INSPECTION OF ENVIRONMENTAL PROTECTION

Methodology of nature monitoring

Methodological guide for:

Natural habitats:
4030 Dry heath communities *Calluno-Genistion, Pohlio-Callunion, Calluno-Arctostaphylion*

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4030 **Dry heath communities** *Calluno-Genistion, Pohlio-Callunion, Calluno-Arctostaphylion*

Photo 1 Heathland in the "Diabelskie Pustacie" Reserve in Western Pomerania (© P. Pawlaczyk)

I. INFORMATION CONCERNING THE NATURAL HABITAT

1. Phytosociological identifiers

Class: *Nardo-Callunetea* vegetation of heathlands and species-poor mat-grass swards

Order: *Calluno-Ulicetalia* sub-Atlantic and subcontinental inland dry heathlands

Alliance: *Calluno-Genistion* Dry genista heaths

Genisto germanicae-Callunetum genista heath

Genisto pilosae-Callunetum genista heath

Alliance: *Pohlio-Callunion* dry heaths

Pohlio-Callunetum heath with nodding thread-moss

Alliance: *Calluno-Arctostaphylion* dry bearberry heaths

Calluno-Arctostaphylion bearberry heath

Scabioso canescentis-Genistetum flowery genista heaths

2. Description of the natural habitat

Heaths usually have the form of low bush communities with diverse vascular flora and a rich flora of cryptogams and lichens. Seemingly simple and monotonous, the habitat exhibits a considerable internal diversity. The most commonly occurring type is a heath community with prevailing *Calluna vulgaris* heath and a moss-grown layer dominated by nodding thread-moss *Pohlia nutans*. Such heaths are common in coniferous forest landscapes and they may also cover large areas on former and existing military training grounds.

Less common and very interesting forms of this habitat include:

- bearberry heaths with prevalent kinnikinnick *Arctostaphylos uva-ursi*: most of them can be found in central and eastern Poland, they are much less frequent than typical forms of heaths;
- wet heaths with peat mosses Sphagnum spp., round-leaved sundew *Drosera rotundifolia*, bog blueberry *Vaccinium uliginosum*, are very rare in Poland; they have only been found in the "Diabelskie Pustacie" Reserve on the heathland of Borne Sulinowo – they could even be classified as a natural habitat code 4010, were it not for the lack of cross-leaved heath Erica tetralix;
- *Genisto-Callunetum* heaths and "flowery heaths" representing the *Scabioso canescentis–Genistetum* plant association, originating from western Poland, occur rarely.

Heaths come in a wide variety of forms – from natural heaths, usually growing in small patches in clearings in pine forests, semi-natural, taking the form of small strips and patches on the outskirts of pine forests and species-poor oak forests, through to anthropogenic vast heaths on military training grounds.

Photo 2 Heaths on the military training grounds near Drawsko Pomorskie (© P. Pawlaczyk)

Photo 3 The former military training grounds near Borne-Sulinowo is gradually being overgrown by trees (© P. Pawlaczyk)

3. Ecological conditions

Heaths develop in poor, oligotrophic locations, exclusively on a sandy stratum, often in dune areas. They usually grow on poor and acidic podzolised soils with pH of between 4.0 – 5.0, composed of loose sands or slightly loamy sands. Heaths occupy different areas, including: sandy plains and depressions, hill-sides, mountain sides, tops of dunes or entire extensive areas of dune landscape. The above-described habitats are most often, but not always, dry. They may also grow near the groundwater level and on soils with a distinct gleyic pattern: in such conditions, heaths are known to be accompanied by different hygrophilous species.

Habitat conditions are important for the distribution of heaths; however, there is a “causal agent” which seems to affect these predominantly semi-natural ecosystems even more. An example of such an agent is the use of military training grounds (giving rise to the following factors: maintenance of these grounds as non-forested areas, removal of self-sown trees and bushes, occasional disturbance of soil and destruction of heaths by military vehicles and sporadic fires). Heaths persist on active military training grounds, being a characteristic landscape component of most of them. When the use of military training grounds is discontinued, heaths are usually recolonised by trees, unless active measures are undertaken to protect them.

Heaths may also appear in dune, oligotrophic landscapes where forest vegetation has been destroyed by fires – of course unless forest-ravaged areas have been afforested again (and where afforestation attempts have not been unsuccessful). For example, such is the genesis of the

bearberry heaths on the Lucynowsko-Mostowieckie Dunes in Mazovia and of some heaths in the Kampinos Forest.

In the case of heaths covering smaller areas in coniferous forest landscapes, the causal agent is usually the existence and maintenance of treeless strips along the sides of forest roads and under power lines, as well as maintenance of wide fire breaks, etc. and forest management involving timber logging, where microhabitats are constantly created at the edges of wood-cleared and cultivated areas.

Another factor that may sometimes contribute to the maintenance of heaths is extensive grazing. For example, the heathland in the Natura 2000 site "Wrzosowisko w Orzechowie" in the Region of Lublin covers a dune formerly used as a pasture, owned by a rural community. The area has not been used for agricultural purposes for many years; however, at the turn of the 1980s and 1990s it was subjected to quite heavy grazing, with up to 5 heads of cattle per hectare. At present, the heathland is affected by slow but noticeable secondary succession and is being recolonised by trees.

In a natural coniferous forest landscape, small and scattered patches of heath would normally appear at sites of disruptions – in clearings and forests thinned out following the death of trees or as a result of small- and large-area fires.

Heaths are a frequent component of a dynamic mosaic of entire plant landscapes, including in particular:

- heaths with nodding thread-moss, and in eastern Poland also bearberry heaths, are a natural element of the oligotrophic landscape of pine forests, even though the heaths cover small areas and are scattered;
- heaths on former or present military training grounds are usually a component of a mosaic with sand grasslands (particularly on dunes), different types of grassy vegetation (including areas overgrown with reed grass), fragments of forest or different stages of succession towards a forest;
- bearberry heaths, e.g. on the Lucynowsko-Mostowieckie Dunes, form a mosaic with dune grasses and fragments of forests;
- flowery, stenothermal heaths can form a mosaic with xerothermic grasses and stenothermal bushes;
- wet heaths have been found to form a mosaic with purple moor-grasses *Molinia caerulea* and patches of moor grass forest.

Locally, heaths can serve as very important mainstays and habitats of precious species of plants and animals – e.g. unique invertebrate species. In various parts of Poland, heaths are inhabited by very rare species: mantis *Mantis religiosa* (Sandomierz Wilderness) and *Eresus cinnaberinus* spider (Oder River Valley, Tuchola Forest). Heaths provide an important habitat for birds, including: wood-lark *Lullula arborea*, tawny pipit *Anthus campestris*, black grouse *Tetrao tetrix*, amphibians and reptiles (natterjack toad *Bufo calamita*, common European adder *Vipera berus*).

Photo 4 The Niepust heathland in the Kampinos Forest is being recolonised by trees (© A. Kębłowska)

Photo 5 Heaths in the forest complex known as the Red Wood (Czerwony Bór) near Łomża – former military training grounds (© U. Biereznoj)

Photo 6 A bearberry heath on the Lucynowsko-Mostowieckie Dunes (© A. Kębłowska)

Photo 7 Bearberry heath undergrowth (© A. Kębłowska)

4. Typical plant species

The most common heaths with nodding thread-moss (*Pohlio-Callunetum*) usually take the form of a shrub community, characterized by the absolute dominance of common heather *Calluna vulgaris*. In terms of its structure, the association consists of two predominant layers. The first layer with the dominant common heather *Calluna vulgaris*, determines the characteristic physiognomy of these heaths. The second layer is composed of low plants such as the mouse-ear hawkweed *Hieracium pilosella*, common bent *Agrostis capillaris* and sand sedge *Carex arenaria*. Stag's-horn clubmoss *Lycopodium clavatum* can sometimes be found there, too. There are also numerous mosses and lichens.

Due to the stratum with a wide amplitude of humidity, heaths with nodding thread-moss incorporate moist patches composed of purple moor-grass *Molinia coerulea*, sometimes also with bog blueberry *Vaccinium uliginosum*.

Bearberry heaths *Arctostaphylo-Callunetum* have a characteristic physiognomy dominated by *Calluna vulgaris* heath and patches of kinnikinnick *Arctostaphylos uva-ursi* with creeping sprouts. The shrub layer is composed of heath and kinnikinnick, filling free spaces between clumps of heather. The second layer comprises low plants such as the mouse-ear hawkweed *Hieracium pilosella* and sheep fescue *Festuca ovina*.

Genista heaths, which are rare in Poland, are composed of German greenweed *Genista germanica* and common heather *Calluna vulgaris*). The second layer consists of low plants, often taking the form

of creeping undergrowth, incorporating slender eyebright *Euphrasia micrantha*, heath speedwell Veronica officinalis and heath dog-violet *Viola canina*.

In all types of heaths, there may be single and scattered species of trees and bushes, mostly Scots pine *Pinus sylvestris*, warty birch *Betula pendula* and common broom *Sarothamnusscoparius*. If these species are present in larger quantities, it is a sign that a heathland is turning into a woodland.

Photo 8 "Flowery heath" undergrowth in the Oder River valley near Krajnik (© K. Barańska)

Photo 9 Wet heath undergrowth with purple moor-grass *Molinia coerulea* and bog blueberry *Vaccinium uliginosum* in the "Diabelskie Pustacie" Reserve in Western Pomerania (© P. Pawlaczyk)

Photo 10 Common heather *Calluna vulgaris* regenerating on the heathland after having been mown. "Diabelskie Pustacie" Reserve in Western Pomerania (© P. Pawlaczyk)

Photo 11 Heath undergrowth regenerating after having been mown. "Diabelskie Pustacie" Reserve in Western Pomerania (© P. Pawlaczyk)

5. Distribution in Poland

The distribution of these heaths in Poland has not been sufficiently studied. Therefore, the range specified in this paper is purely indicative.

This habitat occurs throughout lowland Poland, exclusively in the continental region. Patches of vegetation with heaths that occur in the Carpathian Mountains (in the Alpine region) should be classified as Nardus grasslands with heaths (habitat 6230) rather than heaths themselves.

Small patches of heaths appear in pine forest complexes, on verges of forest roads, under power lines, etc. Large-area dry heaths, with an area of up to several thousand hectares, have developed on military training grounds as a result of military training activities. Their occurrence in Poland is nearly exclusively connected with either active or abandoned military training grounds.

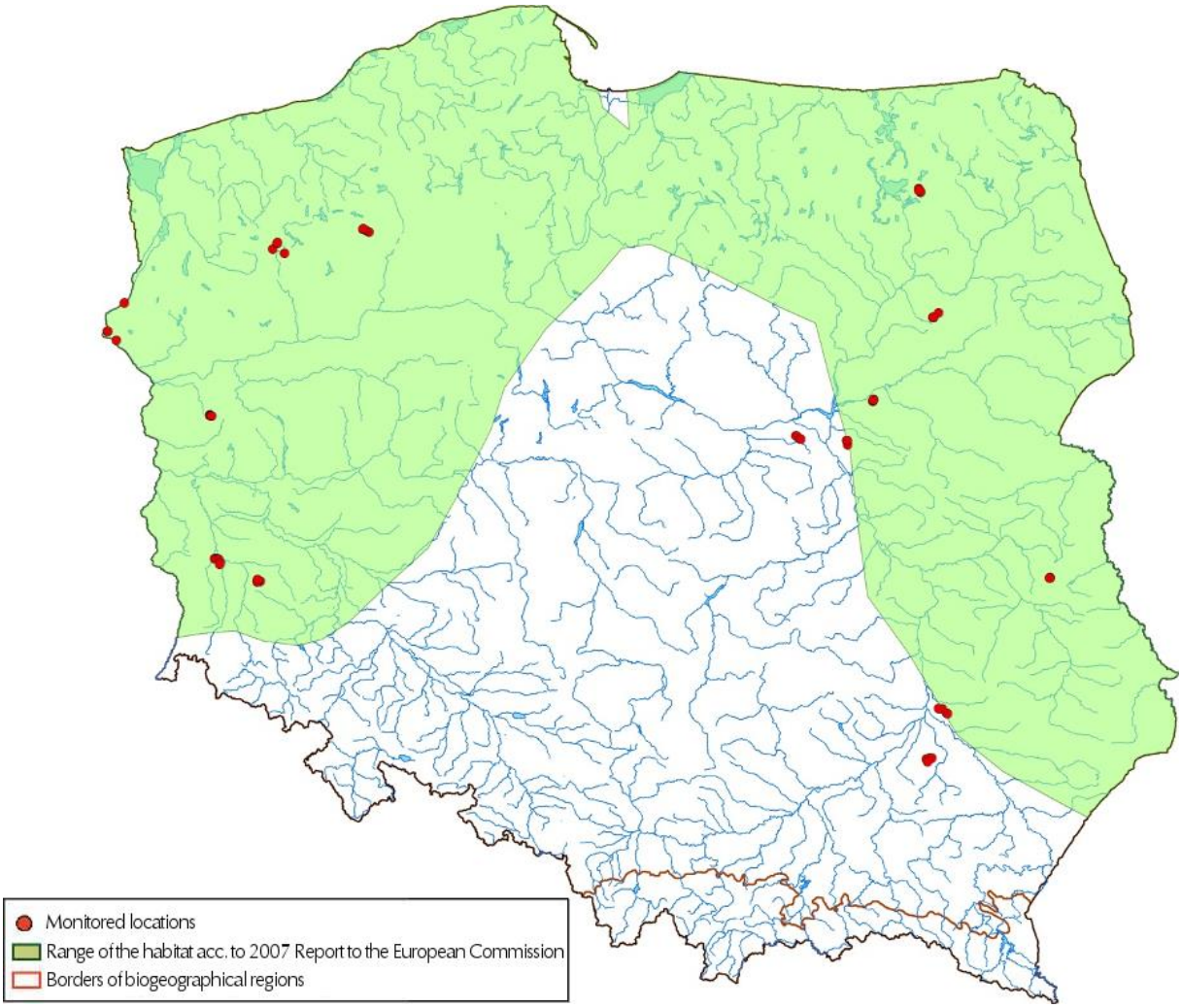

Fig. 1 Distribution of monitored locations in the context of the geographical range of the habitat

II. METHODOLOGY

1. Methodology of monitoring studies

Selection of monitoring locations

The monitoring should include the entire diversity of the habitat in the area concerned - taking into account such aspects as the diversity of types of heaths, their spatial forms and the state of their conservation. A set of monitored locations should be selected in such a way so that it is representative for habitat resources in a given area.

Before monitoring can be undertaken at an area level (Natura 2000 site, national park, landscape park), it is necessary to identify a "spatial pattern" and to evaluate the diversity of heaths at a given site. Most of all, it must be found out if heaths grow on large areas or in small scattered patches in a coniferous forest landscape, because it will determine their monitoring methodology.

Study method

In the case of large-area heaths, the most suitable monitoring area is a transect with a length of 200 m and a width of 10 m. Within this transect, 3 phytosociological relevés must be performed, each with an area of 100 m^2, and monitoring indices must be described with respect to the entire

area of the transect. If the transect does not fit into the habitat patch, its dimensions should be modified without altering its area. In the case of patches of heath with an area of >10 ha, more than one transect can be established there. The location of the site must obligatorily be identified with its GPS-tracked geographical coordinates and entered onto a 1:10000 topographic map, a forest economic overview map or a photo-map of the same scale, with the to-be-researched biochore of habitat 4030 being marked on such a map.

In the case of small-area heaths, the monitoring must concern:

- occurrence of patches of heaths in the landscape; e.g. in the form of a map of their distribution in a test area of about 100 ha (the size of patches should be mapped with dots, with field survey mapping of larger patches);
- the characteristics of selected patches using a single phytosociological relevé and a description based on monitoring indices at the point under examination.

To analyse habitat resources in larger areas (e.g. Natura 2000 site), field studies must be carried out. To facilitate preliminary identification of heaths, photointerpretation data can be used (in the case of heaths, colour photographs are especially useful because it is hard to distinguish the photophone of heaths from the photophone of grass communities on a black and white photograph), together with forest inventory data of the State Forests. It must be noted, however, that they are especially useful for finding large-area heaths. In addition, each piece of information from these sources must be verified in field conditions. To identify small-area heaths, field work is usually required; however, even a general field survey is sufficient for establishing if a given fragment of the forest abounds with small patches of heath or not.

Time and frequency of studies

July, August and September are the best months for studying heaths. One observation per year is sufficient. Habitat conservation status can usually be assessed in other seasons too; however, there is a risk that the phytosociological documentation will contain erroneous assessments of area coverage by certain species and that it will not be possible to identify some of them at all. Studies at monitoring sites should be carried out at least once every 5-6 years, preferably every 3 years.

Equipment used in studies

No specialized equipment is required for carrying out observations of heaths. The necessary equipment includes a notebook (a form 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 indicators of specific structure and function of the natural habitat, as well as 'conservation prospects' for natural habitat 4030 – dry heaths

Parameter/ Indicator	**Description**
Specific structure and functions	
Coverage by common heather Calluna vulgaris or in the case of bearberry heaths - joint coverage by heather and kinnikinnick Arctostaphylos uva-ursi	The indicator determining the structure of the habitat and its classification as a "heath". The measure is the coverage of the area by a species (multiple species) expressed as %. It should be treated as a cardinal indicator. For assessing the conservation status of an area as satisfactory, it should be required that at least 75% of sites have a satisfactory conservation status.
Coverage by grasses	A negative indicator, indicative of the most common type of degeneration of heaths. The measure is the total coverage of the area by grass species, expressed as % rounded up to full tens, as understood by phytosociologists. It should be an auxiliary indicator. To assess the conservation status of an area as satisfactory, it should be required that at least 50% of sites have a satisfactory conservation status.
Incursion of trees	A n indicator which shows the main risk and a factor contributing to the degeneration of heaths - recolonisation by trees. The measure is the coverage of the area by trees expressed as %. Both self-sown seedlings and trees planted in afforestation projects are taken into account. It should be treated as a cardinal indicator. For assessing the conservation status of an area as satisfactory, it should be required that at least 75% of sites have a satisfactory conservation status. If some fragments of a heathland are so strongly overgrown by trees that the habitat may disappear, it should also have an effect on the evaluation of such parameters as the "area" and "conservation prospects".
Geographically alien species	Most common: wild black cherry Padus serotina, Canadian fleabane Conyza canadensis, large-leaved lupine Lupinus polyphyllus, late goldenrod Solidago gigantea; sometimes other species as well. A negative indicator suggesting the likely presence of invasive alien species (neophytes). To evaluate this indicator, a list of all such species (all geographically alien and locally invasive species) should be given together with their percentage share in the coverage of the transect. It should be treated as a cardinal indicator. For assessing the conservation status of an area as satisfactory, it should be required that at least 90% of sites have a satisfactory conservation status.
Expansive native species (apophytes)	The most common: bushgrass Calamagrostis epigejos, blackberries Rubus spp., ruderal species – although in flowery heaths even the white swallow-wort Vincetoxicum hirundinaria was observed to act as an apophyte. A negative indicator suggestive of possible apophytization. To evaluate this indicator, a list of all such species should be given together with their percentage share in the coverage of the transect. It should be treated as an auxiliary indicator. For assessing the conservation status of an area as satisfactory, it should be required that at least 75% of sites have a satisfactory conservation status.
The population structure of key species	For the purposes of this indicator, "key species" include common heather and, on bearberry heaths - heather and kinnikinnick Arctostaphylos uva-ursi. It is an indicator which shows the "completeness" of age and development stages of key structure-forming species, evaluated on the basis of an expert's opinion – a satisfactory state is defined as a state in which all age and development stages are present (juvenile, mature, generatively reproducing and senile specimens) and the structure of the population is indicative of its continuity over time; an unsatisfactory state is a state in which different age and development stages are present, but not to the extent evidencing the full sustainability of the population and its renewal processes; bad state – dominance of senile stages only, with no renewal of key species. It should be treated as an auxiliary indicator. The conservation status of the area can be assessed as satisfactory when the conservation status of at least 50% of sites is satisfactory.

Parameter/ Indicator	**Description**
The condition of locally typical species which are of key importance for the biodiversity of the habitat (optional indicator, to be used only when appropriate data are available)	An optional indicator for evaluating an additional aspect of the conservation status of a habitat – its ability to sustain locally typical species that are important for its biodiversity (protected, endangered, rare species). The selection of species that are to be taken into account will depend on the specific characteristics of the local area. Such species may include, for example: stag's-horn clubmoss Lycopodium clavatum, wood-lark Lullula arborea, tawny pipit Anthus campestris, black grouse Tetrao tetrix, mantis Mantis religiosa, ladybird spider Eresus cinnaberinus and other unique invertebrates locally associated with heaths. This indicator should only be used when appropriate data are available. It should be treated as an auxiliary indicator.
Other distortions	E.g. contamination with litter, sand harvesting, etc. This indicator makes it possible to take into account non-specific but sometimes occurring distortions. Heath sustaining factors (such as traces of local fires on military training grounds) should not be treated as distortions. If distortions are identified, assessments should be downgraded to U1 or U2 (depending on their scale, extent and intensity). It should be treated as an auxiliary indicator. For assessing the conservation status of an area as satisfactory, it should be required that at least 90% of sites have a satisfactory conservation status.
Conservation prospects	Evaluating “future conservation prospects of the habitat”, one should pay attention to the following aspects: continuous existence of heath sustaining factors (e.g. active military training grounds, grazing, recurrent occasional fires) or factors giving rise to their dynamic emergence (fires, forest management involving the harvesting of wood); undertaken protective measures; presence of afforested areas whose extension inevitably leads to heaths being overgrown by trees; succession processes, expansion of trees; the structure of heath populations and the presence of heath “renewal” processes; inclusion of heaths in the forest management plan and the nature conservation plan (do they include any planned afforestation or cultivation activities that may affect heaths? Do they envisage active protection measures for heaths if such protection is required?) the risk of neophytisation; other anticipated forms of pressure

Table 2 Assessment of status parameters and indicators of specific structure and functions for natural habitat 4030 – dry heaths

Parameter/ Indicators	**Favourable FV**	**Unsatisfactory U1**	**Bad U2**
Area of the habitat at the monitored location	Is not decreasing, is not anthropogenically fragmented	Is showing a slow downward trend or is anthropogenically fragmented	Is showing a fast downward trend or is strongly anthropogenically fragmented
Specific structure and functions			
Coverage by common heather Calluna vulgaris (or jointly by common heather and kinnikinnick Arctostaphylos uva-ursi)	>50%	30-50%	<30%
Coverage by grasses	<10%	10-30%	>30%
Incursion of trees	<10%	10-30%	>30%
Geographically alien species	None	Single species, <10%	>10%
Expansive native species (apophytes)	None	Single species, <10%	>10%
The population structure of key species (common heather Calluna vulgaris / common heather and kinnikinnick Arctostaphylos uva-ursi)	All development stages are present in large numbers – juvenile, generative and senile specimens	All development stages are present, but juvenile specimens are poorly represented	Absence of juvenile specimens and the population appears to be aging with no renewal
The condition of locally typical species which are of key importance for the biodiversity of the habitat (optional indicator, to be used only when appropriate data are available), e.g. stag's-horn clubmoss Lycopodium clavatum, wood-lark Lullula arborea, tawny pipit Anthus campestris).	All species evaluated as being in a satisfactory (FV) condition	Some species evaluated as being in an unsatisfactory (U1) condition	Some species evaluated as being in a bad (U2) condition
Other distortions (litter, sand harvesting, etc.)	none	occurring but insignificant	strong
General structure and functions	All cardinal indicators evaluated as FV, other indicators evaluated at least as U1	All cardinal indicators evaluated at least as U1	One or more cardinal indicators evaluated as U2
Conservation prospects	There are no risks or negative trends. It is almost certain that the habitat will be preserved in a non-deteriorated condition for 10-20 years	Preservation of the habitat in a non-deteriorated condition in the next 10-20 years is not certain, but likely, as long as the existing risks are eliminated	Preservation of the habitat in a non-deteriorated condition in the next 10-20 years is very difficult: advanced recession processes, strong negative trends or considerable risks
Overall assessment	**All three parameters evaluated as FV**	**At least one of the three parameters evaluated as U1, no U2 assessments**	**One or more of the three parameters evaluated as U2**

Cardinal indicators

- Coverage by common heather Calluna vulgaris (or jointly by common heather and kinnikinnick Arctostaphylos uva-ursi),
- Expansion of trees,
- Geographically alien species

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

Habitat observation sheet for the monitored location	
Monitored location – basic information	
Code and name of the natural habitat	4030 Dry heaths (Calluno-Genistion, Pohlio-Callunion, Calluno-Arctostaphylion)
Site name	Duchny Młode I
Type of the monitored location	reference
Plant communities	Subcontinental variation of Calluno-Genistetum
Description of the habitat at the monitored location	The site is situated on former military training grounds. The habitat area is quite large, however, a considerable part of the forest management unit is affected by secondary succession, whereas the remaining part has been afforested (mainly with pine and birch trees). The area is clearly undulating, with a changing direction of exposure. Within the site, there are single elevations - dunes, mostly overgrown with trees and bushes. The community is homogeneous, but in some places there may be one-species assemblages of bushgrass Calamagrostis epigejos or the community may be dominated by sheep fescue Festuca ovina, with a large area covered by Rumex acetosella (outside the transect). The site visit coincided with common heather Calluna vulgaris entering into a full blooming stage. German greenweed Genista germanica has not been found, but dyer's greenweed Genista tinctoria has been found to be present. Structure of the layer (c) visibly two-layer, height (c): 10-50 cm. The upper layer is formed by greenweed, common broom and heather, whereas the lower layer consists of plants such as: red sorrel Rumex acetosella, heath dog-violet Viola canina, heath speedwell Veronica officinalis and rare spring sedge Carex ericetorum. The moss layer, moderately developed, is dominated by red-stemmed feathermoss Pleurozium scherberi.
The area of habitat patches	0.8 ha
Protected areas where the site is located	PLH200018 Czerwony Bór
Manager of the area	State Forests, Forest District of Łomża
Geographical coordinates	Beginning of the transect: 22º 02' 54.2''E 52º 59' 48.4''N Centre of the transect: 22º 02' 54.8''E 52º 59' 44.9''N End of the transect: 22º 02' 54.5''E 52º 59' 41.5''N
Dimensions of the transect	10 m * 200 m
Elevation a.s.l.	Minimum elevation a.s.l. 138 m Maximum elevation a.s.l. 141 m
Name of the area	Czerwony Bór
Annual report – basic information	
Year	2011
Monitoring type	General
Coordinator	Biereżnoj Urszula
Additional coordinators	
Threats	secondary succession and vegetation artificially planted by the managing entity (State Forests).
Other natural values	not observed
Is monitoring required?	Yes
Justification	The patch of habitat 4030 is well developed and fairly varied in terms of species; monitoring is advisable also to make sure that appropriate protective measures are taken to prevent excessive expansion of tree and bush species.
Protective measures taken	not observed, in most cases there are none
Proposed protective measures	removal of self-sown trees and bushes at intervals of several or a dozen or so years; controlled small-area burning
Date of monitoring	26.08.2011
Comments	new artificial plantings should be discontinued; a large part of the former military training grounds is now being afforested

Habitat observation sheet for the monitored location	
Conservation status of the natural habitat at the monitored location	
Phytosociological 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: 22º 02' 54.2''E 52º 59' 48.4''N 141 m above sea level Area of the relevé: 25 m^2, Inclination: 0, Exposure: Density of layers: C – 75%, D – 5% Height of layers: C – 50 cm, D – 2 cm Phytosociological unit: Calluno-Genistetum Layer C: Arctostaphyllos uva-ursi +, Calluna vulgaris 4, Danthonia decumbens r, Festuca ovina +, Genista tinctoria +, Hieracium pilosella +, Hypericum perforatum +, Juniperus communis r, Rumex acetosella +, Sarothamnus scoparius +, Solidago virgaurea +, Thymus serpyllum +, Viola canina + Layer D: Pleurozium schreberi 1
Phytosociological 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: 22º 02' 54.8''E 52º 59' 44.9''N 140 m above sea level Area of the relevé: 25 m^2, Inclination: 0, Exposure: 0 Density of layers: B – 1%, C – 85%, D – 5% Height of layers: B – 1.5 m, C – 50 cm, D – 2 cm Phytosociological unit: Calluno-Genistetum Layer B: Pinus sylvestris r Layer C: Calluna vulgaris 5, Carex ericetorum +, Festuca ovina +, Genista tinctoria +, Jasione montana r, Rumex acetosella +, Sarothamnus scoparius 1, Viola canina + Layer D: Pleurozium schreberi 1
Phytosociological 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: 22º 02' 54.5''E 52º 59' 41.5''N 139 m above sea level Area of the relevé: 25 m^2, Inclination: 1, Exposure: NW Density of layers: C – 80%, D – 5% Height of layers: C – 50 cm, D – 2 cm Phytosociological unit: Calluno-Genistetum Layer C: Agrostis capillaris +, Betula pendula r, Calamagrostis epigejos r, Calluna vulgaris 4, Festuca ovina 1, Genista tinctoria +, Jasione montana r, Pinus sylvestris+, Rumex acetosella +, Sarothamnus scoparius 1, Solidago virgaurea r, Vaccinium myrtillus +, V. vitis-idaea +, Veronica officinalis + Layer D: Pleurozium schreberi 1

TRANSECT				
Parameters/ Indicators	**Description of the indicator**	**Value of the parameter/ indicator**		**Evaluation of the parameter /indicator**
Surface area of the habitat		The potential surface area of the habitat is much larger. The range of habitat 4030 has been limited by artificial plantings, mainly of birch trees and pine trees. A smaller part of the area became recolonised by trees when it ceased to be used for military training purposes.		U1
Specific structure and functions				FV
Coverage by common heather Calluna vulgaris (or jointly by common heather and kinnikinnick Arctostaphylos uva-ursi)	Proportion of the area covered by common heather Calluna vulgaris (or jointly by common heather and kinnikinnick Arctostaphylos uva-ursi) in the transect	common heather covers 75-80% of the transect and kinnikinnick covers 2%		FV
Coverage by grasses	Percentage share of the area covered by particular grass species in the transect	Festuca ovina 5%, Agrostis capillaris 0.5%, Calamagrostis epigejos 2-3%		FV
Incursion of trees	Percentage share of the area occupied by particular tree species in the transect	Pinus sylvestris 3%, height of 1.5-2.5 m; Betula pendula 2%, height of 5-8 m		FV
Geographically alien species	List of invasive and geographically alien species (Polish and Latin name); specify the percentage share of the area occupied by every species in the transect (with accuracy of up to 10%)	no geographically alien species have been found		FV
Expansive native species (apophytes)	List of native expansive species (Polish and Latin name); specify the percentage share of the area occupied by every species in the transect (with accuracy of up to 10%)	bushgrass Calamagrostis epigejos is present, but in small quantities and it currently does not pose any threat to the monitored habitat		FV
The population structure of key species (common heather Calluna vulgaris / common heather and kinnikinnick Arctostaphylos uva-ursi)	Development stages of the population of common heather Calluna vulgaris and kinnikinnick Arctostaphylos uva-ursi	all development stages of heather and kinnikinnick are present and numerous; the population is in a stable condition		FV
The condition of locally typical species that are of key importance for the biodiversity of the habitat (optional indicator, to be used only when appropriate data are available), e.g. stag's-horn clubmoss Lycopodium clavatum, wood-lark Lullula arborea, tawny pipit Anthus campestris.	Optional indicator, to be used only when appropriate data are available, e.g. stag's-horn clubmoss Lycopodium clavatum, wood-lark Lullula arborea, tawny pipit Anthus campestris.	No data		XX
Conservation prospects		progressive secondary succession; if no actions are taken, habitat 4030 will be degraded over a longer-term period		U1
Overall assessment The percentage share of areas representing different conservation status in the entire area of the monitored location (in comparison with the total habitat area in that location) shall also be provided		FV	-	U1
		U1	100%	
		U2	-	

Human activities				
Code	**Name of activity**	**Intensity**	**Impact**	**Description**
100	Cultivation	B	-	artificial plantings on former military training grounds
161	Afforestation	B	-	large areas of the former military training grounds have already been afforested
950	Biocenotic evolution	A	-	secondary succession

4. Habitats of similar ecological characteristics

Most methodology components (in particular the indicators relating to the structure and functions) can be adapted for the purpose of monitoring wet heaths (4010).

5. Protection of the habitat

Heaths on active military training grounds are in a good condition and do not require active protection measures. It is more difficult to protect heaths on former military training grounds where military practice activities have been discontinued. Without any doubt, trees overgrowing those heaths must be removed. It is a procedure which must be periodically repeated. The removal of trees itself is usually insufficient for sustaining heaths, which also need – at least on a long-term basis – a factor stimulating periodic "rejuvenation" of the heath population. Protective measures in this respect are still undertaken on an experimental basis. On the heaths of the former military training ground in Borne-Sulinowo, common heather *Calluna vulgaris* has been experimentally mown in a quarter-based system. As a result, the population of heaths is "rejuvenated" and sustained, but this method should not be used too often, because it temporarily reduces the diversity of species. It seems that the mowing of the same area should be repeated at intervals of about 7-10 years; however, it still needs to be verified by experiments.

Other proposed methods include extensive sheep grazing (e.g. on flowery heaths near Krajnik) or cattle grazing (heaths in Orzechowo in the Region of Lublin). Such method of sustaining heaths by means of extensive grazing is quite commonly used in Western Europe and a lot of the relevant experience has been gained there.

In Scotland, Ireland and Norway, different types of heaths are traditionally maintained by means of quarter-based burning of areas of 6-15 acres, each year a different one (the same area is burnt every 8-10 years). Therefore, the heaths covering the slopes of the Scottish mountains have a characteristic "patchy" appearance. Mosaic burning has also proved to be an effective method of active protection of heaths in Holland, Denmark and Germany (e.g. in the Zschornoer Heide Reserve near the border with Poland), despite quite different climatic conditions. Perhaps this method should be considered and tested in Polish heath areas too.

Another problem which still needs to be solved is how to stop the expansion of bushgrass *Calamagrostis epigejos* (some protection plans suggest frequent mowing of bushgrass – at least 4 times per annum for 3 years).

The protection of heaths may also be hindered by deposition of nitrogen compounds contained in atmospheric pollutants, due to which initially oligotrophic habitats are becoming more fertile. In Holland, Denmark and Great Britain, some disappearing heaths have been restored by removing the top layer of fertilized soil.

Attempts are made to combine active protection measures (e.g. eradication of self-sown trees) with the use of heaths as a "bee pasture" (beekeepers are allowed to place their beehives on heaths

on condition that they perform some protection-related tasks there). One example of such areas is the Heath of Przemków, where heath honey is produced as an important regional product. In the same area, the protection of heathland has been combined with the harvesting of heath as a roofing material.

Of course, every heath should be scrupulously and effectively protected against devastation, such as excavation of sand or dumping of waste.

Heaths occurring as small-area patches in a coniferous forest landscape usually do not require any special activities, as long as the factors that determine this landscape continue to exist.

The protection of heaths should take into account their biodiversity, especially the unique species associated with them – such as, for example, interesting species of invertebrates or birds (e.g. in Great Britain detailed rules have been developed for the "maintenance of heaths for the purpose of sustaining invertebrate fauna associated with them"). However, protection of the biotope itself and ensuring its structural diversity (presence of sites with naked soil, mixed-aged population of heath, including senile clusters, presence of single trees and bushes, preservation of flora diversity), as well as avoidance of activities which might be harmful for particular species (e.g. mowing heath in the breeding season of birds nesting on the ground) should also contribute to the protection of habitat-related diversity.

The protection of heaths should focus on large-area patches. One should be aware that active protection may be necessary. In Polish conditions, effective protection methods must be developed or the existing ones should at least be clarified. The protection measures undertaken thus far still have an experimental character and their specific results must be monitored. The protection measures should imitate, to the largest possible extent, the factors which determine the development of heaths.

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