

Evaluation of current status, threats and means of protection of heaths *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 in the Czerwony Bór (NE Poland)

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Abstract. The study was performed to identify, delimit and evaluate the current status of *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 heaths, as well as to point out possible threats to these communities and means of their protection. The heaths are in Czerwony Bór (PLH 200018) in Podlaskie voivodeship, NE Poland, in the area included in the Natura 2000 network. The study was performed in 2008 with the use of GPS method over the study area of 3,784.04 ha.

The area of Czerwony Bór includes 8 stands with dry heaths of *Arctostaphylo-Callunetum* of the total area of 21.7 ha. They are represented by typically developed and well-preserved patches of vegetation (90%) of the area of 19.5 ha and not so well preserved patches (10%) occupying the area of 2.2 ha. In general, their natural value in the area of study is high and the representative character, degree of preservation of the structure and functions are excellent. The main threat to the dry heaths *Arctostaphylo-Callunetum* in the area of Czerwony Bór comes from the forest management procedures aimed at reclamation of the area left after the army training grounds, reforestation in the form of large-area single-species forest plantations, forestation of the land that has not been forested earlier. In the areas where no plantation have been started the process of secondary succession is observed. As a result of this process heaths are replaced by forest-thicket formations. The active protection of the heaths in the area studied should include prevention of secondary succession, mowing and removal of forest-thicket formations and changes in forest management policy towards maintenance of open space by periodical removal of vegetation to bare soil.

Key words: dry heath, Natura 2000, Czerwony Bór PLH200018, nature habitats, active protection.

1. Introduction

The *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 communities found in Czerwony Bór, in Podlaskie voivodeship, have not been earlier described. These stands of dry heaths are new and for the first time reported in the expertise on nature by Łaska (2008) from the earlier designed and approved in 2011 Site of Community Importance (SCI) (based on the Act on the protection of nature) under the name of Czerwony Bór PLH200018 in Natura 2000 ecological network in Podlaskie voivodeship (www.natura2000.gdos.gov.pl).

Czerwony Bór encompasses the area earlier occupied by forest known as Red Forest whose name alluded to the

domination of larch trees of brown-red bark. Later the name of the dominant larch forests was changed to Czerwony Bór. In 1926, after the total destruction of the forest by the mass appearance of *Panolis flammea*. The forest stand had to be removed and the area became the army training ground (Płany, 2005–2015). In the large area devoid of trees, the army systematically destroyed the upper soil layer and the vegetation cover, so that all the time it was used by the army the land was covered by the vegetation in the initial stage of development. Thanks to the use of the land by the army, some valuable non-forest habitats were preserved in the area of Czerwony Bór, such as inland dunes with psammophilous vegetation *Spergulo vernalis-Corynophoretum* (R.Tx. 1928) Libb. 1933, psam-

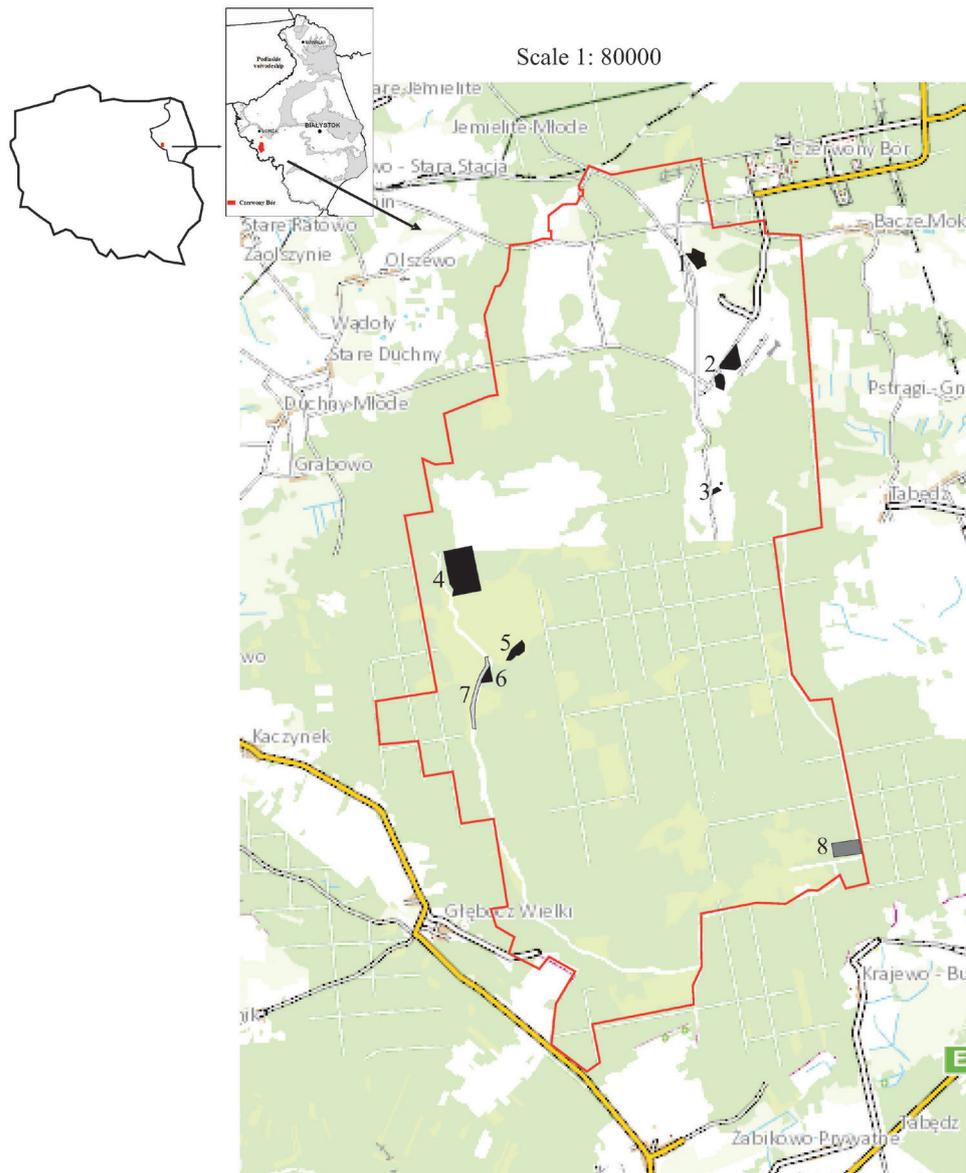


Fig. 1. Location of *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 heaths in the Czerwony Bór (NE Poland)

(Source base maps: www.geoportal.gov.pl, www.natura2000.gdos.gov.pl, changed)

mophilous grasslands *Koelerion glaucae* (Volk 1931) Klika 1935, dry heaths *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 and juniper formations *Juniperus communis* (Matuszkiewicz, 2001; Bargielski, 2007; Łaska, 2008). In 2002 the army training ground was closed down and the

area was granted to the Łomża Forest Division. From that time this area has been reclaimed as forest area and the artificial tree stand renewals and reforestation started (Płany, 2005–2015). At present the specificity of the forests in the area is determined by dominant pine stands growing on

Table 1. List of natural habitats included in Enclosure 1 to the Habitats Directive 92/43/EEC identified in the area of Czerwony Bór

Representativeness (typical character of plant communities development in a given area): A – excellent, B – good, C – significant, D – insignificant;

Relative area (area of a given community relative to the total area of this community in a given country): A > 15–100%, B > 2–15%, C > 0–2%;

State of preservation (state of preservation of structure and function of the community, possibility of its renewal): A – excellent, B – good, C – medium or impoverish state;

General evaluation (the value of a given area for protection of a given type of community): A – excellent, B – good, C – significant.

Code	Name of habitats/communities	Area A, B, C, [ha]			Total area [ha]	Cover [%]	Representativeness	Relative area	State of preservation	General evaluation
		A	B	C						
2330-1	Ass. <i>Spergulo vernalis-Corynophoretum</i> (R.Tx. 1928) Libb. 1933	4.11	0.20		4.31	0.11	A	C	A	A
4030-3	Ass. <i>Arctostaphylo-Callunetum</i> R.Tx. et Prsg 1940	19.50	2.20		21.70	0.54	A	C	A	A
5130	Formations with <i>Juniperus communis</i> L.	207.37	279.60	205.0	691.97	17.29	A	C	B	B
6120-1	All. <i>Koelerion glaucae</i> (Volk 1931) Klika 1935	3.30	48.45		51.75	1.29	A	C	A	A
9170-2	Ass. <i>Tilio-Carpinetum</i> Tracz. 1962		25.00		25.00	0.62	B	C	B	B
91T0-1	Ass. <i>Cladonio-Pinetum</i> Juraszek 1927		5.00		5.00	0.12	B	C	B	B
	Total area [ha]	234.28	360.45	205.0	799.73	19.97				

3.2. Heaths *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 within Czerwony Bór

In Czerwony Bór the plant association *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 is represented by subcontinental inland dry heaths of anthropogenic origin. They are found in the form of treeless shrub communities with the dominant heath *Calluna vulgaris* and with rich flora of moss and lichens. The communities are made of low and colourful plants, localised mainly in the north-eastern, south-eastern and western parts of the former army training ground (Fig. 1). The communities make large-area patches occupying all forest sections (section 126a) or grow in small-area patches along the forest roads, on dunes or steep slopes, where they occur in the initial stages of plant development. They grow on very poor and acidic podzolized soil of pH 4.0–5.0, formed from loose sands and of very deep ground water table. The extreme thermal and soil conditions ensure the stability of these communities.

Within the area of Czerwony Bór, 8 sites with dry heaths *Arctostaphylo-Callunetum* were found, of the total area of 21.7 ha (Fig. 1). These communities were repre-

sented by typically developed and excellently preserved patches (A – 90%) occupying the area of 19.5 ha and good preserved patches (B – 10%) of the area 2.2 ha (Table 2). The natural value of the heaths is high and their representativeness is excellent.

Arctostaphylo-Callunetum is a community of boreal-continental type of range. Its structure is composed of two layers, that of herbs and that of moss and lichens. In the herbal layer of the coverage of 60–80% the dominant is *Calluna vulgaris* with *Arctostaphylos uva-ursi* as a subdominant. The floristic composition of differential species (*Carex ericetorum*, *Carex praecox*, *Peucedanum oreosalinum*, *Scorzonera humilis*, *Arnica montana*, *Platanthera bifolia*) and accompanying species (*Hieracium pilosella*, *Solidago virgaurea*, *Geranium sanguineum*, *Thymus serpyllum*, *Trientalis europaea*, *Festuca ovina*) are also well represented. The patches of heath, besides the species characteristic of All. *Calluno-Arctostaphylion*, also host the species characteristic of psammophilous grassland from the class *Koelerio glaucae-Corynephoretea canescentis* (*Helichrysum arenarium*, *Corynephorus canescens*) and

Table 2. Characteristics of the locations Ass. *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940 (4030–3) in the Czerwony Bór (for details see Figure 1)

Location number	Code habitats	Forest section	Location Forestry	Geographical coordinates		Area [ha]	State of preservation
				N latitude	E longitude		
1.	4030–3	42 a	Czerwony Bór	53 02 02.5	22 06 06.0	0.5	B
2.	4030–3	64d/74a	Czerwony Bór	53 01 15.6	22 06 11.8	1.0	B
3.	4030–3	102b	Czerwony Bór	53 00 18.8	22 06 01.9	0.2	B
4.	4030–3	126a	Czerwony Bór	52 59 50.8	22 02 53.8	17.5	A
5.	4030–3	155b/156c*	Czerwony Bór	52 59 15.6	22 03 36.5	1.0	A
				52 59 06.9	22 03 16.8		
6.	4030–3	157 f	Czerwony Bór	52 59 03.3	22 03 12.7	0.5	A
7.	2330–1/	157b	Czerwony Bór	52 59 08.7	22 03 12.1		
	4030–3	172c	Tabędz	52 58 54.4	22 03 02.2	0.5	B
		173c	Tabędz	52 58 40.7	22 03 00.4		
8.	91T0–1/	244b*	Tabędz	52 57 41.6	22 07 32.8	0.5	A
Total area [ha] / State of preservation						19.5	A – excellent
						2.2	B – good

* The geographical coordinates after Wolkowycki 2008 (unpublished)

thermophilic herbal communities from the class *Trifolio-Geranietea sanguinei* (*Digitalis grandiflora*, *Inula hirta*, *Peucedanum cervaria*). The layer of moss and lichens is rich, 100% coverage (*Pleurozium schreberi*, *Hylocomium splendens*, *Dicranum scoparium*, *Dicranum polysetum*, *Polytrichum piliferum*, *Pohlia nutans*, *Hypnum jutlandicum*, *Ceratodon purpureus*) and lichens (*Cladonia mitis*, *Cladonia arbuscula*, *Cladonia chlorophaea*, *Cladonia furcata*). The patches of heath may also sporadically show some trees and bushes, including *Pinus sylvestris*, *Betula pendula*, *Populus tremula* and *Juniperus communis*. The height of heaths varies from a few cm to 25–30 cm.

4. Possible threats and protective measures – discussion

The heaths of the type *Arctostaphylo-Callunetum* occur at dispersed sites, mainly in north-eastern and central-eastern Poland (Ciosek, 2000; Rakowski, 2003). They are composed of subcontinental-subboreal heath type vegetation sustained at these localities only thanks to the specific habitat conditions and human activity (Britton et al., 2003; Holden et al., 2007; Albert et al., 2011, 2012; Kongstad et al., 2012). That is why they are classified as vulnerable communities and need active protection measures (Britton

et al., 2000; Hulme et al., 2002; Pakeman et al., 2003; Littlewood et al., 2006a; Mitchell et al., 2008a; Pywell et al., 2011; Quin et al., 2014). Their floristic composition includes species (*Arctostaphylos uva-ursi*, *Lycopodium clavatum*, *Botrychium lunaria*) that are under legal protection.

Dry heaths *Calluno-Arctostaphyilion* were maintained in the area of Czerwony Bór only thanks to the former use of the area as an army training ground. The army systematically destroyed the soil surface and vegetation cover, so that the initial stages of plant development did not have a chance to develop further. In 2002 the army training ground was granted to the Łomża Forest Division and the process of planned management started, including artificial forestation in the form of large-area monocultural forest crops and plantations. At present Czerwony Bór is within the Łomża Forest Division, District Zambrów II, Forestry Czerwony Bór and Tabędz of the total area of Zambrów II (6848.1805 ha), in Czerwony Bór area forests take 64.4%, and non-forest grounds take 37.6%. From among forest area, 98.6% are the forests of economical use subjected to forest management control (3,984.03 ha), the dominant type of habitat is that of fresh mixed forest (52.3%) and fresh forest (39.8%) with the dominant *Pinus sylvestris* (Plany, 2005–2015). The above mentioned types of management in the area left after the army training ground brings threat to further existence of the heaths. In the are-

as with no artificial forestation but also with no measures aimed at maintenance of open space, the secondary succession is observed, leading to spontaneous phase out of the heaths by thickets formations or forest communities made by pioneer species (*Betula pendula*, *Populus tremula*, *Pinus sylvestris*, *Juniperus communis*). The patches of heaths are often accompanied by thickest of *Sarothamnus scoparius*, which is geographically foreign to Podlaskie Province and whose expansion together with eutrophication of habitats also pose threats to the functioning of the communities. Eutrophication of the habitats and changes in the edaphic and luminous conditions are conducive to transformation of the heaths towards mesotrophic thermophilic herbal communities and later to thickest and forest communities (Alonso et al., 2001; Littlewood et al., 2006b; Britton & Fisher, 2008; Sowerby et al., 2008).

The active protection of the heaths in Czerwony Bór should include the means preventing the secondary succession such as removal of trees and bushes as well as periodical mowing, but first of all the change in methods of forest management. Inhibition of secondary succession will provide the access of light desired by the heath and will restrict accumulation of non-decomposed organic matter leading to increased trophy of the habitat (Britton et al., 2003; Rinnana et al., 2007; Mitchell et al., 2008b; Nielsen et al., 2009; Kongstad et al., 2012). The measures within the forest management in the area should be aimed at preservation of open space land by periodical removal of vegetation to bare soil.

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