inclination, exposure. Density of layers a, b, c, d. Height of layers a, b, c, d. Phytosociological unit.	Species: alphabetical order, as above
Relevé III	
Geographical coordinates of the centre, elevation a.s.l. Area covered by the relevé, inclination, exposure. Density of layers a, b, c, d. Height of layers a, b, c, d. Phytosociological unit.	Species: alphabetical order, as above

The next part of the form is for the recording of current impacts on the natural habitat at the monitored location, as well as predicted threats. Only the most essential information found in the field should be filled in. In order to make the records uniform, a list of coded impacts in accordance with Annex E to the standard Data Form for Natura 2000 areas was used (the list is attached at the end of the Introduction).

Determination of intensity (high A, moderate B, low C) and the type of effect (negative – , positive +, and neutral 0) for a given impact or threat are required as well as its short description.

The list of the most important impacts on a natural habitat on the monitored location (including its use). The coding of impacts should follow the one given in Annex E to the Standard Data Form for Natura 2000 areas.

Current impacts				
Code	**Name of activity**	**Intensity**	**Impact**	**Synthetic description**
		A/B/C	+/0/-	
		A/B/C	+/0/-	

The list of factors which – in a longer perspective – may constitute a threat to the species and its habitat: future foreseeable impacts such as, for example, planned capital projects, changes in management and use, and increasing pressure from urban development. The codes of threats according to Annex E of the Standard Data Form for Natura 2000 areas should be used. If there is no suitable code, its description should be entered into the table 'other information' in the cell 'other remarks'.

Threats (future, foreseeable impacts)				
Code	**Name**	**Intensity**	**Impact**	**Summary description**
		A/B/C	+/0/-	
		A/B/C	+/0/-	

The habitat observation sheet should also contain space for recording other essential information which has not been envisaged in previous parts of the form, including, in particular, information on natural values other than the monitored 'object' observed in the monitored area, other field observations that may affect the current monitoring studies, comments pertaining to the protection measures carried out in the area, methodological remarks or suggestions pertaining to detailed studies.

Other information	
Other natural values	*Other observed species of animals and plants listed in Annexes to the Habitats and Birds Directives: endangered species (Red book) and other rare species (give their numbers in the following scale: numerous, moderately numerous, rare); other unique values in the area.*
Other observations	*Any information helpful for the interpretation of results, e.g. weather anomalies.*
Management of the area	*List the institutions, organisations, legal entities responsible for the management of the area (e.g. national park, forest directorate and forest districts, Regional Water Management Authority and the like).*
Existing plans of conservation /management/ land management	*Protection plans for national parks and nature reserves, forest management plans, nature conservation plans in the State Forests, re-naturalisation plans (e.g. LIFE, EcoFund). Any documents which can be of significance to the conservation of the described natural habitat in the area.*
Protection measures carried out	*E.g. strict protection, mowing, increasing water level, grazing, other re-naturalisation measures.*
Methodological remarks/Other remarks	*Any other remarks associated with the work carried out, including, above all, information essential to the further planning of monitoring (methodology of work; indices to be studied in monitoring, regionally optimal timing of studies and the like).*

Examples of filled forms for the monitoring locations of each described natural habitat have been included in the detailed part of each guide.

The assessment of the conservation status of a natural habitat at the national level

As it has been mentioned earlier, the results of monitoring of a natural habitat at particular locations provide a basis for the assessment of its conservation status at the national level and, more precisely, at the level of so-called biogeographical regions distinguished in the country. In Poland, these are the following regions: alpine (the Carpathians with part of its foothills), continental (the remaining part of the land area of Poland, and Baltic (territorial waters of the Baltic Sea). In the case of habitats whose occurrence in one given region is completely covered by monitoring (e.g. dwarf pine brush in the alpine region), its results provide the majority of data necessary for drafting a report on the conservations status of the species at the level of this region. With respect to most habitats, however, the monitoring is performed only in selected locations. If they constitute a relevant representation of resources/ locations of the given habitat in the biogeographical region (cf. detailed studies), it will only be necessary to complement the results of monitoring with information pertaining to the distribution of the habitat. If, for various reasons, the monitoring of a habitat does not include a relevant representation of its resources/ locations, then the assessment of the habitat conservation status at the regional level will require, apart from the results of monitoring, also collecting available information about the habitat from other places of its occurrence.

The assessment of the conservation status of a natural habitat is, to a considerable degree, an expert's assessment, therefore it should be performed (or at least verified) by specialists.

Description of the procedure for natural habitat monitoring at the level of a Natura 2000 site

The methodology of habitat monitoring, prepared for the purpose of assessing the conservation status of habitats at the level of biogeographical regions, may also be used in the monitoring of the habitat conservation status in Natura 2000 sites, in line with the requirements of national laws. The compatibility of data collected at the national level and at the site level enables their combined analysis, and henceforth makes possible the much better conclusions about the conservation status of the studied natural habitats on both levels. In the case of natural habitats with only on a few occurrences, national monitoring can cover all known locations of a given habitat and therefore its results can be used directly in managing a Natura 2000 site. In many cases, it is enough to supplement the locations of national monitoring with additional places, significant for the assessment of the diversity of conservation status in the Natura 2000 site. At present, data from national monitoring is often used in conservation plans for Natura 2000 sites and „national" monitoring methods and locations are included in the system of monitoring in a given Natura 2000 site. Primarily this approach reduces the cost of performing nature monitoring and makes communication between various institutions dealing with the implementation of the Natura 2000 network in Poland, much more efficient. The ultimate target should be to ensure the possibility of the joint gathering and storing of data from both levels, or developing an efficient system to exchange information obtained in various efforts implemented with the same research methodology.

Selection of locations for monitoring

Indicating locations for monitoring carried out at the level of a Natura 2000 site is one of the principal tasks for the drafters of conservation tasks and conservation plans for Natura 2000 sites. The basis for the correct selection of the monitoring locations in a Natura 2000 site is provided by current inventory data. When the locations for monitoring are selected, the following factors should be considered: the distribution of habitat sites within the area, the size of its resources in particular locations (if such data is available), and the diversity of locations in terms of pressure from various types of impacts. The number of locations for monitoring is established individually for a given Natura 2000 site, in the framework of the plan of conservation tasks or the conservation plan. Monitoring should definitely cover all places under active conservation measures. In the case of small-size sites, established for the purpose of conservation of a single type of habitat, the entire Nature 2000 area (e.g. a nature reserve for xerothermic vegetation) may constitute a monitoring location. It is also often that within a Natura 2000 site only one or several places of occurrence of a monitored habitat are known. If this is so then all of these patches should be monitored. In the case of natural habitats occurring within a Natura 2000 site in a larger number of s (or even occurring commonly) it is recommended that larger patches of it should be monitored, to consider local diversity in terms of abiotic conditions (exposure, inclination, situation in the area etc.) and from the viewpoint of phytosociology (e.g. alder and willow riparian groves occurring upon various parts of a river course, classified into the same type of habitat). Attention should also be paid to en-

sure the proper representation of habitats (percentages of their resources) on the selected monitoring locations.

The scope of monitoring activities within a Natura 2000 site

The scope of monitoring activities at monitoring locations within a Natura 2000 site should be the same as at locations selected for the monitoring at the level of biogeographical regions (cf. chapter *The scope of monitoring activities at a monitored location*).

The assessment of the natural habitat conservation status on the level of Natura 2000 site

Pursuant to the Annex to the Regulation of 17 February 2010 by the Minister of the Environment on preparing a plan of conservation tasks for a Natura 2000 site (J. of Laws of 2010, No. 34, item 186 with later amendments), and pursuant to the Annex to the Regulation of 30 March 2010 by the Minister of the Environment on preparing a draft plan of conservation for a Natura 2000 site (J. of Laws of 2010, No. 64, item 401, with later amendments):

The conservation status of the natural habitat in a Natura 2000 site is characterized by the following parameters:

1) *parameter 1: surface area of the habitat;*
2) *parameter 2: structure and function;*
3) *parameter 3: conservation prospects for the habitat.*

The assessment of conservation status of natural habitat at monitoring locations within a Natura 2000 area is one of the principal items of information considered in the assessment of this status at the level of Natura 2000 site.

In the case when the monitored location is the sole occurrence of the habitat within a given Natura 2000 site, the assessment of conservation status of a habitat on this location is also its assessment of conservation status in a Natura 2000 site.

In the remaining cases, when each of the indices of specific structure and functions of the habitat is assessed for the whole area as well as each of the parameters, the data from all monitored location within the given site should be taken into account. When a portion of the habitat occurrences withi the site has not been monitored, it is recommended to take into account data from other sources, if available. The principle for assessing the parameter of 'specific structure and functions' as well as other parameters remain the same as at the level of monitoring location.

In future, the assessment of the conservation status of a natural habitat within a Natura 2000 site, based on the data from monitored locations, may need to be established more precisely. Plans of conservation tasks or conservation plans have to be drafted first because these plans define the proper understanding of a habitat's proper conservation status in a given area. In the light of these findings, the revisions of the way in which the evaluation of the indicators of structure and function of a natural habitat can be required are defined individually for various biogeographical areas or regions.

Forms detailing the characteristics of a Natura 2000 site

The forms describing the conservation status of natural habitats within Natura 2000 sites are filled on the basis of data obtained for monitoring locations in these sites. The structure of such forms is similar to that drafted for a single location.

The first part of the form, being a specific 'display window' of the site, includes information allowing its identification, describing its situation and short characteristics, pertaining to the previous observations of the habitat in the site, and also technical data such as time and date of making the observation, the name of the observer and the like.

Natural habitat observation sheet at the site	
Code and name of the natural habitat	*Code of the habitat as in Annex I of the Habitats Directive; name based on guides of habitat conservation (J. Herbich 2004), available in Internet at :* http://natura2000. mos.gov.pl/natura2000/pl/poradnik.php
Site name	*Name of the monitored Natura 2000 site*
Site code	*Filled in by coordinating institution*
Names of monitored locations	*Names of the monitored locations within the Natura 2000 site. here is no possibility to create an easily recognizable, unambiguous name, the serial numbers of subsequent sites may be added to the name of the area (or its part).*
Other protected areas	*Nature reserves, national and landscape parks, sites of ecological interest, documentation sites etc.*
Geographical coordinates	*Fill in the geographical coordinates of the beginning, centre, and the end of the transect.*
Elevation a.s.l.	*The minimum and maximum elevation a.s.l. within the entire area of the site. It may be taken from topographic maps supported with GPS measurements*
Description of the natural habitat on the site	*Synthetic information on distribution, diversity as well as on topography and relief of the terrain.*
Plant communities	*List all plant communities characterizing the natural habitat on the site.*
Surface area of the habitat patches	*The combined surface area (in hectares) of monitored patch/patches of the habitat*
Dimensions of the transect	*2 (0.2 hectare).*
Observer	*Full name of the local expert responsible for this site (according to the contract).*
Dates of observations	*Dates of all observations (as in partial forms).*
Date of filling	*Date of filling in the form by the expert.*
Date of entering	*Date of entering into the database (filled in by the coordinating institution).*
Date of approval	*Date of approval by the authorised person (filled in by the coordinating institution).*

Conservation status of a natural habitat in the site					
Parameters and indices		**Value of the index**	**Assessment of the index**		
Area of the habitat			FV/U1/U2		
Specific structure and function	Index 1		FV/U1/U2/XX		FV/U1/U2
	Index 2		FV/U1/U2/XX		
	Index ...		FV/U1/U2/XX		
Conservation prospects					FV/U1/U2
Overall assessment					FV/U1/U2
Proportion of the habitat area with different conservation status			FV	x%	FV/U1/U2
			U1	x%	
			U2	x%	

The list of the most important impacts on a natural habitat in the studied area (including its use). The coding of impacts should follow the one given in Annex E to the Standard Data Form for Natura 2000 areas.

Current impacts				
Code	**Name of activity**	**Intensity**	**Impact**	**Synthetic description**
		A/B/C	+/0/-	
		A/B/C	+/0/-	

The list of factors which – in a longer perspective – may constitute a threat to the species and its habitat: (future foreseeable impacts such as, for example, planned capital projects, changes in management and use, and increasing pressure from urban development). The codes of threats according to Annex E of the Standard Data Form for Natura 2000 areas should be used.

Threats (future, foreseeable impacts)				
Code	**Name**	**Intensity**	**Impact**	**Synthetic description**
		A/B/C	+/0/-	
		A/B/C	+/0/-	

Other information	
Other natural values	*Other observed species of animals and plants listed in Annexes to the Habitats and Birds Directives: endangered species (Red book) and other rare species (give their numbers in the following scale: numerous, moderately numerous, rare); other unique values in the area.*
Other observations	*Any information helpful for the interpretation of results, e.g. weather anomalies.*
Management of the area	*List the institutions, organisations, legal entities responsible for the management of the area (e.g. national park, forest directorate and forest districts, Regional Water Management Authority and the like).*
Existing plans of conservation/management/ land management	*Protection plans for national parks and nature reserves, forest management plans, nature conservation plans in the State Forests, re-naturalisation plans (e.g. LIFE, EcoFund). Any documents which can be of significance to the conservation of the described natural habitat in the area.*
Protection measures carried out and assessment of their effectiveness	*E.g. strict protection, mowing, increasing water level, grazing, other restoration measures.*
Methodological remarks	*Any other remarks associated with the work carried out, including, above all, information essential to further planning of monitoring (methodology of work; indices to be studied in monitoring, regionally optimal timing of studies and the like).*

Layout of guides

The guides for particular habitats were prepared in accordance with the following pattern:

I. Information on the natural habitat

1. Phytosociological indicators *(alliances, associations, communities)*
2. Description of the natural habitat
3. Ecological conditions
4. Typical plant species
5. Distribution in Poland

II. Methodology

1. Methodology of monitoring studies
   - Selection of monitoring locations
   - Ways of carrying out the studies
   - Time and frequency of studies
   - Research equipment
2. Assessment of parameters of the conservation state of the natural habitat, and the indices of specific structure and functions *(with distinguished cardinal indices)*
3. Example of a filled-in habitat observation sheet for a monitored location
4. Natural habitats of similar ecological characteristics *(for which the described methodology can be adapted)*
5. Conservation of the natural habitat
6. References

Additionally, in the Annex at the end of the guide here is an example of a form filled in for each particular habitat containing crude data from field studies carried out in 2006–2008. Thus, the reader can see how the results of observations are reported in practice.

The names of plants were adopted from Mirek *et al.* (2002) while phytosociological nomenclature generally followed Matuszkiewicz (2006). In some instances other syntaxonomic approaches were suggested. All publications used were cited in the References section of the description of a given natural habitat.

When describing natural habitats, extensive use was made of the texts *Poradniki ochrony siedlisk i gatunków Natura 2000 podręcznik metodyczny [The guides of the Natura 2000 habitats and species conservation – A methodological textbook]* (2004) edited by Professor Jacek Herbich, vols 1–5, published by the Ministry of the Environment in Warsaw, at times quoting directly from them.

Data gathering (database)

The system for gathering data for the needs of monitoring has been organised in a way which enables the full utilisation of the organisational structure within which the central system of information gathering has been set up. Direct supervision of the system, both substantive and technical, is exercised by the coordinating institution. Information technology solutions, developed to meet the needs of gathering monitoring data, ensure continuous, recorded, and limited access to data via the Internet. The relevant application software has been installed on the central computer in the coordinating institution.

General references

Assessment and reporting under Article 17 of the Habitats Directive. Explanatory Notes & Guidelines for the period 2007-2012. Final draft July 2011 (http://circa.europa.eu/Public/irc/env/ monnat/library?l=/habitats_reporting/reporting_2007-2012&vm=detailed&sb=Title).

Dzwonko Z. 2007. Przewodnik do badań fitosocjologicznych. Sorus, Poznań–Kraków.

Ellenberg H., Weber H. E., Dull R., Wirth V., Werner W., Paulissen D. 1992. Zeigerwerte von Pflanzen in Mitteleuropa. Scripta Geobotanica 18.2: 5–258.

Explanatory Notes & Guidelines for Assessment, monitoring and reporting under Article 17 of the Habitats Directive. Final draft – October 2006. 2006(http://www.bfn.de/fileadmin/MDB/documents/themen/natura2000/ec_guidance_2006_art17.pdf).

Herbich J. (ed.) 2004. Siedliska przyrodnicze. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Ministerstwo Środowiska. Warszawa.

Hulten E., Fries M. 1986. Atlas of North European vascular plants. North of the Tropic of Cancer. T. 1. Koeltz Scientific Books, Kšnigstein.

Kaźmierczakowa R., Zarzycki K. (eds). 2001. Polska Czerwona księga roślin. IB im. W. Szafera PAN, IOP PAN, Krak—w.

Matuszkiewicz J.M. 2001. Zespoły leśne Polski. PWN, Warszawa.

Matuszkiewicz W. 2008. Przewodnik do oznaczania zbiorowisk roślinnych Polski. PWN, Warszawa.

Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M. 2002. Flowering plants and pteridophytes of Poland a checklist. IB im. W. Szafera PAN, Krak—w.

Mirek Z., Zarzycki K., Wojewoda W., Szeląg Z. 2006. Red list of plants and fungi in Poland. IB PAN, Krak—w.

Mróz W., Perzanowska J., Olszańska A. (eds). 2011. Natura 2000 w Karpatach. Strategia zarządzania obszarami Natura 2000. IOP PAN, Kraków.

Ochyra R., Żarnowiec J., Bednarek-Ochyra J. 2003. Census catalogue of Polish mosses. Katalog mch—w Polski. IB im. W. Szafera PAN, Krak—w.

Piękoś-Mirkowa H., Mirek Z. 2003. Flora Polski. Atlas roślin chronionych. Mulico Oficyna Wydawnicza, Warszawa: 88–89.

Studnik-Wójcikowska B., Werblan-Jakubiec H. (eds). 2004. Gatunki roślin. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Ministerstwo Środowiska. Warszawa.

Wysocki C., Sikorski P. 2002. Fitosocjologia stosowana. Wyd. SGGW. Warszawa.

Zając A., Zając M. (eds) 1997. Atlas rozmieszczenia roślin naczyniowych chronionych w Polsce. Distribution Atlas of Vascular Plants Protected in Poland. Prac. Nakł. Chorologii Komputerowej Instytutu Botaniki UJ, Kraków.

Zając A., Zając M. (eds). 2001. Atlas rozmieszczenia roślin naczyniowych w Polsce. Distribution Atlas of Vascular Plants in Poland. Prac. Nakł. Chorologii Komputerowej Instytutu Botaniki UJ, Krak—w.

Zarzycki K., Trzcińska-Tacik H., Różański W., Szeląg Z., Wołek J., Korzeniak U. 2002. Ecological indicator values of vascular plants of Poland. Ekologiczne liczby wskaźnikowe roślin naczyniowych Polski. Biodiversity of Poland 2. Instytut Botaniki im. W. Szafera, PAN, Krak—w.

Zarzycki K., Szeląg Z. 2006. Red list of the vascular plants in Poland. Czerwona lista roślin naczyniowych w Polsce. In: Z. Mirek, K. Zarzycki, W. Wojewoda, Z. Szeląg (eds). Red list of plants and fungi in Poland. Czerwona lista roślin i grzybów Polski. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków: 9–20.

Glossary of selected terms

Abiotic – describes a non-living component of the environment (e.g. water, sediments).
Abrasion – the destruction of coastal cliffs and the removal of its contents caused by the mechanical scraping and friction of rock material carried by waves and sea currents. This destructive process is aided by wind and ice.
Anthropogenic pressure – all direct and indirect human activities leading to various (negative or positive) changes in the natural environment.
Ascension – the upward movement of underground water in rocks, resulting from differences in hydrostatic pressures.
Nutrients (bioelements) – chemical elements indispensable to life, which constitute organisms and participate in life processes. They are divided into macroelements (nitrogen, phosphorus, potassium, calcium, iron, and magnesium), and microelements (e.g. zinc, copper, sodium, selenium, and silicon).
Habitats Directive – international legal act defining the setting up and functioning of the Natura 2000 ecological network, and – more generally – the principles of the conservation of natural habitats in the European Union. Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
Ecosystem – a system encompassing all living organisms in a specific area (biocoenosis), organic matter and the abiotic environment (biotope). The biocoenosis and biotope are linked functionally through matter circulation and energy flow.
Expansive plant species – rapidly spreading , usually common plant species, which – as a result of secondary succession – constitute a threat to rare plant communities, by its abundant occurrence reducing the biodiversity of natural habitats.
Aeolian (process) – occurring as an effect of wind action causing deflation (i.e. blowing away) of fine mineral and organic material or its build-up i.e. accumulation. As the result of the aeolian process, in dune habitats dunes and depressions between sand dunes are formed by either the blowing away of sand or being buried by sand.
Erosion – mechanical destruction of Earth surface (rocks, soils) coupled with the removal of eroded material effected chiefly by water (e.g. river erosion, abrasion), and by wind (e.g. deflation).
Eutrophication – increase in fertility, a process of accumulation of nutrients, chiefly nitrogen and phosphorus.
Phytocoenosis – really existing plant community constituting a part of a given ecosystem.
Characteristic species – a species (or a taxon of lower rank) which occurs chiefly in a specific syntaxon i.e. in a certain territory, it has a 'gravity point' of occurrence in a given syntaxon (Matuszkiewicz 2008). It means that: (1) in other syntaxa it is not found or very rarely, (2) occurs with a significantly higher degree of constancy in the given syntaxon, and (3) in this syntaxon it achieves a higher degree of viability.
Dominant species – this term was applied in the definitions of some of the indicators of the specific structure and functions of a natural habitat, in the following meaning: species (one or more) occurring most frequently (occurring in highest numbers) on a monitored location or transect; generally these were 1-2of the most frequent species of vascular plants.

Expansive plant species – this term was applied in the definitions of some of the indicators of specific structure and functions of a natural habitat, in the following meaning: a species increasing its numbers at very high rate, supplanting the species typical to a natural habitat.

Differential species – a species (or a lower-rank taxon) which occurs in a given syntaxon but does not occur in other syntaxa. These are usually taxa with wide amplitude. As a rule, these taxa are not classified in the group of characteristic taxa, nevertheless they can sometimes, at the same time, be characteristic taxa for the syntaxa of higher rank (Matuszkiewicz 2008).

Alien species – a species occurring outside its natural range of distribution in the form of individuals or viable gametes, spores, seeds, eggs or parts of individuals by which they can proliferate (definition follows the Nature Conservation Act, Dz.U. (J. of Laws) of 2004, No. 92, item 880, Article 5.1 c, with later amendments). The current list of alien species occurring in Poland is available on the following website: www.iop.krakow.pl/ias.

Typical species – a plant or animal species whose occurrence is particularly associated with a given natural habitat. Both characteristic and differential plant species are included as well as species whose finding may facilitate identification or assessment of the conservation status of natural habitat.

Sea ingression – a process involving the inundation of low-elevation land areas by sea resulting from either increasing water levels or the lowering of the land. Sea water ingression also means that salt water penetrates inland fresh water areas.

Introduction – aided by the direct or indirect human actions, the purposeful or accidental transfer or translocation of an alien species into a natural habitat, outside the range in which the species occurs, or has occurred naturally in the past.

Invasive alien species – alien species whose introduction and spreading threatens biological diversity.

Impoverished plant communities – plant communities of poorer floristic composition, most often resulting from strong, one-sided anthropogenic pressure, devoid of characteristic species, and – because of it – often impossible to classify into a defined association, but only to units of higher rank (alliance or even order).

Class of associations – the highest unit in the systematics of plant communities, often corresponding to principal ecological groups of plant communities, such as coniferous forests, alder woods, or grasslands.

Shrublet – a perennial plant with lignified stems lower than 0.5 m in height, often with many branchings and stolons.

Littoral zone – a transitional zone between land and water. It also includes the shallow sea bottom, coast and the portion of land periodically inundated with water.

Lithosols – initial rocky soils, skeleton soils formed out of solid rock; generally occurring in mountains.

Macrophytes – large macroscopic (visible to a naked eye) aquatic plants.

Fen, mire – a type of peat-generating community, whose physiognomy is defined by prevailing proportion of brown mosses which form compact sods or tufts.

Sphagnum bog – community of peat bog vegetation, with the characteristic outlook given by turf made of peatmosses.

Natural seeding – young seedlings and young trees occurring in high numbers on a forest floor or other grounds, developing spontaneously from seeds until the time they grow above the layer of herbaceous plants.

Neophytes, neophytisation – plant species of alien origin, arriving after the 15th century, permanently settled in primary habitats, entering natural communities. Neophytisation is one of the forms of degeneration of plant communities involving alien species entering and settling in natural communities.

Nitrophilous – a concept in the field of plant ecology – plant species that require great quantity of nitrogen in the soil for their development.

Oligotrophic – poor in terms of nutrient content.

Parameters of the conservation status of a natural habitat – surface area of a habitat, structure and functions, and conservation prospects. On the basis of these, an overall assessment is made of the status of the habitat within a biogeographical region, in a Natura 2000 area, or on a monitoring location. The names of parameters were borrowed from forms drafted by the European Commission for reports on the conservation statuses of habitats and species in biogeographical regions in particular Member States. It may be generally stated that a parameter of a habitat status describes, in a synthetic way, a group of features of a natural habitat as well as the factors affecting them.

Breast-height diameter – the diameter of a tree, measured traditionally at height of 130 cm from the ground.

Piezometer – a device (usually a pipe with a small diameter) for measuring the level of underground waters.

Underwood – young generation of trees more than 50 cm high, which has grown under the forest canopy, when fully grown they later constitute the higher layer of a forest stand.

Brushwood – lower layer of forest community, composed of shrub species and trees with heights from 50 cm to 4 m.

Subassociation – syntaxon, hierarchically lower than association, distinguished on the basis of the presence of certain species (differential species) as reflecting the differences among local habitats or regions.

Relict, relict species – a plant or animal species preserved in a given region, on limited, usually small area; more widely distributed in the past; this term is usually used in referring to populations which have survived during glaciation periods; most often in highly elevated mountain areas.

Cutting, tree cutting – a way of forest management (wood harvesting from a forest) and simultaneous forest regeneration.

Shelterwood cutting – a way of forest management and regeneration, involving thinning the forest stand, repeated several times over a relatively short period, up to the complete removal of trees. Most often, the gradual thinning serves the purpose of emergence of natural regeneration which will replace the old forest stand.

Group cutting – a way of forest management and regeneration, which involves cutting a group of trees resulting in creating so-called nests where new regeneration emerges, or is introduced.

Selection cutting (continuous) – a forest management and regeneration technique, which involves the continuous cutting of single trees or tree groups and the incessant regeneration of the forest, with the young generation of trees having permanent shelter under the canopy of the stand.

Stepwise cutting – a forest management and regeneration technique, involving various kinds of regenerative cutting, leading to the balanced thinning of the forest, well spaced in time, which results in mixed forest stands being diversified in terms of age and spatial structure.

Clear cutting – a forest management and regeneration technique, involving the simultaneous felling of all trees on a relatively large area called a clear cut area, where a new generation of trees is often planted.

Ruderal communities – communities occurring in secondary habitats, relatively deeply modified by humans, often on polluted soils, vulnerable to rapid changes.

Seminatural – a term denoting plant communities or natural habitats which have developed owing to human activities, but on the basis of native vegetation cover.

Natural habitats – within the meaning of the Habitats Directive (and the Polish Nature Conservation Act following it): *terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features, whether entirely natural or semi-natural.* The list of natural habitats of European importance was given in Annex I of the Habitats Directive, and also in one of the regulations to the Polish Nature Conservation Act. It should be emphasised that in this expression, the concept approximates the definition of 'ecosystem' as it includes both abiotic biotope, and biotic biocoenosis. On the other hand, the best component helping to identify a natural habitat is vegetation – and more precisely – plant communities which are phytosociological identifiers of a given natural habitat.

Conservation status (favourable conservation status) – the conservation status of a natural habitat will be taken as "favourable" when: 1. the features of the natural habitat have the prospect of being maintained over a long time perspective; 2. the natural range and areas it covers within that range are stable or increasing and are likely to continue to exist for the foreseeable future; and 3. its specific structure and functions are maintained.

Monitoring/monitored location – a relatively uniform area of the examined natural habitat, easily distinguished in the field. The surface areas of such locations may range from several hundred square meters to over ten hectares, depending on the spatial structure of the studied natural habitat.

Succession – directional changes in vegetation, which consist of subsequent plant communities (ecosystems) following one after another, differing in terms of structure and species composition. The succession starts from an initial stage, followed by transitional stages, and ends with the most sustainable stage, suitable for the given habitat, called climax.

Natural succession – succession occurring spontaneously i.e. without human interference.

Primary succession – the process of colonising previously uninhabited places, leading to developing complex ecosystems.

Secondary succession – succession occurring in places where the previously growing vegetation was destroyed.

Syntaxon – a general name of any unit within the systematics of plant communities (subassociation, association, alliance, order, class).
Syntaxonomy – science of systematics of plant communities.
Taxon – a general name of any taxonomic unit within the systematics of living things (subspecies, species, genus, family, order etc.).
Raised bog – a bog supplied exclusively by water from atmospheric precipitation, extremely poor in terms of nutrient components.
Transect – a line along which observations are made, an elongated study area serving most often to record the variability of the studied feature in an environmental gradient. In the monitoring of natural habitats, the transect is marked in order to ensure standardisation and repetitiveness in fieldwork methods in a patch of natural habitat, being as homogenous as possible.
Thinning – a sylvicultural measure, removing a certain number of trees from a stand in order to improve the condition of development for the remaining trees, the objective of thinning is also aimed at improving the species composition of a tree stand by eliminating undesired trees (so-called converting thinning).
Glacitectonic faults – deformations of the substrate below a glacier as well as sediments deposited by it, resulting from ice pressure or friction against the substrate.
Variant – in phytosociological systematics: a unit lower than a subassociation, differentiated on the basis of the presence of certain species (differential species) as an effect of local-habitat diversification.
Indices of the natural habitat conservation status – partial assessments of the 'specific structure and functions' parameter; these are the most important features of the studied habitats or the phenomena affecting the key ecological processes for the conservation of a given habitat.

3110 Lobelia lakes – Oligotrophic waters containing very few minerals of sandy plains *(Littorelletalia uniflorae)*

Photo 1. Obrowo Małe lobelia-lake (© Photo M. Kraska).

I. INFORMATION CONCERNING THE NATURAL HABITAT

1. Phytosociological identifiers

Class: Littorelletea uniflorae Br.Bl. et R.Tx. 1943
- Order: Littorelletalia uniflorae Koch 1926
  - Alliance: *Isoetion lacustris* Nordh. 1936 em. Dierss. 1975
    - *Isoetetum lacustris* Szankowski et Kłosowski 1996 n.n.
    - *Isoetetum echinosporae* Koch 1926 em. Dierss. 1975
  - Alliance: *Lobelion* (Van Den Bergen 1944) R.Tx. et Dierss. ap. Dierss. 1972
    - *Lobelietum dortmannae* (Oswald 1923) Tx. ap. Dierss. 1972
    - *Myriophylletum alterniflori* LemŽe 1937 em. Siss. 1943
    - *Ranunculo-Juncetum bulbosi* Oberd. 1957
  - Alliance: *Eleocharition acicularis* Pietsch 1966 em. Dierss. 1965
    - *Luronietum natantis* Szankowski 1988 n.n.

Class: Fontinalietea antipyreticae von Hubschmann 1957
- *Order: Leptodictyetalia riparii Philippi 1956*
  - *Alliance: Fontinalion antipyreticaea W. Koch 1936*
    - *Community with Drepanocladus tenuinervis*

Class: Utricularietea intermedio-minoris Den Hartog et Segal 1964 em. Pietsch 1965

Order: Utricularietalia intermedio-minoris Pietsch 1965
Alliance: Sphagno-Utricularion Th. Mźller et Gšrs 1960
Sparganietum minimi Schaaf 1925
Warnstorfietum exannulatae Szankowski 1998 n.n.
Community with Sparganium angustifolium
Community with Sphagnum denticulatum
Class: Scheuchzerio-Caricetea fuscae (Nordhagen 1936) R. Tx. 1937
Order: Scheuchzerietalia palustris Nordhagen 1936
Alliance: *Caricion lasiocarpae* Vanden Berghen in Lebrun et al. 1949
Calletum palustris (Osvald 1923) Vanden Bergen 1952
Caricetum lasiocarpae Osvald 1923
Menyantho-Sphagnetum terestis WarŽn 1926
Sphagno apiculati-Caricetum rostratae Osvald 1923 em. Steffen 1931
Class: *Charetea* Krausch 1964
Order: Charetalia fragilis Sauer 1937
Alliance: *Nitellion flexilis* (Corill. 1957) Dąmbska 1966
Nitelletum flexilis Corill. 1957
Nitelletum capillaris Corill. 1957
Class: *Potametea* Tx. et Prsg. 1942
Order: *Fotametalia* Koch 1926
Alliance: *Nymphaeion* Oberd. 1957
Potametum natantis So— 1927
Nymphaeo albae-Nupharetum luteae Nowiński 1928
Polygonetum natantis So— 1927
Nymphaeetum candidae Milian 1958
Nupharetum pumili Oberd. 1957
Alliance: *Potamion* Koch 1926 em. Oberd. 1957
Elodeetum canadensis (Pign.1953) Pass. 1964
Ceratophylletum demersi Hild. 1956
Class: *Phragmitetea australis* (Klika in Klika et Nov‡k 1941) R. Tx. et Prsg. 1942
Order: *Phragmitetalia australis* W. Koch 1926
Alliance: *Phragmition australis* W. Koch 1926
Phragmitetum australis (Gams1927) Schmale 1939
Equisetetum limosi Steff. 1931
Alliance: Magnocaricion elatae W. Koch. 1926
Caricetum rostratae Rubel 1912
Caricetum elatae W. Koch 1926

2. Description of the natural habitat

Soft-water lakes, oligotrophic, mesotrophic or in the early developmental stages of dystrophic lakes, marked by the presence of isoetids grouped in associations: *Lobelietum dortmannae*, *Isoetetum lacustris,* the markedly rarer *Isoetetum echinosporae,* and also *Myriophylletum alterniflorae.*

The name Lobelia-type lake pertains to such a lake where characteristic plant species (isoetids) (Photos 2–6) occur together or separately: water lobelia *Lobelia dortmanna,* quillwort *Iso'tes lacustris,* thorny quillwort *Iso'tes echinospora,* European shoreweed

Photo 2. Quillwort *Isoëtes lacustris* in Wielki Staw lake in the Karkonosze mountains (© Photo R. Knapik).

Littorella uniflora, alternate water-milfoil *Myriophyllum alterniflorum*, and – more rarely – floating water-plantain *Luronium natans.* These plant species develop specific associations and reproduce freely.

The lakes which in the past were classified as lobelia-type lakes, and do not meet the criteria at present, are considered to be historical lobelia lakes or degraded lobelia lakes. The detailed description of the habitat as well as references broadening the knowledge about lobelia lakes can be found in *Poradniki ochrony siedlisk i gatunków Natura 2000,* vol. 2. *Wody słodkie i torfowiska* (Kraska 2004).

3. Ecological conditions

Lobelia-type lakes (Oligotrophic waters containing very few minerals of sandy plains) are most often inland lakes. Only a few of them have an inflow of water from temporary water courses. Characteristic features of lobelia-type lakes include specific physicochemical properties of their waters and the occurrence of characteristic vegetation – isoetids. The occurrence of isoetids from the *Lobelion dortmannae* and *Isoetion lacustris* alliances is possible only in lakes characterised by low mineralisation and low calcium content. The features which are necessary for a lobelia-lake to remain in good condition and guarantee the presence of specific vegetation, are: transparent bluish-coloured water; pH of water from 5.5–7.5; electrolytic conductance lower than 100 μS cm^{-1}, trace quantity of calcium, low concentrations of nitrogen and phosphorus, high transparency of water, characteristic composition of plankton, and no algal blooms.

Based on the physicochemical properties of their waters and the proportion of characteristic plant species, Lobelia-type lakes were divided into four subtypes:

- dystrophic lakes: oligohumic and polyhumic,
- nutrient-balanced lakes,
- eutrophicated lakes,
- degraded lakes.

The acid reaction of water (pH 3.8–5.9) is a distinct feature of dystrophic lobelia lakes. It results from the low quantities of calcium and magnesium and thus lacks the reaction buffering capacity with the inflows of fulvic acids from catchment areas in coniferous forests, acidic Pomeranian beech forests, as well as from coastal vegetation zones – ecotones – whose floristic compositions correspond to the initial stages of bryophyte or high-moor peatbogs. Water in the dystrophic, oligohumic lobelia lakes contain low levels of humic substances, therefore its colour is relatively light, sometimes very light-blue.

On the other hand, the waters of dystrophic polyhumic lobelia lakes contain high levels of humic substances – humins which give them more intensive colour, light-brown or dark-brown. In the polyhumic lakes there are fairly large point concentrations of nitrogen and phosphorus compounds. These elements are permanently bound with humic substances in metaloorganic complexes and therefore are not available to plants.

NOTE: dystrophic lobelia lakes are not the same as dystrophic lakes. Because of the presence of large quantities of humic substances, their waters are brown-coloured, similarly as in dystrophic lakes. However, they can be easily distinguished owing to the presence of plant characteristic of lobelia-type lakes.

Nutrient-balanced lobelia lakes have a neutral water reaction or close to neutral: pH 6.0–7.6, low electrolytic conductance (low quantities of mineral salts), and higher levels of calcium and bicarbonates, compared with dystrophic lobelia lakes.

Eutrophicated lobelia lakes are marked by higher concentrations of nitrogen and phospohorus, calcium, and magnesium. The nitrogen and phosphorus are not bound into permanent complexes and thus they are available to plants. This situation results in the occurrence of undesirable algae or also algal blooms, changes in the physicochemical properties of the water as well as the disappearance of vegetation typical of Lobelia-type lakes and the emergence of vegetation typical of eutrophicated lakes.

Degraded lobelia lakes are those lakes which historically were lobelia lakes but the long-lasting eutrophication process of waters has resulted in the disappearance of vegetation typical of lobelia lakes. In waters of this type of lake, high concentrations of nitrogen and phosphorus compounds, and high values of electrolytic conductance are found.

Because of their small surface areas and often shallowness, lobelia lakes are particularly vulnerable to adverse impacts, especially those resulting from human activities. Changes in hydrological systems through draining peat bogs near the lakes, dumping humic water into the lakes, liming and fish stocking lead to changes in the physicochemical properties of their waters and – as a consequence – to the disappearance of characteristic vegetation. Lobelia lakes are at risk either of eutrophication or of dystrophication. Therefore, this habitat is unstable, susceptible to changes and can rapidly degrade and disappear. The good conservation status of lobelia lakes depends primarily on maintaining the specificity of landscape in form of natural associations in the catchment areas of the lakes, with its most essential elements such as pine forests, acidic beech forests, Sphagnum bogs and highmoor peatbogs.

Photo 3. Quillwort *Isoëtes lacustris* (left) and water lobelia *Lobelia dortmanna* (© R. Piotrowicz).

Photo 4. Water lobelia *Lobelia dortmanna* (© R. Piotrowicz).

Photo 5. European shoreweed *Littorella uniflora* (© R. Piotrowicz).

Photo 6. Kapka lake shore with flowering water lobelia *Lobelia dortmanna* (© R. Piotrowicz).

The following species from Annex II of the Habitats Directive are present in lobelia lakes: floating water-plantain *Luronium natans*, diving water beetle *Dytiscus latissimus*, water beetle *Graphoderus bilineatus*.

4. Typical plant species

The plant species that differentiate this habitat from other lakes are water lobelia *Lobelia dortmanna* (Photos 3, 4 and 6), quillwort *Iso'tes lacustris* (Photo 3), thorny quillwort *Iso-'tes echinospora,* European shoreweed *Littorella uniflora* (Photo 5), alternate water-milfoil *Myriophyllum alterniflorum,* floating water-plantain *Luronium natans.*

5. Distribution in Poland

Lobelia lakes in Poland are situated in the Pomeranian Lake District, Bory Tucholskie forest, Charzykowska plain, and the Kashubian Lake District. The greatest numbers occur near Kartuzy, Sulęczyn, Bytów, Miastko, Bobolice, Czaplinek, Złocieniec, Swornegacie, and Charzykowy localities. Apart from these areas, there are also three lakes classified as lobelia lakes in the Olsztyn Lake District and Wielki Staw lake in the Karkonosze mountains, where the abundant presence of quillwort *Iso'tes lacustris was found.*

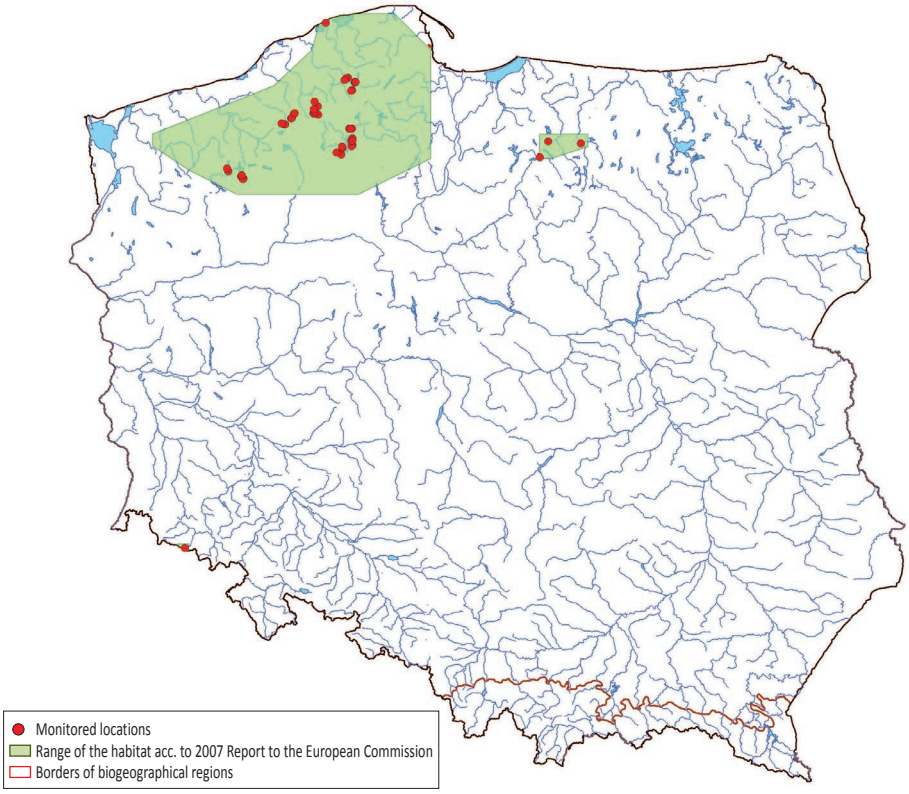

Fig. 1. Distribution of monitoring locations against the background of the geographical distribution of the habitat.

II. METHODOLOGY

1. Methodology of monitoring studies

Selection of monitoring locations

On account of the great value of the habitat and the possibility of its rapid degradation as well as the resultant possibility of disappearance of plants characteristic of lobelia lakes, monitoring should cover the lakes situated in all regions of their occurrence. The monitoring should cover the lakes within the Olsztyn Lake District and Wielki Staw lake in the Karkonosze mountains. In 2009–2010 the monitoring of lakes was performed in the Pomeranian Province (in the neighbourhoods of Byt—w‚Miastko, and Charzykowy localities), in the Western Pomeranian province (near Bobolice), Warmia-Masuria, and Lower Silesia provinces (Karkonosze mountains). The monitoring studies encompassed the area of the Bory Tucholskie forest, Charzykowska plain, Olsztyn Lake District, and the Karkonosze mountains. The monitored locations are representative of lobelia lakes occurring in Poland and covered all the regions where this type of lake was found and described.

Before any detailed field studies are initiated it should be first confirmed that the given lake was correctly classified as a lobelia lake. The monitoring locations can cover the entire lake or its clearly distinct part. As a consequence, habitat 3110 may not necessarily

cover the whole lake. So, in the case of large lakes, more than one monitoring location can be situated on the given lake. The presence of the characteristic plants should be assessed on a selected transect. The person who carries out the monitoring should have the possibility to sail around the lake or its evidently distinct part. Samples for the determination of physicochemical indices as well as plankton samples should be collected from the deepest location, usually situated centrally on the lake or its evidently distinct part, and not from the littoral zone.

Method of performing studies

The experience from the monitoring of lobelia lakes indicates that it is a habitat which cannot be properly assessed without cooperation with experts. Additional problems in identifying some characteristic species are associated with the difficulty of finding these species and actually confirming their presence. In this situation the most recommended method of searching for indicator species would be to use divers. This method is, however, very specialised, difficult and costly when used for monitoring. In order to avoid the too easy neglect of the assessment of a habitat, or not to commit an error when assessing the status of a habitat, it would be wise to nevertheless consider this method for monitored locations which meet the criteria required for habitat 3110 and where well-developed communities of species characteristic of lobelia lakes, and where their presence was not confirmed in the field studies.

During the implementation of monitoring activities in the field, the following observations and studies should be performed:

- evaluating overgrowth of lake shores, shallowing, fragmentation of the habitat, and changes which have taken place in the habitat since the time of the previous study;
- taking note of possible damage, littering, sewage dumping, poaching etc.;
- finding the place where the transect was marked at the previous study (GPS data available). If the habitat is examined for the first time, a representative transect should be found and marked;
- determining the characteristic combination of aquatic plant communities in the marked transect;
- determining the dominant species in particular communities;
- determining the occurrence of rare, protected, characteristic species or species alien to the habitat and performing their quantitative assessments (sporadic, very scarce, abundant, massive occurrence);
- in the central part of the lake or in the central selected part of the lake (open water table, not overgrown, pelagial zone), the following elements should be determined: colour of water, transparency (visibility of the Secchi disk), conductance, and reaction of water (pH). The samples should be taken from the surface layer (ca. 0.5–1 m);
- The sample should be collected to analyse the plankton (auxiliary parameter). The samples should be taken from the surface layer (ca. 0.5–1 m) of water and stabilised with Lugol's solution.

If the transect marked in previous studies was moved, the new geographical coordinates should be identified and recorded and the size of the community should be assessed

whether it was reduced, expanded, or remained comparable with the size of the previously examined community.

If the lake is not large, and it is technically possible, the lake should be – additionally to the central part – sailed around in order to find the occurrence of vegetation patches or even single individuals of rare, protected, characteristic species or species alien or invasive towards the habitat, situated outside the studied transect. If a marked part of the lake is selected for the studies and meets the criteria for the habitat, it should be sailed around.

The point of collection of samples made to determine plankton should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake). The samples are taken with the use of a plankton net (a net with a tiny mesh size, ř 20 µm or less, is recommended because it will allow both phyto- and zooplankton to be identified). After concentrating in the plankton net, the sample should be poured into a plastic container and several drops of Lugol's solution should be added to stabilise it. It should also be well secured against spilling during transportation. A rough analysis of the diversity and percentage proportions of phytoplankton and zooplankton should be done in at least twenty visual fields under a light microscope.

If a plankton net is unavailable, phytoplankton may be assessed in samples with the use of the sedimentation method.

No precise determination of phyto- and zooplankton is required, and if in doubt, consultations with experts are recommended.

Time and frequency of studies

The monitoring studies of the habitat conservation status in the areas should be conducted once every three years. In cases where the additional indices indicate the evidently bad status of the habitat, a repeated study should be considered after a shorter interval, e.g. after one year.

It is recommended to carry out the studies in summer, in the months of July and August but not earlier than the beginning of July, and not later than mid September.

Equipment used in studies

Equipment indispensable for field studies:

- map, GPS, pencil, notebook,
- vessel suitable for local conditions: dinghy or boat,
- field boots or rubber boots,
- camera,
- probe for measuring conductivity and reaction of water,
- Secchi disk,
- probe measuring the depth of a water body, or any other simple device to measure maximum depth of the examined water body,
- an anchor for pulling submerged vegetation.

Non-obligatory equipment, required in the case of describing additional indices:

- plankton net,

- small container for plankton,
- Lugol's solution,
- access and possibility to use a simple light microscope.

2. Assessment of the conservation status of the natural habitat as well as indices of specific structure and functions

Table 1. Description of indices of specific structure and function of the natural habitat, as well as 'conservation prospects' for natural habitat 3110 Lobelia lakes (Oligotrophic waters containing very few minerals of sandy plains)

Parameter Index	Description
Specific structure and functions	
Characteristic combination of communities within the transect	This index describes the occurrence of plant communities within the selected transect (typical, representative of the habitat). In the description and assessment, the identified taxa should be listed although without the necessity of listing details of sedge communities. This index evaluates whether the communities typical of a given habitat occur and in what conservation status they are. The presence of indicator species of lobelia lakes should also be found and described, and their quantitative assessment made. The assessment should be performed on the basis of the transect determined and defined (geographical coordinates available) earlier. In the case of moving the studied transect, it is necessary to identify and record the new geographical coordinates.
Species indicating habitat deterioration	This index describes the occurrence of species typical of eutrophicated waters, providing the possibility to find the progressive deterioration of the habitat. In the case of lobelia-lakes communities, these are: yellow water-lily *Nuphar lutea,* rigid hornwort *Ceratophyllum demersum,* spiked water-milfoil *Myriophyllum spicatum,* frogbit *Hydrocharis morsus-ranae,* Canadian pond-weed *Elodea canadensis.* The assessment should be performed on the basis of the transect determined and defined (geographical coordinates available) earlier. In the case of moving the studied transect, it is necessary to identify and record the new geographical coordinates.
Water colour	One of the parameters describing water quality. The colour of water is affected by organic waste, humic substances, soil erosion, sewage, and the abundant development of phytoplankton. All the above-listed components have an adverse effect and lead to the deterioration of the habitat's condition. The colour of water is assessed at a point situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake).
Water Reaction	The parameter describing the acidity or alkalinity of water. It is an index essential to lobelia lakes because the lowering pH of water will testify to the disappearance of the habitat for plants typical of lobelia lakes and its possible transformation into a dystrophic lake. Conversely, if the pH value is too high it testifies to the disappearance of the habitat and the possible transformation of a lobelia-lake into a eutrophic lake. The pH value is measured using a 1 m long pH probe in the surface layer of water (ca. 0.5–1 m) from the pelagial zone. The measuring point should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake).
Conductivity (electrolytic conductance)	The value of electrolytic conductivity reflects the level of ion content in the water and is a measure of the water's capability of conducting an electric current. Pollutants in water undergo electrolytic dissociation which also causes higher conductivity. Conductivity is also affected by the quantity of gases absorbed from the air (CO_2, SO_3 NO_2, NH_3) and by pollutants of anthropogenic origin (sewage discharges, water run-off from farmlands containing nitrogen and phosphorus fertilisers and the like). The value of conductivity is measured by a conductivity probe in the surface layer of the water (ca. 0.5–1 m) from the pelagial zone. The measuring point should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake).

Water transparency	Measured as visibility of the Secchi disk. The Secchi disk is a white disk with a diameter measuring 30 cm. It is lowered – on a calibrated line or measuring tape – into the water until the observer loses sight of the disk. The measuring point should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake). Poor transparency of water adversely affects the development of the immersed vegetation and can be caused by either the abundant development of phytoplankton, or by the presence of suspended matter in the water.
Auxiliary index	
Plankton*	Evaluated on the basis of the analysis of phytoplankton and zooplankton in the examined samples. The three-step assessment of the value of this index is performed as described in Table 2, separately for each of these two groups. If the evaluations of the components differ, the lover value is adopted as a final assessment. Phytoplankton and zooplankton are components which rapidly react to the change of conditions and therefore their response is the fastest. Phytoplankton and zooplankton respond and show changes in a shorter time than higher-level plants.
Conservation prospects	A survey should be made to determine the real possibility of preserving the correct status of the habitat or rectifying the incorrect status. The description should include information about potential conservation measures aimed at the preservation or improvement of the status of the habitat. The following should also be evaluated: the condition of the lakes' catchment areas and the land management methods pursued there e.g. whether water and waste-water management measures are implemented, or whether pollutants are dumped in lakes, which pertains to homes and farms as well as recreational facilities; methods of farm and forestry management in close neighbourhoods of the lake and its catchment area; and finally the management of the lobelia lakes themselves should be assessed. In the case of allowing recreational activities on the lakes, the conditions of recreational infrastructure should be also evaluated.

* In lake ecosystems, the blue-green algal blooms are adverse and undesirable phenomena. In the event that such blooms are found in lobelia lakes it means that their trophism is increasing, leading to the deterioration of the conservation status and, ultimately, to the disappearance of habitat 3110. The presence of blue-green algal blooms prompts us to pay particular attention to the status of the ecosystem in which this phenomenon has been observed and to undertake immediate conservation measures.

Table 2. Evaluation of status parameters and indices of specific structure and functions for natural habitat 3110 Lobelia lakes (Oligotrophic waters containing very few minerals of sandy plains)

Parameter	**FV favourable**	**U1** unfavourable inadequate	**U2** unfavourable bad
Specific structure and functions (including typical species)			
Characteristic combination of communities within the transect	Patches of *Lobelietum dortmannae*, *Isoetetum lacustris* or *Myriophylletum alterniflori association predominate*. *High diversity of species characteristic of* lobelia lakes, great or massive occurrence of characteristic species. Species characteristic of lobelia lakes: water lobelia *Lobelia dortmanna*, quillwort *Isoëtes lacustris*, thorny quillwort *Isoëtes echinospora,* European shoreweed *Littorella uniflora,* alternate water-milfoil *Myriophyllum alterniflorum*, floating water-plantain *Luronium natans.*	The vegetation of the *Isoeto-Lobelietum* asssociation scarcely present, domination of spiked water-milfoil *Myriophyllum spicatum* over alternate water-milfoil *Myriophyllum alterniflorum.* Little diversity among species characteristic of lobelia lakes, few, very few, or sporadic of characteristic species.	At present, species characteristic of lobelia lakes do not occur (but were recorded earlier) or occur as single individuals as accompanying species within the communities of plants typical of eutrophic or dystrophic lakes.

Species indicating degeneration of the habitat	Lack of species indicating degeneration of the habitat.	Species indicating degeneration of the habitat occur as single individuals.	Species indicating degeneration of the habitat increase their proportions in the communities. These are the following species: yellow water-lily *Nuphar lutea*, rigid hornwort *Ceratophyllum demersum*, spiked water-milfoil *Myriophyllum spicatum*, frogbit *Hydrocharis morsus-ranae.*
Water colour	Transparent, livid-blue or blue	Blue with a green or yellow-green tinge	Brown or visibly green
Reaction of water	pH 5.5–7.5	pH <5.5 to 4.5 or >7.5 do 8.5	pH <4.5 or >8.5
Conductivity (electrolytic conductance)	<100 µS cm^{-1}	100–250 µS cm^{-1}	>250 µS cm^{-1}
Water transparency	Visibility of Secchi disk >3.5 m	Visibility of Secchi disk 1.5–3.5 m	Visibility of Secchi disk <1.5 m
Auxiliary index			
Plankton: Phytoplankton	In the dystrophic lakes, many mixotrophic taxa, chrysophytes or tiny green algae and/or chroococcus blue-green algae occur, except those of the *Microcystis and Woronichinia genera*. *Also possible is the domination of dinophytes or cryptophytes as well as the occurrence of Gonyostomum semen (Raphidophyceae).*	Co-domination of blue-green and green algae	Domination of filamentous blue-green algae, or those of the *Microcystis and Woronichinia genera*, blue-green algal blooms.
Zooplankton	*Rotatoria* and *Cladocera occur often but at low densities,* few *Copepoda*, prevalence of large forms of filtrators/cladocerans *(Daphnia!).*	*Rotatoria* and small *Cladocera (Bosmina*, *Chydorus) present.*	Domination of *Rotatoria*, particularly *Keratella cochlearis* f. *tecta.*
Overall structure and functions	All FV ore one U1	Two or three U1, none U2	One or more parameters assessed as U2
Conservation prospects	Conservation prospects for the habitat are good or excellent, no significant impact of threatening factors predicted, survival of the habitat in longer time perspective is very probable.	Intermediate combinations	Conservation prospects for the habitat are bad, strong impact of threatening factors is predicted or observed, (draining of the area, bad management of the lakes, bad land management in lake catchment areas and the like), no survival of the habitat can be guaranteed in the long term.
Overall assessment	All FV or two FV and one U1	Two or three U1, U2 – none	One or more parameters evaluated as U2

Cardinal indices

- Characteristic combination of communities within the transect
- Species indicating degeneration of the habitat

- Colour of water
- Reaction of water
- Conductivity (electrolytic conductance)
- Water transparency

Additional indices

- Plankton

3. An example of a filled-in habitat observation sheet for a monitored location

Habitat observation sheet for the monitored location	
Basic information	
Code and name of the natural habitat	**3110 Lobelia lakes**
Name of the location	*Jezioro Chlewo*
Type of the location	*Research*
Plant communities	*Isoeto-Lobelietum littorelletosum* *Isoeto-Lobelietum isoetosum* (syn. *Isoetetosum lacustris*) *community with Drepanocladus tenuinervis* moss
Description of the habitat on the site	Large lobelia-lake (area of 54.9 hectares) distinctly divided into two parts. Shoreline not very varied. Lake shore sandy, on the southern side – steep, currently densely built with recreational huts of holiday centres. The northern side of the closest part of the lake catchment area is overgrown with deciduous forest and – to a lesser extent – coniferous forest. Over the whole of the catchment area, forests cover more than half. The remaining portion is chiefly farmlands, grasslands, and buildings. The vegetation characteristic of lobelia lakes occurs abundantly, particularly in shallow and gently sloped places on the lake bottom. Up to the depth of 100 cm, water lobelia *Lobelia dortmanna* and European shoreweed *Littorella uniflora occupy the largest proportions of the area.* In this lake, quillwort *Isoëtes lacustris occupies the depth interval* from 100 to 300 cm, and the density of quillwort *Isoëtes lacustris* often exceeds 60%. Up to the depth of 4–4.5 m, *Drepanocladus tenuinervis moss occurs.* Chlewo lake shows symptoms of eutrophication. They are manifested in the form of occurrence of filamentous algae on the underwater vegetation. Thus, the sewage disposal management in the recreational buildings on the lake shores should be assessed.
Area of habitat patches	Area with *Isoeto-Lobelietum littorelletosum:* 150 m^2 Area with *Isoeto-Lobelietum isoetosum:* 480 m^2 Area with *Drepanocladus tenuinervis* moss*:* 270 m^2 Combined area of habitat patches: 900 m^2
Protected areas where the monitored location is situated	PLH320001 Bobolickie Jeziora Lobeliowe
Manager of the area	
Geographical coordinates	Geographical coordinates of the beginning of the transect: 16° 40'..."E, 53° 56' ..."N
Transect dimensions	30x30 m
Elevation a.s.l.	152.3 m
Area	Bobolickie Jeziora Lobeliowe
Annual report – basic information	
Year	2009

Monitoring type	Integrated
Local experts	Piotr Klimaszyk, Marek Kraska, Ryszard Piotrowicz
Threats	Intensive recreational development on the fringes of the lake
Other natural values	
Is monitoring required?	Yes
Justification	Trends towards degradation
Conservation measures performed	
Proposed conservation measures	Prohibition of stocking with cyprinoid fish as well as with alien fish species, prohibition of fish baiting, bathing outside designated zones, regulated sewage management in recreational facilities
Date of inspection	September 2009
Comments	

TRANSECT			
Parameters/ Indices	**Description of index**	**Value of parameter/index**	**Assessment of index**
Surface area of the habitat		The area has not changed	FV
Specific structure and functions			**FV**
Characteristic combination of communities within the transect	List the syntaxa occurring in the transect	*Isoeto-Lobelietum littorelletosum Isoeto-Lobelietum isoetosum community* with *Drepanocladus tenuinervis* moss	FV
Species indicating deterioration of the habitat	The parameter describes the emergence of species characteristic of eutrophicated waters. The list of such species recorded in the transect should be given.	None	FV
Colour of water	Colour of water is expressed in mg Pt/dm^3	Transparent water of bluish colour. In the epilimnion zone, the colour is 8 mg Pt/dm^3.	FV
Reaction of water	The value of reaction is measured with 1 m-long pH probe	The reaction of water in the epilimnion zone is: pH 6.35	FV
Conductivity (electrolytic conductivity)	Measurement is made in the surface layer by a conductivity probe and expressed in µSm cm^{-1}	The conductivity in the epilimnion zone is 60 µSm cm^{-1}	FV
Water transparency	Visibility of Secchi disk, measurement in cm	Visibility 5.1 m	FV
Phytoplankton	Describe and give the percentage proportion of species groups	No bloom. In terms of total numbers, *Chlorophyceae algae* occurred in the highest proportion (80% of total numbers of phytoplankton). The second most numerous group were cryptophytes(9% of total numbers).	FV
Zooplankton	Describe and give the percentage proportion of species groups	Rotifers *Rotatoria* definitely dominate in surface layers of open water (domination of *Keratella cochlearis* rotifer*).* Copepods *Copepoda* occur in half the number (domination of copepod species *Diaphanosoma brachyurum*)	U1

Conservation prospects				FV
Overall assessment	Proportion of the habitat area representing different conservation status within the monitoring location	FV	100%	FV
		U1	–	
		U2	–	

Human activities				
Code	**Name of the activity**	**Intensity**	**Impact**	**Description**
251	Plundering the vegetation	B	–	Destruction of lobelia lake vegetation caused by intensive recreational activities.
600	Sport and recreational infrastructure	C	–	Intensive recreational development on the fringes of the lake.

4. Habitats of similar ecological characteristics

Similar characteristics as the lobelia-type dystrophic lakes are shown by dystrophic lakes, natural habitat code 3160. However, lobelia lakes can be easily distinguished from dystrophic lakes owing to the absence of plants characteristic of lobelia lakes in the latter.

5. Conservation of the natural habitat

Eutrophication and dystrophication are the most dangerous threats to lobelia lakes as both can cause the disappearance of the habitat.

In order to avoid the eutrophication of the habitats, the principles of conservation based on conscious actions aimed at preventing adverse phenomena should be adopted. The destructive processes include the processes going on within the lake and along its shores, but also phenomena occurring in its catchment area. For this reason, its is important to protect not only the lakes themselves but also to draw up the principles for the protection of the catchment areas. Sewage management should be regulated in order to stop the dumping of sewage into lakes. This pertains to homes, farmsteads, recreational facilities as well. In order to prevent the introduction of compounds contributing to increased trophism, fertiliser use in farmlands situated in the immediate surroundings of the lake and its catchment area should be regulated.

Lobelia lakes should be excluded from commercial fishing management and free of angling. If the lakes are made available for angling, the absolute ban should be imposed on any baiting of fish. In the case of strong pressure from angling, and applying baits, the trophism of these lakes increases rapidly. Lobelia lakes may not be stocked with cyprinoid fish nor with alien fish species. These procedures result in the destruction of macrophyte vegetation including also that which is subject to conservation. The secondary side effect of this kind of fish stocking is disturbing bottom sediments leading to accelerated eutrophication. There should be special places for anglers (jetties) prepared, outside of which angling is prohibited in order to prevent the trampling and destruction of vegetation. These places should be regularly cleaned.

Whenever the lakes are made available to bathers, designated places should be marked, with the relevant sanitary facilities made available. Bathing should be prohibited

outside these places. Walking should also be permitted only on marked routes, again in order to prevent the destruction of vegetation.

Bans should be strictly enforced along with campaigns addressing the general public, to make them aware of the value of nature in the protected areas, and indicate the advantages for local communities resulting from the good conservation status of unique aquatic habitats.

The basis of conservation measures should include the permanent monitoring of lobelia lakes, particularly the status of plant species characteristic of this type of habitat. There should also be the option of reintroducing quillwort *Iso'tes lacustris* and other species typical of lobelia lakes into lakes where the parameters indicate the presence of good lobelia lake-type habitat and where such species occurred in the past but disappeared due to human activities.

6. References

Burchardt L. (ed.). 2010. Klucz do oznaczania gatunków fitoplanktonu jezior i rzek. Przewodnik do ćwiczeń laboratoryjnych i badań terenowych. UAM, Wydział Biologii, Biblioteka Pomocy Dydaktycznych.

Kłosowski S. 1994. Ekologia głównych zbiorowisk roślin wodnych z klasy *Littorelletea uniflorae* Br.-Bl. ex Tx. 1943 w Polsce. In: M. Kraska (ed.), Jeziora lobeliowe, charakterystyka, funkcjonowanie i ochrona. Cz. I. Idee Ekol. 6, ser. Szkice 4, Poznań, pp. 93–104.

Kraska M. 2004. Jeziora lobeliowe. In: J. Herbich (ed.), Siedliska przyrodnicze. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Tom 2. Wody słodkie i torfowiska. Ministerstwo Środowiska. Warszawa.

Kraska M., Piotrowicz R. 1994. Roślinność wybranych jezior lobeliowych na tle warunków fizyczno-chemicznych ich wód, In: M. Kraska (ed.). Jeziora lobeliowe, charakterystyka, funkcjonowanie i ochrona. Cz. I. Idee Ekol. 6, ser. Szkice 4, Poznań, pp. 67–83.

Kraska M., Piotrowicz R., Klimaszyk P. 1996a. Jeziora lobeliowe w Polsce. Chrońmy Przyr. Ojcz. 52(3): 5–25.

Matuszkiewicz W. 2001. Przewodnik do oznaczania zbiorowisk roślinnych Polski. Wydawnictwo Naukowe PWN, Warszawa.

Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M. 2002. Flowering plants and pteridiophytes of Poland a checklist. W. Szafer Institute of Botany, Polish Academy of Sciences. Kraków.

Rybak I.J. 1994. Przegląd słodkowodnych zwierząt bezkręgowych. *Aschelminthes Rotatoria.* PIOŚ, Biblioteka Monitoringu Środowiska, Warszawa.

Rybak I.J. 1994. Przegląd słodkowodnych zwierząt bezkręgowych. *Copepoda.* PIOŚ, Biblioteka Monitoringu Środowiska, Warszawa.

Rybak I.J. 1994. Przegląd słodkowodnych zwierząt bezkręgowych. *Cladocera.* PIOŚ, Biblioteka Monitoringu Środowiska, Warszawa.

Szafer W., Kulczyński S., Pawłowski B., 1988. Rośliny polskie, cz. I i II. Wydanie VI. PWN. Warszawa.

Szmeja J. 1992. Struktura, organizacja przestrzenna i demografia populacji isoetidów. Stud. ekol. roślin podwod., Rozpr. i Monogr. 175, Uniw. Gdański, Gdańsk.

Szoszkiewicz K., Jusik Sz., Zgoda T. 2008. Klucz do oznaczania makrofitów dla potrzeb oceny stanu ekologicznego wód powierzchniowych w Polsce. Biblioteka Monitoringu Środowiska, IOŚ, Warszawa.

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6210* Xerothermic grasslands
Festuco-Brometea

Photo 1. Grassland on gypsum in „Przęślin" nature reserve (© J. Perzanowska)

I. INFORMATION CONCERNING THE NATURAL HABITAT

1. Phytosociological identifiers

Class*:* Festuco-Brometea
- Order: Festucetalia valesiacae
  - Alliance: Seslerio-Festucion duriusculae
    - *Associations and communities:*
    - *Festucetum pallentis*
    - *Teucrio-Melicetum ciliatae*
    - *Community: Festuca pallens*
  - *Alliance: Festuco-Stipion*
    - *Associations and communities:*
    - *Association Sisymbrio-Stipetum capillatae*
    - Association *Potentillo-Stipetum capillatae*
    - *Association Koelerio-Festucetum rupicolae*
    - *Alliance: Cirsio-Brachypoclion pinnati*
    - *Associations and communities*:
    - *Inuletum ensifoliae*
    - *Thalictro-Salvietum pratensis*

Adonido-Brachypodietum pinnati
Seslerio-Scorzoneretum purpureae
Community *Carexglauca-Tetragonolobus maritimus* subsp. *siliquosus*
Origano-Brachypodietum
Alliance: *Mesobromion*
Associations and communities:
Gentiano-Koelerietum pyramidatae
Onobrychido-Brometum erecti

2. Description of the natural habitat

Xerothermic grasslands are a stenothermic grassland habitat of steppe nature, whose occurrence depends on climatic, soil and orographic conditions. It occurs mainly in south-eastern and southern Europe. Outside this zone, it occurs all over Europe, occupying slopes in the valleys of big rivers or eastern limestone slopes rich in calcium carbonate.

These habitats have the form of colourful grasslands with rich and diversified flora, often accompanied by relict and rare species. They usually occur on large slopes of hills and ravines, on the steep slopes of river valleys, on fixed screes, at the foot of limestone rocks, on mountain shelves and walls, on limestone outcrops, and even on southerly exposed artificial banks, excavation sites or waste piles.

Photo 2. Grassland on a rock, with fescue *Festuca pallens* in the Jura (© J. Perzanowska)

Photo 3. Grassland with marjoram *Origanum vulgare* on Podskalnia Góra in the Pieniny mountains (© J. Perzanowska)

Photo 4. Grassland with feathergrass *Stipa joannis* in Skorocice reserve (© J. Perzanowska)

Photo 5. Grassland with capillary needlegrass *Stipa capillata* in Gartatowice (Niecka Nidziańska) (© J. Perzanowska)

Xerothermic grasslands grow on shallow pararendzina and rendzina soil, loess and chernozem on dry basic or neutral substrate, rich in calcium carbonate. They occur on locations with high solar exposure, exposed to the west, with high air and soil temperatures.

3. Ecological conditions

Substrate type – sandy, rocky, dry, with a basic or neutral reaction. Soils – pararendzinas and rendzinas, loesses, chernozems, on dry substrate, with neutral or basic reaction, rich in calcium carbonate. Inclination – highly diversified, 0˚ to 45˚. Exposure – mostly southern, south-eastern, and south-western.

4. Typical plant species

Italian aster *Aster amellus*, Pannonic thistle *Cirsium pannonicum*, narrow-leaved inula *Inula ensifolia*, stool iris *Iris aphylla*, yellow flax *Linum tlavum*, rough-haired flax *Linum hirsutum*, carline *Carlina onopordifolia*, satiny canary clover *Dorycnium germanicum*, pale bellflower *Campanula bononensis*, Siberian bellflower *Campanula sibirica*, lady orchid *Orchis purpurea*, field cow-wheat *Melampyrum arvense*, field eryngo *Eryngium campestre*, spring adonis *Adonis vernalis*, cross gentian *Gentiana cruciata*, purple ser-

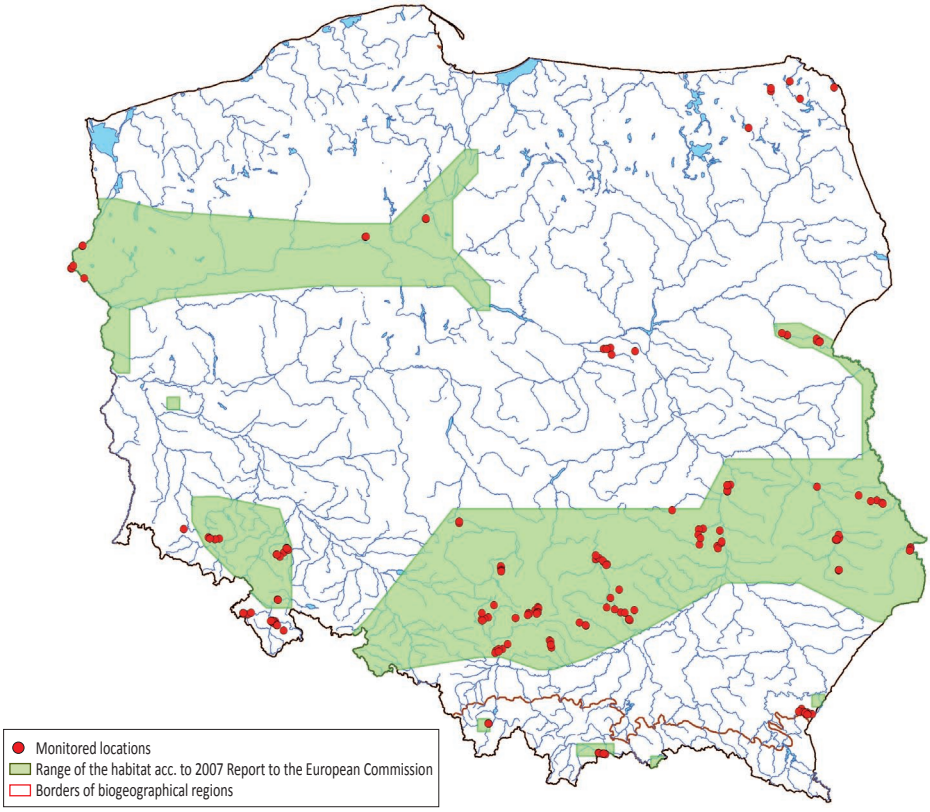

Fig. 1. Site distribution map with the sites monitored from 2006 to 2008 marked

pent root *Scorzonera purpurea*, teesdale violet *Viola rupestris*, blue sesleria *Sesleria uliginosa*, low sedge *Carex humilis*, Michel sedge *Carex michelii*, vernal sedge *Carex praecox*, Illyrian buttercup *Ranunculus illyricus*, hoary ragwort *Senecio erucifolius*, field fleawort *Senecio integrifolius*, meadow saxifrage *Seselii annuum*, feathergrass *Stipa joannis*, small meadow-rue *Thalictrum simplex*, broad-leaved speedwell *Veronica austriaca*, stiff-hair wheat grass *Elymus hispidus* subsp. *barbulatus*, furrow fescue *Festuca rupicola*, wild marjoram *Origanum vulgare*, yellow woundwort *Stachys recta*, wild Basil savory *Clinopodium vulgare*, tor-grass *Brachypodium pinnatum*, common agrimony *Agrimonia eupatoria*, cinamonroot inula *Inula conyza*, carnation grass *Carex flacca*, dragon's teeth *Tetragonolobus maritimus* subsp. *siliquosus*, dyer's woodruff *Asperula tinctoria*, northern bedstraw *Galium boreale*.

5. Distribution in Poland

Grasslands occur in small patches all over Poland, but only in areas with specific climatic and habitat considerations – among others in the Nidziańska Basin, Kielecko-Sandomierska highland, Lubelska highland, Krakowska highland, Lower Oder Valley, Warta Valley, the Lower Vistula Valley, the Western Pieniny mountains, Skalice Nowotarskie and Spiskie mountains, southern part of Krakowsko-Częstochowska highland, eastern part of the Śląska Highland, Kaczawskie foothills, Wałbrzyskie foothills, Sowie mountains, Ślęża range, Strzegomskie hills.

II. METHODOLOGY

1. Methodology of monitoring studies

Selection of monitoring locations

The distribution of monitoring locations should reflect the regional diversification of the habitat. The appropriate number of locations (e.g. 50) should correspond to each habitat subtype. Attention should be paid to less studied grasslands in north-western Poland. The monitoring location should match a unit clearly defined in space such as a hill or scarp of an area measuring ca.10,000 square metres.

Study method

One transect, 200m long, should be marked in each selected area. It should be a straight line, which can be adapted to the topographic conditions of the monitoring locations. Three points for taking three relevŽs are selected along the transect: at the beginning, middle and end of the transect, respectively. If the delineation of the transect is not possible, three closely located patches of the grasslands are marked. Coordinates for these points are determined using a GPS receiver. The value of the below-mentioned indicators for the specific structure and functions of the habitat is determined when walking along the transect defined by this method.

Timing and frequency of studies

The period between May and mid-August, when the majority of species are in full bloom, is preferred for conducting studies. Studies conducted in the later part of the vegetative season are possible, but the probability of incorrect evaluations of the coverage by some species and the inability to identify some of them should be taken into account. Observations should be made every 5–6 years.

Equipment required

The studies do not require any specialised equipment. Necessary tools include a notepad (a form for filling-in) a GPS receiver, a measuring tape, a camera.

2. Assessment of parameters of the conservation status of a natural habitat and the indicators of its specific structure and functions

Table 1. Description of indicators of specific structure and function of the natural habitat and of "prospects for conservation" for natural habitat 6210 Xerothermic grasslands *(Festuco-Brometea)*

Parameter/ Indicator	Description
Specific structure and functions	
Characteristic species	When analysing floristic composition, proportions of species forming the structure should be taken into account: fescue *Festuca* (*F. pallens* fescue in grasslands growing on rocks, furrow fescue *F. rupicola*, Valais fescue *F. vallesiaca* in xerothermic grasslands), needle grass *Stipa*, sedge *Carex* (low sedge *C. humilis*, soft sedge *C. ornithopoda*, serradella sedge *C. supina*, Michel sedge *C. michelii*), koeleria *Koeleria* (crested hair-grass *K. macrantha*, pyramidal koeleria grass *K. pyramidata*), and remaining characteristic species for class *Festuco-Brometea*. - in subtype 6210-1 xerothermic grasslands on rocks, presence of such species as *Festuca pallens* fescue, hen-and-ducken houseleek *Jovibarba sobolifera*, rock onion *Allium montanum*, bluish-green hawkweed *Hieracium bitidum*, mountain meadow seseli *Libanotis pyrenaica*, Transylvanian melic grass *Melica transsilvanica*, hairy thyme *Thymus praecox*, cilated melic grass *Melica ciliata*, cut-leaved germander *Teucrium botrys*, Carthusian pink *Dianthus carthusianorum*, yellow woundwort *Stachys recta*, Jersey knapweed *Centaurea stoebe* is recorded; in subtype 6210-2 stipa grasslands, the presence of such species as those listed below is recorded: annual rockcress *Arabis recta*, soft sedge *Carex supina*, Valais fescue *Festuca valesiaca*, brush rocket *Sisymbrium polymorphum*, capillary needlegrass *Stipa capillata*, feathergrass *Stipa joannis*, elegant needlegrass *Stipa pulcherrima*, mountain alyssum *Alyssum montanum*, grey cinquefoil *Potentilla arenaria* (in northern Poland), fastigiate gysophila *Gysophila fastigiata*, *Hieracium echioides* hawkweed, wolly milk-vetch *Oxytropis pilosa*, *Erysimum crepidifolium* mustard treacle, St.-Bernards lily *Anthericum liliago*, furrow fescue *Festuca rupicola* and crested hair-grass *Koeleria macrantha*; in subtype 6210-3 flowering xerothermic grasslands, the presence of such species as those listed below is recorded: Italian aster *Aster amellus*, Pannonic thistle *Cirsium pannonicum*, narrow-leaved inula *Inula ensifolia*, stool iris *Iris aphylla*, yellow flax *Linum flavum*, rough-haired flax *Linum hirsutum*, carline *Carlina onopordifolia*, satiny canary clover *Dorycnium germanicum*, feathergrass *Stipa Joannis*, pale bellflower *Campanula bononensis*, lady orchid *Orchis purpurea*, spring adonis *Adonis vernalis*, purple serpent root *Scorzonera purpurea*, large-leaved ragwort *Senecio macrophyllus*.
Alien invasive species	Optimum values of this indicator occur when alien invasive species are absent. In sites studied to-date, the invasion of alien species was not found.

Native expansive species of herbaceous plants	In the case of xerothermic grasslands the expansion of highly competitive grass species, especially tor-grass *Brachypodium pinatum*, *is a threat to the proper species structure.* It is a permanent component of mesophilic grasslands *Cirsio-Brachypodion*, *but if it is managed in an inappropriate way it drives other species out*, *to the* impoverishment of species composition of grassland patches. Other grass species, e.g. wood small-reed *Calamagrostis epigejos*, wheat grass *Elymus* spp., bramble (*Rubus*) *play a similar role.* Their presence in relevés with the quantity ratio above 4 is treated as unfavourable – bad status (U2).
Expansion of shrubs and underwood	Secondary succession is one of the biggest threats to xerothermic grasslands. The presence of shrubs and undergrowth is the best indicator of its progress. In addition, the composition of growing shrub species is essential.
Number of orchid species	It is one of the requirements of the Habitats Directive to classify the habitat as a priority habitat. In Poland, in xerothermic grasslands, they occur rarely, (mainly in south-eastern Poland).
Maintenance of the ecotonal zone	Absence of the ecotonal zone with forest was assumed to be the optimum value of the index; only a mosaic with other patches of grasslands or meadows.
Conservation prospects	Prospects for habitat conservation and maintaining it in an undeteriorated state are assessed together with realistic impacts on habitat that can occur in the near future. The current conservation status (location in the protected area, conservation regime), biotic, abiotic and anthropogenic state, economic impact and tourism are taken into account.

Table 2. Evaluation of selected status parameters and indicators of the specific structure and functions of natural habitat 6210 – xerothermic grasslands (*Festuco-Brometea*)

Parameter/ indicator	Appropriate FV	Unsatisfactory U1	Bad U2
Surface area of the habitat on the monitored location	Does not change or increases	Other combinations	An evident decrease in the habitat area in comparison with previous studies or cited in references
Specific structure and functions			
Characteristic species	There are at least five species of vascular plants among the characteristic species listed	There are 2–5 species of vascular plants among the characteristic species listed	There is one species of vascular plant among the characteristic species listed or these species are absent
Alien Invasive Species	None	Invasive species occur singly and they occupy no more than 5% of the area (up to 2 species)	Invasive species are numerous, occupying more than 5% of the area (more than 2 species)
Native expansive species of herbs	None or possibly one species occurring singly	Present, 1–2 species with scattered occurrence	More than 2 species forming dense patches
Expansion of shrubs and underwood	None or a small coverage by shrubs and undergrowth below 10% of the area, sporadic occurrence	Coverage by shrubs or trees from 10 to 25% of the area (shrubs do not form dense bushes), with scattered occurrence	Coverage by trees and shrubs in more than 25% of the area (they form compact shrub), occur in dense groups
Number of orchid species	Occurs when there are more than 3 species	1–2 species	None
Maintenance of the ecotonal zone	Grasslands transform gradually into other natural and seminatural plant communities	Grasslands border partially with anthropogenic communities or there is not a gradual transition into other natural or seminatural habitats	Clear boundary between grasslands and anthropogenic communities (mainly arable land), delineated by the range of human activity (e.g. ploughing)
General structure and functions	All cardinal indices evaluated as FV, other evaluated at least as U1	All cardinal indices evaluated at least as U1	One or more cardinal indices evaluated as U2

Conservation prospects	Prospects for the maintenance of the habitat good or excellent, no impact of threatening factors is predicted	Other combinations	Conservation prospects for the habitat are bad, strong impact of threatening factors observed, no survival of the habitat can be guaranteed in longer time perspective
Overall assessment	All parameters evaluated as FV	One or more parameters evaluated as U1, no U2 assessments	One or more parameters evaluated as U2

Cardinal indices

- Characteristic species
- Expansive native species of herbs
- Expansion of shrubs and underwood

3. An example of a filled-in habitat observation sheet for a monitored location

Habitat observation sheet for the monitored location	
Basic information	
Code and name of the natural habitat	**6210 Xerothermic grasslands *(Festuco-Brometea)*** 6210-3 Flowering xerothermic grasslands
Name of the location	Radomice
Type of the location	Research
Plant communities	Probably the *Cirsio-Brachypodion pinnati alliance, Scabioso ochroleucae-Brachypodietum pinnati association.* The habitat requires more detailed syntaxonomic studies
Description of the habitat	Xerothermic grasslands grow on a south-facing slope. near an abandoned limestone quarry in Radomice. This habitat occurs in the complex with another habitat 6510.
Area of habitat patches	20,000 square metres (2 hectares)
Protected areas where the monitored location is situated	Landscape Park of the Bóbr Valley, PLH020054 „Ostoja nad Bobrem”
Manager of the area	Forests and the Bóbr Valley are owned by the State Treasury. The Lower Silesian Landscape Park Complex in Wrocław, forests managed by the Management Board of the Regional State Forest Directorate in Wrocław (Lwówek Śląski Forest District), the Regional Water Management Board in Wrocław
Geographical coordinates	N 50º29' ...''; E 15º37' ...''
Dimensions of the transect	Rectangular area, 20x100 m
Elevation a.s.l.	415–420 m
Name of the Natura 2000 site	PLH020054 „Ostoja nad Bobrem”
Annual report – basic information	
Year	2008
Monitoring type	Integrated
Coordinator	Kamila Reczyńska
Additional coordinators	

Threats	The abandonment of traditional land management methods, i.e. grazing and possibly mowing leads to the presence of shrub species (roses, hawthorns, blackthorn) and invasive species (Canada goldenrod)
Other natural values	The habitat was formed only on one location where several protected species occur: cross gentian *Gentiana cruciata* (VU), fringed gentian *Gentiana ciliata*, carline thistle *Carlina acaulis* (LR), common twayblade *Listera ovata*
Is monitoring required?	Yes
Justification	The only patch of the habitat in the "Ostoja nad Bobrem" Natura 2000 site; evident disturbances in the structure (proportions of invasive species, underwood)
Applied conservation measures and evaluation of their efficiency	Habitat protected within the limits of the Bóbr River Valley landscape park; no significant conservation measures are observed
Proposals for introducing protective measures	Placing the habitat under active protection that will inhibit secondary succession, extensive grazing and removing shrub underwood layer (especially blackhorn) would be the most preferred option
Date of monitoring	26 July 2008
Remarks	

Conservation status of the natural habitat on the monitored location	
Relevé I	
Geographical co-ordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 50°29' ..."; E 1 5°37' ...", elevation of 417 m a.s.l. Area of the relevé: 25 m^2, inclination of 5°, S exposure. Density of layer C 100%, height of layer C 0.6 m. Phytosociological unit: *Scabioso ochroleucae-Brachypodietum pinnati* (requires further syntaxonomic studies). Species: *Agrimonia eupatoria* +, *Arrhenatherum elatius* +, *Brachypodium pinnatum* 1, *Briza media* +, *Carex flacca* 1, *Carlina acaulis* +, *Centaurea jacea* +, *Centaurea scabiosa* 3, *Clinopodium vulgare* 1, *Coronilla varia* +, *Crataegus monogyna* +, *Dactylis glomerata* +, *Festuca rubra* 2, *Fragaria vesca* 1, *Galium mollugo* 1, *Hypericum perforatum* +, *Knautia arvensis* +, *Lathyrus pratensis* 1, *Pimpinella saxifraga* +, *Poa pratensis 1*
Relevé II	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 50°29' ..."; E 1 5°37' ...", elevation of 41 7 m a.s.l. Area of the relevé: 25 m^2, Inclination: 5°, S exposure. Density of layer C 95%, Height of layer C 0.6 m. Phytosociological unit: *Scabioso ochroleucae-Brachypodietum pinnati (requires further syntaxonomic studies)*. Species: *Agronomia eupatoria* +, *Anthoxanthum odoratum* +, *Arrhenatherum elatius* 1, *Brachypodium pinnatum* 1, *Briza media* +, *Campanula rotundifolia* +, *Carex flacca* +, *Carlina acaulis* +, *Centaurea jacea* +, *Centaurea scabiosa* 2, *Clinopodium vulgare* 1, *Coronilla varia* +, *Crataegus monogyna* +, *Dactylis glomerata* +, *Festuca ovina* +, *Galium mollugo* 1, *Gentiana cruciata* 2, *Hypericum perforatum* +, *Knautia arvensis* +, *Lathyrus pratensis* +, *Pimpinella saxifraga* 1, *Poa pratensis* 2, *Prunus spinosa* +, *Pyrus communis* +, *Rosa canina* 1, *Solidago canadensis* +, *Vicia cracca* +
Relevé III	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 50°29' ..."; E 1 5°37' ...", elevation 41 5 m a.s.l. Area of the relevé: 25 m^2, Inclination: 5°, S exposure S. Density of layers C 100%, Height of layer C 0.6 m. Phytosociological unit: *Scabioso ochroleucae-Brachypodietum pinnati (requires further syntaxonomic studies)*. Species: *Achillea millefolium* +, *Agrimonia eupatoria* 1, *Artemisia vulgaris* +, *Brachypodium pinnatum* 2, *Briza media* 1, *Carex flacca* +, *Carlina acaulis* +, *Centaurea jacea* +, *Centaurea scabiosa* 3, *Clinopodium vulgare* 1, *Coronilla varia* +, *Dactylis glomerata* +, *Galium mollugo* +, *Hypericum perforatum* +, *Pimpinella saxifraga* +, *Poa pratensis* 2, *Rosa canina* +, *Silene vulgaris* +, *Solidago canadensis* +, *Viola hirta* +

TRANSECT				
Indicators	**Description**	**Value of the indicator**		**Assessment of indicator**
Surface area of the habitat	Estimated total area of the habitat within the Natura 2000 site is ca 20,000 square metres; 2,000 square metres were evaluated (one monitoring location). The area of the habitat at the monitoring location tends to decrease due to increasing coverage by trees and shrubs. The change rate is not too fast. Current density of layers is ca 10% and there are still characteristic as well as rare and protected species in the habitat.			U1
Specific structures and functions				**U1**
Percentage proportion of the habitat in the transect	Percentage of the area occupied by the habitat in the transect (with accuracy of up to 10%)	Habitat occupies 100% of the monitored area		FV
Characteristic species	List of characteristic species (Latin names); cite the percentage share of area occupied by every species in the transect (with accuracy of up to 10%)	Greater knapweed *Centaurea scabiosa* 25%, tor-grass *Brachypodium pinnatum* 15%, carnation grass *Carex flacca* 5%, carline thistle *Carlina acaulis* 5%, cross gentian *Gentiana cruciata* 5%		FV
Alien invasive species	List of invasive species alien in terms of geographical location (Latin names); cite the percentage share of area occupied by every species in the transect (with accuracy of up to 10%)	Canadian goldenrod *Solidago canadensis* 3%		U1
Native expansive species of herbs	List of species (Latin names); cite the percentage share of area occupied by every species in the transect (with accuracy of up to 10%)	Tall oat grass *Arrhenatherum elatius 3%*		U1
Expansion of bushes and underwood	List of species (Latin names); cite the percentage share of the area occupied by all expansive species of shrubs and trees in the transect (with accuracy of up to 10%)	Density of shrub layers 10% perry *Pyrus communis* below 2% dog rose *Rosa canina* 5% blackthorn *Prunus spinosa* 2% whitehorn *Crataegus monogyna* 2%		U1
Number of orchid species	Number and list of species	*2* Species: common twayblade *Listera ovata*, broad-leaved helleborine *Epipactis helleborine*		U1
Maintenance of ecotonal zone	Gradual transformation of grasslands into other natural and seminatural plant communities is an optimal status	Poorly developed ecotonal zone, created mainly by blackthorn *Prunus spinosa* (b)		U1
Conservation prospects	Prospects for protecting the natural habitats are very good provided that appropriate measures are taken (extensive grazing, removing shrub layer)			FV
Overall assessment Proportion of the habitat area representing different conservation status within the monitoring location		FV	85%	U1
		U1	15%	
		U2	–	

Human activity				
Code	**Name of activity**	**Intensity**	**Impact**	**Description**
141	Abandoned pasturing	A	–	Extensive grazing which maintains correct habitat structure is not applied in the monitoring location

4. Habitats of similar ecological characteristics

Other similar habitats whose development is conditional on grazing and cutting, and on specific ecological conditions: 6120 – grasslands on the sandrock, 6510 Lowland hay meadows (–fresh meadows in the lowland and mountains, extensively used as hay meadows (alliance *Arrhenatherion* –stenothermic variants of fresh meadows).

5. Protection of natural habitat

Cutting or controlled grazing (e.g. by goats) is the basic recommendation in xerothermic grasslands. The mechanical removing of shrubs or underwood in areas with secondary succession can be applied as short-term measures.

Historical factors: long-term extensive grazing, cutting or burning were important in the developing specific species composition of flowery xerothermic and *Stipa* grasslands, along with climatic and edaphic historical factors. Without regular use of grasslands, most flowering xerothermic grasslands transform completely into floristically poor shrubs within 25–30 years of secondary succession. Over the last few years arable land of lower quality with valuable patches of xerothermic grasslands is being massively abandoned as a result of socioeconomic changes. These areas are often afforested resulting in rapid degradation. The measures of active conservation which include primarily removal of trees and shrubs, and – rarely – grazing, are insufficient, chiefly due to inadequate financial resources for implementing such measures and the lack of scientific knowledge, providing the necessary grounds to carry them out.

6. References

Bąba W. 2003. Changes in the structure and floristic composition of the limestone grasslands after cutting trees and shrubs and mowing. Acta Soc. Bot. Pol. 1 (72): 61–69.

Ceynowa M. 1968. Zbiorowiska roślinności kserotermicznej nad dolną Wisłą. Studia Soc. Sc., Toruń, Sec. D. 8 (4): 1–156.

Dzwonko Z., Loster S. 1998. Dynamics of species richness and composition in a limestone grassland restored after tree cutting. Journal of Vegetation Sciences, 9: 387–394.

Fijałkowski D., Świerczyńska S. 1991. Zmiany powierzchni zespołów roślinności kserotermicznej na Wyżynie Lubelskiej. Prądnik, Pr. Muz. im. Prof. W. Szafera, 3: 121–123.

Filipek M. 1974. Murawy kserotermiczne regionu dolnej Odry i Warty. Pr. Kom. Biol. PTPN, 38: 1–110.

Grodzińska K. 1982. Naskalne zbiorowiska roślinne [In:] Zarzycki K. (ed.). Przyroda Pienin w obliczu zmian. Stud. Nat., Ser. B 30: 329–336.

Kaźmierczakowa R., Perzanowska J. 1995. Szata roślinna. Siedliska kserotermiczne [In:] Waloryzacja przyrodnicza Nadnidziańskiego Parku Krajobrazowego wraz z waloryzacją form krasowych. Zarząd Świętokrzyskich i Nadnidziańskich Parków Krajobrazowych, Kielce. Instytut Ochrony Przyrody PAN, Kraków.

Medwecka-Kornaś A. 1959. Roślinność rezerwatu stepowego „Skorocice" koło Buska. Ochr. Przyr. 26: 172–260.

Michalik S. 1990. Sukcesja wtórna półnaturalnej murawy kserotermicznej *Origano-Brachypodietum* w latach 1960-1984 wskutek zaprzestania wypasu w rezerwacie Kajasówka. Prądnik, Pr. Muz. im. Prof. W. Szafera 2: 59–65.

Michalik S., Zarzycki K. 1995. Management of xerothermic grasslands in Poland: botanical approach. Colloques Phytosociologiques 24: 881–895.

Mirek Z. 1974. Zmiany degeneracyjne w płatach zespołów *Koelerio-Festucetum sulcatae* i *Peucedano cervariae-Coryletum* na Bielanach pod Krakowem. Phytocoenosis, 3–4(3): 239–250.

Szczęśniak E. 1999. Sudeckie murawy naskalne siedlisk naturalnych i antropogenicznych -zróżnicowanie, sukcesja, ochrona. Przegl. Przyr. 3–4(10): 59–68.

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6520 Mountain Yellow Trisetum and Bent-grass Hay Meadows
(Polygono-Trisetion and Arrhenatherion)

Photo 1. A Pieniny mountain meadow, abundant with *Anthyllidi-Trifolietum montani* – Wielka Dolina, the Pieniny mountains, southern Poland (© I. Wróbel).

I. INFORMATION CONCERNING THE NATURAL HABITAT

1. Phytosociological identifiers

Class: Molinio-Arrhenatheretea
Order*: Arrhenatheretalia*
Alliance: Arrhenatherion elatioris
Association: *Gladiolo-Agrostietum capillaris*
Association: *Campanulo serratae-Agrostietum capillaris*
Association: *Anthyllidi-Trifolietum montani*
Community: *Campanula patula-Trisetum flavescens*
Community: *Festuca rubra-Holcus lanatus*
Alliance: *Polygono-Trisetion*
Association: *Meo-Festucetum rubrae (=Geranio sylvatici-Trisetetum flavescentis)*
Association: Alchemillo-Festucetum rubrae
Association: Phyteumo (orbicularis)-Trifolietum pratensis

2. Description of the natural habitat

Unlike what is presented in the Manuals on Natura 2000 Habitats (Herbich 2004), habitat no 6520 includes bent-grass meadows occurring commonly in the Carpathians and the

Pieniny stenothermic meadow which are classified to-date as lowland and mountain fresh meadows utilised extensively from *alliance Arrhenatherion* (habitat 6510). Thus, Habitat 6520 includes fresh mountain meadows, belonging to the alliances *Arrhenatherion* and *Polygono-Trisetion,* located at an elevation of over 550–600 m a.s.l., under extensive use as hay meadows that are moderately fertilized and often grazed. These include meadows located in lower or upper areas of the foothills. Extensively used fresh meadows from the foothills are usually transient between lowland (6510) and mountain (6520) meadows, and their syntaxonomic classification of specific patches is dubious at most. Sown meadows (they stand out and are distinctive due to the considerable fractions of papilionaceous plants and grasses which produce quality fodder, e.g. roughle cock's-foot *Dactylis glomerata,* timothy grass *Phleum pratense,* perennial ryegrass *Lolium perenne) and so-called* grassland, i.e. alternating areas which are ploughed from time to time, under the crop rotation scheme, cannot be classified as habitat 6520. The occurrence of numerous species from alliance *Cynosurion* which are typical for grazed areas is a disqualifying feature.

Habitat 6520 has a distinctively seminatural nature, it is secondary to forests cleared by humans. The creation and maintenance of this habitat is related to the specific type of land management encompassing mowing, fertilization and pasturage. Due to this reason the diversification of the habitat does not only reflect edaphic and climatic factors, but also the intensity of form and utilisation, as well as historical considerations. Meadows excluded from mowing and pastoral management undergo natural transformation and succession in tall-herb communities and grass communities as well as bilberry *Vaccinnia myrtillum* swards, thickets or young growth (depending on edaphic and ecological conditions). Such meadows are usually more abundant in species in the Carpathians than in the Sudety mountains.

Photo 2. *Meo-Festucetum rubrae* vegetation, Hala Izerska in the Sudety mountains (© J. Potocka).

Photo 3. A Sudety mountain meadow represented by a community of *Agrostis capillaris-Festuca rubra*, Grodczyn and Homole near Duszniki (© G. Wójcik).

3. Ecological conditions

Habitat 6520 is related to relatively fertile, unbogged and undried mineral soils. It occurs mainly in the lower montane forest of the Sudety mountains and the Carpathians, whilst it is rarer in the upper montane forest (the highest occurrences in the Tatra mountains were recorded at 1,350 m a.s.l.) and foothills. It shows regional variability. Sudety meadows grow in moderately fertile and fertile habitats, mainly in medium-depth brown soil generated from acidic silicate rock. They are located on variably exposed slopes in the lower alpine forests and in the upper sections of the foothills. *Gladiolo-Agrostietum,* the main complex of the Carpathian hay meadows and related bent-grass meadows from alliance *Arrhenatherion* occur mainly in brown soil deriving from flysch formations, no exposure is preferred. They occur in valleys, slopes and mountain summits. On the other hand, Tatra *Phyteumo-Trifolietum pratensis* in the Chochołowska Valley is associated with shallow skeletal limestone rock soil and grows in sunny places with a light to medium inclination. High insolation, the exposure of the southern sector of the horizon and soils abundant in calcium carbonate are distinguishing features of *Anthyllidi-Trifolietum montani Pieniny meadows.*

4. Typical plant species

Species typical of alliance Arrhenatherion (but excluding taxa typical of lowland Arrhenatheretum elatioris, such as tall oat grass *Arrhenatherum elatius*, meadow crane's bill *Ge-*

Fot. 4.

Photo 5. Vegetation of species-rich bent-grass meadow with lance-leaved bellflower *Campanula serrata*, Beskid Pass in the Bieszczady mountains (© J. Korzeniak).

ranium pratense, parsnip *Pastinaca sativa*, panicle-shaped dock *Rumex thyrsiflorus*), and *Polygono-Trisetion* as well as diagnostic species for associations considered identifiers of the mountain meadows in the Sudety mountains and the Carpathians are typical for the habitat.

The following species were classified as diagnostic for the Sudety mountain meadow species: baldmoney *Meum athamanticum*, red fescue *Festuca rubra*, northern hawk's beard *Crepis succisifolia*, ball-headed mixed-flower *Phyteuma orbiculare*, spiked moxed-flower *Phyteuma spicatum*, lady's mantles *Alchemilla spp.*, red campion *Melandrium rubrum*, meadow rock-cress *Cardaminopsis halleri*, yellow trisetum *Trisetum flavescens*, wood crane'sw bill *Geranium sylvaticum*, *Potentilla aurea*, Chaix's-speargrass *Poa chaixii*.

For the Carpathians, diagnostic species include species connected with *Gladiolo-Agrostietum* meadows and other forms of floristically abundant bent-grass meadow: dwarf lady's mantle *Alchemilla gracilis*, pastoral lady's mantle *A. monticola*, crinite lady's mantle *A. crinita*, *A. walasii* lady-'s mantle, *Centaurea oxylepis* knapweed, Spiš saffron crocus *Crocus scepusiensis*, lance-leaved bellflower *Campanula serrata* (locally specific for bent-grass meadows in the Wysokie Bieszczady mountains), meadow rock-cress Cardaminopsis halleri, northern hawk's beard *Crepis mollis* [syn. *Crepis succissifolia*], meadow gladiolus *Gladiolus imbricatus*, Alpestrine violet *Viola saxatilis*.

Another group is formed by species which are characteristic and differentiating for thermophilous *Anthyllidi-Trifolietum* montani: kidney vetch anthyllis *Anthyllis vulneraria*, mountain clover *Trifolium montanum*, sickle medick *Medicago falcata*, tufted milkwort *Polygala*

comosa, lilac sage *Salvia verticillata*, large thyme *Thymus pulegioides*, multiflowered buttercup *Ranunculus polyanthemos*.

Also plants related to the calciphilous Tatry-specific *Phyteumo* (*orbicularis*)-*Trifolietum pratensis* such as: red clover *Trifolium pratense*, primrose *Primula elatior*, lamb's tongue *Plantago media*, bitter milkwort *Polygala brachyptera*, as well as species characteristic of high mountain limestone swards: ball-headed mixed-flower *Phyteuma orbiculare*, mountain buttercup *Ranunculus oreophilus*, *Thymus pulcherrimus* thyme, verticillate lousewort *Pedicularis verticillata*, are considered locally representative for the habitat (Balcerkiewicz 1978).

5. Distribution in Poland

Mountain meadows are the most common non-forest habitat in the Alpine region. In the Carpathians they occur in mountain forests of all ranges at ca 600 to 1,350 m a.s.l. A typically formed meadow *Gladiolo-Agrostietum* is considered an alliance endemic for the Western Carpathians, and is connected with the flysch Beskidy mountain ranges, Podtatrze and the Spisko-Gubałowskie Highlands.

The *Anthyllidi-Trifolietum* montani meadows are concentrated in the Pieniny Proper, the Małe Pieniny mountains and the eastern part of the Pieniny Klippen Belt. In the Gorce mountains, Beskid Sądecki and the Lower Beskid mountains, meadow phytocenoses somewhat transient between *Gladiolo-Agrostietum* and *Anthyllidi-Trifolietum* montani occur. Mountain bent-grass meadows are common in the lower montane forest in the

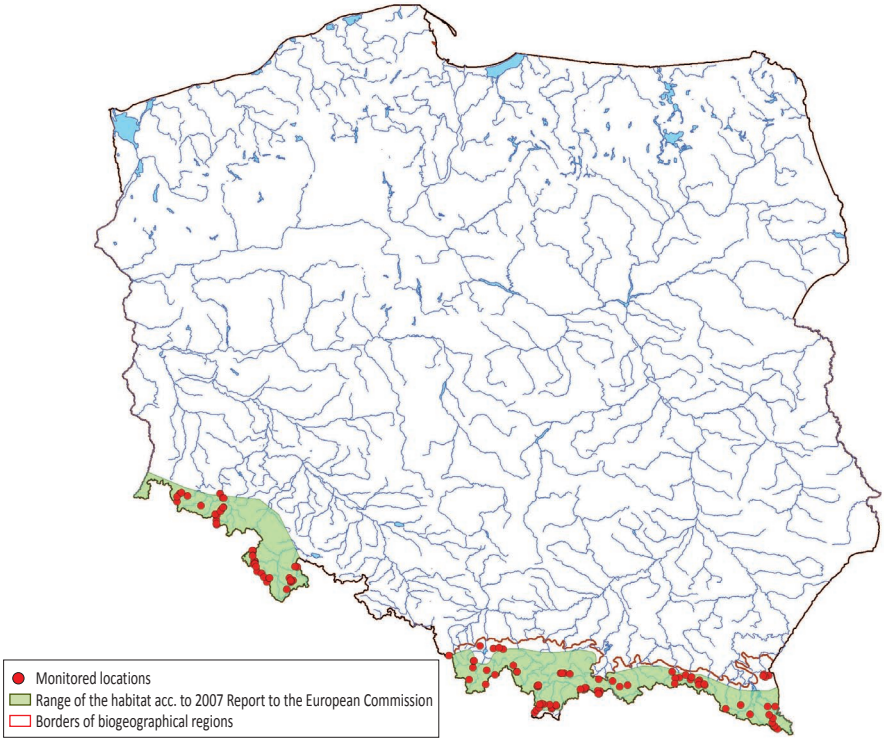

Fig. 1. Distribution of the habitat in Poland and monitored locations.

Bieszczady mountains (the Eastern Carpathians), in habitats analogous to *Gladiolo-Agrostietum*, typical of the Western Carpathians, and they have much in common.

In the continental region the occurrence of the habitat is limited to foothills and the lower mountain forest in the Sudety mountains. Alliance *Meo-Festucetum*, considered the most specific variety for the Sudety mountains, was rarely recorded in the Izerskie mountains, the Kaczawskie mountains and in the western part of the Karkonosze mountains. Meadows classified in the rank of the community, into alliances Arrhenatherion and *Polygono-Trisetion* were reported in the Western Sudety mountains, and the Middle and Eastern Sudety mountains. *Alchemillo-Festucetum* rubrae meadows occur in the Izerskie mountains.

II. METHODOLOGY

1. Methodology of monitoring studies

Selection of monitoring locations

When selecting monitoring sites and locations, subtypes of the habitat typical of the Carpathians and the Sudety mountains, its edaphic and climatic variability and diversity in terms of economic use and its history should be considered. The habitat is widespread yet strongly diversified, even at the local scale. Due to this fact, the selection of monitoring locations in a specific area is key to the assessment of the habitat conservation status. Next to the best developed patches of the habitat (reference locations), other patches, representative of the status of habitat preservation in the area, which are a good reflection of ecological transformations affecting the habitat (research locations) should be monitored.

Study method

Field observations provide both general information on the monitore location (siting, natural description of the habitat, plant associations and communities, the area of the habitat in the monitoring location, current impacts on the environment and predicted threats) and information on detailed field observations include sensitive features of the habitat. They are analysed in a belt transect 10 m wide, 200 m long or of rectangular shape, of various shapes, with an area amounting to 2000 m2. Among other things, spatial relationships of the habitat (area of mountain meadow patches, their fragmentation, the presence and character of ecotone), species composition of phytocoenosis / phytocoenoses in the transect (percentages of characteristic, expansive, dominant and invasive species, areas of shrubs and underwood), as well as environmental features which are indicative of the habitat's utilisation (the thickness of undegraded organic matter) are determined. The species composition of phytocoenoses presented in the transect is illustrated by three relevŽs taken at the opposite ends of the transect and in the central part of the transect (the area of the relevŽ is 25 m2, and the quantity of species is evaluated using the Braun-Blanquet scale). The proportion between areas of the various preservation stages of the habitat against the total area of the habitat in the transect is assessed. Realistic chances for maintaining

unchanged conservation status are assessed and information on the utilisation type, protective measures and their efficiency is quoted for each monitored location.

Timing and frequency of studies

The monitoring location should be investigated every 3-5 years. The optimal date for monitoring depends on region, altitude (m a.s.l.) and falls within June and July. Evaluation of the species composition, coverage by specific species depends strongly on the phenological stage of the phytocoenosis under study. Data should be collected after the earing of the grasses, but before the first crop. In the Sudety mountains and lower elevations in the Carpathians, the end of June and beginning of July is the most suitable time, while early July is better in higher locations of the lower montane forest, in the high Bieszczady mountains, the Tatra mountains and bogs in the Izerskie mountains with their specific microclimate.

Equipment required

Monitoring equipment should include: GPS receiver, a notepad, a photographic camera (preferably digital), a pocket knife for cutting turf when the thickness of the plant litter (undecomposed dead plant material on the top layer of the organic horizon of the soil) is measured, and a ruler for this measurement.2. Assessment of parameters of the conservation status of a natural habitat and the indicators of its specific structure and functions

Table 1. Description of the indicators of the specific structure and functions of the natural habitat and of "prospects for conservation" for natural habitat 6520 Mountain yellow trisetum and bent grass hay meadows *(Polygono-Trisetion* and *Arrhenatherion*)

Parameter/ Indicator	Description
Specific structure and functions	
Characteristic species	List of species characteristic of the *Arrhenatherion* alliance (excluding taxa characteristic of lowland *Arrhenatheretum elatioris)* and *Polygono-Trisetion was compiled,* including the approximate coverage of the transect by a given species. Due to the insufficient studies on the Polish part of the Western Sudety mountains, studies by Czech botanists (Krahulec et al. 1996; Chytry 2007) were used for the selection of diagnostic species for patches in this area. This indicator is used for the typicality of the species composition in the phytocoenoses representing the habitat in the monitoring location and the Natura 2000 site. Its assessment is complex because apart from the number of the diagnostic species for mountain meadows, it also depends on their abundance. The following are the characteristic and differential species for the higher syntaxonomic unit (order Arrhenatheretalia, class Molinio-Arrhenatheretea), as well as species listed as representative of habitat 6520 in the Interpretation Manual of European Union Habitats – EUR 27: yellow trisetum *Trisetum flavescens*, hogweed cow parsnip *Heracleum sphondylium*, great masterwort *Astrantia major*, caraway *Carum carvi*, northern hawk's beard *Crepis mollis* [syn. *Crepis succissifolia*], bistort *Polygonum bistorta*, inflated catchfly *Silene vulgaris*, clustered bellflower *Campanula glomerata*, meadow sage *Salvia pratensis*, sweet vernal grass *Anthoxanthum odoratum*, red campion *Melandrium rubrum*, Dusky crane's bill *Geranium phaeum*, wood crane's bill *G. sylvaticum*, globe flower *Trollius europaeus*, great burnet-saxifrage *Pimpinella major*, orange lily *Lilium bulbiferum*, Alpestrine violet *Viola saxatilis*, ball-headed mixed-flower *Phyteuma orbiculare*, primrose *Primula elatior*, hairy chervil *Chaerophyllum hirsutum*, lady's mantles *Alchemilla* spp.

Dominant species	List of several species with the highest coverage in the transect and approximate percentage coverage of the transect by a specific species. The assessment of the indicator is complex, it depends on the nature of the dominants (these should be fresh meadow species typical of the habitat, mainly grass) and the level of the domination because a high domination ratio is usually connected with low species diversity, and floristically abundant meadows are subject to protection.
Alien invasive species	List of species alien in geographic and ecological terms to the habitat, with an estimated coverage percentage by a species. The assessment of the indicator incorporates biological tendencies to quick spreading of the species and its abundant occurrence. In the case of plants with the highest invasiveness, e.g. Japanese knotweed, even the presence of this species alone lowers the assessment.
Expansive species of herbs	List of native expansive herb species spreading in the habitat which can pose a threat to the habitat with the approximate coverage percentage of the transect by a given species. Special attention was paid to expansive grasses (among others tussock-grass *Deschampsia caespitosa*, wheat grass *Elymus repens*), herbs (aromatic chervil *Chaerophyllum aromaticum*, *Senecio ovatus* ragwort, common goatweed *Aegopodium podagraria*) and others testifying to the absence of mowing (bramble genus *Rubus spp*., fireweed *Chamaenerion angustifolium*, bracken fern *Pteridium aquilinum*, bilberry *Vaccinium myrtillus*), as well as nitrophilous species (stinging nettle *Urtica dioica*, Canada thistle *Cirsium arvense*). The assessment of this indicator is complex and, as in the case of invasive species, is the resultant of species and their coverage.
Expansion of shrubs and undergrowth	The indicator is described by the total coverage of shrubs and underwood in the transect. To provide detailed information, the list of trees and shrubs monitored in the transect and their coverage percentage are given. It is quite a sensitive indicator of the correct utilisation of the habitat. Presence of young shrubs and underwood in the meadow is indicative of the absence of cutting.
Preservation of the ecotonal zone	Assessment of this indicator requires additional plant analysis for the area located outside the studied transect – in the ecotonal zone of the studied meadow. The evaluation of the indicator incorporates an average width of the transient zone between the meadow and neighbouring forest (in meters) and % of the shrub layer (possibly trees and shrubs), including the determination of the dominant species in the undergrowth and higher layers. The assessment draws attention to the possible dissemination of the species present in the ecotone, thus posing a potential threat to meadow phytocoenoses.
Dead litter(dead organic matter)	Measurement of undecomposed organic matter deposited above the humus layer, taken after cutting the turf, using the ruler or a folding rule (in centimetres). The value of the indicator is an average figure from twenty measurements taken in the habitat patch, and the minimum and maximum. The indicator shows whether the meadow is regularly mown. The evaluation of the indicator should also include local climatic conditions, e.g. for patches in the Hala Izerska meadow where light frost occurs practically throughout the year, lowering the decomposition rate throughout the year, milder criteria were applied.
Area occupied by the habitat in the transect	Percentage proportion of the habitat in the transect assessed in tens of per cents during experts' assessment. The indicator allows the more precise determination of surface relationships of the habitat than that of a site.
Spatial structure of the habitat patches	Determination of the habitat fragmentation level in the ordering scale (high, medium or low fragmentation level) and quoting areas of specific meadow patches. The indicator shows *patchiness* of the habitat, which usually occurs in form of medium-sized and big patches (> several thousand square metres).
Conservation prospects	Assessment of realistic possibility for the maintenance of the habitat in an appropriate status, its current conservation status and factors that can affect it in the near future are taken into account. Determination of the extensive use by mowing or by cutting and grazing is here of special importance

Table 2. Evaluation of selected status parameters and indicators of the specific structure and function of natural habitat 6520 Mountain yellow trisetum and bent-grass hay meadows *(Polygono-Trisetion* and *Arrhenatherion)*

Parameter	Status		
	FV	U1	U2
Surface area of the habitat in the transect	80–100%	60–70%	50% and less
Spatial structure of the habitat patches	Lacking or slight fragmentation	Average fragmentation level (patches with an area of a thousand square metres or so)	High fragmentation level (patches with an area of a several hundred square metres or so)
Characteristic species	Species characteristic for alliances of *Polygono-Tri- setion* and *Arrhenatherion* numerous (>5) and showing a considerable coverage numerous species typical of mountain meadows	Species characteristic for alliance *Polygono-Trisetion and Arrhenatherion* – moderately numerous (3–5) and other species typical of mountain meadows also present	Species characteristic for alliance *Polygono-Trisetion* and *Arrhenatherion*, *scarce* (two or fewer), scarce meadow species
Dominant species	Co-dominance of typical meadow species and habitat patches rich in species	Intermediate state	Among dominants, expansive species or species alien to the habitat in ecological terms are present the habitat very poor in species
Alien invasive species	Absent or single individuals of low invasiveness level	Species of a low invasiveness level, <5% coverage of the transect or single individuals of higher invasiveness level I	Highly invasive species present or >5% of the transect occupied by species of low invasiveness
Expansive species of herbaceous plants	Lacking or species with low coverage	Average number of expansive species and/or coverage with highly expansive species <10%	Numerous expansive species, with a considerable coverage and/or highly invasive species reaching >10% coverage
Expansion of brush and underwood	Total coverage in the transect <1%	Total coverage in the transect 1–5%	Total cover in the transect >5%
Maintenance of the ecotone zone	No ecotone or absence of expansive species in the ecotone	Average level of dissemination of species that can pose a threat to meadows	Expansion of species posing a potential threat to the meadows is marked in the ecotone
Dead litter(dead organic matter)	<2 cm deep	2–5 cm deep	>5 cm deep
Habitat area in the monitored location	Does not change or increases	Other combinations	A distinct decrease in the habitat's area in comparison with previous studies or data in References
General structure and functions	All cardinal indices evaluated as FV, remaining indices as at least U1	All cardinal indices evaluated at least as U1	One or more cardinal indices evaluated as U2
Conservation prospects	Conservation prospects for the habitat are good or excellent, no significant impact of threatening factors predicted	Other combinations	Conservation prospects for the habitat are bad, strong impact of threatening factors observed, no survival of the habitat can be guaranteed in longer time perspective
Overall assessment	All parameters evaluated as FV	One or more parameters evaluated as U1, no U2 evaluations	One or more parameters evaluated as U2

Cardinal indices

- Characteristic species
- Expansive species of herbaceous plants
- Expansion of shrubs and underwood
- Spatial structure of the habitat patches

3. An example of a filled-in natural habitat observation sheet for a monitored location

Natural habitat observation sheet for the monitored location	
Code and name of the natural habitat	**6520 Mountain yellow trisetum and bent-grass hay meadows (*Polygono-Trisetion* and *Arrhenatherion*) 6520-1 Sudety yellow trisetum meadow**
Name of the site	PLH020061 Dzika Orlica
Name of the monitored location	Lasówka
Protected areas where the monitored location is situated	Natura 2000 Network: SOO PLH020061 Dzika Orlica, Area of the Protected Landscape, the Bystrzyckie and Orlickie mountains
Geographical co-ordinates	Beginning: N 50° 18' ..." – E 16° 26' ..." Centre: N 50° 18' ..." – E 16° 26' ..." End: N 50° 18' ..." – E 16° 26' ..."
Elevation a. s. l.	705–720 m
Description of the natural habitat	The locality of Lasówka, slope of the Dzika Orlica valley, in the northern part of the village. Near the road. Mostly cut by hand mountain meadows. Slope with SW exposure and a slight inclination, ten degrees on average. Acidic clay soil.
Plant communities	Community from alliance *Polygono-Trisetion*, Community of common bent *Agrostis capillaris* (*Arrhenatheretalia*), community of wood softgrass *Holcus mollis* (*Arrhenatheretalia*)
Area of habitat patches	15000 sq. metres (± 1000 square metres). Stable area.
Dimensions of the transect	20x100 m via slope traverse
Observer	Michał Smoczyk
Dates of observations	25 July 2009
Filling-in date	24 September 2009

Relevé I	
Geographical co-ordinates of the centre, elevation a.s.l., area of the relevé, inclination, exposure, Density of layers a, b, c, d Height of layers a, b, c Phytosociological unit	Geographical coordinates: N 50° 18' ..." – E 16° 26' ...", elevation 710 m a.s.l., area of the relevé 5x5 m, inclination of 10 degrees, SW exposure Density of layers: c 100%, d 30% Height of layers: c 0,5 m Community of alliance *Polygono-Trisetion* Species: *Achillea millefolium* 1, *Aegopodium podagraria* +, *Agrostis capillaris* 3, *Alchemilla monticola* 1, *Alopecurus pratensis* +, *Angelica sylvestris* +, *Avenula pubescens* +, *Briza media* +, *Campanula rotundifolia* +, *Cardaminopsis halleri* +, *Centaurea jacea* +, *Cirsium palustre* +, *Crataegus monogyna juv.* +, *Crepis succisifolia* +, *Dactylis glomerata* +, *Deschampsia caespitosa* +, *Euphrasia stricta* +, *Festuca rubra* 2, *Galeopsis tetrahit* +, *Galium mollugo* 1, *Hieracium pilosella* +, *Hieracium sulphureum* +, *Holcus mollis* +, *Hypericum maculatum* 2, *Lathyrus pratensis* +, *Leontodon autumnalis* +, *Leontodon hispidus* 1, *Leucanthemum vulgare* +, *Lotus corniculatus* +, *Luzula multiflora* +, *Nardus stricta* +, *Phleum pratense* +, *Plantago lanceolata* +, *Poa pratensis* 2, *Polygala vulgaris* +, *Potentilla erecta* +, *Ranunculus acris* +, *Rhinanthus minor* +, *Rumex acetosa* +, *Sanguisorba officinalis* +, *Stellaria graminea* +, *Trifolium pratense* +, *Trifolium repens* 1, *Trisetum flavescens* 1, *Veronica chamaedrys* 2, *Vicia cracca* +, *Vicia sepium* +, *Brachythecium* sp. *(d)* +, *Rhytidiadelphus squarrosus (d) 3*

Relevé II	
Geographical coordinates, elevation a.s.l., area of the relevé, inclination, exposure, Density of layers a, b, c, d, Height of layers a, b, c, Phytosociological unit	Geographical coordinates N 50° 18' ..." – E 16° 26' ...", elevation 710 m a.s.l., area of the relevé 5x5 m, inclination of 10 degrees, SW exposure Density of layers: c 100%, d 20% Height of layers: c 0,6 m Community of alliance *Polygono-Trisetion* Species: *Achillea millefolium* 1, *Agrostis capillaris* 3, *Alchemilla monticola* 2, *Alopecurus pratensis* +, *Angelica sylvestris* +, *Briza media* +, *Campanula patula* +, *Campanula rotundifolia* +, *Cardaminopsis halleri* +, *Carex spicata* +, *Cirsium palustre* +, *Crepis succisifolia* 1, *Dactylis glomerata* +, *Festuca rubra* 2, *Galium mollugo* +, *Heracleum sphondylium* +, *Holcus mollis* 2, *Hypericum maculatum* 3, *Knautia arvensis* +, *Lathyrus pratensis* +, *Leontodon autumnalis* +, *Leucanthemum vulgare* +, *Luzula multiflora* +, *Melandrium rubrum* +, *Nardus stricta* +, *Phleum pratense* +, *Plantago lanceolata* 1, *Poa pratensis* 1, *Polygonum bistorta* +, *Potentilla erecta* +, *Prunella vulgaris* +, *Ranunculus acris* +, *Rhinanthus minor* +, *Rumex acetosa* +, *Rumex crispus* +, *Senecio ovatus* +, *Stellaria graminea* +, *Taraxacum officinale* +, *Trifolium pratense* +, *Trifolium repens* +, *Trisetum flavescens* +, *Veronica chamaedrys* 1, *Vicia cracca* +, *Vicia sepium* +, *Brachythecium* sp. *(d)* +, *Rhytidiadelphus squarrosus (d) 3*
Relevé III	
Geographical co-ordinates of the centre, elevation a.s.l., area of the relevé, inclination, exposure, Density of layers a, b, c, d Height of layers a, b, c Phytosociological unit	Geographical coordinates N 50° 18' ..." – E 16° 26' ...", elevation 710 m. a.s.l., area of the relevé 5x5 m, inclination of 10 degrees, SW exposure, Density of layers: c 100%, d 20% Height of layers: c 0,6 m Community with *Agrostis capillaris* of order *Arrhenatheretalia* Species: *Achillea millefolium* 1, *Agrostis capillaris* 4, *Alchemilla monticola* 1, *Alopecurus pratensis* +, *Angelica sylvestris* 2, *Anthoxanthum odoratum* +, *Avenula pubescens* +, *Briza media* +, *Campanula rotundifolia* +, *Cardaminopsis halleri* +, *Carex spicata* +, *Carex pallescens* +, *Crepis succisifolia* +, *Dactylis glomerata* 1, *Euphrasia stricta* +, *Festuca rubra* 2, *Galium mollugo* +, *Heracleum sphondylium* +, *Hieracium pilosella* +, *Hieracium sulphureum* +, *Holcus mollis* 2, *Hypericum maculatum* 2, *Knautia arvensis* +, *Lathyrus pratensis* +, *Leucanthemum vulgare* +, *Luzula multiflora* +, *Lychnis flos-cuculi* +, *Melandrium rubrum* +, *Nardus stricta* 1, *Phleum pratense* +, *Plantago lanceolata* 1, *Poa pratensis* 1, *Polygonum bistorta* +, *Potentilla erecta* +, *Ranunculus acris* +, *Rhinanthus minor* +, *Rumex acetosa* +, *Sanguisorba officinalis* +, *Senecio ovatus* +, *Solidago virgaurea* +, *Stellaria graminea* +, *Trifolium pratense* +, *Trifolium repens* +, *Trisetum flavescens* +, *Veronica chamaedrys* 1, *Vicia cracca* +, *Vicia sepium* +, *Rhytidiadelphus squarrosus (d) 2*

Conservation status of the natural habitat on the monitored location		
Parameters and indicators	**Value of the indicator**	**Assessment of indicator**
Surface area of the habitat		FV
Specific structures and functions		**FV**
Percentage of the habitat in the transect	80% and slowly decreasing due to impoverishment of species composition of the meadow. Increasing percentage of acidophilic species diagnostic for class *Nardo-Callunetea*	U1
Spatial structure of habitat patches	No fragmentation, uninterrupted patch	FV
Characteristic species	Layer c: lady's mantles *Alchemilla* spp. 10%, remaining 1% or <1%: meadow rock-cress *Cardaminopsis halleri*, yellow trisetum *Trisetum flavescens*, red campion *Melandrium rubrum*, northern hawk's beard *Crepis succisifolia*.	FV
Dominant species	Layer c: common bent *Agrostis capillaris* 30%, four-angled St. John's-wort *Hypericum maculatum* 30%, red fescue *Festuca rubra* 10% Layer d: springy turf-moss *Rhytidiadelphus squarrosus* 20%	FV
Alien invasive species	None	FV

Expansive species of herbaceous plants	Four-angled St. John's-wort *Hypericum maculatum* 30%. A very low coverage of remaining species: among others common goatweed *Aegopodium podagraria*, curly dock *Rumex crispus*, common hemp-nettle *Galeopsis tetrahit*			FV
Expansion of shrubs and underwood	Total coverage <1% – only single and scarce specimens of whitehorn *Crataegus monogyna.*			FV
Maintenance of the ecotonal zone	No ecotone			FV
Litter layer (dead organic matter)	0.5–3 cm, 1 cm on average, in herbal and grass patches thicker than in grass patches			U1
Conservation prospects	There are plans to construct a single family house in the monitored location; the possible construction will destroy the habitat in thisplace.			U1
Overall assessment	Proportion of the habitat area representing different conservation status within the monitored location	FV	40%	U1
		U1	60%	
		U2	0%	

Human activity				
Code	**Name of activity**	**Intensity**	**Impact**	**Description**
102	Mowing /cutting	B	+	The whole area is cut by hand, hay collected, no data on mowing frequency
403	Dispersed land development	B	–	Area probably intended for single family houses. In 2007–2009, construction of gravel road section from the roadway to the meadow. In adjacent areas, in similar meadow patches, several single family houses were built – the village becomes a recreational locality
502	Roads, roadways	C	0	On the eastern part, an asphalt roadway (regional road No 389) is adjacent to the transect
511	Cable lines	C	0	In vicinity, there is an overhead cable line (poles)

4. Habitats of similar ecological characteristics

Fresh lowland hay meadows from alliance Arrhenatherion (habitat 6510) are similar in nature and ecological requirements, they also strongly depend on regular mowing, and – to a lesser extent – on grazing. The methodology of monitoring studies adopted for hay mountain meadows may be partly adapted to observations of other meadow habitats: 6410 molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion*) and 6440 alluvial meadows of river valleys of the *Cnidion dubii* (*Cnidion dubii*).

5. Protection of natural habitats

Preservation of fresh mountain meadows depends on following traditional management: cutting grass once or twice per year combined with hay harvesting, moderate organic fertilization and low intensity grazing (sheep, cattle, horses) in late summer and autumn. The most serious threat is posed by secondary succession resulting from abandonment of traditional land use. Other threats include afforestation (the Małe Pieniny mountains,

Beskid Żywiecki mountains, the Izerskie *mountains*), intensified grazing (the Tatra mountains and Podhale region), selling land and conversion of meadows into recreational plots in areas with attractive landscape.

Most national parks run meadow species and habitat conservation programmes, and monitor the results of applied measures. However, many mountain meadows are privately owned and thus legally enforceable protection of meadows is limited. In the two regions some revitalisation of meadow and pastoral uses compared to a very strong regress the 1990s is observed. Under the framework of the agricultural and environmental program implemented in 2004, some meadows in the Karkonosze mountains, the Sudety Zachodnie mountains, Krowiarka range in the Eastern Sudety mountains, Beskid Niski and Bieszczady mountains, are part of the "Owca plus" programme which provides the opportunity of reinstating the culture of tradition-related sheep grazing in mountain pastures and glades in montane forests.

6. References

Balcerkiewicz S. 1978. Vegetation of Polana Chochołowska (Chochołowska Clearing) in the West Tatras. In: T. W. Wojterski (ed.). Guide to the Polish International Excursion. Wyd. UAM, Poznań, pp. 355–381.

Chytry M. (ed.). 2007. Vegetace Ceske republiky 1. Travinna a keri

kova vegetace. Vegetation of the Czech Republic 1. Grassland and Heathland Vegetation. Academia, Praha.

Herbich J. (ed.). 2004. Murawy, łąki, ziołorośla, wrzosowiska, zarośla. Poradniki ochrony siedlisk i gatunków Natura 2000. Tom 3. Wyd. Ministerstwo Środowiska, Warszawa, pp. 192–219.

Krahulec F., Blážková D., Balátová-Tulácková E., Štursa J., Pechášková S., Fabši

ová M. 1996. Louky Krkonoś: rostlinna spolecenstva a jejich dynamika. Grasslands of the Krkonośe Mountains: Plant communities and their dynamics. Opera Corcontica 33: 3–250.

Matuszkiewicz W. 2008. Przewodnik do oznaczania zbiorowisk roślinnych Polski. Wyd. Naukowe PWN, Warszawa.

Perzanowska J., Świerkosz K., Mróz W. 2004. 6520 Górskie łąki konietlicowe użytkowane ekstensywnie *(Polygono-Trisetion).* In: J. Herbich (ed.). 2004. Murawy, łąki, ziołorośla, wrzosowiska, zarośla. Poradniki ochrony siedlisk i gatunków Natura 2000. Tom 3. Wyd. Ministerstwo Środowiska, Warszawa, pp. 212–219.

Świerkosz K. 2002. Flora i zbiorowiska roślinne rezerwatu „Krokusy w Górzyńcu" (Góry Izerskie). Przyroda Sudetów Zachodnich 5: 51–64.

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7230 Alkaline fens (Mountain and lowland alkaline fens of spring fen, sedge fen, and sedge-moss fen characteristics)

Photo 1. Eutrophic mountain spring fen *Valeriano-Caricetum flavae* in the Bieszczady mountains (© A. Koczur).

I. INFORMATION CONCERNING THE NATURAL HABITAT

1. Phytosociological identifiers

Class: Scheuchzerio-Caricetea nigrae Order*: Caricetalia davallianae*
Alliance: Caricion davallianae
Association: Valeriano-Caricetum flavae
Association: Caricetum davallianae
Association: Orchido-Schoenetum nigricantis
Community *Schoenus ferrugineus*

Certain problems in discussing the phytosociological unit under consideration are posed by poor knowledge of the systematics of plant communities in alkaline fens. The communities listed above (after Matuszkiewicz 2001) do not show the diversity of this habitat. It is not exhaustively treated in the system suggested by Pałczyński (1975). In the course of monitoring studies completed to date, many authors have not provided definitive syntaxa but have only described the species composition of the studied communities. This also relates to the best-preserved sites, not disturbed by human intervention. Habitat 7230 needs further phytosociological studies of the communities and the updating of their systematics, in the light of new data.

2. Description of the natural habitat

Habitat 7230 covers alkaline fens. The neutral and alkaline mountain spring fens, spring and valley mires, chiefly of soligenic fen type are included (Herbichowa, Wołejko 2004). Alkaline fens develop in places where underground waters, containing various quantities of alkaline (basic) ions (chiefly calcium) flow to the surface. At present, in some of the places, travertines precipitate. The habitat is permanently saturated with water, and ground water levels nears the ground level (it is either identical with it, somewhat higher or lower), and relatively stable. Some of the elements have the shape of clearly distinguishable mounds growing as a result of peat and calcareous tufa deposition. Vegetation is highly diversified, in most cases the moss layer is very well developed.

3. Ecological conditions

Type of rock substrate – rocks containing calcium carbonate (limestone, dolomite), and others where calcium carbonate is an admixture (some varieties of Carpathian flysch, glacial tills, loesses).

Soils – chiefly peat soils, usually containing travertines, with muck soils only occurring in degraded fens. In places where the deposition of larger quantities of peat was impossible, peaty gley soils occur. The calcium carbonate content is variable – from traces to very high levels. On well-preserved sites, the peat soils are heavily saturated with water, and the ground water level is stable and close to the ground surface. On disturbed sites, the lowered level of ground water undergoes periodic, sometimes major fluctuations. The pH of the peat and waters supplying the fen ranges from neutral to strong alkaline.

Inclination – very diversified: from 0 to ca. 30°; these fens, however, as a rule, occupy flat places and very gentle slopes.

Exposure: alkaline fens do not show preferences towards any particular exposure.

4. Typical plant species

Species characteristic of the *Caricetalia davallianae* order and *Caricion davalianae* alliance: common green bryum moss *Bryum pseudotriquetrum* var. *bimum*, yellow starry feather-moss *Campylium stellatum*, sedges: Davall sedge *Carex davalliana*, dioecious sedge *C. dioica*, yellow sedge *C. flava*, Hostian-sedge *C. hostiana*, lepidocarpous sedge *C. lepidocarpa*, flea sedge *C. pulicaris*, abtuse rush *Eleocharis quinqueflora*, marsh helleborine *Epipactis palustris*, broad-leaved cotton-grass *Eriophorum latifolium*, Cosson's lipmprichtia moss *Limprichtia cossonii*, Loesel's twayblade *Liparis loeselii*, Jersey orchis *Orchis palustris*, grass of Parnassus *Parnassia palustris*, butterwort *Pinguicula vulgaris*, bird's-eye primrose *Primula farinosa*, scorpidium moss *Scorpidium scorpioides*, marsh felwort *Swertia perennis*, Alpine asphodel *Tofieldia calyculata*.

Some species characteristic of the *Scheuchzerio-Caricetea nigrae* class, inhabiting chiefly alkaline habitats: crescent moss *Drepanocladus aduncus*, slender green feather-moss *Hamatocaulis vernicosus*, Alpine rush *Juncus alpino-articulatus*, marsh housewort *Pedicularis palustris* and Charles sceptre *P. sceptrum-carolinum*, arrow pod grass *Triglochin*

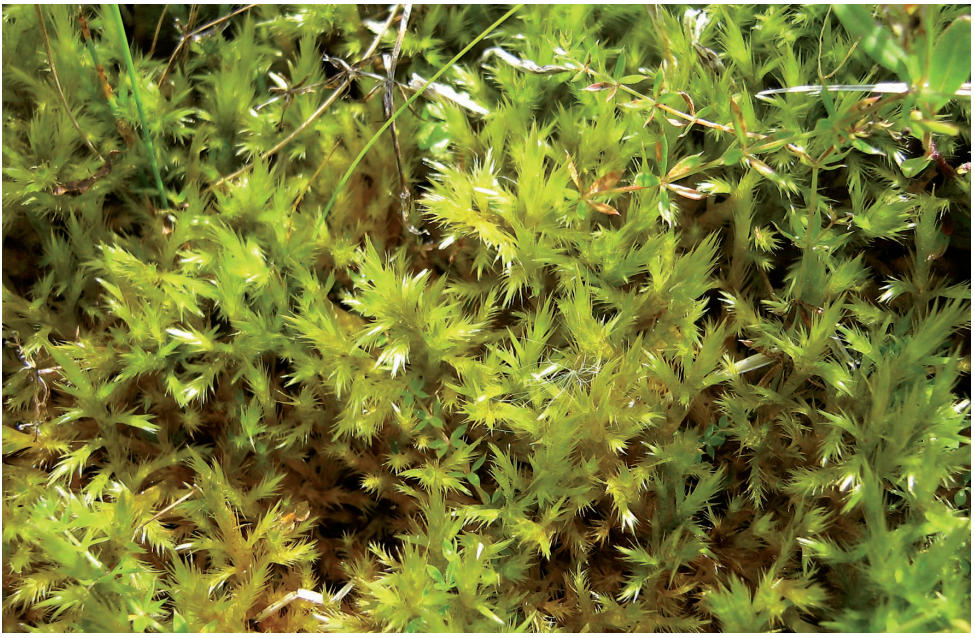

Photo 2. Tomentypnum moss *Tomentypnum nitens* (© A. Koczur).

palustre, Warnstorfia mosses: *Warnstorfia exannulata*, *W. fluitans*, *W. sarmentosa*. Species characteristic of particular associations and communities, e.g.: globular-leaved valerian *Valeriana simplicifolia*, rusty bog rush *Schoenus ferrugineus*, black bog rush *Schoenus nigricans*, and also miliary sedge *Carex panicea*, mollusc ctenidium moss *Ctenidium molluscum*, early marsh orchid *Dactylorhiza incarnata*, broad-leaved marsh orchid *Dactylorhiza majalis*, maidenhair moss *Fissidens adianthoides*, Blandow's feather moss *Helodium blandowii*, tufted fen-moss *Paludella squarrosa*, peat mosses: rigid bog-moss *Sphagnum teres*, Warnstorf's bog-moss *S. warnstorfii*, tomentypnum moss nitens.

Photo 3. Marsh housewort *Pedicularis palustris* (© A. Koczur).

5. Distribution in Poland

In Poland, alkaline fens are unevenly distributed. They occur in the southern part of the country (in the Carpathians, Sudety mountains, as well in areas bordering the Carpathians, and on uplands) as well as in the northern part of lowlands. They occur when there is limestone or other formations rich in calcium carbonate. In the Carpathians, they occur fairly

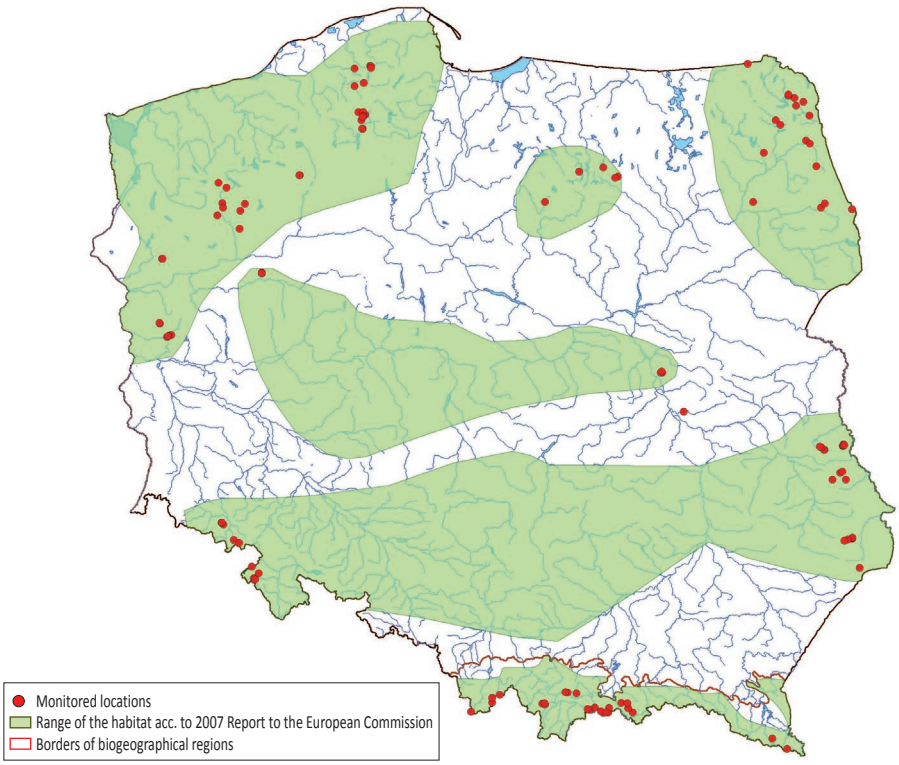

Fig. 1. Distribution of the habitat in Poland and monitored locations.

often although – as a rule – they occupy rather small areas. The presence of alkaline fens has been recorded in practically all the mountain ranges of the Polish Carpathians. Over the last several decades, a decrease in the surface area of alkaline fens has been observed, coupled with the deterioration of the conservation status of most of them (Koczur 2009). The reasons behind this phenomenon include both drainage systems, excessive water extraction, and the abandonment of the practice of cutting and grazing (Herbichowa, Wołejko 2004).

II. METHODOLOGY

1. Methodology of monitoring studies

Selection of monitoring locations

The distribution of monitoring locations should correspond with the distribution of alkaline fens throughout their range of occurrence in Poland, and should also reflect the regional and elevation-related diversity of the habitat. The monitoring of alkaline fens was performed in 2009. The principle guiding the selection process was to include the greatest diversity of habitat 7230 in Poland, and to cover the whole range of habitat occurrence. As regards the continental region, the northern part of the range is fairly well represented and this sample will permit drawing conclusions about the status of habitat 7230 in this

part of Poland. As far as the southern part of the range is concerned, it would be advisable to include the area of Ponidzie (where there are no communities with blue sesleria *Sesleria uliginosa*) as well as the Kraków-Częstochowa uplands and the Podkarpacie (the Carpathian Foothills). As it was not possible for the monitoring to cover all the Natura 2000 sites in the Carpathians, an attempt was made to select monitoring locations in a way that showed the diversity of the habitat in alpine region. Thus, spring fens which have developed on calcareous substrate (the Pieniny Klippen Belt), flysches of various calcium carbonate contents (e.g. the Beskid Żywiecki, Gorce, and Bieszczady mountains), as well as fens that have developed in old fluvioglacial cones (the Kotlina Orawsko-Nowotarska basin) were selected. In principle, the monitoring pertains to the whole range of occurrence of the habitat. This sample will permit drawing conclusions about the status of habitat 7230 throughout the alpine region. It would be advantageous to include locations from the Beski Niski mountains area (as the eastern part of the region is not represented fairly), and the Tatra mountains (and particularly the Biały Potok glade which deviates from the characteristics of typical mountain spring fens). In each of the areas, at least three locations should be monitored. In most cases, either the whole fen or a clearly distinguishable part of a fen in the area representing habitat 7230 should be selected as a monitoring location. In the case of very large areas (fen complexes), the monitored location should consist of a single, homogeneous fragment of fen, different from the rest of area (either having homogeneous characteristics or being separated from other locations by habitats of different type). If, in some areas the habitat occurs as small, scattered patches, all such isolated patches situated in the specific area which constituted a whole (e.g. small spring fens within a single montane glade) should be considered jointly as a monitoring location.

Study method

Wherever possible, one transect with an area measuring 10x200 m should be delineated on each of the selected locations. On account of various dimensions, shapes and situations of the areas occupied by the studied habitat, a number of modifications may be applied, such as:

- changing the shape of the transects so that its longer axis is not a straight line, or the transect is shorter and wider;
- reducing the surface area of the transect in order to fit the surface occupied by the habitat;
- selecting three plots, at certain points in the transect (when the patches are isolated).

The beginning, middle, and end of the transect are places where phytosociological relevŽs are taken (their coordinates are determined with a GPS receiver). When the transect area is not typical, the relevŽs can be situated differently, and in extreme situations (the studied habitat is disappearing) their number can be reduced. The relevŽs are performed on 5x5 m surfaces, using a classic Braun-Blanquet's scale. Apart from these, the following measurements and assessments should be made:

- the depth of the ground water table, or – when needed – surface water table, determined (without using specialised equipment) at five points, in 50 m intervals along the transect (three at places where relevés were performed, two – between the relevés);

- pH of the surface layer of peat (measurement with either a field pH-meter or by Helig's method), at five points, in 50 m intervals along the transect (three at places where relevés were performed, and – if possible – two between the relevés);
- checking whether travertines occur;
- checking whether the field bears traces of peat extraction (determining the method of extraction, estimating the annual extraction in m^3, the percentage of destroyed peat bog, and the time interval during which the peat was extracted);
- checking the presence of drainage ditches in the area, their depths, level of water in ditches, and also whether the water in ditches flows out or stagnates;
- determining the percentage coverage of the transect by mosses, and the proportion between brown mosses and peat mosses;
- determining the percentage of the surface occupied by the habitat on the transect;
- determining the percentage coverage of the transect by particular characteristic species, dominant species, alien invasive species, expansive species of herbaceous plants, tree and shrub species.

Timing and frequency of studies

The best time for conducting studies is from mid-June to mid-August when a significant proportion of plant species are flowering. Studies conducted during the later portion of the vegetation season are possible, but account should be taken of the problems with identifying some species (sedge family, grasses, orchid family), and with evaluation of their coverage. Observations should be repeated every four years.

Equipment required

The necessary equipment includes: a portable pH-meter, or a plate and Helig's liquid, a GPS device, a measuring tape, a camera, a small shovel, and a notebook (with empty forms to be filled in).

2. Assessment of parameters of the conservation status of a natural habitat and the indicators of its specific structure and functions

Table 1. Description of parameters of specific structure and function, as well as 'conservation prospects' for natural habitat 7230 Alkaline fens (Mountain and lowland alkaline fens of spring fen, sedge fen, and sedge-moss fen characteristics)

Parameter/Index	Description
Surface area of the habitat	An assessment should be made not of the surface area occupied by habitat 7230 but rather its size related to the potential habitat (whether it occupies the entire area where favourable habitat conditions prevail), and its dynamics (whether the surface area occupied by the habitat is stable, increases or decreases, e.g. as a result of being overgrown by shrubs).
Specific structure and functions	
Percentage proportion of the habitat in the transect	Percentage of surface area occupied by habitat 7230 on the transect should be determined. This parameter defines indirectly the spatial structure and the degree of fragmentation of the habitat on the monitored location.

Characteristic species	List of characteristic species for a given plant community and higher syntaxonomic units: *Caricetalia davallianae* and *Scheuchzerio-Caricetea* (species typical of alkaline habitats) should be provided together with their percentage proportions on the transect. This parameter describes the conservation status and specific richness of species composition in plant communities on the monitored location (showing to what extent the dominating plant communities are typical).
Dominant species	List of species dominating the transect and their percentage proportions should be given. This parameter describes the structure of plant communities on the monitored location as well as their conservation status (or possibly the degree of their deformation). It answers the question whether the species characteristic of the habitat dominate the monitored location.
Coverage and moss species composition	Percentage of surface area of the transect occupied by all moss species should be determined together with the percentage proportions of coverage by brown mosses versus the coverage by (Sphagnum) peat mosses. This indicator characterises the condition of the habitat on the monitored location, and – indirectly – indicates the direction of processes occurring there (the possible acidification of the habitat). Mosses typical of habitat 7230 react before any other to the adverse changes in the ground water level. The moss layer is best developed in habitats with stable ground water level not subject to great fluctuations. When the ground water table begins to move and there is more intensive drying of the surface layer of peat, the mosses begin to die out. (Sphagnum) peat mosses develop in those places where the moss layer loses contact with fertile ground water. With the water supply shifting to an ombrogenous or mixed type, a gradual acidification of the habitat occurs, usually resulting in an invasion of (Sphagnum) peat mosses.
Alien invasive species	List of invasive species (geographically and ecologically alien species) in the transect should be given together with their percentage proportions. This parameter describes the degree of deformation of the habitat.
Expansive species of herbaceous plants	List of expansive species in the transect should be given together with their percentage proportions. This parameter describes the direction and stage of succession in disturbed habitats while in the case of minor disturbances it warns about a possible threat.
pH range	pH of the surface layer of peat should be measured (with either a field pH-meter or by Helig's method), at five points, in 50 m intervals along the transect (three at places where relevés were performed, and – if possible – also two between the relevés); This parameter characterises the present status of the habitat and can document its stage of succession in cases of natural and anthropogenic transformations. It answers the question to what extent a given monitoring location represents the typical form of alkaline fens (which depends on the chemical properties of waters supplying the habitat, and – indirectly – on the geological substrate). The parameter also shows the degree of acidification of the habitat resulting from either natural (accumulation of peat and weakening contact with ground waters) or anthropogenic causes (artificial lowering of the ground water levels caused by the partial draining of the habitat).
Expansion of shrubs and underwood	List of tree and shrub species occurring in the transect should be given together with the approximate percentage coverage by each species and the total coverage by all trees and shrubs. This parameter characterises the threat that the fen will be overgrown by shrub formations and forest communities.
Degree of saturation by water	Depth of groundwater table – and surface water if it occurs – should be determined in the summer season (without using specialised equipment) or – if such a possibility exists – on the basis of reading from a piezometer. Measurements should be taken at five points, in 50 m intervals along the transect (three at places where relevés were performed, two – between the relevés); The objective of this exercise is to check at what depth the water table is in relation to the surface of the fen.

Peat extraction	Extent of damage caused by peat extraction should be estimated as well as the possible degree of regeneration of the habitat. It helps when the following facts are determined: the method of extraction (manual, mechanical, or on an industrial scale), annual extraction in m^3, percentage of the fen surface damaged, and the time interval during which peat was extracted. This parameter determines the degree of the devastation of the habitat resulting from peat extraction.
Drainage systems	Extent of damage caused by draining should be estimated as well as the possible degree of regeneration of the habitat. In order to achieve these objectives, the existence of draining infrastructure should be found, its condition (maintenance of ditches), and its impact on water conditions in the fen should be assessed. It helps when the following items of information are determined: presence of drainage ditches, their depths, water levels in ditches, and whether water in the ditches flows out or stagnates. This parameter determines the degree of the devastation of the habitat resulting from draining the area.
Conservation prospects	Real possibilities of maintaining the proper status of the habitat as well as correcting the improper status should be assessed. The description should contain information on performed and potential conservation measures aimed at maintaining or improving the conservation status of the habitat. Typical measures of active conservation include: neutralising the impact of drainage ditches, shrub removal, grass cutting, and – in some cases – controlled burning. When assessing the conservation prospects for this habitat and for maintaining it in an undeteriorated state in the short-term future, apart from the current conservation status (location in a protected area, known provisions in conservation plans and working documents), the impact of biotic and anthropogenic factors and the conservation status of the habitat should be taken into account. A high evaluation of 'specific structure and functions' parameter should result in the higher evaluation of 'conservation prospects'.

Table 2. Evaluation of conservation status parameters and indices of 'specific structure and functions' for the natural habitat 7230 Alkaline fens (Mountain and lowland alkaline fens of spring fen, sedge fen, and sedge-moss fen characteristics)

Parameter/Index	Favourable status FV	Unfavourable inadequate U1	Unfavourable bad U2
Surface area of the habitat at the monitored location	Does not change or increases	Other combinations	Evident decrease in the area of the habitat compared with earlier studies or given in references
Specific structure and functions			
Percentage proportion of the habitat in the transect	80–100%	50 – 80%	below 50%
Characteristic species	More than eight characteristic species, or more than 50% coverage by characteristic species in the transect.	4–8 characteristic species, or 20–50% coverage in the transect.	1–3 characteristic species, or below 20% coverage in the transect.
Dominant species	Species characteristic of the habitat dominate, or no dominant present but characteristic species predominate.	No evident dominants, more or less equal proportions of species characteristic of the habitat 7230 and other species.	Species. not classified as characteristic of the habitat, dominate.
Coverage and moss species composition	Total coverage by mosses – over 50%, all brown mosses occupy more than 70% of the total surface occupied by all moss species.	Total coverage by mosses in the 20–50% range, brown mosses occupy from 20 to 70% of the total surface occupied by all moss species.	Total coverage by mosses – below 20%, brown mosses absent or they occupy a combined surface of up to 20% of the total surface occupied by all moss species. with evident domination of (*Sphagnum*) peat mosses.

Alien invasive species	None	Occupy up to 5% of the area.	Occupy more than 5% of the area.
Expansive species of herbaceous plants	None or single.	Occupy up to 5% of the area	Occupy more than 5% of the area.
pH range	Above 7	6–7	Below 6
Expansion of shrubs and underwood	None or single.	Proportion below 15%.	Proportion above 15%.
Degree of saturation by water	Water level measured in a piezometer – up to 2 cm above, equal or up to 10 cm below the surface of the peat bog (in practice when one walks on peat bog, water can be seen always, at least sole-deep)	Water level measured in a piezometer – 2–10 cm above or 10–20 cm below the surface of the peat bog,	Water level measured in a piezometer – more than 10 cm above, or more than 20 cm below the surface of the peat bog,
Peat extraction	No peat extraction ever, and if extracted in the past (more than 30 years ago) it was only small-scale operations (up to 5% of the peat bog), the traces of past extraction barely noticeable.	In the past, peat extracted on a much larger scale (more than 5% of the peat bog), traces of extraction clearly visible, at present – no extraction, or only sporadically and on a very small-scale.	Large-scale peat extraction by local inhabitants, or exploitation on an industrial scale.
Drainage systems	No network of drainage ditches and channels as well as other elements of infrastructure draining the peat bog, or the drainage infrastructure sufficiently 'neutralised' as a result of conservation measures undertaken e.g. construction of gates, filling in ditches and the like).	Network of drainage ditches and other elements of infrastructure has little impact on the water conditions in the peat bog, because of lack of maintenance, partial damage and natural overgrowing of ditches, or owing to conservation measures undertaken e.g. construction of gates, filling in ditches and the like.	The existing drainage infrastructure evidently worsens the water conditions in the peat bog.
Conservation prospects	Conservation prospects for the habitat are good or excellent, no significant impact of threatening factors predicted.	Other combinations.	Conservation prospects for the habitat are bad, strong impact of threatening factors observed, no survival of the habitat can be guaranteed in the long term.
Overall assessment	All parameters evaluated as FV, or two FV and one U1	Two or three evaluated as U1, no U2 evaluations	One or more parameters evaluated as U2

Cardinal indices

- Characteristic species
- Coverage by mosses and their species composition
- pH range
- Expansive species of herbaceous plants
- Expansion of shrubs and tree undergrowth
- Degree of saturation by water

3. An example of a filled-in habitat observation sheet for a monitored locatione

Habitat observation sheet for the monitored location	
Basic information	
Code and name of the natural habitat	7230 Alkaline fens (Mountain and lowland alkaline fens of spring fen, sedge fen, and sedge-moss fen characteristics) 7230-1 Mountain spring fens
Site name	Obszar Pieniny PLH120013
Name of the monitored location	Za Stronią
Type of the monitored location	Research
Plant communities	*Valeriano-Caricetum flavae*
Description of the habitat on the site	The mountain spring fen on the Za Stronią glade, occupies the major part of the glade and borders directly with a forest on the eastern, western and northern sides, whereas on the southern side – with a hay meadow. The spring fen forms one large, dense patch. The glade has two distinctly different levels linked by a steep south and southeast-facing slope.
Area of habitat patches	1.44 hectares
Protected areas where the monitored location is situated	The Pieniny National Park Obszar Pieniny PLH120013 Obszar Pieniny PLB120008
Manager of the area	Private landowners
Geographical coordinates	N 49° 24' ..." – E 20° 22' ..."
Transect dimensions	0.2 hectare
Elevation a.s.l.	640–670 m a.s.l.
Name of the area	Pieniny
Annual report – principal information	
Year	2009
Monitoring type	Integrated
Coordinator	Grzegorz Vonćina
Auxilliary coordinators	–
Threats	Abandonment of land use, secondary succession.
Other natural values	In three places within the site, a glacial relict tomentypnum moss *Tomentypnum nitens* occurs. In 2009, the author found the occurrence of the white adder's mouth orchid *Malaxis monophyllos* orchid.
Is monitoring required?	Yes
Justification	On these fens, which display high values in terms of nature (the occurrence of protected species of vascular plants and mosses), no economic activities are pursued at present (including cutting with scythes and the removal of hay) even once every several years, because of the land ownership status, while the private owners do not manage the spring fens in a traditional manner (they only occasionally drive sheep across the glade).
Conservation measures performed	At present, no economic activities are pursued except incidental, grazing by passing sheep flocks.
Proposed conservation measures	The author does not suggest any subsequent forms of conservation. It would be justified to introduce a motivational scheme (extra payments) for the glade owners who – under present economic realities – do not have the opportunity to manage this area in commercial terms.
Date of inspection	15.07.2009
Comments	–

Conservation status of the natural habitat at the monitored location	
Relevé I	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 49° 24' ..." – E 20° 22' ..."; elevation: 640 m a.s.l.; area of the relevé: 25 m^2; inclination: 2° ; exposure: S. Density of layer C – 98%, density of layer D – 100 %; height of layer C – 30 cm, height of layer D – 5 cm. Phytosociological unit – *Valeriano-Caricetum flavae* Vascular plants: *Achillea millefolium* +, *Briza media* 3, *Calamagrostis varia* +, *Caltha palustris* +, *Carex davalliana* 3, *Carex flacca* 1, *Carex flava* +, *Carex nigra* 2, *Carex panicea* 2, *Centaurea jacea* +, *Cirsium rivulare* 1, *Colchicum autumnale* +, *Crepis paludosa* 1, *Deschampsia caespitosa* +, *Epipactis palustris* 1, *Equisetum fluviatile* +, *Equisetum palustre* 3, *Equisetum variegatum* 1, *Eriophorum latifolium* 1, *Eupatorium cannabinum* +, *Festuca pratensis* +, *Festuca rubra* 1, *Galium mollugo* +, *Gymnadenia conopsea* 1, *Juncus articulatus* +, *Juncus inflexus* +, *Knautia arvensis* +, *Lathyrus pratensis* 1, *Leontodon hispidus subsp. hastilis* +, *Linum catharticum* +, *Lychnis flos-cuculi* +, *Lysimachia vulgaris* +, *Mentha arvensis* 1, *Ononis vulgaris* +, *Picea abies c* +, *Plantago lanceolata* +, *Poa trivialis* +, *Potentilla erecta* 2, *Prunella vulgaris* 1, *Ranunculus acris* 1, *Tussilago farfara* +, *Valeriana simplicifolia* 1, *Vicia cracca* +. Bryophytes: *Calliergonella cuspidata* 2, *Campylium stellatum* 2, *Climacium dendroi- des* 1, *Cratoneuron filicinum* +, *Plagiomnium elatum* +, *Tomentypnum nitens 3.*
Relevé II	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 49° 24' ..." – E 20° 22' ..."; elevation 660 m a.s.l.; area of the relevé: 25 m^2; inclination: 5°; exposure: SE. Density of layer C – 100%, density of layer D – 80 %; height of layer C – 40 cm, height of layer D – 5 cm. Phytosociological unit – *Valeriano-Caricetum flavae* Vascular plants: *Briza media* 1, *Caltha palustris* 1, *Carex davalliana* 2, *Carex flacca* 1, *Carex nigra* 1, *Carex panicea* 1, *Carex rostrata* +, *Cirsium rivulare* +, *Crepis paludosa* 1, *Cruciata glabra* +, *Dactylorhiza majalis* 1, *Deschampsia caespitosa* +, *Epipactis palustris* 1, *Equisetum palustre* 4, *Equisetum variegatum* +, *Eriophorum latifolium* 1, *Eupatorium cannabinum* +, *Festuca rubra* 1, *Galium mollugo* +, *Gymnadenia conopsea* +, *Juncus articulatus* 2, *Lathyrus pratensis* +, *Lysimachia nummularia* 1, *Lysimachia vulgaris* 1, *Mentha arvensis* +, *Picea abies c* +, *Poa trivialis* 1, *Potentilla erecta* 2, *Prunella vulgaris* +, *Ranunculus acris* +, *Trifolium pratense* +, *Triglochin palustre* +, *Tussilago farfara* +, *Valeriana simplicifolia 2.* Bryophytes: *Bryum pseudotriquetrum* +, *Calliergonella cuspidata* 2, *Campylium stellatum* +, *Cratoneuron filicinum* 3, *Plagiomnium elatum 2.*
Relevé III	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 49° 24' ..." – E 20° 22' ..."; elevation 670 m a.s.l.; area of the relevé: 25 m^2; inclination: 1°; exposure: SE. Density of layer C – 90%, density of layer D – 90 %; height of layer C – 20 cm, height of layer D – 5 cm. Phytosociological unit – *Valeriano-Caricetum flavae* Vascular plants: *Blysmus compressus* +, *Briza media* 2, *Calamagrostis varia* +, *Carexflacca* 2, *Carex nigra* 1, *Carex panicea* 2, *Carex paniculata* +, *Centaurea jacea* +, *Cirsium palustre* +, *Corylus avellana c* +, *Dactylorhiza majalis* +, *Eleocharis quinqueflora* +, *Epipactis palustris* 1, *Equisetum palustre* +, *Eriophorum latifolium* +, *Eupatorium cannabinum* +, *Euphrasia* sp. +, *Lathyrus pratensis* +, *Leontodon hispidus subsp. hastilis* 1, *Linum catharticum* +, *Picea abies c* +, *Polygala* sp. +, *Potentilla erecta* 3, *Prunella vulgaris* 2, *Triglochin palustre* +, *Valeriana simplicifolia* +. Bryophytes: *Bryum pseudotriquetrum* +, *Campylium stellatum* 2, *Limprichtia cossoni* 3, *Philonotis calcarea* +.

TRANSECT			
Indices	**Value of index**	**Description of index**	**Assessment of index**
Surface area of the habitat	Homogeneous, dense surface of habitat ensures the continued existence of eutrophic spring fen in the monitored location.		FV
Specific structure and functions			**U1**
Percentage proportion of the habitat in the transect	100 %	The transect was marked in the largest complex of eutrophic spring fens representing habitat 7230 in the Pieniny mountain area, in such a way that it does not encompass other communities not belonging to the habitat.	FV
Characteristic species	List of characteristic species (Latin names); percentage proportions of areas covered by each species in particular layers (a,b,c,d) should be given (with accuracy to the nearest 10%).	Layer C: Globular-leaved valerian *Valeriana simplicifolia* 5%, marsh helleborine *Epipactis palustris* 2%, abtuse rush *Eleocharis quinqueflora* - 1%, Davall sedge *Carex davalliana* - 10%, *Carex panicea* - 10%, yellow sedge *C. flava* 1%, broad-leaved cotton-grass *Eriophorum latifolium* - 2%, Layer D: tomentypnum moss *Tomentypnum nitens* - 1%, Cosson's lipmprichtia moss *Limprichtia cossonii* - 5%, yellow starry feather-moss *Campylium stellatum* - 5%	FV
Dominant species	List of dominant species (Latin names); percentage proportions of areas covered by each species in particular layers (a,b,c,d) should be given (with accuracy to the nearest 10%).	March horsetail *Equisetum palustre* – 25%	U1
Coverage and moss species composition	% of the transect surface area occupied by all moss species, also the percentage coverage by brown mosses versus percent coverage of (Sphagnum) peat mosses.	70%, only brown mosses	FV
Alien invasive species	List of species (Latin names) geographically and ecologically alien to the habitat; percentage proportions of areas covered by each species in the transect should be given (with accuracy to the nearest 10%).	No alien species found on the site.	FV
Expansive species of herbaceous plants	List of species (Latin names); approximate percentage proportions of areas covered by each species in the transect should be given (with accuracy to the nearest 10%).	heny eupatorium *Eupatorium cannabinum* – 5%	U1
pH	Measurement made with a portable pH-meter, or a plate and Helig's liquid, measurement of the surface layer of peat.	pH 7.2–7.6	FV
Expansion of shrubs and underwood	List of species (Latin names) should be given together with approximate percentage cover for each species and a total coverage (to the nearest 10%).	may rose *Viburnum opulus* – 1%, common spruce *Picea abies* – 1%.	FV

Degree of saturation by water	Depth of ground water table should be determined, or surface water if it is there.	places where relevés have been taken, water emerges from the surface when one walks on it but the area do not bear traces of flooding. Similarly, between the relevés, the soil is saturated with water but does not show traces of flooding.			FV
Peat extraction	Method of peat extraction; Scale of peat extraction; Time interval during which peat was extracted.	No traces of peat extraction.			FV
Drainage systems	Existing draining infrastructure and its impact on water conditions of the peat bog. Presence of draining ditches, their depths, water level in the ditches, as well as whether water flows out or stagnates.	No draining infrastructure.			FV
Conservation prospects	Location of the habitat within the Pieniny National Park guarantees the proper conservation of the habitat. However, the habitat is now in private hands preventing the application of proper commercial measures allowing the habitat to be kept in conditions similar to those traditionally managed by humans in the past. A large homogenous patch of the plant community makes the conservation of the habitat possible even with strong pressure from tree species coming from the surrounding forest.				U1
Overall assessment	Proportion of the habitat area representing different conservation status within the monitoring location		FV	90%	U1
			U1	10%	
			U2	0%	

Human activities				
Code	**Name of activity**	**Intensity**	**Impact**	**Description**
140	grazing	A	0	In the habitat, traces of passing sheep flocks are visible in the form of a few paths on which sward and mosses are crushed. The intensity of sheep grazing does not pose a threat to plants growing in the monitored location, but does stop the succession of tree species. Observations carried out since 1998 have not shown any adverse changes resulting from traditional human management.

4. Habitats of similar ecological characteristics

Alkaline fens often occur in complexes with moist meadows of *Calthion* and *Molinion* alliances, with high-sedge rushes. In some cases, the proportion of meadow species is so high, that the identification of both habitat and its borders may become difficult. This regards, above all, patches of transient nature and those that are degraded. The habitats of similar ecological characteristics include, before any other: 7220 – Petrifying springs with tufa formation (*Cratoneurion commutati*) *and* 7140 – Transition mires and quaking bogs, with which they form transient forms.

5. Conservation of the natural habitat

At present, the majority of alkaline fens are – to a variable degree – transformed by humans. Only a few, better preserved and fully natural can survive without the application

of active conservation measures. Such measures have been carried out with great success in many alkaline fens and, therefore, their methodology is known. The basic conservation measures in habitat 7230 is extensive cutting (collecting hay and taking it away from the fen) and successive cutting down of emerging shrubs and tree seedlings. In some of the fens within the continental region, controlled burning has had some positive effects. This measure may be permitted as a conservation measure provided that a thorough analysis of each case is made individually and strict control provisions are observed during its implementation. Burning is applied in early spring or in winter, always with the water level staying below the surface of the ground, so the fire "glides" above the surface of the fen. This is to prevent damage to the moss level, lower (living parts) of herbaceous plants as well as to the seed bank deposited in the soil. Burning may never be applied to the whole surface of the fen but must be limited to relatively small spots, and be applied in a mosaic pattern to minimise the threat to animal populations living in the fen. On account of the specificity of mountain fens (situated on steep slopes and the lack of water outflows associated with these locations), this measure is inadmissible in the alpine region.

A number of fens (chiefly in the alpine region) have been drained in the past. The conservation measures in such areas should aim at returning the groundwater levels to their initial state. This is achieved by the gradual removal of the effects exerted by the existing draining infrastructure, and finally to eliminate it altogether. Water gates are constructed to drain ditches or the latter are filled in (partially or completely).

In cases of extremely degraded fens, more advanced restoration measures are necessary. They include (apart from elevating the groundwater level) the gradual removal of the surface layer of muck, and the reintroduction of plant species typical of fens.

All the measures listed above are practically applied in selected fens. It is necessary to continue it in future and to extend them to more fens.

6. References

Herbichowa M,. Wołejko L. 2004. Górskie i nizinne torfowiska zasadowe o charakterze młak turzycowisk i mechowisk. W: J. Herbich (red.). Wody słodkie i torfowiska. Poradniki ochrony siedlisk i gatunków Natura 2000. Tom 2. Wyd. Ministerstwo Środowiska, Warszawa, pp.178–195.

Koczur A. 2009. Zbiorcze sprawozdanie z obserwacji monitoringowych dla siedliska 7230 Górskie i nizinne torfowiska zasadowe o charakterze młak turzycowisk i mechowisk w roku 2009. In: G. Cierlik, M. Makomaska-Juchiewicz, W. Mróz, J. Perzanowska, W. Król (eds.). Monitoring gatunków i siedlisk przyrodniczych ze szczególnym uwzględnieniem specjalnych obszarów ochrony siedlisk Natura 2000". Commisioned by: Główny Inspektorat Ochrony Środowiska, Warszawa.

Matuszkiewicz W. 2001. Przewodnik do oznaczania zbiorowisk roślinnych Polski. – Vademecum Geobotanicum 3. PWN, Warszawa.

Pałczyński A. 1975. Bagna Jaćwieskie. Pradolina Biebrzy. Roczn. Nauk. Rol., ser. D, Monografie PWN, p. 145.

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9180* *Tilio-Acerion* forests of slopes, screes and ravines

Tilio platyphyllis-Acerion pseudoplatani

Photo 1. An example of natural habitat code 9180. Ostoja Środkowojurajska refuge (© J. Bodziarczyk).

I. INFORMATION CONCERNING THE NATURAL HABITAT

1. Phytosociological identifiers

Class: Querco-Fagetea

Order: Fagetalia sylvaticae

Alliance: Tilio platyphyllis-Acerion pseudoplatani *Associations and communities:*

Phyllitido-Aceretum, Lunarno-Aceretum,

Sorbo aucupariae-Aceretum pseudoplatani,

Aceri platanoidis-Tilietum platyphylli

Community: *Acer pseudoplatanus-Aruncus sylvestris*

2. Description of the natural habitat

Multi-species, fertile, sycamore maple, sycamore maple-beech, and maple-lime forests developing on steep slopes and screes, as a rule at inclinations from 20–50°, on strongly skeletal soils, often superficially covered with rubble, boulders, and blocks of rock, and with active erosion processes. The forest stands are dominated by sycamore maple, Norway maple, or broad-leaved lime. These forests are limited in occurrence to mountain

and foothill regions of Southern Poland. Forest habitat type: upland forest and mountain forest.

3. Ecological conditions

Type of substrate – rocky, rock rubble with variable diameter, and bare rocks;

chiefly on calcareous, basalt and greenstone substrates, rarely on other types of rocks (noted also on porphyries and gneisses).

Soils – shallow, initial, strongly skeletal.

Inclination – great, 20° to 40° (70°).

Exposure – most often facing north, or near north.

Microclimate – greatly diversified – from microclimates of a thermophilous nature (some forms of maple-lime forests *Aceri-Tilietum* on slopes) through moderately cold and subhumid climates (sycamore maple forest *Phyllitido-Aceretum,* sycamore maple forest *Lunario-Aceretum,* and most forms of maple-lime forests *Aceri-Tilietum* on slopes*)* up to alpine microclimates (Carpathian sycamore maple forest *Sorbo-Aceretum).*

4. Typical plant species

Depending on subtype:

9180-1 Maple-lime forests of the Sudety mountains, their foothills, and foreland, marked with mixed, multi-species forest stands with domination of broad-leaved lime, Norway maple, sycamore maple, and European ash.

Trees and shrubs: large-leaved lime *Tilia platyphyllos*, Norway maple *Acer platanoides*, European ash *Fraxinus excelsior*, sycamore maple *Acer pseudoplatanus*, Scotch elm *Ulmus glabra*, chestnut oak *Quercus petraea*, Alpine currant *Ribes alpinum*, European fly honeysuckle *Lonicera xylosteum*.

Herbaceous plants: German vetch *Vicia dumetorum*, creeping bellflower *Campanula rapunculoides*, wood vetch *Vicia sylvatica*, giant bellflower *Campanula latifolia*, wonder violet *Viola mirabilis*, black baneberry *Actaea spicata*, spilcet fern *Polystichum aculeatum*, Benekeni brome *Bromus benekenii*, hedge garlic *Alliaria petiolata*, throatwort *Campanula trachelium*, narrow-leaved bellflower *Campanula persicifolia*, dog's mercury *Mercurialis perennis*, sweet woodruff *Galium odoratum*.

9180-2 Sycamore maple forest with hart's tongue *Phyllitis scolopendrium* – habitat of foothill and mountain type, with stand principally of sycamore maples although with admixture of many other tree species, with the occurrence of the rare fern species hart's tongue *Phyllitis scolopendrium* as a differential feature.

Trees and shrubs: sycamore maple *Acer pseudoplatanus*, large-leaved lime *Tilia platyphyllos*, Scotch elm *Ulmus glabra*, European ash *Fraxinus excelsior*, common beech *Fagus sylvatica*, hornbeam *Carpinus betulus*, silver fir *Abies alba*, common elder *Sambucus nigra*, gooseberry *Ribes uva-crispa*.

Herbaceous plants: hart's tongue *Phyllitis scolopendrium*, perennial honesty *Lunaria rediviva*, male fern *Dryopteris filix-mas*, dog's mercury *Mercurialis perennis*, weaselsnout *Galeobdolon luteum*, spilcet fern *Polystichum aculeatum*, black baneberry *Actaea spi-*

Fot. 2.

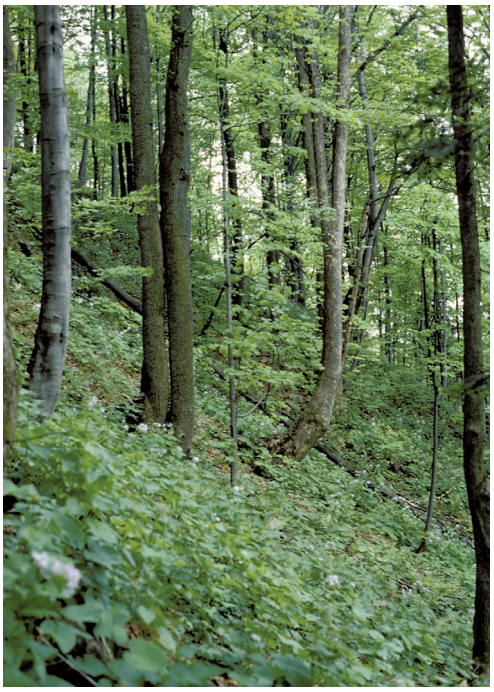

Photo 3. Carpathian sycamore maple forests with perennial honesty *Lunaria rediviva* – an example of natural habitat subtype code 9180-3. Kostrza (© J. Bodziarczyk).

cata, European wild ginger *Asarum europaeum*, false crowfoot *Geranium robertianum*, common lungwort *Pulmonaria obscura*, stinging nettle *Urtica dioica*.

9180-3 Carpathian sycamore maple forests with perennial honesty *Lunaria rediviva* – sycamore maple forests of the Carpathian arc, developing principally on acid and neutral substrates with dominant perennial honesty *Lunaria rediviva*, and with many Carpathian forest floor species:

Trees and shrubs: sycamore maple *Acer pseudoplatanus*, common beech *Fagus sylvatica*.

Herbaceous plants: perennial honesty *Lunaria rediviva*, male fern *Dryopteris filix-mas*, wood ragwort *Senecio nemorensis*, dog's mercury *Mercurialis perennis*, touch-me-not Impatiens noli-tangere, weaselsnout *Galeobdolon luteum*, sweet woodruff *Galium odoratum*.

9180-4 Sudetian sycamore maple forests with perennial honesty *Lunaria rediviva – sycamore maple forests of the Sudety mountains, with perennial honesty *Lunaria rediviva,* more often found on calcium carbonate-rich substrates, characterised by the occurrence of species with western type of distribution, generally poorer in terms of floristics than the corresponding Carpathian sycamore maple forests, with very small proportions of species of the *Betulo- Adenostyletea* class, and generally much thinner:

Trees and shrubs: sycamore maple *Acer pseudoplatanus*, Scotch elm *Ulmus scabra*, Norway maple *Acer platanoides*, black-fruited honeysuckle Lonicera nigra.

Herbaceous plants: perennial honesty *Lunaria rediviva*, cow parsley *Anthriscus nitida*, sweet spurge *Euphorbia dulcis*, enneapetalous toothwort *Dentaria enneaphyllos*, reed fescue *Festuca altissima*, wood starwort *Stellaria nemorum*, lady

fern *Athyrium filix-femina*, male fern *Dryopteris filix-mas*, broad buckler fern *Dryopteris dilatata*, white bryony *Petasites albus*.

***9180-5 Carpathian sycamore-maple forest** – habitat of a low-coppice sycamore maple-mountain ash forest, with abundant tall-herb forest floor vegetation, limited to lower- and higher montane habitats of the Carpathian arc.

Trees and shrubs: sycamore maple *Acer pseudoplatanus*, rowan *Sorbus aucuparia*, *Ribes petraeum*, black-fruited honeysuckle *Lonicera nigra*, Alpine rose *Rosa pendulina* (regionally).

Herbaceous plants: adenostyles *Adenostyles alliariae* (locally), Alpine lady fern *Athyrium distentifolium*, sylvan goatbeard *Aruncus sylvestris* (locally), wood millet *Milium effusum*, white bryony *Petasites albus*, common lungwort *Pulmonaria obscura* (locally), columbine meadow-rue *Thalictrium aquilegifolium* (locally), great wood rush *Luzula sylvatica*, American false hellebore *Veratrum lobelianum* (locally), reed grass *Calamagrostis arundinacea*.

***9180-6 Sudetian sycamore maple forests and tall-herb beech forests** – extremely rare type of habitat, known so far only from three isolated patches, much different from the floristic viewpoint but showing a high proportion of species of the *Betulo-Adenostyletea class,* particularly sylvan goatbeard *Aruncus sylvestris* and American false hellebore *Veratrum lobelianum* as a common feature.

Trees and shrubs: sycamore maple *Acer pseudoplatanus*, common beech *Fagus sylvatica*, rowan *Sorbus aucuparia*, black-fruited honeysuckle *Lonicera nigra*, Alpine rose *Rosa pendulina*.

Herbaceous plants: Alpine sow-thistle *Cicerbita alpina*, mountain dock *Rumex alpestris*, white buttercup *Ranunculus platanifolius*, clasp-leaf twisted-stalk *Streptopus amplexifolius*, American false hellebore *Veratrum lobelianum*, Manchurian monkshood *Aconitum variegatum*, sylvan goatbeard *Aruncus sylvestris*, goldenrod *Solidago virgaurea*, bilberry *Vaccinium myrtillus*, common hairgrass *Deschampsia flexuosa*.

5. Distribution in Poland

In Poland, the habitat was described from the Sudety mountains, their foreland and foothills, on the Kraków-Częstochowa Jura, and on the entire Carpathian arc.

II. METHODOLOGY

1. Methodology of monitoring studies

Selection of monitoring locations

A distinct patch of the environment should be regarded as a monitoring location (a scree, boulder field, rocky slope) with a surface area of at least 100 m^2.

The monitoring locations should be situated within the main regions of the occurrence of a given type of habitat, which cover the following Natura 2000 areas:

- in the continental region: Kaczawskie mountains and foothills, Kamienne mountains, Ostoja nad Bobrem refuge, Ostrzyca Proboszczowicka, Nysa Kłodzka river ravine

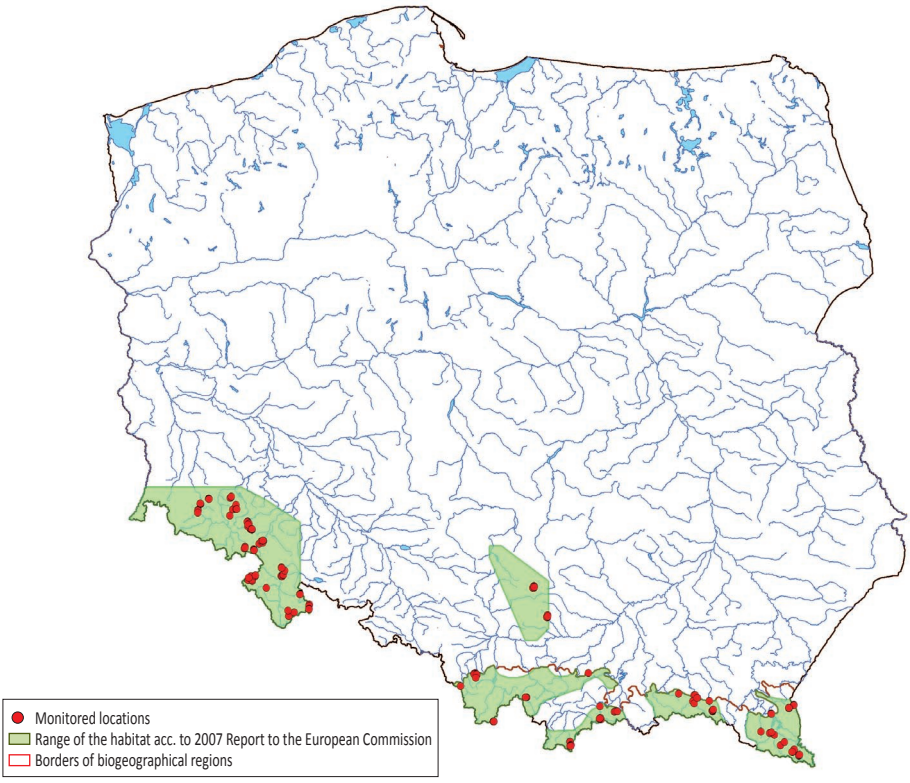

Fig. 1. Distribution of the habitat in Poland and locations monitored from 2006 to 2008

near Morzyszów, Śnieżnik mountain area, and Bialskie mountains, Czarne Urwisko near Lutynia, Ostoje Nietoperzy Gór Sowich bat refuges in Sowie mountains, Bardzkie mountains, Krowiarki mountain range, Pełcznica gorgey, Stołowe mountains, Środkowojurajska refuge, Prądnik river valley.

- in the alpine region: Tatry mountains, Ostoja Jaśliska refuge, Babia Góra mountain, Pieniny Klippen Belt, Ostoja Popradzka refuge, Kostrza, Bieszczady mountains, Słonne mountains, Ostoja Magurska refuge, Łysa Góra mountain, Beskid Żywiecki and Beskid Śląski mountains.

Study method

Because of the insular nature of habitat 9180 distribution, two methodological approaches are possible:

- in watercourse valleys on steep slopes more than 200 m long, it is possible to establish a standard 200 m long transect, along which 3 relevŽs are made: at its beginning, in the middle part, and at the end of the transect;
- in the case of the distribution of patches in a small area, delineating the transect may prove impossible (e.g. Ostrzyca Proboszczowicka or the majority of Carpathian sites). In such cases transect studies are usually impossible because the size of the combined patch of the habitat can be smaller than the potential transect. The observations can,

however, be carried out on individual patches of the habitat and the total surface area can be regarded as a monitored location (analogically as on a transect). The sum of surface areas of individual patches on the site (e.g. in a ravine) may be treated as the monitored area.

The sums of surface areas of 3 patches in which the relevŽs were made covering these patches, may thus be deemed to be the area of the habitat irrespective of whether they are situated in the transect or not.

Timing and frequency of studies

The best time for conducting studies is from May to July when the forest floor vegetation is in an easily identifiable state, and when a significant proportion of plants are flowering. Studies conducted during the later portion of the vegetation season are possible, but account should be taken of the possibility to commit erroneous estimates of coverage by some species, and the impossibility of identifying a few of them.

Equipment required

The studies do not require any specialised equipment. Necessary items include: a notebook (with empty forms to be filled in), a GPS device, a measuring tape, and a camera.

2. Assessment of parameters of the conservation status of a natural habitat and the indicators of its specific structure and functions

Table 1. Description of parameters of specific structure and functions, as well as 'conservation prospects' for natural habitat 9180 – sycamore maple and maple-lime forests on steep slopes and screes (*Tilio platyphyllis- Acerion pseudoplatani*)

Parameter/ Index	Description
Specific structure and functions	
Characteristic species	On account of the great syntaxonomic, ecological, and elevational diversity of the habitat, expressed in a large number of subtypes, the characteristic species differentiating the subtypes show great variability. The most valuable are: Tree and shrubs: large-leaved lime Tilia platyphyllos, Norway maple *Acer platanoides*, sycamore maple *Acer pseudoplatanus*, Scotch elm *Ulmus glabra*, Alpine currant *Ribes alpinum*, black-fruited honeysuckle *Lonicera nigra*, Alpine rose *Rosa pendulina*, in higher mountain situations – rowan *Sorbus aucuparia* subsp. *glabrata*. Herbaceous plants: in foothill and lower mountain subtypes – German vetch *Vicia dumetorum*, creeping bellflower *Campanula rapunculoides*, wood vetch *Vicia sylvatica*, great bellflower *Campanula latifolia*, black baneberry *Actaea spicata*, spilcet fern *Polystichum aculeatum*, hedge garlic *Alliaria petiolata*, hart's tongue *Phyllitis scolopendrium*, and perennial honesty *Lunaria rediviva*; in mountain and high-mountain subtypes: Alpine sow-thistle *Cicerbita alpina*, mountain dock *Rumex alpestris*, white buttercup *Ranunculus platanifolius*, clasp-leaf twisted-stalk *Streptopus amplexifolius*, American false hellebore *Veratrum lobelianum*, Manchurian monkshood *Aconitum variegatum*, sylvan goatbeard *Aruncus sylvestris*, adenostyles *Adenostyles alliariae* (locally), and Alpine lady fern *Athyrium distentifolium*.

Dominant species	This group of species is difficult to define because of major local differences between the dominant species on particular sites. They coincide generally with expansive or characteristic species. For habitat 9180 it is natural to find the occurrence of some species of herbaceous plants in facies (depending on subtype: sweet woodruff *Galium odoratum*, dog's mercury *Mercurialis perennis*, weaselsnout *Galeobdolon luteum*, perennial honesty *Lunaria rediviva*, stinging nettle *Urtica dioica*, hedge garlic *Alliaria petiolata*, Benekeni brome *Bromus benekenii*, wood melic grass *Melica uniflora* etc.). Similarly, the forest stand of the patches is very diversified which is a feature of the natural form of forests – patches where 6–8 tree species coexist can be found parallel to patches where just one species dominates (e.g. sycamore maple *Acer pseudoplatanus*, small-leaved lime *Tilia cordata*, Norway maple *Acer platanoides*). In principle, the 'dominant species' parameter cannot be quantified in relation to the species typical of the habitat, but only with respect to the invasive species or those alien to this type of habitat. The situation is complicated still further by the fact that in forests retaining their natural dynamics, particularly on western slopes, the emergence of species typical of clearings, in gaps left by falling trees, is also a natural phenomenon. Quantifying these indicators requires great experience and knowledge of various habitat types and the full range of their variability.
Alien invasive species	In forests growing on slopes, invasive species are rare among the components of flora, but the occurrence of small balsam *Impatiens parviflora* is highly probable (particularly in the western part of the range) while other species are much rarer. Areas with the occurrence of one alien species were sporadically noted in the Piekielna valley and Ostoja Srodkowojurajska refuge areas. The proportion of invasive species is generally low – if they occur their quantities are below 10% of coverage (again in the case of small balsam *Impatiens parviflora),* the status of the index should be regarded as Unfavourable inadequate (U1), and only in the case of massive occurrence – as Unfavourable bad (U2).
Native expansive species of herbs	The values of 'dominant species' and 'expansive species of herbaceous plants' parameters partially overlap. In 9180 habitats we should talk about expansive species only in relation to the appearance of massively occurring species typical of forest clearings (reed grass *Calamagrostis arundinacea*, wood small-reed *C. epigeios*, bramble *Rubus* spp., fireweed *Chamaenerion angustifolium*), whose massive occurrence may (but does not have to) result from degenerative processes. It should be remembered, however, that in insolated exposures, these species may emerge naturally in gaps of forest stands, representing a natural element of the habitat dynamics.
Tall herb and nitrophilous species	The permanent presence of such species as: hedge garlic *Alliaria petiolata*, false crowfoot *Geranium robertianum*, stinging nettle *Urtica dioica* and wood avens *Geum urbanum* is desirable. Their occurrence in facias is possible in some patches of the habitat thus – similarly as in the case of riparian forests – the frequent occurrence of nitrophilous species is a feature positively differentiating the habitat. It pertains even more to herbaceous species of the *Betulo-Adenostyletea* class which are characteristic, differentiating or even dominant species in mountain and high-mountain subtypes of the habitat.
Structure of forest stand	In the typical forms of the habitat, the forest stand should be highly diversified with respect to height and breast height diameter of trees. It should, however, be remembered that sycamore maple forests and slope forests occurring in difficult ecological conditions are not characterised by high age structure with a major proportion of old forests. The presence of at least several old trees in a study area indicate the natural character of the habitat and the low intensity of forest management practices or their complete absence in the past.
Vertical structure of vegetation	The properly developing patch of habitat 9180 should consist of at least 5 layers: bryophytes, forest floor vegetation, shrubs, and at least two layers in the forest stand. The density of these layers fluctuates, however, in very broad limits, and strongly depends upon local conditions and the internal dynamics of phytocoenoses. Habitat patches where the bryophyte layer is limited to single occurrences are frequent whereas on wet slopes and those on more stable substrates, and with more gentle inclination, they can – together with liverworts – occupy up to 50% of the surface. The lack of „a2" or „b" layers may – in most cases – testify to the degeneration of the habitat resulting from management measures (the simplified vertical structure of a forest stand) carried out in the past, or those pursued currently (lack of underwood and shrubs). However, it can also result from extreme conditions of growth of the species contributing to the development of phytocoenosis and intensive disturbing processes which can significantly affect the species composition and structure of the whole system and its dynamics.

Alien species in the forest stand	In forest stands growing on steep slopes and screes, alien species appear very rarely. Nevertheless, their occurrence represents a clear indication of habitat degeneration. These situations are very rare – in 75 of the examined sites none was found to contain introduced alien species of the invasive type. In mountain areas, Norway spruce *Picea abies* can be admixed, but in many cases it is a natural component of the habitat. Therefore, it may be difficult to establish the origin of the species in case of the occurrence of single trees. It may often be associated with the surrounding habitats which, in a certain way, provide the background for small-area habitats.
Natural regeneration of the forest stand	Most often this occurs as large numbers of seedlings of which only few (because of difficult habitat conditions) enter the stage of brushwood or underwood. In properly developed habitat patches, the presence of regeneration is necessary – depending on the patch, its percentage proportion in the herbaceous plant and shrub layers may fluctuate from several to several dozen. Sycamore maple *Acer pseudoplatanus* and Norway maple *Acer platanoides* usually dominate in the regeneration but most of the seedlings show very low survivability, except in places in open gaps and on at least partially stabilised fragments of slope surfaces. In such places, the rapid development of these species is observed, and they enter the undergrowth layer. The disturbances which markedly affect the formation and diversification of structure are important factors influencing the successful growth and development of a new generation of trees in this habitat. Under these conditions, the fast-growing species (sycamore maple *Acer pseudoplatanus*, Norway maple *Acer platanoides*, large-leaved lime *Tilia platyphyllos*, small-leaved lime *Tilia cordata*, European ash *Fraxinus excelsior* and rowan *Sorbus aucuparia*), gain an advantage, and are capable of reaching a relatively safe height and sustainability of growth in the periods separating subsequent disturbances.
Management-related transformations	The occurrence of stumps, felled trunks, single-layer structure of the forest stand, the lack of dead wood in the form of trunks standing or lying – are clear symptoms of the excessive impact of management on a habitat patch. Even though commercial felling in forests on screes is very rare and has only been noted on several occasions, a shortage of dead wood is still observed, and in the case of fallen trees – the trunks are taken away and only the butt parts and root system are left.
Conservation prospects	The possibility of habitat conservation and keeping it in an undeteriorated state under analysed real imaginable factors affecting the habitat in the near future are assessed. The current conservation status (situated in a protected area), biotic and anthropogenic factors, the impact of economic activities and tourism were taken into account. This parameter is estimated, because often not all information is available on the management plans pertaining to the old fragment of the habitat. As a rule, locations within natural reserves or on very steep slopes guarantee good or very good conservation prospects, however, various threats may appear from human economic activities (e.g. construction of dammed reservoirs, rubble barriers, slope roads etc.).

Table 2. Evaluation of status parameters and indices of specific structure and functions for the natural habitat 9180 – sycamore maple and maple-lime forests on steep slopes and screes (*Tilio platyphyllis-Acerion pseudoplatani*)

Parameter/ Index	Favourable status FV	Unfavourable inadequate U1	Unfavourable bad U2
Surface area of the habitat in the monitored location	Does not change or increases	Other combinations	Evident decrease in the area of the habitat compared with earlier studies or given in references
Specific structure and functions			
Characteristic species	>5 species, characteristic for local conditions including at least 2 in the forest stand	2–5 characteristic species	Lacking, or only single individuals
Dominant species	Possible occurrence of species in facies of the *Querco-Fagetea* class, sporadic occurrence of post-felling and invasive species	Over 30% of the forest floor vegetation area is occupied by species typical of forest clearings (bramble *Rubus* sp., reedgrass *Calamagrostis* sp. and other)	Over 50% of the forest floor vegetation area is occupied by species typical of forest clearings (bramble *Rubus* sp., reedgrass *Calamagrostis* sp. and other)

Alien expansive species	Lacking	Single individuals, 1–2 species	One species or several (>2) species, growing in very high density
Native expansive species of herbs	Possible occurrence of species in facies of the *Querco-Fagetea* class (sweet woodruff *Galium odoratum*, dog's mercury *Mercurialis perennis*, weaselsnout Galeobdolon luteum) which is a natural phenomenon in some of the patches of this habitat; sporadic occurrence of post-felling and invasive species	Over 30% of the forest floor vegetation area is occupied by species typical of forest clearings (bramble *Rubus* sp., reedgrass *Calamagrostis* sp. and others)	Over 50% of the forest floor vegetation area is occupied by species typical of forest clearings (bramble *Rubus* sp., reedgrass *Calamagrostis* sp. and others)
Tall herb and nitrophilous species	Desired permanent presence of such species as hedge garlic *Alliaria petiolata*, false crowfoot *Geranium robertianum*, stinging nettle *Urtica dioica*, wood avens *Geum urbanum*.	Single individuals of nitrophilous species	Lack of nitrophilous species
Structure of forest stand	Forest stand diversified with regard to height and diameter at breast height	Even-aged forest stand, but underwood present	Even-aged forest stand, notdiversified with regard to height and diameter at breast height
Vertical structure of vegetation	All layers of vegetation occur (a1, a2, b, c, d); moss layer can be very poor in species	One layer lacking (usually a1 or b)	Simplified vertical structure made of two layers (a and c)
Alien species in the forest stand	Lacking	1 ecologically alien species, single trees	Plantings or more than 1 ecologically alien species
Natural regeneration of the forest stand	Multi-age regeneration present, minimum 3 species	Even-aged or multi-age regeneration present, no more than 2 species	Lacking, or single regenerations
Management-related transformations	Lacking	Single measures such as removal of fallen trees	Forest management, as applied, adversely affecting the structure and functions of the habitat
Overall structure and functions	All cardinal indices evaluated as FV, the remaining indices as at least U1	All cardinal indices evaluated as at least U1	One or more cardinal indices evaluated as U2
Conservation prospects	Conservation prospects for the habitat are good or excellent, no significant impact of threatening factors predicted	Other combinations	Conservation prospects for the habitat are bad, strong impact of threatening factors observed, no survival of the habitat can be guaranteed in longer time perspective
Overall assessment	All parameters evaluated as FV	One or more parameters evaluated as U1, no U2 evaluations	One or more parameters evaluated as U2

Cardinal indices

- Characteristic species
- Invasive alien species
- Alien species in the forest stand
- Structure of the forest stand

3. An example of a filled-in habitat observation sheet for a monitored location

Natural habitat observation sheet on the site	
Basic information	
Code and name of the natural habitat	*9180 Sycamore maple forests and maple-lime forests
Site name	PLC 120001 Tatry
Name of the monitored location	Waksmundzkie Ścianki
Type of the monitored location	Reference
Plant communities	Tatra sycamore maple forest
Description of the habitat on the site	The habitat occupies a steep, precipitous slope exposed to EES inclined even to as much as up to 45°, at the foot of a high wall in the Waksmundzka Valley. The patches in the site are dispersed into several small areas, they appear as isolated islands on the background of upper montane spruce forests. Each of the patches selected for monitoring is a point site but their system in the area and short distances between them give them the characteristics of a transect
Area of habitat patches	The combined area of 3 patches selected for monitoring amounts to ca. 0.15–0.2 hectare
Protected areas where the monitored location is situated	The Tatra National Park, Natura 2000
Manager of the area	The Tatra National Park
Geographical coordinates	N 49°15' ..."; E 20°04' ..."
Transect dimensions	Point site. Despite isolation, the monitored areas fit into a certain transect shape pattern. In order to make them fully representative, the particular study areas were made to match the size of developed patches. Area. No. 1: 400 m^2, No. 2: 400 m^2, No. 3: 250 m^2.
Elevation a.s.l.	Point 1. 1376 m; 2. 1378 m; 3. 1385 m.
Annual report – basici nformation	
Year	2008
Monitoring type	Detailed
Coordinator	Jan Bodziarczyk
Auxilliary coordinators	–
Threats	No current threats
Other natural values	The habitat includes territories of large carnivores: lynx *Lynx lynx*, grey wolf *Canis lupus*, brown bear *Ursus arctos* (traces of their living there were observed repeatedly), and a refuge of a number of protected plant species, such as: spilcet fern *Polystichum aculeatum*, swallowwort gentian *Gentiana asclepiadea*, American false hellebore *Veratrum lobelianum*, monkshod *Aconitum*, sp., sylvan goatbeard *Aruncus sylvestris*, mountain holly fern *Polystichum lonchitis*, common twayblade *Listera ovata*, martagon lily *Lilium martagon*, marsh felwort *Swertia perennis*, daphne *Daphne mezereum*, bear's ear sanicle *Cortusa matthioli*, adder fern *Polypodium vulgare*, hen-and-ducken houseleek *Jovibarba sobolifera*, dark red helleborine *Epipactis atrorubens*.
Is monitoring required?	Yes
Justification	The habitat is a point-type, very rare in Poland. Phytosociological status of the Tatra sycamore maple forests is not fully known so therefore further studies are recommended. Exceptionally rich habitat typewith great dynamics.
Conservation measures performed and their assessment	None
Proposed conservation measures	No need of such measures

Date of inspection	6.07.2008
Comments	The habitat is situated within the limits of strictly protected areas of a national park, and is subject to natural process of the phytocoenotic dynamics. Difficult to access, exceptional area of wild nature.

Conservation status of the natural habitat on the monitored location	
Relevé I	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 49°15' ..."; E 20°04' ..."; elev. 1376 m a.s.l. (centre of the patch); area 400 m^2, inclin. 38°, exp. E; Density of layers: a1 – 50%, a2 – 20%, b – 40%, c – 80%, d –50%; Height of layers : a1 – ca. 15 m, a2 – 10 m, b – up to 3 m, c – up to 1.0 m, d – 0.05 m Phytosociological unit: *Tatra sycamore maple forest*. Species: *layer a1: Acer pseudoplatanus* 3, *Picea abies 1*; *layer a2: Sorbus aucuparia* 2, *Picea abies 2*; *layer b: Acer pseudoplatanus* 2, *Lonicera nigra* +, *Juniperus communis* +, *Cotoneaster intergerrimus* +, *Salix silesiaca* +, *Picea abies* 3, *Sorbus aucuparia* +, *Daphne mezereum* +, *layer c: Lonicera nigra* +, *Aruncus sylvestris* +, *Sorbus aucuparia* +, *Lilium martagon* 1, *Senecio nemorensis s.l.* 1, *Digitalis grandiflora* 2, *Polystichum lonchitis* +, *Epilobium montanum* +, *Listera ovata* 1, *Galium mollugo* 2, *Asplenium ruta-muraria* +, *Sedum fabaria* +, *Asplenium viride* +, *Calamagrostis arundinacea* 2, *Calamagrostis varia* 3, *Cystopteris fragilis* +, *Ranunculus platanifolius* +, *Pimpinela saxifraga* 1, *Solidago alpestris* 1, *Mycelis muralis* +, *Gymnocarpium robertianum* +, *Clematis alpina* +, *Saxifraga paniculata* +, *Fragaria vesca* +, *Tussilago farfara* +, *Myosotis alpestris* +, *Daphne mezereum* +, *Allium montanum* +, *Polygonatum verticillatum* 2, *Anthyllis alpestris* +, *Lotus corniculatus* +, *Pinus cembra* +, *Carex sempervirens* +, *Cotoneaster intergerrimus* +, *Scabiosa lucida* +, *Orobanche* sp. +, *Melica nutans* +, *Epipactis atrorubens* +, *Carduus glaucus* 1, *Gymnadenia conopsea* +, *Paris quadrifolia* +, *Picea abies* +, *Cirsium erisithales* 2, *Vaccinium vitis-idaea* 1, *Jovibarba sobolifera* +, *Thymus carpaticus* +, *Vaccinium myrtillus* +, *Poa nemoralis* +, *Polypodium vulgare* +, *Dryopteris filix-mas* +, *Delphinium elatum* +, *Thalictrum aquilegiifolium* 1, *Hieracium murorum* +, *Aconitum* sp., *Phyteuma orbiculare* +, *Galeobdolon luteum* +, *Gentiana asclepiadea* +, *Rosa pendulina* +, *Actaea spicata* +, *Swertia perennis* +, *Viola hirta* +, *Athyrium filix-femina* +, *Polystichum aculeatum* +, *Arabis alpina* +, *Sorbus aucuparia* +, *Euphrasia salisburgensis* +, *Luzula luzuloides* +, *Carduus personata* +, *Helianthemum ovatum* +, *Campanula cochleariifolia* +
Relevé II	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 49°15' ..."; E 20°04' ..."; elev. 1378 m a.s.l.; area 400 m^2, inclin. 40°, exp. EES Density of layers: a1 – 50%, a2 – 25%, b – 20%, c – 95%, d – 20% (chiefly on rocks and in dead wood) Height of layers: a1 – 13–15 m, a2 – 10–12 m, b – up to 5 m, c – up to 0.8 m, d – 0.05 m Phytosociological unit: *Tatra sycamore maple forest*. Species: *layer a1: Acer pseudoplatanus 3*; *layer a2: Acer pseudoplatanus* 2, *Picea abies* 1, *Sorbus aucuparia 1*; *layer b: Acer pseudoplatanus* 3, *Lonicera nigra* +, *Ribes alpinum* 1, *Rosa pendulina* 1, *Picea abies* 2, *Sorbus aucuparia* 1, *Sambucus racemosa* +, *Daphne mezereum* 1, *Salix silesiaca* 1, *Rosa canina* +; *layer c: Lunaria rediviva* 2, *Senecio nemorensis s.l.* 1, *Astrantia major* 1, *Pimpinella saxifraga* 2, *Sambucus racemosa* +, *Mycelis muralis* 1, *Delphinium elatum* 1, *Veratrum lobelianum* +, *Rubus idaeus* 1, *Dryopteris filix-mas* +, *Thalictrum aquilegiifolium* +, *Calamagrostis arundinacea* +, *Prenanthes purpurea* +, *Milium effusum* +, *Sorbus aucuparia* +, *Geranium robertianum 1* , *Poa nemoralis* +, *Pulmonaria obscura* 2, *Listera ovata* 1, *Cirsium erisithales* +, *Fragaria vesca* 1, *Petasites albus* 3, *Saxifraga paniculata* +, *Lilium martagon 1* , *Pleurospermum austriacum* +, *Sedum fabaria* +, *Urtica dioica* +, *Phyteuma orbiculare* +, *Melandrium rubrum* +, *Melica nutans* +, *Epilobium montanum* +, *Angelica sylvestris* +, *Daphne mezereum* +, *Polygonatum verticillatum* +, *Cystopteris fragilis* +, *Digitalis grandiflora* 1, *Solidago alpestris* +, *Sanicula europea* +, *Swertia perennis* +, *Chamaenerion angustifolium* +, *Scabiosa lucida* +, *Calamagrostis varia* +, *Asplenium trichomanes* +, *Polystichum lonchitis* +, *Cortusa matthioli* +, *Actaea spicata* +, *Luzula luzuloides* +, *Paris quadrifolia* +, *Athyrium filix-femina* +, *Polypodium vulgare* +, *Geranium sylvaticum* +, *Polystichum aculeatum* +, *Cicerbita alpina* +, *Ranunculus platanifolius 1*

Relevé III	
Geographical coordinates of the centre, elevation a.s.l. Area of the relevé, inclination, exposure Density of layers a, b, c, d Height of layers a, b, c, d Phytosociological unit	Geographical coordinates: N 49°15' ..."; E 20°04' ..."; elev. 1385 m a.s.l.; area 250 m^2, inclin. 40°, exp. ES; Density of layers: a1: 50%, a2: 20%, b: 30%, c: 95%, d: 20% (chiefly on rocks and in dead wood); Height of layers: a1: 13 m, a2: 10 m, b: up to 5 m, c: up to 0.8 m, d: 0.05 m; Phytosociological unit: *Tatra sycamore maple forest*. Species: *layer a1: Acer pseudoplatanus 3*; *layer a2: Acer pseudoplatanus* 2, *Picea abies 1*; *layer b: Acer pseudoplatanus* 2, *Rosa pendulina* +, *Picea abies* 1, *layer c: Lunaria rediviva* 1, *Senecio nemorensis s.l.* +, *Pimpinella saxifraga* 1, *Mycelis muralis* 1, *Delphinium elatum* 1, *Rubus idaeus* 1, *Dryopteris filix-mas* +, *Thalictrum aquilegiifolium* 1, *Sorbus aucuparia* +, *Geranium robertianum* +, *Salix* sp. +, *Pulmonaria obscura* 1, *Listera ovata* +, *Cirsium erisithales* 1, *Petasites albus* 1, *Lilium martagon* +, *Sedum fabaria* +, *Phyteuma orbiculare* +, *Melandrium rubrum* +, *Epilobium montanum* +, *Daphne mezereum* +, *Polygonatum verticillatum* 2, *Cystopteris fragilis* +, *Digitalis grandiflora* 1, *Calamagrostis varia* 2, *Polystichum lonchitis* +, *Polypodium vulgare* +, *Calamagrostis arundinacea* 3, *Polystichum aculeatum* +, *Galium mollugo* +, *Orobanche* sp. +, *Valeriana tripteris* +, *Asplenium trichomanes* +, *Cardaminopsis arenosa* +, *Prunela vulgaris* +, *Rosa pendulina* +, *Myosotis* sp. +, *Carex sempervirens* +, *Circaea alpina* +, *Vaccinium vitis-idaea* +, *Epipactis atrorubens* +, *Gymnadenia conopsea* +, *Asplenium viride* +, *Campanula cochleariifolia* +

TRANSECT (point site)			
Parameters/ Indices	**Description of index**	**Value of parameter/index**	**Assessment of parameter/index**
Surface area of the habitat		The area of 0.15–0.2 hectares subject to assessment is an optimum area selected for monitoring under existing conditions	FV
Specific structure and functions			FV
Percentage proportion of the habitat in the transect	Percentage of space occupied by the habitat in transect (with accuracy to the nearest 10%)	The habitat is of a point type, in mosaic with upper montane spruce forest. The habitat occupies small-area patches whose state is correct and suitably matches the local conditions. In this case, the percentage share of the habitat cannot be used as a criterion to evaluate an index. Because of the extreme conditions and the rarity of occurrence of this community in the Tatra mountains, as well as the very good state of preservation – the highest mark is given	FV
Characteristic species	List of characteristic species (Latin names)	Layer a: sycamore maple *Acer pseudoplatanus*, rowan *Sorbus aucuparia*; Layer b: red elder *Sambucus racemosa*, black-fruited honeysuckle *Lonicera nigra*, Silesian willow *Salix silesiaca*, Alpine rose *Rosa pendulina*, Alpine currant *Ribes alpinum*, daphne *Daphne mezereum*; Layer c: perennial honesty *Lunaria rediviva*, whorled Solomon's-seal, *Polygonatum verticillatum*, black baneberry *Actaea spicata*, Alpine larkspur *Delphinium elatum*, swallowwort gentian *Gentiana asclepiadea*, spilcet fern *Polystichum aculeatum*, stinging nettle *Urtica dioica*, wood ragwort *Senecio nemorensis* s.l., mountain willowweed *Epilobium montanum*, mountain stonecrop *Sedum fabaria*, white buttercup *Ranunculus platanifolius*, wood starwort *Stellaria nemorum*, columbine meadow-rue *Thalictrum aquilegiifolium*, white bryony *Petasites album*, red campion *Melandrium rubrum*.	FV

Dominant species	List of dominant species in the transect (Latin names); percentage proportions of areas covered by particular species in the transect should be given (with accuracy to the nearest 10%); only species with coverage ≥10%	Layer a: sycamore maple *Acer pseudoplatanus*; locally - Layer c: mountain reed grass *Calamagrostis varia* (30%), and reed grass *Calamagrostis arundinacea* (50%). The forest floor vegetation lacks evident dominant species. The two aforementioned species outnumber the other species and co-dominate with distinctly greater coverage. As the habitat is of a point type, the details of percentage coverages are given above in phytosociological relevés.	U1
Alien invasive species	List of geographically alien species (Latin names); percentage proportions of areas covered by particular species in the transect should be given (with accuracy to the nearest 10%)	None	FV
Native expansive species of herbs	List of species (Latin names); percentage proportions of areas covered by particular species in the transect should be given (with accuracy to the nearest 10%)	reed grass *Calamagrostis arundinacea* (50%), mountain reed grass *Calamagrostis varia*. Proportions of these species are of a local nature	U1
Tall herb and nitrophilous species	List of species (Latin names); percentage proportions of areas covered by particular species in the transect should be given (with accuracy to the nearest 10%)	stinging nettle *Urtica dioica*, black-fruited honeysuckle *Lonicera nigra*, *Rosa pendulina*, black baneberry *Actaea spicata*, false crowfoot *Geranium robertianum*, red raspberry *Rubus idaeus*, swallowwort gentian *Gentiana aslepiadea*, columbine meadow-rue *Thalictrum aquilegiifolium*, whorled Solomon's-seal, *Polygonatum verticillatum*, mountain willowweed *Epilobium montanum*, red elder *Sambucus racemosa*, wood millet *Milium effusum*, sylvan goatbeard *Aruncus sylvestris*, Alpine sow-thistle *Cicerbita alpina*, monkshod *Aconitum* sp., great masterwort *Astrantia major*, purple rattlesnake root *Prenanthes purpurea*, white buttercup *Ranunculus platanifolius*, Alpine larkspur *Delphinium elatum*, marsh felwort *Swertia perennis*, mountain stonecrop *Sedum fabaria*, white bryony *Petasites albus*, pleurospermium *Pleurospermum austriacum*, American false hellebore *Veratrum lobelianum*, goldenrod *Solidago alpestris* [syn. *S. virgaurea*], *Cirsium erisithales*, mountain reed grass *Calamagrostis varia*, reed grass *Calamagrostis arundinacea*	FV
Age of forest stand	Average age of forest stand, presence, age, and percentage share of old forest	According to forest stand maps – 150 years, but on some sites this age is definitely exceeded. The age structure is very diversified, single trees may even reach an age of 200 years.	FV
Alien species in the forest stand	List of species (Latin names); percentage proportions of areas covered by particular species in the transect should be given (with accuracy to the nearest 10%)	None	FV
Natural regeneration of the forest stand	Percentage coverage of the transect by natural regeneration (if by different species, provide the percentage for each species) FV – uniform occurrence of regeneration throughout the site U1 – few regenerations occur U2 – total lack of regenerations	Occurring sparsely, chiefly in underwood, more rarely in natural seeding, as single individuals: Swiss stone pine *Pinus cembra*, common spruce *Picea abies*. Regeneration occurs sporadically which is natural in these climatic conditions and elevation. The presence of even single new seedlings or young trees merits high evaluation.	FV

Vertical structure of vegetation	Natural, diversified (FV)/ changed by anthropogenic effects but diversified (U1)/uniform through anthropogenic effects (U2)	Natural, diversified into multi-layer, with regeneration. Typical of the described habitat, particularly in the forest-floor vegetation layer		FV
Management-related transformations	Give the number of trees felled, or damaged through harvesting timber in the entire transect None (FV)/occur but only single (U1)/evident (U2)	None		FV
Conservation prospects		Very good. National park, area under strict protection		FV
Overall assessment Proportion of the habitat area representing different conservation status within the monitored location		FV	100%	FV
		U1	–	
		U2	–	

Human activities				
Code	**Name of activity**	**Intensity**	**Impact**	**Description**
990	Other natural processes	B	+	The habitat is subject to permanent, moderate natural disturbances, particularly in steeper parts of slopes where fallen trees, broken trees and dead wood occur more often. These types of disturbances are prerequisite for better growth and development for sycamore, mountain ash, and herbaceous species which constitute the chief physiognomic element of the habitat.

4. Habitats of similar ecological characteristics

None

5. Conservation of the natural habitat

In order to ensure conservation of the habitat, it is recommended to leave all recognised sites under the state of strict or preserving protection, allowing – at the same time – spontaneous developmental processes in the forest stand layer and in forest-floor vegetation. Any attempts to convert the forest stand or to introduce forest management measures will result in deviation from the habitat type and, as a secondary effect, trigger erosional processes and make continuation of the forest economic use impossible. Because of the very small area and little economic value of some parts of the forest stand, this discontinuation will not result in any significant reduction in the quantity of wood obtained in mountain and upland areas. Giving up obtaining economically valuable items from the habitats of sycamore maple and maple-lime forests is also justified by soil- and water-protecting functions contributed by these forests as well as their enormous biocoenotic value, as they provide habitats to a number of rare and valuable plant and animal species. Some of the sites are situated on slopes so steep that some of the forest tending and management activities could be dangerous to forest workers performing them.

In the case of continued economic use of selected patches, the following principles of forest management should be observed and followed:

- maintaining spontaneous diversity in the species composition of the forest stand (depending on subtype);
- leaving brushwood and underwood;
- abandoning any tending, felling and leaving the dead or dying trees as well as whole fallen trees – without cutting logs;
- adopting the principle of priority for regenerating possible windbreaks or snowbreaks from self-seeding, and only when natural regeneration is not effective, attempting to plant species typical of the given habitat. Gaps and vegetation overgrowing them constitute an essential element of the structure of that habitat, therefore possible regeneration should be applied only in cases of emerging bare lands larger than 10 hectares;
- avoiding the planting of coniferous species which are an alien element to this habitat (except sporadically occurring yews and firs);
- marking new skid roads within the habitat should be absolutely prohibited. These would be a risk to the integrity of the habitat because of its small size and could facilitate the invasion of synanthropic species along skid roads thus creating essential and hardly reversible changes in species composition.

6. References

Anioł-Kwiatkowska J., Świerkosz K. 1992. Flora i roślinność rezerwatu Ostrzyca Proboszczowicka oraz jego otoczenia. Acta Univ. Wrat. 1358 Pr. Bot. 48: 45–115.

Bodziarczyk J. 1999. Struktura i warunki występowania zespołu jaworzyny górskiej *Phyllitido-Aceretum.* Praca doktorska AR Kraków, msc. 1–134.

Bodziarczyk J. 2001. Struktura drzewostanu zespołu jaworzyny górskiej z języcznikiem *Phyllitido-Aceretum* w Ojcowskim Parku Narodowym. Materiały Konferencyjne „Badania naukowe w południowej części Wyżyny Krakowsko-Częstochowskiej". Ojców 2001: 156–159.

Bodziarczyk J. 2002. Zróżnicowanie zespołu jaworzyny górskiej z języcznikiem *Phyllitido-Aceretum* w Polsce. Fragm. Flor. Geobot. Polonica 9: 187–218.

Bodziarczyk J. 2004. Jaworzyny Pienińskiego Parku Narodowego. Studia Naturae 49: 61–86.

Bodziarczyk J., Szwagrzyk J. 1995. Species composition and structure of forest stands in *Phyllitido-Aceretum* community. Ekol. pol. 43(3–4): 153–173.

Celiński F., Wojterski T. 1983. Szata roślinna Babiej Góry [In:] Zabierowski K. (ed.), Park Narodowy na Babiej Górze. Studia Nat. B, 29. Warszawa – Kraków: 121 –177. PWN.

Dzwonko Z. 1986. Klasyfikacja numeryczna zbiorowisk leśnych polskich Karpat. Fragm. Flor. Geobot. 30(2): 93–167.

Jaworski A., Pach M., Skrzyszewski J. 1995. Budowa i struktura drzewostanów z udziałem buka i jawora w kompleksie leśnym Moczarne oraz pod Rabią Skałą (Bieszczady). Acta Agr. et Silv. Ser. Silv. 33: 39–73.

Kasprowicz M. 1996. Zróżnicowanie i przekształcenia roślinności pięter reglowych masywu Babiej Góry (Karpaty Zachodnie). Idee Ekol. ser. Zeszyty 9(3): 1–215.

Kozłowska A. B., Matuszkiewicz J. M. 1993. Przegląd fitosocjologiczny zbiorowisk leśnych Polski – jaworzyny górskie. Fragm. Flor. Geobot. 38(1): 277–302.

Kwiatkowski P. 2001. Zbiorowiska leśne Pogórza Złotoryjskiego [Forest communnities of the Złotoryjskie Foothills (Pogórze Złotoryjskie)]. Fragm. Flor. Geobot. Ser. Polonica 8: 173–218.

Matuszkiewicz A. 1958. Materiały do fitosocjologicznej systematyki buczyn i pokrewnych zespołów (związek *Fagion).* Acta Soc. Bot. Pol. 27(4): 673–725.

Matuszkiewicz J. M. 2001. Zespoły leśne Polski. PWN, Warszawa.

Michalik S. 1990. Zmiany powierzchni zbiorowisk roślinnych kompleksu skalnego „Czyżówki" w Ojcowskim Parku Narodowym w latach 1966–1986. Prądnik. Prace Muz. Szafera 2: 35–42.

Michalik S. 1991. Zmiany powierzchni zespołów leśnych w Ojcowskim Parku Narodowym w ostatnim trzydziestoleciu. Prądnik. Prace Muz. Szafera 4: 65–71.

Michalik S., Michalik R. Wstępna charakterystyka zbiorowisk leśnych Magurskiego Parku Narodowego. Rocz. Bieszczadzkie 6: 113–123.

Michalik S., Szary A. 1997. Zbiorowiska leśne Bieszczadzkiego Parku Narodowego. Monogr. Bieszczadzkie 1:1–175.

Świerkosz K. 2003. Materiały do rozmieszczenia i zróżnicowania lasów klonowo-lipowych *(Aceri-Tilietum* Faber 1936) w Sudetach Środkowych. Przyroda Sudetów Zachodnich 6: 73–82.

Wilczek Z. 1995. Zespoły leśne Beskidu Śląskiego i zachodniej części Beskidu Żywieckiego na tle zbiorowisk leśnych Karpat Zachodnich. Prace Nauk. Uniwer. Śląskiego w Katowicach. Nr 1490, ss.132.

Wilczek Z., Cabała S. 1989. Zespoły leśne grupy Klimczoka w Beskidzie Śląskim. Cz. 2. Zespoły lasów liściastych. Acta Biol. Sil., Katowice,12: 79–90.

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