

There is a special importance of military training areas (MTAs) for the protection and maintenance of our biodiversity in Europe. MTAs host a number of specific habitat types and species protected by the Habitats Directive, especially habitats of the open landscape, which developed through and rely on an extensive (often historical) agricultural use, a disturbance regime (of the military training) and/or specific conservation measures. Many important habitats of EU community relevance, especially those requiring oligotrophic to mesotrophic conditions, have some of their best and largest representation on military areas and thus have been integrated into the Natura 2000 network of protected areas. Most of these habitat types and species have an unfavourable conservation status at the biogeographical level. Actively used, as well as decommissioned, MTAs play an important role in maintaining or improving the conservation status of several of these habitat types and species.

This volume presents the proceedings of the workshop “Management of Natura 2000 sites in Military Training Areas”, which was held by the German Federal Agency for Nature Conservation from 28 September to 1 October 2015 at the International Academy for Nature Conservation at the Isle of Vilm (Germany). The workshop discussed the specific conditions for the management of open landscapes on active and former military training areas (Natura 2000 sites). Experts from several EU Member States presented and discussed management measures to maintain or to restore habitat types and habitats of species on MTAs, problems during management and solutions to overcome these, best practice examples of Natura 2000 management on MTAs and the handling of unexploded ordnance devices (UXO) in order to allow or facilitate the necessary nature management.

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Management of Natura 2000 sites on military training areas

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Military training area Haltern (North Rhine-Westphalia, Germany): What comes after the British troops have left?

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Abstract

The former military training area Haltern is one of the most important heath and bog landscapes in North Rhine-Westphalia. An old landscape with valuable remnants of heaths and bogs was preserved here in an area of more than 3,300 ha. After military activity for more than 140 years, the British Army left the training area in 2015. In the same year, about two thirds of the area was declared as National Natural Heritage site. The project "Westphalia's Wild West", developed by three Biological Stations ("Naturschutzzentrum Kreis Coesfeld", "Biologische Station Kreis Recklinghausen", "Biologische Station Zwillbrock"), aims to preserve and restore these valuable heaths and bogs. Instead of tanks, large herbivores such as European Bison, Red Deer and Wild Horses should keep the landscape open. In smaller areas, grazing by domestic animals and an extensive use of grassland could preserve the landscape. Further conservation measures like the mechanical treatment of heathland, prescribed burning and rewetting of bogs and wetlands could contribute to the restoration of valuable habitats and the maintenance of species. The removal of unexploded ordnance on selected areas and routes is an urgent need before controlled nature tourism can be implemented.

Keywords: former military training area, Borkenberge, Lavesum, biodiversity, disturbance-dependent species, heathland management, Biological Stations, "Westphalia's Wild West"

1 Introduction

The former military training area Haltern is located in the North German Lowland in the federal state of North Rhine-Westphalia. The training area comprises of about 3,300 ha and consists of two sub-areas, Borkenberge and Lavesum (Fig. 1). Military activity occurred here from 1873 until 2015. Immediately after the withdrawal of the British Army in 2015, about two thirds of the training ground was designated as National Natural Heritage site. Today, approximately 30 % of the training area is open landscape such as heathland, grassland or bogs. The remaining area consists of woodland which is dotted with small forest clearings and bogs (Fig. 2). The military training area was recognized as a site of high biodiversity with its large number of rare and endangered species and habitats. Firstly, the military period (1873-2015), the main reason for the preservation of biodiversity, will be described. Secondly, the present situation, a transition period, is looked at. Finally, we propose a management system called "Westphalia's Wild West" that is supposed to protect biodiversity on the former military training area.

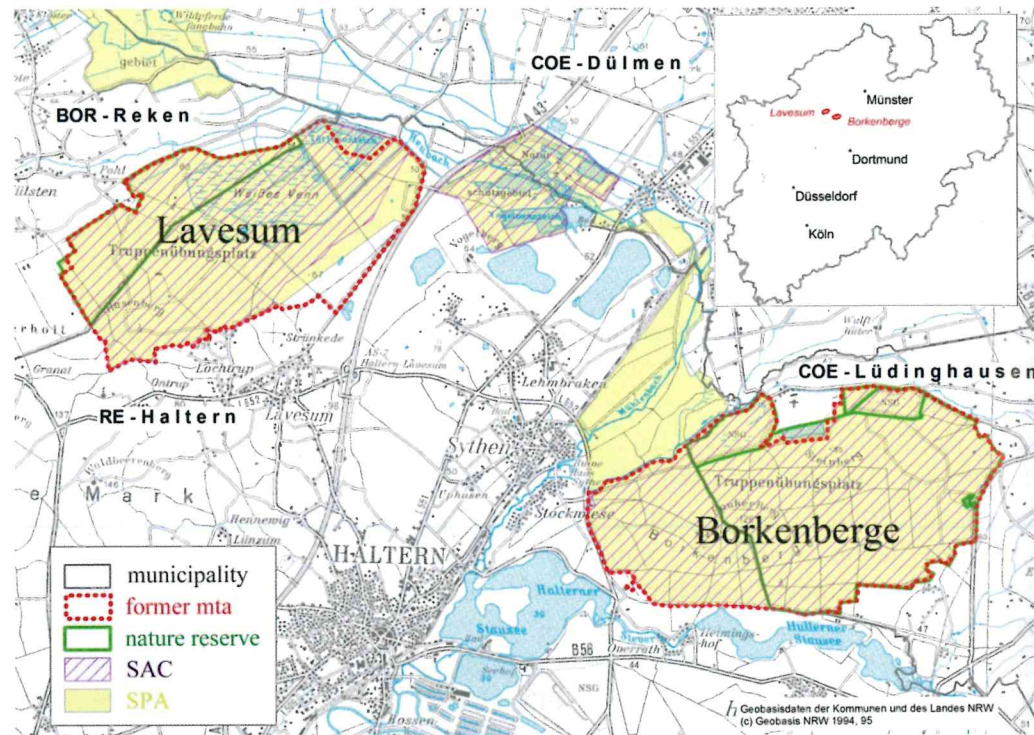


Fig. 1: Overview of the former military training area (MTA) Haltern in North Rhine-Westphalia (small map) with its two sub-areas “Lavesum” and “Borkenberge”. SPA: Special Protection Area, SAC: Special Area of Conservation.

2 The past: military activity (1873-2015)

Military activity began in 1873, when Alfred Krupp, colloquially known as the “cannon king”, started shooting exercises in Borkenberge. He found an open, deforested landscape dominated by heaths and small bogs, which promised to be a good training ground. In the following years the small size of the training area did not meet the requirements for large-scale testing of cannons and so training ceased in 1877. Thereafter the Borkenberge area was mainly used by local farmers for the rearing of sheep and cattle and by forest companies for producing mining timber for the coal mines of the nearby Ruhr area. In the 1930s, parts of Borkenberge were used by the German military for flight exercises. British forces took it over in 1945 and established a military training area on both Borkenberge and Lavesum. In the following years, the military training area was expanded gradually. Landowners were issued with compulsory purchase orders and forced to sell their land. In recent decades, public access to the military site was forbidden (cf. BACKMANN 2015).

Borkenberge was mainly used for infantry exercises and the training of tanks and heavy vehicles. An open area of 300 ha in the centre is dominated by heaths and nutrient poor grasslands (Fig. 2b, 3). Lavesum is characterized by a number of firing rang-

es, which are fringed by woodland (Fig. 2a). The firing ranges are dominated by heaths or grassland. A drained peat bog in the north of Lavesum (“Weißes Venn”) (Fig. 6) served as impact area. The British Army and other NATO troops used the military training area Haltern until the 31 May 2015, when it was finally handed back to the Federal Republic of Germany. As a result of the military activity, unexploded ordnance litters the area.



Fig. 2: Aerial photos of “Lavesum” (a) and “Borkenberge” (b) with the borders of the former military training area Haltern (Aerial photos: Geobasisdaten der Kommunen und des Landes NRW. © Geobasis NRW).

2.1 Military disturbances

Due to the military activity, large parts of the old heath and bog landscape could be preserved at the military training area Haltern. Between 1945 up until the beginning of the 1990s, the British Army carried out the land management. Since the early 1990s, heath and grassland biotopes were mowed and cleared of scrubs and trees by the land maintenance team of the Federal Forests, a division of the Institute for Federal Real Estate (SCHMID 2012), and the range wardens of the British Army. Heathland management was mainly carried out with flail mowers and forest mulchers using specially modified armoured vehicles. Drainage ditches in wetlands were maintained regularly (M. LORENZ, Federal Forests, oral communication 2015).

Numerous types of disturbances occurred on the military training ground. In Borkenberge, tanks and other heavy vehicles created a dense network of sandy tracks (Fig. 3), which covered an area of more than 40 ha at the end of the military era. To prevent the spreading of fire, fire protection strips were created in Lavesum. Other disturbances like explosions, air turbulence from helicopters, digging of trenches and excavations also created bare ground in Borkenberge and Lavesum. Both prescribed fire management and accidental fire occurred. All these disturbances were followed by succession, resulting in a fine-scale mosaic of biotopes in different successional stages.

These military disturbances took place mainly in limited areas (e.g. firing ranges, tank training areas, grenade areas). In marginal areas (e.g. surrounding forests, mires) military use was restricted. Parts of the grassland and a few arable fields were even leased to local farmers and shepherds.



Fig. 3: In Borkenberge, a mosaic of heaths, grasslands, sandy tracks and scattered trees offers habitat for a wide range of species (photo: M. Olthoff).

2.2 High biodiversity

The preservation of an old heath and bog landscape through the military usage is the main reason for the conservation of rare and endangered species. Most parts of the former training area were never used agriculturally. For this reason, a great amount of natural and semi-natural habitats such as heaths, nutrient-poor grasslands and bogs were preserved within an otherwise intensively used agricultural landscape.

Due to the disturbance regime and the resulting richness of biotopes and successional stages, a wide range of different species could thrive on the military training area. During the time of military activity, inventories of biodiversity were carried out in both sub-areas of the military training area (e.g. HANNIG et al. 2009, HANNIG 2005). In Borkenberge, more than 2,700 species of animals, plants and fungi were recorded, of which more than 400 are listed in the Red Data Books of Germany or North Rhine-Westphalia. More than 50 % of all grasshopper and bush cricket species, more than 60 % of all dragonfly species and more than 70 % of all reptile species of North Rhine-

Westphalia were found here (OLTOFF et al. 2011). DIERSSEN (2007) classified Borkenberge as a national representative heathland.

Some species could only thrive because of the massive disturbances of tanks and other heavy vehicles. Water-filled holes in tank tracks became ideal habitats for species like natterjack toad (*Bufo calamita*) (Fig. 5), fairy shrimp (*Branchipus schaefferi*) or tadpole shrimp (*Triops cancriformis*). Those species depend on the mechanical disturbances of the vehicles and the resulting bare and compacted soil. The shrimp species even disperse their eggs with the help of tank tracks or vehicle tires. Furthermore, the sandy tracks were (almost) exclusively used by arthropods like slender blue-winged grasshopper (*Sphingonotus caeruleus*) or plant species like coral-necklace (*Illecebrum verticillatum*) (Fig. 5) and strapwort (*Corrigiola litoralis*). For a wide range of other species such as grayling (*Hipparchia semele*) (LEOPLD 2007), woodlark (*Lullula arborea*) or the ground beetle *Harpalus flavescens*, bare sand and subsequent early successional stages are essential partial habitats (OLTOFF et al. 2009).

But the occurrence of disturbance-dependent species is only one aspect of the rich biodiversity. Rare species like crane (*Grus grus*), Northern Emerald (*Somatochlora arctica*), bog asphodel (*Narthecium ossifragum*) or marsh orchid (*Dactylorhiza sphagnicola*) are confined to the largely undisturbed peat bogs on the former military training area. Forest inhabitants such as Black Woodpecker (*Dryocopus martius*) or Brandt's bat (*Myotis brandtii*) inhabit the older woods (Fig. 9).

WARREN et al. (2007) suggest that the occurrence of heavily disturbed areas on the one hand and virtually untouched nature on the other hand and the spectrum of disturbance and succession between these two extremes provide suitable habitats for a very large number of species with widely varying habitat requirements. This also appears to be the case for the military training area Haltern.

In 2002, three Biological Stations ("Naturschutzzentrum Kreis Coesfeld", "Biologische Station Kreis Recklinghausen", "Biologische Station Zwillbrock") started their nature conservation work – first in Borkenberge, and later in Lavesum – in close collaboration with the Federal Forests, the British Army and the local authorities.

2.3 NATURA 2000

In 2002, large parts of military training area Haltern were designated as Special Areas of Conservation: "Truppenübungsplatz Borkenberge" (DE-4209-304), "Gagelbruch Borkenberge" (DE-4209-301) and "Weißes Venn/Geisheide" (DE-4108-303). In addition, most of the training area is part of the Special Protected Area "Heubachniederung, Lavesumer Bruch und Borkenberge" (DE-4108-401). After the designation of Natura 2000 sites, the districts of Coesfeld and Borken established nature reserves in their respective areas (Fig. 1).

The former military training area contains 12 Annex I habitat types, of which dry heaths (180 ha), degraded raised bogs (29 ha), dystrophic lakes (28 ha) and transition mires (25 ha) cover large areas (Tab. 1). The former training area supports up to 20 % of the North Rhine-Westphalian breeding population of the Annex I bird nightjar (*Caprimulgus europaeus*) (Fig. 4) (cf. GRÜNEBERG & SUDMANN 2013). With two breeding pairs of the crane (*Grus grus*) in 2014 and 2015, the former military training area provides one of the first breeding grounds of this Annex I species in North Rhine-Westphalia. Bird species such as woodlark (*Lullula arborea*), meadow pipit (*Anthus pratensis*), stonechat (*Saxicola torquata*) or common redstart (*Phoenicurus phoenicurus*) reach high breeding densities (Tab. 2). One of North Rhine Westphalia's largest population of the Annex IV species moor frog (*Rana arvalis*) (> 2,500 mating males) can be found in the bog and heathland ponds of the former military training area (Fig. 7).

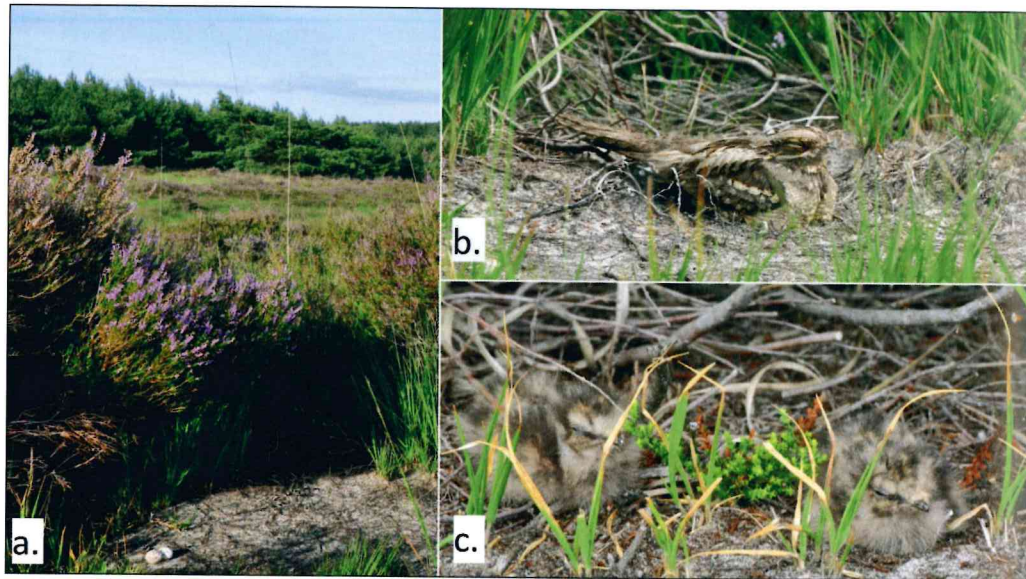


Fig. 4: Nightjar (b) with a clutch of two eggs (a) breeding on a patch of bare sand surrounded by old *Calluna* heath in close vicinity to a forest edge in Borkenberge. Only the existence of these different successional stages next to each other allows the species to breed here. After hatching, the two fledglings hide in the vegetation adjacent to the bare sand (c) (photos: M. Olthoff).



Fig. 5: Natterjack toad and coral-necklace benefited from military activity and the resulting water-filled holes in tank tracks (photo: M. Olthoff).



Fig. 6: Degraded peat bog in Lavesum ("Weißes Venn") – habitat of moor frog and crane (photo: N. Ribbrock).



Fig. 7: In Northwest-Germany the moor frog only breeds in nutrient poor habitats such as bog or heathland ponds (photo: M. Olthoff).

Tab. 1: Annex I habitat types on the former military training area Haltern.

code	name (*priority habitat)	size (ha) (according to standard data forms)
2330	Inland dunes with grassland	0,9
3150	Natural eutrophic lakes	35,5
3160	Dystrophic lakes	28,1
4010	Wet heaths with <i>Erica tetralix</i>	12,4
4030	Dry heaths	180,5
5130	<i>Juniperus communis</i> formations	4,0
7120	Degraded raised bogs	29,1
7140	Transition mires	25,8
7150	Depressions Rhychosporion	1,0
91DO	Bog woodland*	6,1
9110	Beech forest (Luzulo Fagetum)	27,1
9190	Old acidophilous oak woods	30,5

Tab. 2: Populations of selected bird species (2010-2015) on the former military training area Haltern.

Bird species	Scientific Name	Annex I	Breeding Birds	Resting Birds
Nightjar	<i>Caprimulgus europaeus</i>	X	50	
Woodlark	<i>Lullula arborea</i>	X	≥ 50	
Meadow Pipit	<i>Anthus pratensis</i>		≥ 75	> 500
Stonechat	<i>Saxicola torquata</i>		≥ 25	
Common Redstart	<i>Phoenicurus phoenicurus</i>		> 100	
Crane	<i>Grus grus</i>	X	2	≤ 250
Honey Buzzard	<i>Pernis apivorus</i>	X	3-5	
Black Woodpecker	<i>Dryocopus martius</i>	X	3-5	
Red-backed Shrike	<i>Lanius collurio</i>	X	6-7	
Great Grey Shrike	<i>Lanius excubitor</i>			5-10
Hen Harrier	<i>Circus cyaneus</i>			5-10
White-fronted Goose	<i>Anser albifrons</i>			≤ 5,000
Bean Goose	<i>Anser fabalis</i>			≤ 500

3 The present: transition period (2015-??)

The time after the withdrawal of the military on the 31 May 2015 can be seen as a transition period, before a new management system is implemented on the former military training area. Immediately after the withdrawal, an entry ban enforced by heavy fines was imposed on the area by the regional authorities. Access is prohibited and controlled by security guards of the Institute for Federal Real Estate.

The designation of 2,173 ha of the former military training ground as a National Natural Heritage site in June 2015 by the budget committee of the German Parliament and the resultant exemption of this federal land from privatization is an important milestone for protecting the natural value of this area. The land will be transferred to a new owner, probably the German Environmental Foundation (DBU Naturerbe GmbH).

Currently, driving exercises with heavy vehicles on well-defined tracks are carried out by the Federal Agency for Technical Relief ("Technisches Hilfswerk"), local fire brigades and the police. These measures take place in close cooperation with Federal Forests and the Biological Stations and aim to keep selected tank ruts open as a habitat for disturbance-dependent species. Basic heathland management (e.g. removal of scrub encroachment, controlled burning) will be carried out by the land maintenance team of the Federal Forests to prevent a deterioration of habitats (A. URMES, Federal Forests, oral communication 2015).

Grasslands and arable fields are still leased to local farmers and shepherds, who do not currently manage it in the best interests of nature. The few arable fields within the former military training area are farmed intensively. Most of the grassland biotopes covering more than 190 ha do not meet the requirements of nature conservation (e.g. over-fertilisation, intensive rearing of sheep, early cutting date).

At the moment the Institute for Federal Real Estate is undertaking a historical survey to work out what type of ordnance were used on the military training area. The removal of explosive ordnances on selected areas and routes is an urgent need before controlled environmental tourism can start.

The Biological Stations carry out the monitoring of relevant habitats and species of the Habitats and Birds Directive [e.g. Annex I habitat types, European otter (*Lutra lutra*), moor frog (*Rana arvalis*), smooth snake (*Coronella austriaca*), Annex I bird species and regularly occurring migratory birds]. Other target species [e.g. grayling (*Hipparchia semele*)] are also monitored regularly. The Biological Stations advise Federal Forests and the local and regional authorities on nature conservation issues and make proposals for improvement. They inform the general public with lectures, excursions and public relations work about the natural value of the former military training area.

4 The future: the vision "Westphalia's Wild West"

As it is known that the cessation of military activity on former military training areas results in neglected habitats (e.g. GAZENBEEK 2005, ELLWANGER et al. 2012, CIZEK et al. 2013), there is a need for immediate action at the former military training area Haltern. Biodiversity can decline rapidly once the military has gone and open habitats soon overgrow with woody species or are encroached by grasses.

In order to prevent this, the three Biological Stations have developed the project proposal "Westphalia's Wild West". The project aims to establish a new management system comprising different kinds of measures which, in combination, should be able to conserve the rich biodiversity on the former military site.

Key elements of the project "Westphalia's Wild West" are:

4.1 Implementation of a grazing system

An important objective is the reintroduction of wild grazing animals such as European Bison (*Bison bonasus*), Red Deer (*Cervus elaphus*) and Wild Horses (*Equus spec.*) on a large, fenced area in Borkenberge. In Lavesum, populations of Red Deer and Fallow Deer (*Dama dama*) already roam free. In addition, Wild Horses or domestic animals such as cattle, sheep or goats could keep the landscape open. Grazing systems have the potential to keep valuable habitats open and maintain the species richness of the area (c.f. BUNZEL-DRÜKE et al. 2015).

4.2 Heathland management

In addition to the grazing system, further management measures such as prescribed burning, mowing and removal of invading (woody) species are necessary to restore the heathland and nutrient-poor grassland biotopes (e.g. LÜTKEPOHL 1993, GFMC & FIRE ECOLOGY RESEARCH GROUP 2009). Moreover, high-intensity management measures (e.g. sod-cutting, choppering) to remove nutrient rich top soil could be necessary for successful heathland restoration (NIEMEYER et al. 2007). In order to fulfil the demands of a wide range of different species, a large diversity of successional stages is needed.

4.3 Restoration of degraded peat bogs and wetlands

In Lavesum, drained peat bogs and wetlands cover a large area ("Lavesumer Bruch", "Weißes Venn"). In Borkenberge, the smaller bogs and grasslands in the northern part (e.g. "Gagelbruch Borkenberge", "Süskenbrocksmoor") are also drained by ditches. The natural hydrology of these areas should be restored by the blocking of drainage ditches. The rewetting should be carried out carefully with consideration for the species and habitats. Degraded bog habitats should be restored by removal of scrubs and cutting of trees.

4.4 Extensive agriculture

Grassland biotopes outside of the grazed areas should be managed as unimproved hay meadows. Contrary to the current situation, no fertilizer and biocides should be used. The hay can be used for feeding animals in winter.

4.5 “Classic” management measures

“Classic” management measures include the restoration and creation of ponds for target species [e.g. moor frog (*Rana arvalis*)], the installation of artificial nesting sites [e.g. osprey (*Pandion haliaetus*)] or the small-sized biotope management [e.g. marsh orchid (*Dactylorhiza sphagnicola*)].

4.6 Anthropogenic disturbances

In order to protect disturbance-dependent species [e.g. woodlark (*Lullula arborea*), natterjack toad (*Bufo calamita*), slender blue-winged grasshopper (*Sphingonotus caeruleans*), fairy shrimp (*Branchipus schaefferi*), grayling (*Hipparchia semele*) or coral-necklace (*Illecebrum verticillatum*)], bare sand habitats need to be recreated regularly. Grazing animals such as European Bison or Wild Horses can maintain an open landscape to a certain extent, but anthropogenic disturbances of heavy vehicles (e.g. controlled driving exercises on well-defined tracks, use of forest mulcher) or the removal of upper soil layer are needed, in addition, to offer suitable pioneer habitats for those species (cf. WANNER et al. 2004, MAUSE 2012).

4.7 Natural forest development – wilderness

In small areas of the former military training area near-natural deciduous woodlands such as beech forests (Fig. 9), oak forests or bog woodland already exist. These woodlands are inhabited by species such as Black woodpecker (*Dryocopus martius*), Natterer’s bat (*Myotis nattereri*) or Brandt’s bat (*Myotis brandtii*). For those woodlands, which are located within the National Natural Heritage site, an immediate end to forestry activity is recommended. The majority of the forests are, however, dominated by plantations, mostly consisting of pine. These forests should be developed into natural woodlands before being left to natural succession.

4.8 Controlled nature tourism

A development of a zoning concept and careful planning of a route network are needed to offset any negative impact on the natural value of the former military training ground. Without carefully planned visitor management, sensitive Annex I bird species like nightjar (*Caprimulgus europaeus*) or crane (*Grus grus*) or vulnerable Annex I habitat types such as transition mires (7140) are otherwise in danger of being negatively affected (e.g. LANGSTON et al. 2007).

The three Biological Stations have developed a concept that complies both with the Natura 2000 requirements and the growing public desire to discover and enjoy nature at the former military area. Along designated routes, attractions such as observation towers, scenic vantage points or walkways over wetlands should be offered, thus channeling the visitors around the sensitive zones.

For visitors interested in the nature and history of the former military training area, an information centre should be established. It could include general information, an exhibition about the nature and history of the former military area and environmental education projects.



Fig. 8: The undulating lowland of Borckenberge – a suitable site for a grazing project (photo: M. Olthoff).



Fig. 9: Old beech forest inhabited by Black Woodpecker and several forest bats (Borkenberge) (photo: M. Olthoff).

In the opinion of the Biological Stations, the project can only be successful if the following conditions are met:

1. All plans and management measures need to comply with the Natura 2000 requirements.
2. The opening of selected areas or routes for the general public is only possible after clearance of unexploded ordnance.
3. All key stakeholders need to be involved in the future planning of the area. These are – along with the future owner – the neighbouring municipalities, the three districts, the local, regional and state authorities, the agriculture, forestry and hunting authorities, the adjacent landowners, Federal Forests, the local conservation organizations and the general public.

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Wood production and grazing on areas contaminated by unexploded ordnance (UXO) in Eastern Germany

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Abstract

This article presents the results of a project designed to develop methods for a management system on heathlands contaminated by unexploded ordnance in Brandenburg with a view towards nature protection and economic viability. The situation in the area as it is with UXO contamination requires tailor-made clearing measures on roads and logging tracks to allow access to vehicles with splinter protection.

Clearcutting on the heathlands and the usage of energy wood proved to be cost-covering. The subsequent management system of the sites was sheep grazing, a practical method to limit the uncontrolled spreading of *Calamagrostis epigejos* and shrub encroachment by aspen and birch and thus stabilise the *Calluna vulgaris* population. Although the forage plants could meet the demand of heavily pregnant ewes, they were not sufficient for lactating ewes. Sheep grazing as a management system on heathlands only becomes economically viable with the help of revenues from the EU-cofinanced Cultural Landscape Programme.

Keywords: former military training area, unexploded ordnance, heathland management, energy wood production, sheep grazing, economic efficiency, Eastern Germany.

1 Introduction

After the political changes of 1990 numerous military sites in East Germany have been released. These areas are home to extensive oligotrophic open landscapes with a large amount of biotopes protected by the Habitats Directive (EU 2006) such as Annex I-habitat types 4030 European dry heaths, 2310 Dry sand heaths with *Calluna* and *Genista* and 2330 Inland dunes with open *Corynephorus* and *Agrostis* grasslands. Several projects have concentrated on how to develop cost-efficient landscape management systems for these sites despite their UXO contamination (JOHST et al. 2014, JURKSCHAT et al. 2012).

The project „Development of methods for an economically feasible use of heathlands in areas contaminated by ammunition in accordance with nature conservation requirements“ carried out by the Naturschutzfonds Brandenburg on the “Prösa Heathlands“ in Southern Brandenburg focused on the research of heathland management (JURKSCHAT et al. 2012, LÜTKEPOHL 2012, THIELEMANN & PLETTENBERG 2012). It included studies on species inventory as well as on mineral balance in the soil and on ammunition soundings and recovery. In the following some selected results on ecology of heath,