

Baseline monitoring in the raised bog Holmegaards Mose 2010



Baseline monitoring in the raised bog Holmegaards Mose 2010

Report made by AGLAJA for Forest and Nature Agency, Storstrøm, 2010
Field studies: Irina Goldberg and Eigil Plöger
Text and photos: Irina Goldberg and Eigil Plöger
Fotos © AGLAJA

AGLAJA
v. Eigil Plöger
Lundevej 48, Vråby
4652 Hårlev
www.aglaja.dk

Contents

Summary.....	4
1. Introduction	5
2. Survey of vegetation, microtopography, peat formation, and secondary growth of birch	5
2.1. Methods.....	5
2.2. Results	7
2.2.1. Vegetation in the six study areas.....	7
2.2.2. Vegetation in the two transects	8
3. Monitoring of selected species	8
3.1. Fen Orchid (<i>Liparis loeselii</i>).....	8
3.1.1. Methods.....	8
3.1.2. Results	9
3.1.3. Remarks	10
3.2. A water beetle (<i>Graphoderus bilineatus</i>)	10
3.2.1. Methods.....	10
3.2.2. Results	11
3.3. Butterflies	11
3.3.1. Methods.....	13
3.3.2. Results	13
3.3.3. Remarks	14
4. References	15
APPENDICES	16
Appendix 1. Vegetation	17
Appendix 1.1 Map of study area no 1-6.....	17
Appendix 1.2 Map of transects no 1-2.....	18
Appendix 1.3 Study area no 1.....	19
Appendix 1.4 Study area no 2.....	21
Appendix 1.5 Study area no 3.....	23
Appendix 1.6 Study area no 4.....	25
Appendix 1.7 Study area no 5.....	27
Appendix 1.8 Study area no 6.....	29
Appendix 1.9 Transect no 1.....	30
Appendix 1.10 Transect no 2	32
Appendix 2. A water beetle <i>Graphoderus bilineatus</i>	34
Appendix 2.1 Map of potential habitats for <i>Graphoderus bilineatus</i>	34
Appendix 2.2 Vegetation of potential habitats for <i>Graphoderus bilineatus</i>	35
Appendix 3. Map of fixed-route walk for monitoring of butterflies	37
Appendix 4. Panorama photos.....	38

Summary

Holmegaards Mose is the largest raised bog in East Denmark that has been subject to drainage and peat cutting in the past. The LIFE project in Holmegaards Mose is aimed at restoring active raised bog habitat in previously wooded/drained areas as well as at improving conditions for this and the secondarily originated habitat types in the area.

As a part of Action E.2: Monitoring, a survey of the vegetation and a number of rare, protected species (Fen Orchid *Liparis loeselii*, a water beetle *Graphoderus bilineatus* and butterflies *Boloria aquilonaris*, *Cynonympha tullia*, *Plebeius optilete*) was done prior to or during the initial restoration work at the site in 2010. The results of this baseline survey are described in the report.

Survey of the vegetation gives a status of eight parts of the raised bog within the project area where the effect of restoration activities (removal of birch forest and raising of the water table) is expected to be different.

In the population of Fen Orchid, *Liparis loeselii* a decline in numbers of vegetative and generative plants was observed. This may be due to overshadowing by trees, bushes and *Cladium mariscus*.

Mapping of potential habitats for *Graphoderus bilineatus* reveals that three flooded peat pits can be suitable habitats for the species.

Two rare butterfly species, *Boloria aquilonaris* and *Coenonympha tullia* were found in great numbers. Only one individual of *Plebeius optilete* was seen which might be because the species was not on the wing at the time of survey.

1. Introduction

Holmegaards Mose is the largest raised bog in East Denmark that has been subject to drainage and peat cutting in the past. This has resulted in the loss of raised bog habitat (7110) and development of a number of secondary habitat types in the old excavation areas, e.g. wooded bog, quaking bog, rich fen and flooded peat pits.

Holmegaards Mose is a habitats area, and it has been selected for the presence of the Annex I habitats Active raised bog (7110), Degraded raised bog capable of regeneration (7120), Transition mire and quaking bog (7140), Calcareous fens with *Cladium mariscus* (7210), Alkaline fen (7230) and Annex 2 species *Liparis loeselii* (Fen Orchid) and *Graphoderus bilineatus* (a water beetle) /9/.

The LIFE project in Holmegaards Mose is aimed at restoring active raised bog habitat in previously wooded/drained areas as well as at improving conditions for this and the secondarily originated habitat types in the area.

As a part of Action E.2: Monitoring, a survey of the vegetation and a number of rare, protected species was done prior to or during the initial restoration work at the site in 2010. The reason for including a baseline survey in the monitoring scheme is that we find it important to be able to demonstrate the effect of the restoration activities on the vegetation and species in the future.

2. Survey of vegetation, microtopography, peat formation, and secondary growth of birch

2.1. Methods

The project area was divided in 6 study areas with various vegetation types, where the effect of restoration activities (removal of birch forest and raising of the water table) is expected to be different (Appendix 1.1, Table 1). Within each study area a number of permanent plots were installed. The vegetation changes which will take place within the site over the period of the restoration project will be shown by means of observed changes in these plots. In order to ensure the future position of plots the center was marked with a timber stake and a GPS reading in EuRef 89 UTM 32 was also recorded.

In addition 2 permanent transects were established in the eastern part of the study area which is predominantly covered with forest, in places with open bog vegetation (Appendix 1.2). The first transect is 600 m long and contains 21 plots, the second transect is 450 long with 16 plots. The distance between the plots within each transect is 30 m.

Every plot consisted of two circles – with a radius of 5 m and 15 m. Within a 5 m circle the coverage of peat mosses, *Molinia caerulea*, *Campylopus introflexus*, birch, pools / hummocks and amount of wear and tear was estimated, and all the occurring plant species were recorded. In a 15 m circle the coverage of open water surface, shrubs, trees and bushes < 1 m and > 1 m tall was estimated. The collected data are presented in Appendix 1.3-1.10.

Table 1. The study areas

Study area	Vegetation	Restoration activities	Area (ha)	Number of plots
1	Secondary alkaline fen	Felling trees; raising the water table 0-25 cm	0,7	5
2	Degraded raised bog at places turning into active raised bog	The forest was felled in 2007; grazing by sheep; raising the water table 0-25cm	7,1	10
3	Wet birch woodland and bog pool community	Felling trees; the water table will not raise	15,2	10
4	Birch woodland with <i>Molinia caerulea</i>	Felling trees; the water table will not change or raise 0-25 cm only in a part of the area	6,1	10
5	Degraded raised bog	Grazing by sheep; raising the water table 0-25 cm (a half of the area) or 25-50 cm	7,2	10
6	Active raised bog bearing the stamp of peat cutting in the past	The forest was felled in February 2010 (14 ha); 5,5 ha in the central part: raising the water table 0-25 cm	41,5	10

The living bog surface shows a complex of hummocks and pools with different *Sphagnum* species occupying different positions in relation to the degree of water logging. Hummocks are typically colonized by shrubs (*Calluna vulgaris*, *Empetrum nigrum* and *Erica tetralix*) and *Eriophorum vaginatum*, in the pools sedges are frequent (*Rhynchospora alba*, *Eriophorum angustifolium*).

The presence and coverage of peat mosses indicates the process of peat formation in a bog. In an active raised bog the coverage of peat mosses is almost 100%, and the peat consists mostly of *Sphagnum*. Restoration of the habitat type 7110 implies reestablishment of peat moss cover that plays an active part in turf formation.

The presence of *Molinia caerulea* as well as trees and shrubs is a sign of drainage and enrichment of water with nutrients from decomposition of peat. *Betula pubescens* - *Molinia caerulea* woodland is found on raised bogs which have been subject to some disturbance such as drainage or peat cutting. An invasive moss species, *Campylopus introflexus* colonizes surface of rather dry peat without vegetation. In the areas grazed by sheep the amount of wear and tear is a factor that can damage the bog vegetation.

From the center of two plots in each study area / transect panorama pictures of the site and vegetation were taken with a digital camera (Appendix 4).

The field work was carried out in September-October 2010.

2.2. Results

2.2.1. Vegetation in the six study areas

Area 1 (“Westphalerskæret”): The alkaline fen vegetation has developed secondarily in an old turf pit where the peat has been removed completely down to the underlying layer of limey soil. As a result of draining the birch, *Betula pubescens* spreaded into the area, but in 2005 the trees were cut. That caused a rapid growth of *Phragmites australis* that dominates the vegetation and overshadows, and outcompetes the low sedges and mosses. Besides, the re-growth of birch from the remaining stumps has been observed. The northern part of the area is still wooded. As a part of the restoration project felling of the trees will take place in 2011, and the water table is expected to raise 0-25 cm as a result of blocking drains in Holmegaards Mose.

Area 2: Degraded, dried bog that had been covered with birch woodland until 2007 when it was cleared of trees. Grazing by sheep was established in order to prevent the regeneration of birch. The vegetation is dominated by shrubs (*Calluna vulgaris*, *Empetrum nigrum*, *Erica tetralix*) and *Molinia caerulea* (40% in average). Re-growth of birch (ca. 15%) is observed; regeneration of peat mosses is most rapid in the northern part of the area, and the presence of *Sphagnum papillosum*, *S. rubellum*, *S. magellanicum* and *S. cuspidatum* indicates that the vegetation development is going in the right direction. An invasive moss species, *Campylopus introflexus* seems to be a problem on the peat surfaces lacking vegetation. The water table is expected to raise 0-25 cm but only in the south-western part of the area.

Area 3: Predominantly birch woodland on moist, moderately acid, minerogenic, peaty soil. The vegetation is dominated by *Betula pubescens* and *Myrica gale*, the coverage of *Molinia caerulea* and peat mosses is high. The central part is a bog pool community dominated by *Sphagnum denticulatum*, *Eriophorum angustifolium*, *Rhynchospora alba* secondarily arisen in an old peat extraction area. The peat moss cover here is almost total which indicates that peat formation is taking place. At the time of the field survey removing of the forest in the area had already started. It is expected that the water table in this part of Holmegaards Mose will not be raised.

Area 4: *Betula pubescens* – *Molinia caerulea* woodland; peat mosses are very sparse. Removing of the forest had started before the field survey was done. The water table is expected to raise 0-25 cm but only in a minor part of the area.

Area 5: Degraded, dried bog dominated by *Molinia caerulea*, towards north moist / wet depressions with peat mosses, *Vaccinium oxycoccos*, *Eriophorum angustifolium* and *Drosera rotundifolia*. The largest part of the area is grazed by sheep in order to prevent the regeneration of birch and reduce the growth of *Molinia caerulea*.

Area 6: The most intact part of the raised bog; the vegetation is dominated by peat mosses (*Sphagnum magellanicum*, *S. rubellum*, *S. cuspidatum*, *S. fallax*, occasionally *S. papillosum*, only a few places *S. tenellum* and *S. fuscum*) and shrubs (*Calluna vulgaris*, *Empetrum nigrum*, *Erica tetralix* and *Andromeda polyfolia*) and the surface microtopography with hummocks and pools is developed at some places. The central part of the area bears the stamp of peat cutting in the past, and much of the area looks dry, dominated by heaths. In the driest parts of the area the water level is not expected to be raised during the period of restoration, but it is very likely to happen in the central part

that is very wet already. In the northern part the birch trees were removed in February 2010.

2.2.2. Vegetation in the two transects

Transect 1: Wooded bog dominated by *Betula pubescens* and *Molinia caerulea* with a sparse cover of peat mosses. *Sphagnum palustre* and *S. fimbriatum* are the most common peat mosses. Towards south (between plots 15 and 17) the transect crosses an old peat pit (trench) dominated by *Sphagnum* species (especially *S. fallax*), *Eriophorum angustifolium* and *Vaccinium oxycoccos* where the birch trees have been felled but not removed from the site. A rare species, *Sphagnum majus* is found in plot 17. The water table is expected to raise 0-25 cm in the northern half of the transect.

Transect 2: Wooded bog dominated by *Betula pubescens* and *Eriophorum vaginatum*, at places by *Molinia caerulea* and *Empetrum nigrum*. The coverage of peat mosses is rather high, *Sphagnum palustre*, *S. fallax* and *S. fimbriatum* are the most frequent species. The transect crosses a system of old peat pits and baulks. The forest had been partly (in plots 1-2 and 9-13) removed before the field survey was done. The water table is expected to raise 25-50 cm in the central part of the transect, and 0-25 cm towards north and south.

3. Monitoring of selected species

3.1. Fen Orchid (*Liparis loeselii*)

Fen Orchid (*Liparis loeselii*) is a rare, threatened species in Denmark. Its population is located in a secondary rich fen (habitat type 7230 / 7210) in the northernmost part of the habitat area (Fig. 1). As a part of the restoration project the water table is expected to be raised 25-50 cm at this site.

Fen Orchid is monitored every year as a part of the National Monitoring and Assessment Programme for Aquatic and Terrestrial Environment (NOVANA) carried out by the Ministry of Environment.

3.1.1. Methods

Fen Orchid is monitored by the methods described in technical manual for NOVANA-monitoring of *Liparis loeselii* /5/.

The method implies counting of the number of vegetative and generative plants in a permanent plot which area is approximately 300 square meters. The counting has been done every year since 2004. A satellite population was discovered in 2009 during habitat mapping and this population is also monitored.

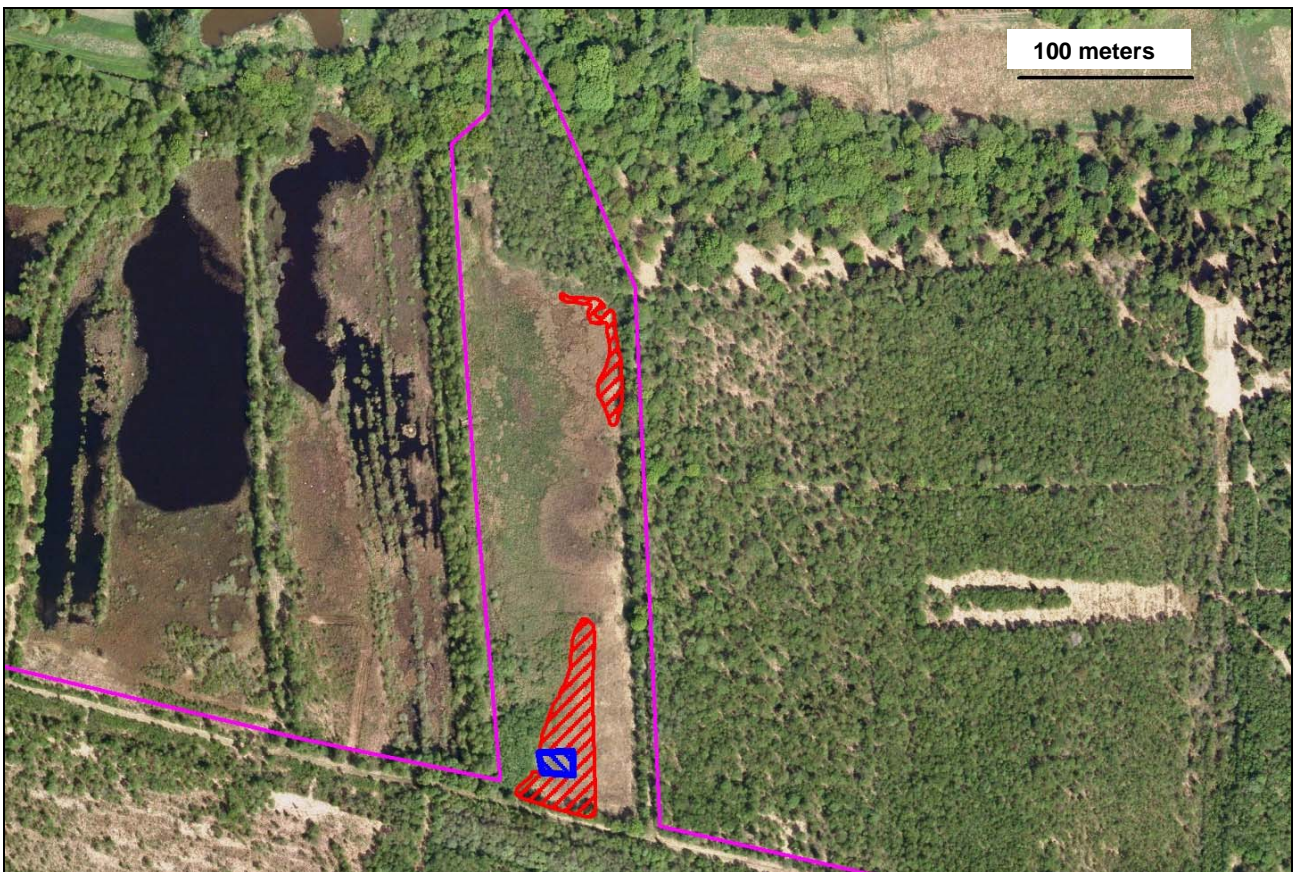


Figure 1. The mapped habitats of *Liparis loeselii* in the northern part (peat pit nr. 40) of the habitat area are shown in red, whereas the permanent plot is shown in blue.

3.1.2. Results

The results of counting of *Liparis loeselii* in the permanent plot can be seen in Figure 2. The satellite population in the northern part of the site there were 8 plants in 2009 and 3 plants in 2010.

The habitat where the permanent plot is placed is a minerotrophic fen dominated by sedges (a number of *Carex* species, *Cladium mariscus*, *Eriophorum angustifolium* and *Rhynchospora alba*). The moss layer is conspicuous with *Campylium stellatum*, *Campylium protensum* and *Calliergonella cuspidata* as dominating species. Peat mosses are not present. The water is constantly at the ground level, and too much humidity seems to make the plants or at least their leaves rotten.

The habitat where the satellite population is placed is very much alike although *Sphagnum subnitens* is present.

Both habitats are threatened by expanding of *Cladium mariscus*, *Myrica gale* and *Alnus glutinosa*. In 2009 both habitats were very wet (flooded).

In 2010 the number of plants in the permanent plot was approximately a quarter of that counted in 2008. It had never been less during the monitoring period since 2004. The cause of this decline is unknown, but overshadowing is a likely explanation. The very wet period in July and August the year before could also be the reason of population decline.

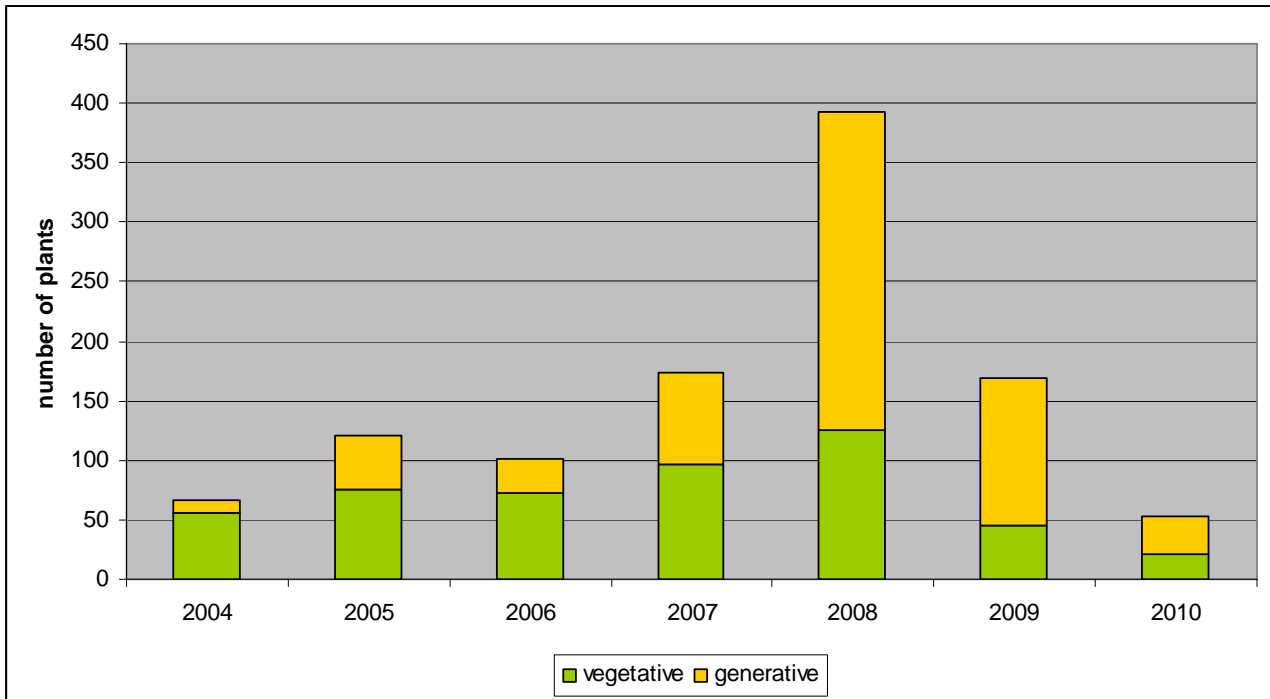


Figure 2. Number of individuals of *Liparis loeselii* in the permanent plot during the period of NOVANA-monitoring.

3.1.3. Remarks

Both in Holmegaards Mose and on other sites with a very high water level it has been observed that Fen Orchid has the best growth and reproduction when growing on tussocks or other elevations. The expected raise of water table in the area where the species occurs may cause a further decline in the two populations of *Liparis loeselii*.

3.2. A water beetle (*Graphoderus bilineatus*)

Graphoderus bilineatus is a rare, threatened aquatic species. It occurs in lakes and ponds with clean, oligotrophic water, not shaded by trees and bushes. It was found in a flooded peat pit in the northern part of Holmegaards Mose just outside the habitat area in 2007 (Appendix 2.1). The purpose of this survey is to assess whether it is possible to improve the quality of potential habitat for the species by removing trees and bushes along the shaded edges of the old, flooded peat pits within the project area.

3.2.1. Methods

A number of abandoned, flooded peat pits have been investigated in search of suitable habitats for the water beetle *Graphoderus bilineatus* by the methods described in technical manual for DEVANO-mapping of habitats for aquatic species (water beetles, amphibians and dragonflies) listed in the Annexes of EC Habitats Directive /3/.

The method implies registration of structural parameters of the habitat and the surroundings as well as registration of vascular plants and mosses occurring in the marginal, floating and submerged vegetation.

During the habitat mapping there have been no attempts to catch *Graphoderus bilineatus* using traps etc. This will be done in 2011.

3.2.2. Results

Results of the habitat mapping are shown in Table 2 and Appendix 2.

The water varies from being oligotrophic in the four pits in the north-western part of the project area to more or less minerotrophic in the majority of the six pits in its eastern part. The water here is not necessarily rich in nutrients, but minerotrophic due to the fact that these pits are deep and reach the underlying layers of mineral rich soil.

The water in a few pits is probably enriched with nutrients through the faeces of ducks fed in these pits for hunting purposes.

In general, the pits have steep edges, and the marginal vegetation is sparse, which is also due to overshadowing by trees and bushes along the edges.

It is most likely that fishes (pikes) occur in all pits.

Three out of ten pits are considered to be potential habitats for the water beetle *Graphoderus bilineatus* if trees and bushes are removed from the edges. They are situated in the north-western part of the project area. In the eastern part of the project area four out of six pits *might* be improved as a potential habitat by selective clearings.

3.3. Butterflies

Several butterfly species occurring in Holmegaards Mose are rare and endangered in Denmark. Cranberry Fritillary (*Boloria aquilonaris*) and Large Heath (*Coenonympha tullia*) are listed on the Danish Red List of Threatened Species as endangered, EN, and Cranberry Blue (*Plebeius optilete*) has a status of near threatened, NT. These species are restricted to nutrient poor habitats like raised bog.

The three species can still be found rather often in the western and northern parts of Jutland, but they are very rare on Zealand. *Coenonympha tullia* is only found in Holmegaards Mose, *Boloria aquilonaris* is also known from two other localities and *Plebeius optilete* from less than 10 localities on Zealand.

The caterpillars of *Boloria aquilonaris* and *Plebeius optilete* feed on Cranberry (*Vaccinium oxycoccos*), while *Coenonympha tullia* feeds on sedges such as *Rhynchospora alba*, *Eriophorum vaginatum* etc.

The restoration project may cause some negative changes in the microhabitats for the species occurring in the peat or lower part of the vegetation – at least at some stages of

their life cycle. A simple monitoring is established to see the impact of water level raise on populations of the three species named above.

Table 2. Results of the habitat mapping in 10 peat pits.

Peat pit nr.	Habitat type	Potential habitat	Remarks and recommendations
20	3160	maybe	Medium sized square pit with steep and overshadowed edges. Very sparse marginal and submerged vegetation. Trees had been removed from the north-eastern edge. Further clearings are not recommended for the purpose of making a habitat suitable for <i>Graphoderus bilineatus</i>
21	3150	maybe	Small but very deep pit with more or less overshadowed steep edges. In some parts marginal vegetation dominated of <i>Phragmites australis</i> is present. Floating vegetation of <i>Potamogeton natans</i> and <i>Nymphaea alba</i> is abundant. Removal of trees in the northern and north-eastern part might have an improving effect on the habitat
22	3150	maybe	Medium sized pit with steep and overshadowed edges. Shallow areas with marginal vegetation are present. Removal of trees in the northern and north-western part might have an improving effect on the habitat
23	3150	maybe	Large pit with steep edges, seems to be very deep. Marginal vegetation is sparse. Floating vegetation of <i>Potamogeton natans</i> and <i>Nymphaea alba</i> is abundant. Removal of trees in the northern part might have an improving effect on the habitat
25	3150 ?/ 3160 ?	no	Large pit with some shallow parts along the edges and old submerged peat baulks. Marginal vegetation is dominated by <i>Phragmites australis</i> . Many ducks are fed for hunting purposes, and it seems likely that their faeces enrich the water with nutrients
26)	3150	no	Large pit with steep edges and sparse marginal vegetation. Removal of trees will probably attract more ducks to the cleared parts of the edges
29	3160	yes	Medium sized pit with some shallower parts with rich marginal vegetation and formation of quaking bog. Removal of trees in the southern (especially south-eastern) part of the pit is recommended
30	3160	yes	Large pit with steep edges. Marginal vegetation is very sparse. Submerged vegetation of <i>Fontinalis antipyretica</i> is very abundant. Removal of trees especially near small peat baulks and "coves" will probably improve the habitat quality significantly
31	3160	yes	Small pit with submerged vegetation of <i>Urticularia</i> sp. and mosses. Removal of trees will probably improve the habitat quality significantly
32	3160	no	Large pit with steep edges. Vegetation is very sparse. Removal of trees will not improve the habitat quality

3.3.1. Methods

A fixed-route walk (transect) was established at the site, and butterflies were recorded along the route under reasonable weather conditions. The method of transect routes was chosen to sample evenly the habitat types and management activity on sites. Care is taken in choosing a transect route as it must then remain fixed to enable butterfly sightings to be compared from year to year.

The transect in Holmegaards Mose is 3.4 km long, divided into 14 sections between 16 fixed points the position of which was recorded as a GPS reading in EuRef 89 UTM 32. The number of butterflies was counted for 5 minutes at each point as well as while walking from one point to another that takes approximately 10 minutes.

Only butterflies that could be identified at a species level without catching were counted. Notes on the weather conditions (e.g. sunshine, cloudy etc.) were taken.



Figure 3: Cranberry Fritillary feeding on *Cirsium palustre*.

3.3.2. Results

The rare species, *Boloria aquilonaris* and *Coenonympha tullia*, are counted in rather big numbers, although it is possible that the same individuals were recorded several times (Table 3). *B. aquilonaris* is restricted to the central part of the study area, from point 2 to 6. This is the most intact part of the raised bog, and *Coenonympha tullia* is mainly found here, but also close to the margin of the investigated area. The species may be a more active flyer than *B. aquilonaris*.

Only one individual of *Plebeius optilete* was seen which might be because the species was not on the wing at the time of survey. On the contrary Idas Blue (*Plebeius idas*) was rather abundant in some sections of the transect. This butterfly is rare on Zealand and has a red list status of near threatened, NT in Denmark.

The Oak Eggar (*Lasiocampa querqus*) was surprisingly numerous at the time of survey, especially in the central part of the bog.

The more common species (Whites, Browns and Skippers) were predominantly found close to the eastern margin (points 0, 1, 7 and 8) where they were feeding on flowering

plants. Some of the species, e.g. Meadow Brown (*Maniola jurtina*) and Ringlet (*Aphantopus hyperanthus*) probably feed on *Molinia caerulea* and sedges in the *Molinia*-dominated part of the bog.

3.3.3. Remarks

If the peat mass is able to follow the movements of the water level it is likely that the restoration project will have no negative impacts on the vegetation and butterflies populations. But if flooding of the peat takes place the most likely effect will be an increase in death rates caused by parasitic or fungal attack on the pupae or problems with hatching caused by higher humidity.

Table 3. Butterfly species recorded in the transect.

Rare species							Common species								Remarks
Point section number	Duration (min)	<i>Boloria aquilonaris</i>	<i>Coenonympha tullia</i>	<i>Plebeius idas</i>	<i>Plebeius optilete</i>	<i>Lasiocampa quercus</i>	<i>Aglais urticae</i>	<i>Pieris rapae</i>	<i>Pieris brassicae</i>	<i>Maniola jurtina</i>	<i>Aphantopus hyperanthus</i>	<i>Polyommatus icarus</i>	<i>Ochlodes sylvanus</i>	<i>Thymelicus lineola</i>	
0	5	no observations													shaddow
0-1	10							1		4	2		2		sunshine
1	5									2	1				
1-2	10	1	3							10	3		3	1	
2	5	2	1												
2-3	10	2	3	4				1							
3	5	4				1		1							
3-4	10	2	1			3	1		1						
4	5	2				11									
4-5	10	3	2			5									
5	5					7						1			
5-6	10	1				2									
6	5					1									
6-7	10			1						1					
7	5								1						
7-8	10			2						1		1	2		
8	5	no observations													cloudy
8-9	10		1			2							2	1	
9	5		1			2									
9-10	10	1				3									
10	5	no observations													sunshine
10-11	10	1	4		1										
11	5		2												
11-12	10					2									cloudy
12	5	no observations													
12-13	10		1	1		2									sunshine
13	5					1									
13-14	10	3		3					1						
14	5			1											
14-15	10		6	3								1		5	
Total number of counts		22	25	15	1	42	1	2	3	12	3	3	7	7	

4. References

- 1) By- og Landskabsstyrelsen 2010: Forslag til Natura 2000-plan 2009-2015. Holmegårds Mose Del af Natura 2000-område nr. 163. Habitatområde H145. http://www2.blst.dk/download/nyk/plannotater/163_Holmegaard.pdf
- 2) Danmarks Miljøundersøgelser, Fagdatacenter for Biodiversitet og Terrestriske Naturdata, Danmarks Miljøundersøgelser 2010: Habitatbeskrivelser, årgang 2010: Beskrivelse af danske naturtyper omfattet af habitatdirektivet (NATURA 2000 typer). http://www.dmu.dk/fileadmin/Resources/DMU/MYndighedsbetjening/FDC_bio/TeknAnvisn/Habitat-beskrivelser-app4b-ver103.pdf
- 3) Danmarks Miljøundersøgelser, Fagdatacenter for Biodiversitet og Terrestriske Naturdata, Danmarks Miljøundersøgelser 2010: Teknisk anvisning til kortlægning af levesteder for vandhulsarter (padder, guldsmede og vandkalve). http://www.dmu.dk/fileadmin/Resources/DMU/MYndighedsbetjening/FDC_bio/TeknAnvisn/TA-OP_vandhulsarter_v_1_2_DMU_27_5_01.pdf
- 4) Danmarks Miljøundersøgelser, Fagdatacenter for Biodiversitet og Terrestriske Naturdata, Danmarks Miljøundersøgelser 2004: Teknisk anvisning til overvågning af Mygblomst. http://www.dmu.dk/fileadmin/Resources/DMU/MYndighedsbetjening/FDC_bio/TeknAnvisn/TA_A33_mygblomst_v.1.0_DMU.pdf
- 5) Fugle og Natur 2010, Felthåndbogen. Lys Skivevandkalv. <http://www.fugleognatur.dk/artsbeskrivelse.asp?ArtsID=2818>
- 6) Holmen, Mogens 2010: Powerpoint til DMU fagmøde i Ebeltoft. <http://www.dmu.dk/fileadmin/Attachments/OvervKalve2010.pdf>
- 7) Naturdatabasen, Danmarks Miljøportal: www.naturdata.dk
- 8) Skov- og Naturstyrelsens hjemmeside: Naturprojekter, Holmegårds Mose http://www.skovognatur.dk/Naturprojekter/Projekter/Sjaelland/holmeg%C3%A5rds_mose/holmegaardsmose.htm
- 9) Storstrøms og Vestsjællands Amt 2006: Basisanalyse for Natura 2000-område nr. 163, Suså, Tystrup-Bavelse Sø, Slagmosen, Holmegårds Mose og Porsmose. http://www.blst.dk/NATUREN/Planforslag/126_246/163_Susaa.htm

APPENDICES

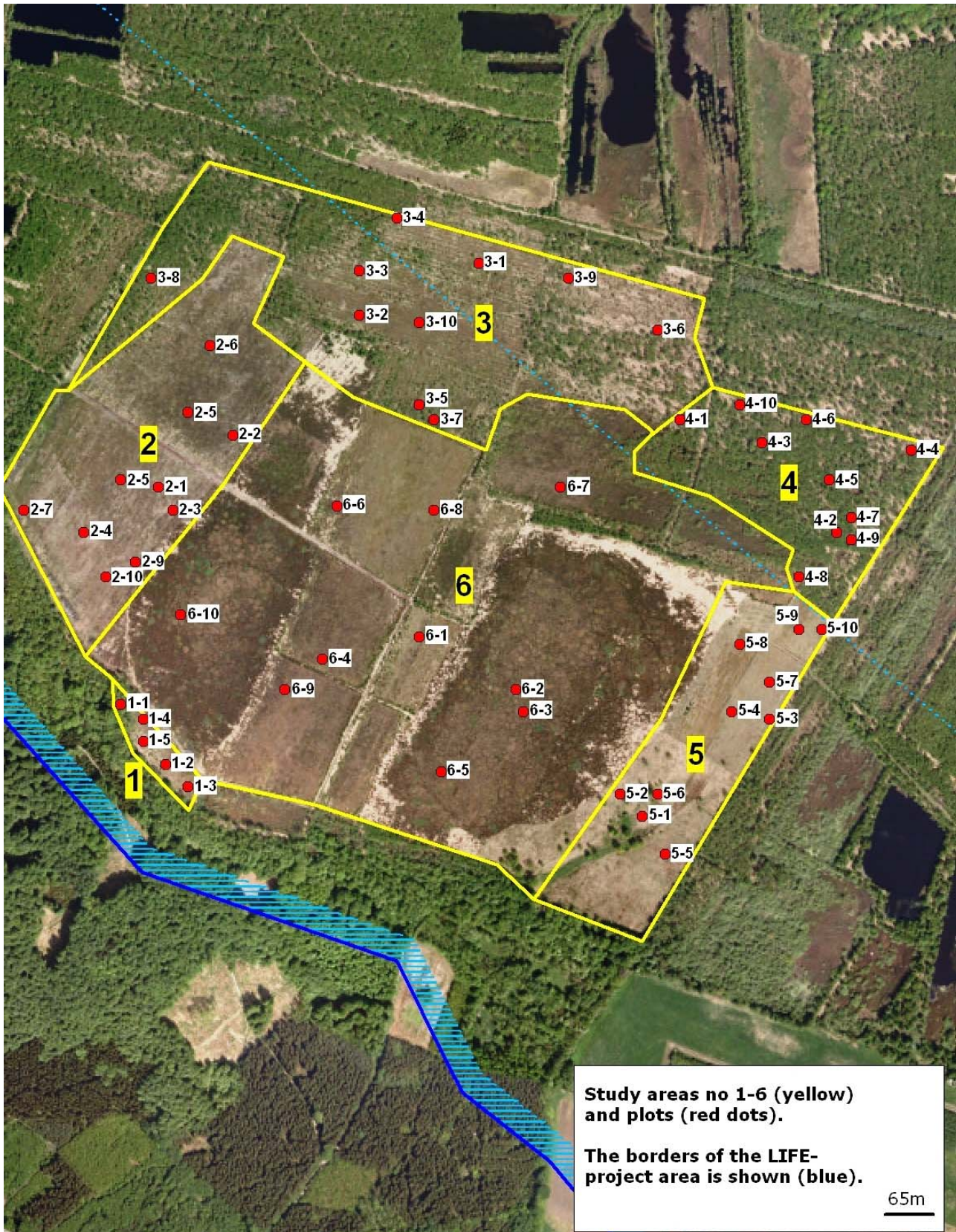
Appendix 1: Vegetation

Appendix 2: *Graphoderus bilineatus*

Appendix 3: Monitoring of butterflies

Appendix 1. Vegetation

Appendix 1.1 Map of study area no 1-6



Appendix 1.2 Map of transects no 1-2



Appendix 1.3 Study area no 1

Species	Plots				
	1	2	3	4	5
Shrubs					
Erica tetralix		1			
Trees and bushes					
Acer pseudoplatanus	1	1	1		
Fraxinus excelsior	1	1	1		1
Betula pubescens		1	1	1	1
Alnus glutinosa	D	1		1	1
Acer campestre					1
Salix repens var. argentea		1			
Salix pentandra	1	1			
Carex cinerea		1	1		1
Myrica gale		1	1	D	1
Rosa sp.					1
Sorbus aucuparia					1
Sorbus intermedia					1
Frangula alnus		1	1	1	1
Other vascular plants					
Valeriana dioica		1	1	1	1
Impatiens noli-tangere	1				
Molinia caerulea	1	1	1	D	D
Menyanthes trifoliata		1	1	1	1
Deschampsia flexuosa			1		1
Deschampsia caespitosa	1				
Succisa pratensis		1		1	
Epilobium palustre			1		
Cardamine pratensis	1		1		
Athyrium filix-femina					1
Lysimachia vulgaris	1		1	1	1
Eupatorium cannabinum		1	1	1	1
Epipactis palustris		1			
Agrostis canina			1	1	1
Agrostis stolonifera	D				
Crepis paludosa					1
Comarum palustre			1		1
Eriophorum angustifolium		1		1	
Dryopteris carthusiana	1		1	1	1
Mentha aquatica			1	1	
Solanum dulcamara	1				
Urtica dioica	1		1		
Equisetum fluviatile		1	1		1
Poa trivialis	1				
Calamagrostis canescens				1	D
Juncus articulatus					1
Juncus effusus					1
Juncus alpinoarticulatus ssp. alpinoarticulatus				1	
Mycelis muralis			1		
Galium palustre	1	1	1		1
Galium uliginosum		1	1	1	
Drosera rotundifolia		1			
Carex nigra var. nigra		1		1	1

Carex panicea		1	1		1
Carex lepidocarpa				1	
Carex appropinquata	1	1	1	1	1
Carex rostrata	1	D	1		1
Carex elata				1	1
Carex paniculata			1		
Carex lasiocarpa		1	1	1	1
Geranium robertianum	1				
Peucedanum palustre		1	1	1	1
Lycopus europaeus	1		1	1	1
Phragmites australis		D	D		
Cirsium palustre	1	1	1	1	1
Cirsium oleraceum		1			
Potentilla erecta		1		1	1
Vaccinium oxycoccos		1			
Triglochin palustris				1	
Mosses and lichens					
Aulacomnium palustre		1		1	
Brachythecium rutabulum	1		1	1	
Calliergon giganteum		1	1	1	1
Calliergonella cuspidata	1	D	1	1	1
Campylium elodes				1	
Campylium protensum		1			1
Campylium stellatum				1	
Fontinalis antipyretica				1	
Hypnum cupressiforme					1
Limprichtia cossonii		1		1	
Mnium hornum	1		1		1
Plagiomnium elatum	1	D	1	1	1
Plagiomnium ellipticum				1	
Plagiomnium undulatum	1				
Scleropodium purum		1			1
Sphagnum palustre		1	1		1
Sphagnum squarrosum					1
Sphagnum subnitens			1	1	
Chiloscyphus sp.		1			
Pellia sp.				1	
Structural parameters					
Peat mosses, m ²	0	2	2	0,2	0,5
Molinia caerulea, m ²	0,1	10	1	40	30
Campylopus introflexus, m ²	0	0	0	0	0
Birch, m ²	0	3	6	2	5
Hummocks / pools, m ²	0/0	0/0	0/0	0/0	0/0
Amount of wear and tear, m ²	0	0	0	0	0
Open water surface, %	0	0	0	0	0
Shrubs, %	0	<1	0	0	<1
Trees / bushes < 1m tall, %	2	25	30	30	20
Trees / bushes > 1m tall, %	100	2	7	20	10

1: presence, D:dominans

Appendix 1.4 Study area no 2

Species	Plots									
	1	2	3	4	5	6	7	8	9	10
Shrubs										
Anromeda polyfolia			1		1				1	
Calluna vulgaris	1	1	1	1	1	1	1	D	1	1
Empetrum nigrum	1	1	1	1	1	1		1	1	D
Erica tetralix	1	1	1	1	1	1		1	1	D
Vaccinium oxycoccus	1	1	1	1	1	1		1	1	1
Vaccinium uliginosum	1	1	1	1					1	
Trees and bushes										
Betula pubescens	1	1	1	1	1	1	1	1	1	1
Frangula alnus				1			1			
Myrica gale							1			
Quercus rubra							1			
Salix aurita							1			
Sorbus aucuparia				1						
Other vascular plants										
Agrostis canina							1			
Carex elata							1			
Carex lasiocarpa							1			
Carex nigra var. nigra							1			
Carex panicea							1			
Carex viridula var. pulchella							1			
Comarum palustre							1			
Deschampsia caespitosa							1			
Drosera rotundifolia						1				
Dryopteris carthusiana					1					
Dryopteris sp.							1			
Epilobium angustifolium				1			1			1
Eriophorum angustifolium	1	1	1		1	1		1	1	1
Eriophorum vaginatum	1	1	1	1	1	1		1	D	1
Juncus effusus										
Molinia caerulea	1	1	D	D	1	1	1	1	D	1
Paucedanum palustre							1			
Potentilla erecta							1			
Rumex acetosella				1						
Mosses and lichens										
Aulacomnium androgynum			1							
Aulacomnium palustre	1	1	1	1	1			1	1	
Brachythecium mildeanum							1			
Brachythecium rutabulum				1						
Calliergonella cuspidata							1			
Campylopus introflexus	1		1	1	1	1			1	1
Campylopus pyriformis	1	1	1	1	1	1	1		1	1
Cephalozia sp.		1	1		1					
Chiloscyphus sp.							1			
Cladonia sp.	1		1			1		1		
Dicranum polysetum				1				1		
Dicranum scoparium		1						1		
Hypnum cupressiforme	1	1	1	1	1	1	1	1	1	1
Leucobryum glaucum				1	1		1	1	1	

Mnium hornum					1		1			
Odontoschisma sphagni						1				
Pleurozium schreberi		1		1				1		
Pohlia nutans				1	1	1	1		1	1
Polytrichastrum longisetum	1		1	1	1	1	1		1	1
Polytrichum strictum			1							
Scleropodium purum				1						
Sphagnum contortum							1			
Sphagnum cuspidatum		1	1			1		1	1	
Sphagnum fallax	1	1	1		1	1		1	1	
Sphagnum fimbriatum	1	1	1	1	1	1	1	1	1	
Sphagnum magellanicum	1	1				1				1
Sphagnum palustre	1	1	1	1	1	1	1	1	1	
Sphagnum papillosum			1							
Sphagnum rubellum	1	1	1			1		1	1	1
Sphagnum russowii			1							
Sphagnum sect. Acutifolia						1				
Sphagnum subnitens	1	1		1	1	1	1	1	1	
Tetraphis pellucida							1			
Structural parameters										
Peat mosses, m ²	4	5	5	0,6	5,5	65	0,7	30	2	0,4
Molinia caerulea, m ²	30	30	60	60	40	0,5	65	0,5	60	1
Campylopus introflexus, m ²	1	0	0,2	2,5	0,2	0,5	0	0	1	5
Birch, m ²	5	20	0,5	6	10	6	0,5	15	4	10
Hummocks / pools, m ²	0/0	0/0	0/0	0/0	0/0	0/0	0/0	77/1	0/0	0/0
Amount of wear and tear, m ²	0	0	0	0	0	0	0	0	0	0
Open water surface, %	0	0	0	0	0	0	0	0	0	0
Shrubs, %	60	80	40	25	50	80	<1	80	70	80
Trees / bushes < 1m tall, %	10	20	5	10	10	30	15	20	10	15
Trees / bushes > 1m tall, %	<1	5	0	0	<1	1	1	10	0	0

Appendix 1.5 Study area no 3

Species	Plots									
	1	2	3	4	5	6	7	8	9	10
Shrubs										
<i>Andomeda polyfolia</i>								1		1
<i>Calluna vulgaris</i>	D	1	1		1					1
<i>Empetrum nigrum</i>	1	1	1		1					
<i>Erica tetralix</i>	1	1	1	1	1			1		1
<i>Vaccinium oxycoccos</i>	1	1	1	1	1			1		1
<i>Vaccinium uliginosum</i>			1		1					
Trees and bushes										
<i>Betula pubescens</i>	1	1	D	D	D	1	D	D	1	1
<i>Alnus glutinosa</i>								1		
<i>Carex aurita</i>			1							
<i>Carex cinerea</i>					1		1			
<i>Frangula alnus</i>				1		1		1		
<i>Myrica gale</i>	1	1	1	D		1		D	1	1
<i>Quercus robur</i>								1		
Other vascular plants										
<i>Molinia caerulea</i>	1	1	D	D	1	1	1	D	1	1
<i>Carex echinata</i>			1				1			
<i>Carex lasiocarpa</i>	D		1					1		
<i>Carex nigra</i> var. <i>nigra</i>	1		1				1			1
<i>Carex rostrata</i>		1			1		D			1
<i>Drosera intermedia</i>										1
<i>Drosera rotundifolia</i>	1	1	1		1		1	1		1
<i>Eriophorum angustifolium</i>	1	1	1		1		1	1		D
<i>Eriophorum vaginatum</i>	1	1	1		1		1			1
<i>Lysimachia thyrsoiflora</i>							1			
<i>Menyanthes trifoliata</i>	1	1	1	1				1		1
<i>Phragmites australis</i>				1						
<i>Potentilla erecta</i>	1									
<i>Rhynchospora alba</i>										1
Mosses and lichens										
<i>Aulacomnium palustre</i>	1	1	1		1		1			1
<i>Campylopus pyriformis</i>								1		
<i>Cephalozia</i> sp.		1								
<i>Chiloscyphus</i> sp.	1									
<i>Dicranum polysetum</i>	1									
<i>Hypnum cupressiforme</i>	1	1				1	1	1		
<i>Leucobryum glaucum</i>	1					1		1		
<i>Mnium hornum</i>						1	1			
<i>Pleurozium schreberi</i>					1					
<i>Polytrichum strictum</i>	1									
<i>Sphagnum denticulatum</i>			1							1
<i>Sphagnum fallax</i>	1	1	1	1	1		1	1		1
<i>Sphagnum fimbriatum</i>	1	1	1	1	1	1	1	1	1	1
<i>Sphagnum flexuosum</i>					1					
<i>Sphagnum inundatum</i>		1								
<i>Sphagnum magellanicum</i>	1									
<i>Sphagnum palustre</i>	1	1	1	1	1	1	1	1	1	1
<i>Sphagnum papillosum</i>	1		1	1				1		

Sphagnum rubellum		1	1		1			1		1
Sphagnum russowii		1								
Sphagnum sect. Acutifolia				1						
Sphagnum squarrosum							1			
Sphagnum subnitens	D	1	1		1	1	1	1		1
Warnstorfia fluitans				1						
Structural parameters										
Peat mosses, m ²	65	70	60	5	75	1	75	70	1	75
Molinia caerulea, m ²	6	5	70	50	12	15	5	70	2	0,2
Campylopus introflexus, m ²	0	0	0	0	0	0	0	0	0	0
Birch, m ²	10	6	65	35	65	4	65	75	40	2
Hummocks / pools, m ²	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
Amount of wear and tear, m ²	0	0	0	0	0	0	0	0	0	0
Open water surface, %	<1	0	0	0	0	0	0	0	1	0
Shrubs, %	70	50	30	10	10	0	3	2	0	50
Trees / bushes < 1m tall, %	40	30	10	5	3	10	1	5	5	20
Trees / bushes > 1m tall, %	70	10	70	70	70	20	70	90	40	1

Appendix 1.6 Study area no 4

Species	Plots									
	1	2	3	4	5	6	7	8	9	10
Shrubs										
Andromeda polyfolia		1								
Calluna vulgaris				1		1		D		
Empetrum nigrum	1	1	1	1	1	1	1	1	1	
Erica tetralix	1	1						1		
Vaccinium oxycoccus		1						1		
Vaccinium vitis-idaea							1			
Trees and bushes										
Betula pubescens	1	1		1	1	D	1	1		D
Frangula alnus		1		1					1	
Myrica gale	D		D	D		D				D
Quercus robur							1			
Salix aurita			1							1
Other vascular plants										
Carex nigra var. nigra	1									
Eriophorum angustifolium								D		
Eriophorum vaginatum		1			1		1	1		
Molinia caerulea	D	D	D	D	1	D	D	1	D	D
Rhynchospora alba								1		
Mosses and lichens										
Aulacomnium androgynum		1					1		1	1
Aulacomnium palustre	1	1						1		
Brachythecium rutabulum		1								
Campylopus introflexus	1	1			1		1		1	
Campylopus pyriformis									1	
Dicranum scoparium		1			1		1		1	1
Herzogiella seligeri									1	
Hypnum cupressiforme		1	1	1	1	1	1	1	1	1
Leucobryum glaucum			1		1	1	1		1	
Mnium hornum	1								1	
Orthodontium lineare							1			1
Plagiothecium curvifolium		1			1		1		1	
Pleurozium schreberi		1	1	1	1	1	1			
Pohlia nutans										1
Polytrichastrum longisetum	1				1		1			
Sphagnum cuspidatum								D		
Sphagnum fallax	1							1		
Sphagnum fimbriatum	1	1						1		
Sphagnum palustre	1	1						1		
Sphagnum russowii		1						1		
Sphagnum subnitens	1									
Cephalozia sp.								1		
Cladonia sp.	1				1					
Structural parameters										
Peat mosses, m ²	3	0,6	0	0	0	0	0	75	0	0
Molinia caerulea, m ²	75	77	77	77	30	78	70	10	77	78
Campylopus introflexus, m ²	0,2	0,01	0	0	0,2	0	0,01	0	0,1	0
Birch, m ²	0,1	2	2	1	0,01	60	0,01	2	0	70
Hummocks / pools, m ²	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0

Amount of wear and tear, m ²	0	0	0	0	0	0	0	0	0	0
Open water surface, %	0	0	0	0	0	0	0	<1	0	0
Shrubs, %	5	<1	3	<1	5	10	1	40	<1	0
Trees / bushes < 1m tall, %	20	<1	20	30	<1	30	<1	30	<1	10
Trees / bushes > 1m tall, %	70	10	50	20	2	70	1	20	0	80

Appendix 1.7 Study area no 5

Species	Plots									
	1	2	3	4	5	6	7	8	9	10
Shrubs										
<i>Andromeda polyfolia</i>									1	
<i>Calluna vulgaris</i>			1	1			1		1	1
<i>Empetrum nigrum</i>									1	1
<i>Erica tetralix</i>			1	1			1	1	1	1
<i>Vaccinium oxycoccus</i>				1			1	1	1	
<i>Vaccinium uliginosum</i>									1	1
Trees and bushes										
<i>Betula pubescens</i>	1	1	1	1			1		1	1
<i>Frangula alnus</i>			1							1
<i>Quercus robur</i>			1			1				
<i>Salix aurita</i>									1	
<i>Salix sp.</i>					1					
<i>Sorbus aucuparia</i>						1				1
Other vascular plants										
<i>Agrostis canina</i>	1				1					
<i>Agrostis capillaris</i>	1					1				
<i>Anthoxanthum odoratum</i>	1									
<i>Anthriscus sylvestris</i>	1									
<i>Calamagrostis canescens</i>					1					
<i>Carex lasiocarpa</i>					1					
<i>Carex nigra var. nigra</i>								1		
<i>Carex panicea</i>	1				1					
<i>Carex pilulifera</i>		1	1	1						
<i>Carex rostrata</i>					1					
<i>Carex viridula var. pulchella</i>					1					
<i>Cerastium fontanum ssp. vulgare</i>	1									
<i>Cirsium palustre</i>	1									
<i>Comarum palustre</i>								1		
<i>Deschampsia caespitosa</i>	1				1	1				
<i>Deschampsia flexuosa</i>	1	D	1	1		1				1
<i>Drosera rotundifolia</i>								1		
<i>Dryopteris sp.</i>			1				1			
<i>Dryopteris carthusiana</i>	1	1				1				
<i>Epilobium angustifolium</i>				1						
<i>Equisetum palustre</i>	1				1					
<i>Eriophorum angustifolium</i>							1	D		1
<i>Eriophorum vaginatum</i>								1		
<i>Galium palustre</i>					1					
<i>Galium uliginosum</i>	1				1					
<i>Holcus lanatus</i>	1				1					
<i>Juncus articulatus</i>	1				1					
<i>Juncus effusus</i>	1					1				
<i>Luzula multiflora</i>	1	1				1				
<i>Moehringia trinervia</i>						1				
<i>Molinia caerulea</i>	D	D	D	D	D	D	D	D	D	D
<i>Oxalis acetosella</i>	1									
<i>Potentilla erecta</i>				1	1					
<i>Rubus ideaus</i>		1								1

Rumex acetosella	1	1				1				
Stellaria graminea	1	1				1				
Taraxacum sp.					1					
Urtica dioica	1									
Veronica chamaedris	1									
Viola sp.	1				1					
Mosses and lichens										
Aulacomnium androgynum	1		1	1	1	1	1	1		
Aulacomnium palustre							1	1		
Brachythecium rutabulum	1									
Bryum pseudotriquetrum					1					
Calliergonella cuspidata	1				1					
Campylium protensum					1					
Campylium stellatum					1					
Campylopus introflexus	1	1	1	1	1	1	1	1	1	1
Campylopus pyriformis			1		1			1	1	1
Cephalozia sp.								1		
Cladonia sp.	1	1	1	1	1	1	1		1	1
Dicranum scoparium	1	1	1			1				
Eurhynchium striatum	1									
Fissidens adianthoides					1					
Hypnum cupressiforme	1	1	1	1	1	1	1		1	1
Leucobryum glaucum			1	1			1			1
Plagiomnium affine	1									
Pleurozium schreberi									1	
Pohlia nutans								1		
Polytrichastrum formosum	1									
Polytrichastrum longisetum		1	1	1	1		1	1		1
Scleropodium purum	1									
Sphagnum fallax								1		
Sphagnum fimbriatum							1		1	
Sphagnum palustre				1			1	1	1	
Sphagnum russowii									1	
Sphagnum subnitens				1					1	
Sphagnum sect. Acutifolia								1		
Straminergon stramineum								1		
Structural parameters										
Peat mosses, m ²	0	0	0	1	0	0	0,5	70	2,5	0
Molinia caerulea, m ²	60	40	75	73	60	65	75	35	75	75
Campylopus introflexus, m ²	0,3	1	2	1	0,2	0,5	0,5	0,1	0,1	1,5
Birch, m ²	0,01	0,01	0,5	0,1	0	0	0,01	0	40	30
Hummocks / pools, m ²	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
Amount of wear and tear, m ²	0	0,5	1	0,5	0	0	0	0	0	0
Open water surface, %	0	0	0	<1	0	0	0	1	0	0
Shrubs, %	0	<1	1	1	0	0	1	10	30	30
Trees / bushes < 1m tall, %	<1	<1	<1	<1	<1	0	<1	0	30	40
Trees / bushes > 1m tall, %	2	7	<1	0	0	40	0	0	30	30

Appendix 1.8 Study area no 6

Species	Shrubs	Plots									
		1	2	3	4	5	6	7	8	9	10
<i>Andromeda polyfolia</i>		1	1	1	1	1			1		1
<i>Calluna vulgaris</i>		1	D	D	1	D	D	D	1	D	D
<i>Empetrum nigrum</i>		1	1	1	1	1	1	1		1	1
<i>Erica tetralix</i>		1	1	1	D	1	1	1	1	1	1
<i>Vaccinium oxycoccus</i>		1	1	1	1	1	1	1	1	1	1
<i>Vaccinium uliginosum</i>		1	1				1				
Trees and shrubs											
<i>Betula pubescens</i>		1			1	1	1	1	1	1	1
Other vascular plants											
<i>Comarum palustre</i>								1			
<i>Drosera intermedia</i>				1							
<i>Drosera rotundifolia</i>			1	1		1		1	1	1	1
<i>Eriophorum angustifolium</i>			1	1	1	1	1	1	1	1	1
<i>Eriophorum vaginatum</i>		D	D	1	D	1	1	D	D	1	1
<i>Molinia caerulea</i>					1		1	1			
<i>Potentilla erecta</i>								1			
<i>Rhynchospora alba</i>			1	1							1
Mosses and lichens											
<i>Aulacomnium palustre</i>		1	1	1	1	1		1		1	1
<i>Cephalozia</i> sp.				1		1					
<i>Cladina</i> sp.				1		1					
<i>Hypnum cupressiforme</i>		1	1	1	1	1	1	1		1	1
<i>Leucobryum glaucum</i>								1			
<i>Mylia anomala</i>				1							
<i>Pleurozium schreberi</i>			1	1		1					1
<i>Sphagnum angustifolium</i>							1				
<i>Sphagnum cuspidatum</i>		1	1	1		1	1	1	1	1	1
<i>Sphagnum fallax</i>		1	1	1	1	1	1	1	1	D	1
<i>Sphagnum fimbriatum</i>			1	1	1		1	1			
<i>Sphagnum fuscum</i>									1		
<i>Sphagnum magellanicum</i>		1		1	1	D	1	1	1	1	
<i>Sphagnum palustre</i>					1		1		1		
<i>Sphagnum papillosum</i>							1	1	1	1	
<i>Sphagnum rubellum</i>		1	1	1	1	1	1	1	1	1	1
<i>Sphagnum subnitens</i>							1				
<i>Sphagnum tenellum</i>						1					
Structural parameters											
Peat mosses, m ²		50	25	40	60	65	35	60	70	50	40
<i>Molinia caerulea</i> , m ²		0	0	0	0,01	0	4	0,01	0	0	0
<i>Campylopus introflexus</i> , m ²		0	0	0	0	0	0	0	0	0	0
Birch, m ²		3	0	0	8	0,01	5	2	12	7	0,1
Hummocks / pools, m ²		0 / 0	76 / 2	75 / 3	0 / 0	77 / 1	0 / 0	0 / 0	0 / 0	0 / 0	65 / 15
Amount of wear and tear, m ²		0	0	0	0	0	0	0	0	0	0
Open water surface, %		0	<1	<1	0	0	0	0	<1	0	<1
Shrubs, %		40	90	90	70	90	80	80	20	60	70
Trees / bushes < 1m tall, %		20	0	0	15	<1	10	10	25	10	<1
Trees / bushes > 1m tall, %		0	0	0	0	0	0	0	0	0	0

Appendix 1.9 Transect no 1

Species	Plots																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Shrubs																					
<i>Calluna vulgaris</i>			1	D	1	1	1	1		1	1		1	D		1	1	1	1	1	
<i>Empetrum nigrum</i>								1			1	1	1	1	1	1	1				
<i>Erica tetralix</i>			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
<i>Vaccinium oxycoccos</i>				1	1						1			1	1	D	1				
<i>Vaccinium uliginosum</i>									1												
Trees and bushes																					
<i>Betula pubescens</i>	1	D	D	D	D	D	1	D	D	D	D	D	D	D	1	1	1	D	D	1	D
<i>Frangula alnus</i>	D	1		1				1			1	1			1			1	1	D	
<i>Myrica gale</i>			1	1	D	1	1														
<i>Picea sitchensis</i>																	1				
<i>Quercus robur</i>		1	1									1	1								
<i>Rubus fruticosus coll.</i>																		1			1
<i>Salix cinerea</i>	1						1	1	1		1	1	1		1	1	1				1
<i>Salix repens var. repens</i>														1							
<i>Sorbus aucuparia</i>	1	1											1								
Other vascular plants																					
<i>Calamagrostis canescens</i>	1																1				
<i>Carex rostrata</i>															1	1	1				
<i>Deschampsia flexuosa</i>	1	1															1	1		1	1
<i>Drosera rotundifolia</i>																	1				
<i>Dryopteris carthusiana</i>	1																			1	1
<i>Eriophorum angustifolium</i>			1	1				1		1	1	1	1	1	1	D	1				
<i>Eriophorum vaginatum</i>			1	1	1	1				1	1			1	1	1					
<i>Molinia caerulea</i>	D	D	D	1	D	D	D	D	D	D	D	D	D	1	D	1	D	D	D	D	D
<i>Potentilla erecta</i>							1	1													
Mosses and lichens																					
<i>Aulacomnium androgynum</i>	1	1				1	1											1	1	1	1
<i>Aulacomnium palustre</i>				1	1						1		1	1	1	1	1		1		
<i>Brachythecium rutabulum</i>	1										1							1			
<i>Campylopus flexuosus</i>		1																			
<i>Campylopus introflexus</i>	1														1		1	1			1
<i>Campylopus pyriformis</i>			1		1								1						1		1
<i>Cephalozia sp.</i>		1																			
<i>Cladonia sp.</i>	1	1				1											1	1	1	1	1
<i>Dicranum bonjeanii</i>										1				1							
<i>Dicranum polysetum</i>				1											1		1				
<i>Dicranum scoparium</i>	1	1	1				1					1	1				1	1	1	1	1
<i>Eurhynchium striatum</i>		1																			
<i>Herzogiella seligeri</i>																			1		1
<i>Hypnum cupressiforme</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1
<i>Leucobryum glaucum</i>		1	1	1	1	1	1						1	1					1		

Mnium hornum		1																1			1
Orthodontium lineare		1												1				1			
Plagiothecium curvifolium	1																		1		1
Plagiothecium latebricola	1																				
Pleurozium schreberi			1	1		1		1		1	1			1	1		1			1	
Pohlia nutans	1	1																1			1
Polytrichastrum formosum	1																	1			
Polytrichastrum longisetum																		1			1
Scleopodium purum	1	1																1			
Sphagnum capillifolium										1			1	1	1						
Sphagnum cuspidatum																		1			
Sphagnum fallax					1									1	1	1					
Sphagnum fimbriatum		1	1				1					1			1	1	1		1		
Sphagnum flexuosum														1		1					
Sphagnum magellanicum										1				1							
Sphagnum majus																		1			
Sphagnum palustre		1	1			1		1	1		1	1	1		1		1		1		
Sphagnum rubellum			1	1			1							1					1		
Sphagnum russowii														1	1		1				
Sphagnum sect. Acutifolia							1														
Sphagnum squarrosum																		1			
Sphagnum subnitens					1																
Tetraphis pellucida		1	1																		1
Structural parameters																					
Peat mosses, m ²	0	0,3	1	0,1	0,3	0	0,3	0,1	0,1	0,1	0,2	0,5	0,1	0,2	3,5	70	35	0	0,3	0	0
Molinia caerulea, m ²	75	75	65	40	77	78	78	76	78	76	75	77	76	5	70	4	40	76	75	70	70
Campylopus introflexus, m ²	1	1	0	0	0	0	0	0	0	0	0	0	0	0,01	0	0,1	0,01	0	0	0	0,05
Birch, m ²	4	75	75	60	50	60	40	50	60	70	65	70	60	60	60	3	4	77	77	20	60
Hummocks / pools, m ²	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Amount of wear and tear, m ²	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open water surface, %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrubs, %	0	<1	1	40	10	1	2	2	1	5	2	1	4	60	7	35	30	1	<1	<1	0
Trees/bushes< 1m tall, %	<1	2	<1	20	50	25	30	<1	<1	<1	1	<1	<1	1	10	5	8	<1	<1	<1	1
Trees/ bushes >1m tall, %	80	90	90	60	70	60	55	70	75	70	80	90	75	70	50	25	40	90	98	80	80

Appendix 1.10 Transect no 2

Species	Plots															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Shrubs																
<i>Calluna vulgaris</i>	1		1	1	1	1	1	1	1	1	1					1
<i>Empetrum nigrum</i>	1		1	1	D	D	D	1	1	1	1	1	1	1		
<i>Erica tetralix</i>			1	1	1	1	1	1	1	1	1			1		
<i>Vaccinium oxycoccos</i>		1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<i>Betula pubescens</i>	1	1	D	D	D	D	D	1	1	1				D	D	1
<i>Myrica gale</i>																1
Trees and bushes																
<i>Picea abies</i>	1															
<i>Salix cinerea</i>																1
Other vascular plants																
<i>Carex paniculata</i>																1
<i>Deschampsia flexuosa</i>																1
<i>Dryopteris carthusiana</i>												1				
<i>Eriophorum angustifolium</i>	1				1	1	1							1		
<i>Eriophorum vaginatum</i>	1	1	D	D	D	D	D	1	1	D	1	1	1	D	1	1
<i>Molinia caerulea</i>	1	1	D		1	1					1	1	1	1	D	D
Mosses and lichens																
<i>Aulacomnium androgynum</i>														1		1
<i>Aulacomnium palustre</i>		1	1	1	1	1	1	1		1		1	1	1	1	1
<i>Calliergonella cuspidata</i>																1
<i>Calyptogeia</i> sp.						1		1								
<i>Campylopus introflexus</i>	1							1						1		
<i>Cephalozia</i> sp.							1	1						1		
<i>Cladonia</i> sp.	1				1		1	1						1		
<i>Dicranum polysetum</i>			1													
<i>Dicranum scoparium</i>	1		1	1				1					1	1	1	1
<i>Hypnum cupressiforme</i>			1	1	1	1	1		1			1	1		1	1
<i>Mnium hornum</i>																1
<i>Orthodontium lineare</i>			1											1		
<i>Plagiothecium curvifolium</i>						1										
<i>Pleurozium schreberi</i>		1	1	1	1	1	1	1	1	1	1		1			1
<i>Pohlia nutans</i>														1		1
<i>Polytrichum strictum</i>															1	
<i>Screopodium purum</i>												1				
<i>Sphagnum angustifolium</i>				1	1	1	1				1		1	1	1	
<i>Sphagnum capillifolium</i>				1												
<i>Sphagnum fallax</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Sphagnum fimbriatum</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Sphagnum magellanicum</i>							1	1							1	
<i>Sphagnum palustre</i>		1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<i>Sphagnum rubellum</i>				1		1				1					1	
<i>Sphagnum russowii</i>				1	1	1					1			1	1	

Sphagnum sect. Acutifolia			1											1		
Tetraphis pellucida														1	1	
Structural parameters																
Pear mosses, m ²	0,4	3	20	25	3	3	40	30	7	15	25	3	2	30	4	0,4
Molinia caerulea, m ²	4	0,05	35	0	0,1	1,5	0	0	0	0	0,1	0,1	2	6	60	30
Campylopus introflexus, m ²	1,5	0	0	0	0	0	0	0,01	0	0	0	0	0	0,01	0	0
Birch, m ²	2	0,05	70	70	60	60	50	30	1	15	0	0	0	76	76	10
Hummocks / pools, m ²	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Amount of wear and tear, m ²	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open water surface, %	0	0	0	0	0	0	0	0	<1	0	<1	0	0	0	0	50
Shrubs, %	10	1	40	60	85	90	80	75	40	40	30	3	<1	15	<1	10
Trees / bushes < 1m tall, %	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	0	<1	<1	10
Trees - bushes >1m tall, %	20	0	70	80	80	85	70	40	20	40	1	0	0	80	90	30

Appendix 2. A water beetle *Graphoderus bilineatus*

Appendix 2.1 Map of potential habitats for *Graphoderus bilineatus*

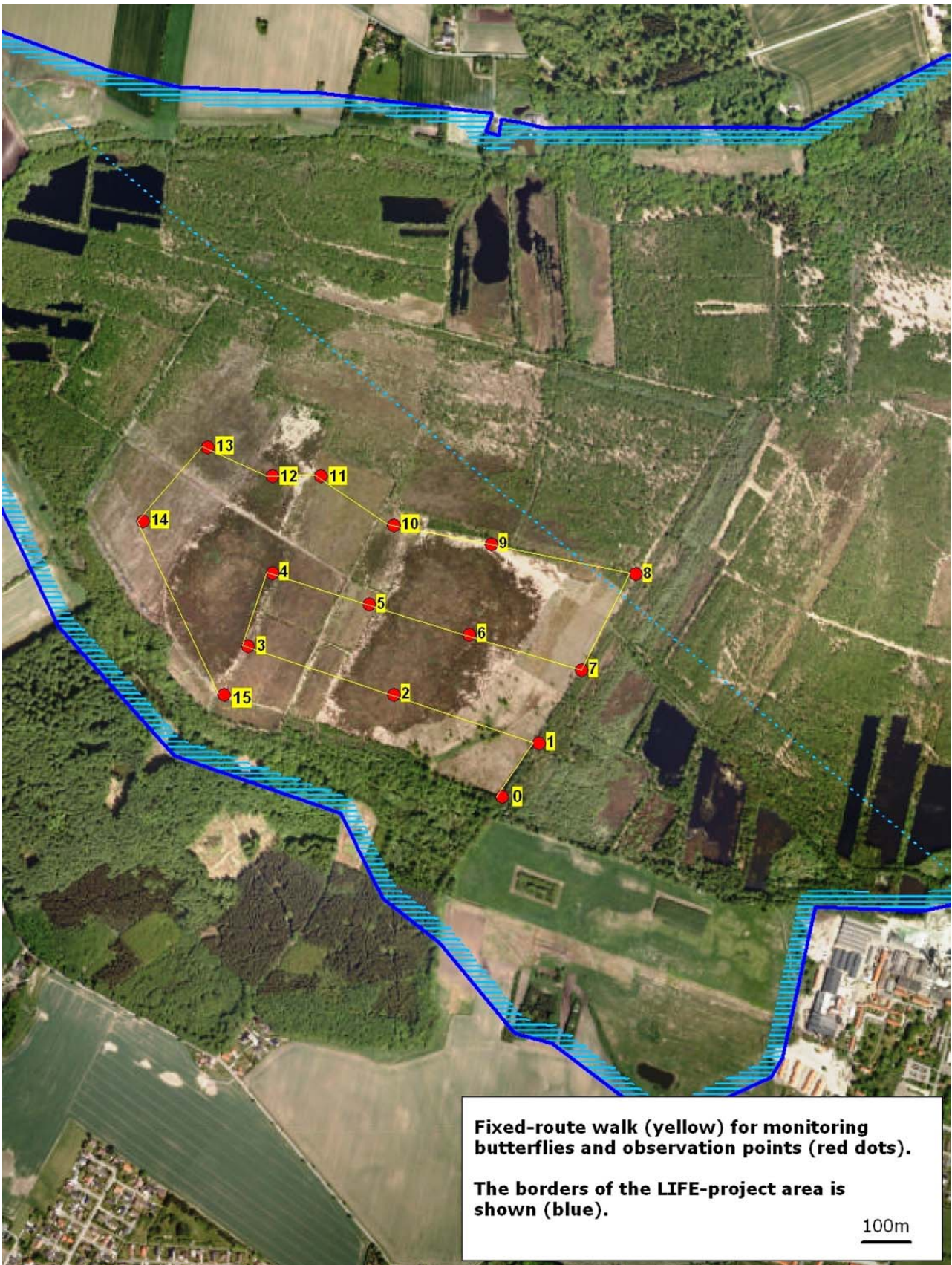


Appendix 2.2 Vegetation of potential habitats for *Graphoderus bilineatus*

	Habitat NO									
	20	21	22	25	26	27	29	30	31	32
Submerged and florating vegetation										
<i>Myriophyllum spicatum</i>				X						
<i>Calliergon coordifolium</i>	X	X			X				X	
<i>Ceratophyllum demersum</i>				X						
<i>Fontinalis antipyretica</i>		X	X	X	X	X	X	X	X	
<i>Lemna minor</i>		X	X			X				
<i>Lemna triscula</i>					X					
<i>Nymphaea alba</i>		X				X				
<i>Potamogeton natans</i>		X				X				
<i>Utricularia</i> sp.									X	
Marginal vegetation										
<i>Agrostis canina</i>				X	X			X	X	
<i>Agrostis stolonifera</i>		X				X				
<i>Alnus glutinosa</i>		X		X	X					
<i>Betula pendula</i>		X				X				
<i>Betula pubescens</i>	X	X	X	X		X	X	X	X	X
<i>Calamagrostis canescens</i>	X		X							
<i>Calliergon coordifolium</i>						X	X			
<i>Calliergonella cuspidata</i>	X			X		X	X	X		
<i>Calluna vulgaris</i>										X
<i>Campylium polygamum</i>								X		
<i>Carex acuta</i>		X		X						
<i>Carex elata</i>							X	X	X	X
<i>Carex lasiocarpa</i>							X			
<i>Carex nigra</i> ssp. <i>nigra</i>	X	X				X				X
<i>Carex paniculata</i>	X	X	X	X	X	X				
<i>Carex pseudocyperus</i>		X		X	X		X	X		
<i>Carex rostrata</i>	X	X	X	X		X	X	X	X	X
<i>Cicuta virosa</i>								X		
<i>Cladium masriscus</i>			X							
<i>Erica tetralix</i>							X	X	X	X
<i>Eriophorum angustifolium</i>		X	X						X	X
<i>Frangula alnus</i>				X		X				
<i>Hypnum cupressiforme</i>								X	X	
<i>Juncus effusus</i>							X	X		X
<i>Leucobryum glaucum</i>								X		X
<i>Lycopus europaeus</i>		X			X					
<i>Lysimachia thyrsoiflora</i>	X	X				X		X	X	
<i>Molinia caerulea</i>	X	X	X	X	X	X		X	X	X
<i>Myrica gale</i>	X		X			X	X		X	
<i>Phragmites australis</i>		X	X	X	X	X	X			
<i>Salix aurita</i>			X			X	X			X

Salix cinerea ssp. cinerea		X			X	X	X			X
Scirpus lacustris						X				
Scutellaria galericulata		X								
Sorbus aucuparia				X						
Sphagnum cuspidatum							X			
Sphagnum fallax	X									
Sphagnum fimbriatum	X						X	X		
Sphagnum palustre	X						X	X		
Sphagnum subnitens	X						X	X		
Thelypteris palustris							X	X		
Thypha angustifolia			X	X	X		X			
Thypha latifolia	X	X		X	X	X	X	X		

Appendix 3. Map of fixed-route walk for monitoring butterflies



Appendix 4. Panorama photos



Panorama photo of plot no 1-7, transect 1.

The photos should be seen from left to right and from top to bottom. The panorama is taken clockwise with the first picture towards north. .







N







Panorama photo of plot no 4-2, study area 4.