



MONITORING THE VEGETATION RECOVERY IN ØSTERILD PLANTAGE 2015

Part 2

Technical Report from DCE – Danish Centre for Environment and Energy

No. 73

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Data sheet

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Abstract:	The trees in a part of Østerild Plantage have been cut down to give room for a national test center. Before the afforestation, DCE performed a baseline monitoring in the summer of 2011. In the summer 2015, DCE re-monitored the recovery of the vegetation cover in the northernmost part of the afforested area that was covered by plantation of <i>Pinus mugo</i> . The results from the re-monitoring are presented in the report.
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Summary

The overall objective of the monitoring program in Østerild is to document the succession of the vegetation cover as an outcome of the restoration project targeting open dune habitats following the clear-cutting of parts of the dune plantations at the National Test Centre facility. The first phase of the monitoring program, performed in July, 2011, included recording plant species composition and soil conditions prior to the clearing of the dune plantations (the baseline monitoring).

Sample areas and plots for the baseline monitoring were established in 2011 in a stratified random way in order to cover the variation in the development of the vegetation and the restoration measure that was described in the implementation plan. Stratification was applied according to the baseline condition (forest type), planned post-cutting treatments of litter layer, and the hydrology, the expected management regimes, the distance to appropriate seed sources, and the topography in the deforested area.

During the first 10 years following the clear-cutting, systematic monitoring of the vegetation cover to follow the succession towards open dune habitat types (post-construction monitoring) has been planned. The results of the monitoring program will, as far as possible, contribute to the recommendations for future restoration projects, which aim to convert plantations of especially conifer trees in dune areas into light open habitats that have previously prevailed in the areas.

In 2015, the third monitoring phase was initiated. The results of the third phase are presented in the report. The third phase was performed by re-monitoring the vegetation cover in the dune area formerly dominated by *Pinus mugo*. The 2011 monitoring methodology was repeated (Nygaard et al. 2011). The method is based on the variables in the Danish NOVANA program for terrestrial habitats (Fredshavn et al. 2015). The plant species composition and vegetation structure were recorded in a pin point frame (0.5 * 0.5 m²). Additional species were recorded in a documentation circle with a radius of 5 m for each of the twenty sample plots.

In the twenty sample plots monitored in 2015, 64 taxa of vascular plant species, bryophytes and lichens were recorded, ranging between twelve and 27 taxa in each plot. The most frequent species was *Avenella flexuosa* recorded in nineteen sample plots. Other abundant species were *Carex arenaria*, *Dicranum scoparium*, *Empetrum nigrum*, *Hypnum jutlandicum* and *Pleurozium schreberi*. Two species, *Hypochaeris radicata* and *Rumex acetosella*, which each were recorded as additional species in one sample plot in 2011, were recorded in one and nine sample plots in 2013 and in fourteen and eleven sample plots in 2015, respectively. The rest of the 64 taxa were either recorded one, two, or three times in the pin point frames, or solely as additional species in the documentation circles.

The recorded species were also aggregated in nine different more or less systematic groups, where the number of species was compared between the three years. The species number has clearly improved in the group of broad-leaved herbal species, the grasses and the rushes and sedges. Thus, the vegetation cover has become more species rich due to the lighter conditions fol-

lowing the deforestation and, after an initial stage, has become denser, as the frequency of bare litter and naked sand recorded in the pin point frames between 2011 and 2015 has decreased.

The disturbance of the soil layer caused by cutting of the trees and removing the trunks and the stumps may lead to the release of nutrients that can favour problematic vascular plant species that prefer higher nutrient levels in the soil than originally present in the *P. mugo* plantation or to a flourishing of invasive species. In 2015, two problematic species, *Epilobium angustifolium* and *Senecio sylvaticus*, were recorded in the sample plots. As the two species were only recorded in a few, scattered populations they are not considered as a serious problem and will probably not become dominant in the long term.

Sammenfatning

Det overordnede formål med overvågningsprogrammet i Østerild Klitplantage er at dokumentere successionen i vegetationsdækket mod lysåbne klitnaturtyper efter rydningen af nåletræsbevoksninger i det nationale testcenter for vindmøller, der er blevet opført i en del af plantagen. Overvågningsprogrammets første fase i 2011 omfattede en registrering af jordbundsforhold, vegetationens struktur og artssammensætning, før træerne blev fældet (basis overvågning).

Overvågningsstationer og prøvefelter blev i 2011 udlagt stratificeret tilfældigt med henblik på at dække variationen i vegetationsudviklingen og de behandlinger, der er skitseret i implementeringsplanen. Stratificeringen omfatter udgangspunktet (skovtype), de planlagte behandlinger af førne laget, hydrologien, den forventede pleje og drift af den lysåbne klitnatur, afstanden til egnede spredningskilder og topografien.

I de første 10 år efter fældningen er der planlagt en systematisk registrering af ændringerne af vegetationsdækket for at følge successionen mod lysåbne klitnaturtyper ("post-construction overvågning"). Resultaterne af overvågningsprogrammet vil så vidt muligt indgå i anbefalinger til fremtidige genopretningsprojekter, hvor formålet er at konvertere klitplantage til lysåbne naturtyper.

Tredje fase af overvågningsprogrammet blev iværksat i 2015. Denne rapport præsenterer resultaterne af genovervågningen af vegetationsdækket på de klitarealer, der førhen var dækket af bjerg-fyr (*Pinus mugo*) plantage. Ved genovervågningen, hvor tyve prøvefelter blev genundersøgt, blev metodikken, som blev anvendt ved basis monitoreringen i 2011, gentaget (Nygaard m.fl. 2011). Metoden er baseret på de økologiske variabler, der anvendes i det nationale NOVANA overvågningsprogram af terrestriske naturtyper (Fredshavn et al. 2015). Artssammensætning og vegetationsstruktur blev registreret i en pin point ramme (0,5 * 0,5 m²), mens der i en 5 m dokumentationscirkel blev registreret supplerende arter.

I de tyve prøvefelter blev der i 2013 registreret 64 taxa af karplanter, mosser og laver. Antallet af registrerede taxa varierede med tolv som det laveste og 27 som det højeste i de undersøgte prøvefelter. Den hyppigste art, som blev registreret i 19 af de 20 prøvefelter, var bølget bunket (*Avenella flexuosa*). De andre hyppige arter var sand-star (*Carex arenaria*), almindelig kløvtand (*Dicranum scoparium*), trind fyrremos (*Pleurozium schreberi*), hede-cypresmos (*Hypnum jutlandicum*) og revling (*Empetrum nigrum*). Almindelig kongepen (*Hypochaeris radicata*) og rødknæ (*Rumex acetosella*), der blev noteret én gang som supplerende art i hvert sit prøvefelt i 2011, blev registreret i henholdsvis ét og ni prøvefelter i 2013 og i fjorten og elleve i 2015. Resten af de 64 taxa blev kun registreret én, to eller tre gange i pin point rammerne og ellers som supplerende arter i dokumentationscirklerne.

De registrerede arter blev samlet i ni forskellige mere eller mindre systematiske enheder, hvor artsantallet blev sammenlignet for de tre år. Der er sket en tydelig forøgelse af artsantallet blandt de bredbladede urter og blandt græsserne samt blandt halvgræsser og siv/frytle. Vegetationsdækket er således blevet mere artsrigt og mere tæt som følge af den forøgede lysmængde

efter fældningen af træerne, mens andelen af bar førne og nøgent sand registreret i pin point rammerne er faldet fra 2011 til 2015.

Forstyrrelserne som følge af fældningen af nåletræerne og fjernelsen af stammer og stubbe kan medføre en frigivelse af næringsstoffer i jordbunden. Dette kan favorisere problematiske plantearter, der foretrækker et højere indhold af tilgængelige næringsstoffer i jordbunden end det, der oprindeligt var til stede i bjerg-fyr plantagen, eller fremme en opblomstring af invasive arter. I 2015 blev de to problemarter, gederams (*Epilobium angustifolium*) og skov-brandbæger (*Sencio sylvaticus*), registreret i prøvefelterne. Da de to arter kun blev registreret i få, spredte bestande, anses det ikke for sandsynligt, at de vil gå hen og blive dominerende på langt sigt.

1 Objectives

DCE – Danish Centre of Environment and Energy at Aarhus University - has performed the second monitoring of the recovery of the vegetation cover following the clear-cutting of a part of in the Østerild plantation complex in the county of Thy in Northern Jutland. The southern part of the plantation complex was afforested in late 1800 with *Picea abies*, *Picea sitchensis* and *Pinus sylvestris* as dominant conifer tree species. The northern part of the complex, the plantation of Hjardemål, was established on a drifting sand area dominated by dunes that have been reforested mostly with the sand drift and draught resistant *Pinus mugo*. In the summer 2011, part of the Østerild plantation complex dominated by conifer trees was deforested to give room for the National Test Centre facility. The clearing was formed as an ellipsoidal opening reaching from Hjardemål in the north to the southern part of Østerild. Before the clear-cutting took place, DCE performed a baseline monitoring of the prevailing vegetation cover and the ecological state in the forested areas of the plantation (Nygaard et al. 2011).

2 Methodology

In the spring 2011, DCE selected twelve monitoring sites where a reference net with grid cells on 10 x 10 m² was established. The monitoring sites were established in plantations where *Picea sitchensis*, *Pinus sylvestris* and *Pinus mugo* were the dominant conifer trees. On each monitoring site, five sample plots were randomly placed among grid cells. On the two sites at Hjärdemål, an additional five sample plots were placed in order to cover the topographical variation of the reforested drifting sand area that would be affected by the establishment of the National Test Centre facility. All the hundred sample plots were loaded as way points in a GPS prior to the baseline monitoring (Nygaard et al. 2011).

The baseline monitoring was performed by DCE in 2011 prior to the clear-cutting of the conifer trees. The baseline monitoring of the hundred sample plots was performed by using pin point analysis and a documentation circle to record the species composition and frequency. Besides, a number of vegetative and ecological parameters were recorded. The parameters were measurement of the depth of the accumulated organic matter in the forest floor (the litter layer) and the penetration of light, the vegetation structure, the inclination and direction of the slope where the pin point frame was located. Finally, soil samples for measurements of pH, organic matter and nitrogen in the laboratory were collected at the four corners of the pin point frame.

In the pin point analysis, a frame on 0.5 * 0.5 m² with 16 points was used, defined by the crossover point between four plus four stretched strings. The frame was placed with the straight sides towards the four main corners of the Earth. A pin was placed at each of the 16 crossover points starting in the north western and ending in the south eastern corner of the frame. Each living part of vascular plant, bryophyte and lichen species touched by the pin was recorded. If no part of a plant species was touched, the underlying substratum (litter, non-decomposed organic matter, sand etc.) was recorded. Species that were rooted inside the pin point frame and untouched by the pin were recorded as supplementary species. The documentation circle had a radius of 5 m covering 78.5 m² with its centre placed at the southwestern leg of the pin point frame. The additional species not found inside the pin point frame were then recorded.

DCE re-monitored the vegetation cover at the dune area in the Hjärdemål plantation on July 28th and 29th in 2015. A part of the *Pinus mugo* plantation was cut clear during the autumn, 2011, except for one sample plot where the pine trees were still present. Re-monitoring was performed by using pin point analysis and documentation circle as well as the vegetation structure, the penetration of light measured at the straight sides of the pin point frame towards the four corners of the world, and the inclination and direction of the slope where the pin point frame was located. The height of the vegetation cover was measured at the four corners of the pin point frame starting with the north western leg next to the north eastern, then to the south western, and ending with south eastern leg. In the documentation circle, the coverage of dwarf shrubs, woody plant species below and above one meter, bryophytes and lichens, and bare soil and free water surface was estimated in m².

The twenty sample plots monitored in 2011 and 2013 (Wind 2013) were approximately recovered by the use of the waypoints of GPS and by the use of the digital images taken in 2013. Consequently, the twenty sample plots were re-monitored in 2015.

3 Results

The floristic data, the vegetation and ecological parameters have been compiled in two tables separately in Appendix 1 for each of the twenty sample plots.

The floristic data are sorted in the following order: 1) the records from the pin point frame in descending frequency, i.e. the number of touches by the pin, 2) the supplementary species, 3) the additional species, sorted in alphabetical order. All lichen, bryophyte and vascular plant species are mentioned by their international name, while, in addition, the vernacular (English) name has been added for the vascular plants, bryophytes and liverworts. The English names of the vascular plant species are based on Stace (2010). The vernacular names of the bryophytes and liverworts have been found on the web.

Occasionally, the litter layer, the sand cover, branches, or other fragments of abandoned wood were pinned without touching any parts of the aboveground vegetation cover. Such touches are registered separately in the appendix.

In the twenty sample plots at Hjärdemål, 64 taxa were recorded with the species numbers ranging from twelve species at sample plot 94 to 27 species at sample plot 85. The species number touched by the pin in the frames ranged from one in sample plot 93 to five at sample plot 95.

In the sample plots, nineteen broad-leaved herbal species, nine grasses, six rushes and sedges, five dwarf shrubs, four deciduous bushes and trees, four coniferous trees, three ferns, eight bryophytes and liverworts and six lichens were recorded (Table 1). The most frequent species recorded was the grass *Avenella flexuosa*, which was recorded in 19 sample plots. The second most frequent species in the pin point frame was the bryophyte *Pleurozium schreberi*, which together with the sedge *Carex arenaria*, the bryophyte *Dicranum scoparium* and the dwarf shrub *Empetrum nigrum* was recorded in fourteen, nineteen, eighteen, and twelve documentation circles, respectively. The remaining 58 taxa were recorded in one or two frame plots, or solely as supplementary or additional species (Table 2, 3, and 4).

Table 1. The trend in the number of species (taxa) in nine different species groups in 2011, 2013, and 2015 in the pinpoint frames and 5 m documentary circles.

Group of species/year	2011	2013	2015
Broad-leaved herbal species	8	18	19
Grasses	3	6	9
Rushes and sedges	1	2	6
Dwarf shrubs	5	4	5
Deciduous trees and shrubs	6	7	4
Coniferous trees	4	5	4
Ferns	3	3	3
Bryophytes and liverworts	9	8	8
Lichens	6	5	6
Total	45	58	64

Table 2. The plant species recorded in the sample areas at Hjørdemål in 2015 in alphabetical order. The six most frequent plant species are in the top of the table.

International species name	Vernacular name English/Danish	Recorded no. of pin point frames	Recorded no. of pins in percent of 320 pins	Recorded as supplementary species	Recorded in documentary circle	No. of records in total
<i>Avenella flexuosa</i>	Wavy hairy-grass/Bølget bunke	19/20	65 %	-	-	19
<i>Carex arenaria</i>	Sand sedge/Sand-Star	7/20	18 %	5	7	19
<i>Dicranum scoparium</i>	Broom moss/Almindelig kløvtand	7/20	3 %	1	10	18
<i>Empetrum nigrum</i>	Crowberry/Revling	2/20	4 %	1	7	10
<i>Hypnum jutlandicum</i>	Heath plait-moss/ Hede-cypresmos	4/20	2 %	2	12	18
<i>Pleurozium schreberi</i>	Red-stemmed feather-moss/ Trind fyrremos	8/20	19 %	3	3	14
<i>Agrostis capillaris</i>	Common Bent/ Almindelig hvene	0	0 %	0	2	2
<i>Aira praecox</i>	Early Hair-grass/ Tidlig dværgbunke	0	0 %	0	3	3
<i>Ammophila arenaria</i>	Marram/ Hjælme	0	0 %	0	1	1
<i>Aulacomnium palustre</i>	Bog Bead-moss/ Almindelig filtmos	0	0 %	0	1	1
<i>Betula pubescens</i>	Downy Birch/Dun-birk	0	0 %	0	5	5
<i>Calluna vulgaris</i>	Heather/Hedelyng	0	0 %	0	13	13
<i>Carex panicea</i>	Carnation Sedge/ Hirse-star	0	0 %	0	1	1
<i>Carex pilulifera</i>	Pill Sedge/Pille-star	0	0 %	0	1	1
<i>Chenopodium album</i>	White Goosefoot/ Hvidmelet gåsefod	0	0 %	0	1	1
<i>Chiloscyphus profundus</i>	Forskelligbladet kamsvøb	1/20	<1 %	0	0	0
<i>Cirsium arvense</i>	Creeping Thistle/Ager-tidsel	0	0 %	0	1	1
<i>Cladonia chlorophaea</i>	Bægerlav	1/20	1 %	0	8	9
<i>Cladonia micilenta</i>	Lakrød bægerlav	1/20	1 %	0	1	2
<i>ssp. floerkeana</i>						
<i>Cladonia portentosa</i>	Hede-rendyrlav	1/20	<1 %	0	9	10
<i>Conyza canadensis</i>	Canadian Fleabane/ Canadisk bakkestjerne	0	0 %	0	1	1
<i>Corynephorus canescens</i>	Grey Hair-grass/ S andskæg	0	0 %	0	3	3
<i>Cytisus scoparius</i>	Broom/Gyvel	1/20	<1 %	0	2	3
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern/ Smalbladet mangeløv	0	0 %	1	8	9
<i>Dryopteris dilatata</i>	Broad Buckler-fern/ Bredbladet mangeløv	0	0 %	0	2	2
<i>Elytrigia repens</i>	Common Couch/ Almindelig kvik	0	0 %	0	1	1
<i>Epilobium angustifolium</i>	Fireweed/Gederams	0	0 %	0	10	10
<i>Epilobium montanum</i>	Broad-leaved Willow-herb/ Glat dueurt	0	0 %	0	1	1
<i>Erica tetralix</i>	Bog Heather/Klokkelyng	0	0 %	0	2	2
<i>Galium saxatile</i>	Heath Bedstraw/Lyng-snerre	1/20	<1 %	0	8	9
<i>Holcus lanatus</i>	Yorkshire-fog/Fløjlsgræs	0	0 %	0	4	4

<i>Hypochaeris radicata</i>	Cat's ear/Almindelig kongepen	1/20	<1 %	0	13	14
<i>Hypogymnia physodes</i>	Almindelig kvistlav	0	0 %	0	10	10
<i>Jasione montana</i>	Sheep's-bit/Blåmunke	0	0 %	0	1	1
<i>Juncus effusus</i>	Soft Rush/Lyse-siv	0	0 %	0	2	2
<i>Juncus squarrosus</i>	Heath Rush/Børste-siv	0	0 %	0	2	2
<i>Lotus corniculatus</i>	Birdsfoot-trefoil/ Almindelig kællingetand	0	0 %	0	2	2
<i>Luzula multiflora</i>	Many-headed Woodrush/ Mangeblomstret frytle	0	0 %	0	4	4
<i>Lysimachia europaea</i>	Chickweed-wintergreen/ Skovstjerne	2/20	2 %	0	5	7
<i>Molinia caerulea</i>	Purple Moor-grass/Blåtop	0	0 %	0	11	11
<i>Parmelia saxatilis</i>	Salted Shield Lichen/ Farve- skållav	0	0 %	0	2	2
<i>Persicaria laphathifolia ssp pallida</i>	Pale Persicaria/ Bleg pileurt	0	0 %	0	2	2
<i>Picea sitchensis</i>	Sitka Spruce/Sitka-gran	0	0 %	1	3	4
<i>Pilosella officinarum</i>	Mouse-ear Hawkweed/ Håret høgeurt	0	0 %	0	1	1
<i>Pinus contorta</i>	Lodgepole Pine/Klit-fyr	0	0 %	0	1	1
<i>Pinus mugo</i>	Mountain Pine/Bjerg-fyr	0	0 %	0	5	5
<i>Pinus sylvestris</i>	Scots Pine/Skov-fyr	0	0 %	0	4	4
<i>Poa annua</i>	Annual Meadow-grass/ Enårig rapgræs	0	0 %	0	1	1
<i>Polygonum aviculare</i>	Knotgrass/Vej-pileurt	0	0 %	0	1	1
<i>Polypodium vulgare</i>	Polypody/Almindelig engelsød	0	0 %	0	7	7
<i>Ptilidium ciliare</i>	Almindelig frynsemos	0	0 %	0	2	2
<i>Quercus robur</i>	Pedunculate oak/ Almindelig eg	0	0 %	0	8	8
<i>Rhytidiadelphus triquetrus</i>	Shaggy Moss/Stor kransemos	0	0 %	0	1	1
<i>Rumex acetosella</i>	Sheep's Sorrel/Rødknæ	0	0 %	0	11	11
<i>Salix repens ssp repens</i>	Creeping Willow/Krybende pil	0	0 %	0	3	3
<i>Senecio sylvaticus</i>	Wood-Groundsel/ Skov-brandbæger	0	0 %	1	13	14
<i>Senecio viscosus</i>	Sticky Groundsel/ Klæbrig brandbæger	0	0 %	0	4	4
<i>Sorbus aucuparia</i>	Rowan/Almindelig røn	0	0 %	0	1	1
<i>Spergula arvensis</i>	Corn Spurrey/Spergel	0	0 %	0	1	1
<i>Taraxacum sect. Taraxacum</i>	Common Dandelion/ Vej-mælkebøtte	0	0 %	0	1	1
<i>Tripleurospermum inodorum</i>	Scentless Mayweed/ Lugtløs kamille	0	0 %	0	1	1
<i>Vaccinium uliginosum</i>	Bog Bilberry/Mose-bølle	1/20	2 %	0	5	6

Table 3. The plant species recorded in the sample areas at Hjardemål in 2013 in alphabetical order. The six most frequent plant species are in the top of the table.

International species name	Vernacular name English/Danish	Recorded no. of pin point frames	Recorded no. of pins in percent of 320 pins	Recorded as supplementary species	Recorded in documentary circle	No. of records in total
<i>Avenella flexuosa</i>	Wavy hairy-grass/ Bølget bunke	13/20	38 %	3	4	20
<i>Carex arenaria</i>	Sand sedge/Sand-Star	9/20	14 %	1	8	18
<i>Dicranum scoparium</i>	Broom moss/ Almindelig kløvtand	0/20	0 %	5	13	18
<i>Empetrum nigrum</i>	Crowberry/Revling	3/20	3 %	-	9	12
<i>Hypnum jutlandicum</i>	Heath plait-moss/ Hede-cypresmos	5/20	5 %	1	9	15
<i>Pleurozium schreberi</i>	Red-stemmed feather-moss/ Trind fyrremos	9/20	8 %	-	10	19
<i>Agrostis capillaris</i>	Common Bent/ Almindelig hvene	0	0 %	0	1	1
<i>Ammophila arenaria</i>	Marram/Hjælme	0	0 %	0	1	1
<i>Atriplex patula</i>	Common Orache/ Svine-mælde	0	0 %	0	1	1
<i>Betula pubescens</i>	Downy Birch/Dun-birk	0	0 %	0	2	2
<i>Calluna vulgaris</i>	Heather/Hedelyng	2	3 %	0	6	8
<i>Cerastium fontanum</i> <i>ssp. vulgare</i>	Mouseear Chickweed/ Almindelig hønsetarm	0	0 %	0	1	1
<i>Chenopodium album</i>	White Goosefoot/ Hvidmelet gåsefod	0	0 %	0	2	2
<i>Chiloscyphus profundus</i>	Forskelligbladet kamsvøb	1/20	<1 %	0	1	1
<i>Cirsium arvense</i>	Creeping Thistle/ Ager-tidse	0	0 %	0	1	1
<i>Cladonia chlorophaea</i> agg.	Bægerlav	1/20	<1 %	0	1	2
<i>Cladonia micilenta</i> <i>ssp. floerkeana</i>	Lakrød bægerlav	0	0 %	0	1	1
<i>Cladonia portentosa</i>	Hede-rendyrav	1/20	<1 %	0	8	9
<i>Corynephorus canescens</i>	Grey Hair-grass/Sandskæg	0	0 %	0	1	1
<i>Crataegus</i> sp.	Hawthorn/Hvidtjørn	0	0 %	0	1	1
<i>Cytisus scoparius</i>	Broom/Gyvel	0	0 %	0	2	2
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern/ Smalbladet mangeløv	0	0 %	1	7	8
<i>Dryopteris dilatata</i>	Broad Buckler-fern/ Bredbladet mangeløv	0	0 %	0	4	4
<i>Epilobium angustifolium</i>	Fireweed/Gederams	0	0 %	0	7	7
<i>Erica tetralix</i>	Bog Heather/Klokkelyng	0	0 %	0	1	1
<i>Galium saxatile</i>	Heath Bedstraw/Lyng-snerre	1/20	<1 %	0	2	3
<i>Holcus lanatus</i>	Yorkshire-fog/Fløjlsgræs	0	0 %	0	3	3
<i>Hypochaeris radicata</i>	Cat's ear/Almindelig kongepen	0	0 %	0	1	1

<i>Hypogymnia physodes</i>	Tube Lichen/ Almindelig kvistlav	0	0 %	0	6	6
<i>Juncus bulbosus</i>	Bulbous Rush/Liden siv	0	0 %	0	1	1
<i>Lysimachia europaea</i>	Chickweed-wintergreen/ Skovstjerne	1/20	<1 %	0	2	3
<i>Molinia caerulea</i>	Purple Moor-grass/Blåtop	1	2 %	0	3	4
<i>Parmelia saxatilis</i>	Salted Shield Lichen/ Farve-skållav	0	0 %	0	1	1
<i>Persicaria laphathifolia ssp pallida</i>	Pale Persicaria/ Bleg pileurt	0	0 %	0	2	2
<i>Picea abies</i>	Norway Spruce/Rød-gran	0	0 %	0	4	4
<i>Picea sitchensis</i>	Sitka Spruce/Sitka-gran	0	0 %	0	9	9
<i>Pinus contorta</i>	Lodgepole Pine/Klit-fyr	1/20	<1 %	0	2	3
<i>Pinus mugo</i>	Mountain Pine/Bjerg-fyr	0	0 %	0	9	9
<i>Pinus sylvestris</i>	Scots Pine/Skov-fyr	0	0 %	0	6	6
<i>Polygonum aviculare</i>	Knotgrass/Vej-pileurt	0	0 %	0	1	1
<i>Polypodium vulgare</i>	Polypody/Almindelig engelsød	0	0 %	0	8	8
<i>Ptilidium ciliare</i>	Almindelig frynsemos	0	0 %	1	0	1
<i>Quercus robur</i>	Pedunculate oak/ Almindelig eg	0	0 %	0	10	10
<i>Rhytidiadelphus triquetrus</i>	Shaggy Moss/ Stor kransemos	0	0 %	0	2	2
<i>Rubus sect. Rubus</i>	Bramble/Brombær	0	0 %	0	1	1
<i>Rumex acetosella</i>	Sheep's Sorrel/Rødknæ	1/20	<1 %	0	8	9
<i>Salix repens ssp repens</i>	Creeping Willow/Krybende pil	0	0 %	0	2	2
<i>Scleropodium purum</i>	Hulbladet fedtmos	0	0 %	0	2	2
<i>Senecio sylvaticus</i>	Wood-Groundsel/ Skov-brandbæger	0	0 %	0	7	7
<i>Senecio viscosus</i>	Sticky Groundsel/ Klæbrig brandbæger	0	0 %	1	5	6
<i>Solanum nigrum</i>	Black Nightshade/ Sort natskygge	0	0 %	0	2	2
<i>Sonchus asper</i>	Spiny Sow-thistle/ Ru svinemælk	0	0 %	0	1	1
<i>Sorbus aucuparia</i>	Rowan/Almindelig røn	0	0 %	0	1	1
<i>Spergula arvensis</i>	Corn Spurrey/Spergel	0	0 %	0	4	4
<i>Stellaria media</i>	Common Chickenweed/ Fuglegræs	0	0 %	0	2	2
<i>Vaccinium uliginosum</i>	Bog Bilberry/Mose-bølle	0	0 %	0	7	7
<i>Viola arvensis</i>	Field Pansy/ Ager-stedmoderblomst	0	0 %	0	1	1

Table 4. The plant species recorded in the sample areas at Hjardemål in 2011 in alphabetical order. The six most frequent plant species are in the top of the table.

International species name	Vernacular name English/Danish	Recorded no. of pin point frames	Recorded no. of pins in percent of 320 pins	Recorded as supplementary species	Recorded in documentary circle	No. of records in total
<i>Avenella flexuosa</i>	Wavy hairy-grass/ Bølget bunke	15/20	33 %	0	5	20
<i>Carex arenaria</i>	Sand sedge/Sand-Star	7/20	6 %	0	6	13
<i>Dicranum scoparium</i>	Broom moss/ Almindelig kløvtand	10/20	7 %	6	-	16
<i>Empetrum nigrum</i>	Crowberry/Revling	2/20	2 %	1	11	14
<i>Hypnum jutlandicum</i>	Heath plait-moss/ Hede-cypresmos	14/20	15 %	3	-	17
<i>Pleurozium schreberi</i>	Red-stemmed feather-moss/ Trind fyrremos	14/20	32 %	5	-	19
<i>Aulacomnium palustre</i>	Bog Bead-moss/ Almindelig filtmos	0	0 %	0	1	1
<i>Betula pubescens</i>	Downy Birch/Dun-birk	0	0 %	0	1	1
<i>Calluna vulgaris</i>	Heather/Hedelyng	3	6 %	2	4	9
<i>Cerastium fontanum</i> ssp. <i>vulgare</i>	Mouseear Chickweed/ Almindelig hønsetarm	0	0 %	0	1	1
<i>Chiloscyphus profundus</i>	Forskelligbladet kamsvøb	7/20	9 %	0	1	8
<i>Cladonia chlorophaea</i> agg.	Bægerlav	0	0 %	3	0	3
<i>Cladonia ciliata</i>	Spinkel rensdyrlav	0	0 %	1	0	1
<i>Cladonia micilenta</i> ssp. <i>floerkeana</i>	Lakrød bægerlav	1/20	1 %	0	0	1
<i>Cladonia portentosa</i>	Hede-rendyrlav	2/20	1 %	1	0	3
<i>Cladonia</i> sp.s.str.		1/20	<1 %	2	1	4
<i>Cytisus scoparius</i>	Broom/Gyvel	0	0 %	0	2	2
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern/ Smalbladet mangeløv	0	0 %	0	8	8
<i>Dryopteris dilatata</i>	Broad Buckler-fern/ Bredbladet mangeløv	0	0 %	0	3	3
<i>Epilobium angustifolium</i>	Fireweed/Gederams	0	0 %	0	2	2
<i>Erica tetralix</i>	Bog Heather/Klokkelyng	0	0 %	0	3	3
<i>Fagus sylvatica</i>	Beech/Bøg	0	0 %	0	1	1
<i>Galium saxatile</i>	Heath Bedstraw/Lyng-snerre	0	0 %	0	2	2
<i>Holcus lanatus</i>	Yorkshire-fog/Fløjlsgræs	0	0 %	0	1	1
<i>Hylocomium splendens</i>	Almindelig etagemos	0	0 %	1	0	1
<i>Hypochaeris radicata</i>	Cat's ear/ Almindelig kongepen	0	0 %	0	1	1
<i>Lophozia ventricosa</i>		1/20	1 %	0	0	1
<i>Lysimachia europaea</i>	Chickweed-wintergreen/ Skovstjerne	1/20	<1 %	1	2	4
<i>Molinia caerulea</i>	Purple Moor-grass/Blåtop	0	0 %	0	3	3

<i>Picea glauca</i>	White Spruce/Hvid-gran	0	0 %	0	1	1
<i>Picea sitchensis</i>	Sitka Spruce/Sitka-gran	0	0 %	0	10	10
<i>Pinus mugo</i>	Mountain Pine/Bjerg-fyr	1/20	1 %	2	16	19
<i>Pinus sylvestris</i>	Scots Pine/Skov-fyr	0	0 %	0	4	4
<i>Platismatia glauca</i>	Blågrå papirlav	1/20	1 %	0	0	1
<i>Polypodium vulgare</i>	Polypody/Almindelig engelsød	0	0 %	0	8	8
<i>Ptilidium ciliare</i>	Almindelig frynsemos	3	4 %	2	0	5
<i>Quercus robur</i>	Pedunculate oak/ Almindelig eg	0	0 %	0	9	9
<i>Rhytidiadelphus triquetrus</i>	Shaggy Moss/Stor kransemos	0	0 %	1	0	1
<i>Rosa rugosa</i>	Rugosa Rose/Rynket rose	0	0 %	0	1	1
<i>Rumex acetosella</i>	Sheep's Sorrel/Rødknæ	0	0 %	0	1	1
<i>Salix repens ssp repens</i>	Creeping Willow/Krybende pil	0	0 %	0	2	2
<i>Senecio sylvaticus</i>	Wood-Groundsel/ Skov-brandbæger	0	0 %	0	1	1
<i>Sorbus aucuparia</i>	Rowan/Almindelig røn	0	0 %	0	3	3
<i>Stellaria media</i>	Common Chickenweed/ Fuglegræs	0	0 %	0	1	1
<i>Vaccinium uliginosum</i>	Bog Bilberry/Mose-bølle	0	0 %	0	7	7

In nine pin point frames, the litter layer was hit by the pin 24 times (8 %) without touching any part of the subterranean vegetation, while the bare sand layer was hit in four frames by the pin 14 times (4 %) (Table 5).

Table 5. The trend in pinned litter and soil in the pinpoint frames 2011, 2013, and 2015.

Feature	2011		2013		2015	
	Recorded no. of pin point frames	Recorded no. of pins in percent of 320 pins	Recorded no. of pin point frames	Recorded no. of pins in percent of 320 pins	Recorded no. of pin point frames	Recorded no. of pins in percent of 320 pins
Litter	15/20	21 %	15/20	26 %	9/20	8 %
Sand	1/20	1 %	5/20	7 %	4/20	4 %

4 Discussion

4.1 Species richness

Following the cutting of the coniferous trees, some dominant species have improved in frequency, like *Avenella flexuosa* and *Carex arenaria*, while other species have remained at the same frequency level or even declined, in frequency from 2011 to 2015, especially the planted coniferous species, *Picea sichensis* and *Pinus mugo*, (Figure 1, 2, 3, and 4, Table 2, 3, 4, and 6).

Figure 1. Sample plot 91 in 2013, southern direction.



Figure 2. Sample plot 91 in 2015, southern direction. The vegetation cover is dominated by *Avenella flexuosa*.



Figure 3. Sample plot 91 in 2013, southeast direction.



Figure 4. Sample plot 93 in 2015, southeast direction. The vegetation cover is dominated by *Carex arenaria*.



The number of recorded species (taxa) in the sample plots increased from 45 in 2011 to 58 in 2013 and to 64 species in 2015 (Table 1). Especially the number of broad-leaved herbal species, grasses, rushes and sedges has improved, while there is a slight decline in the number of deciduous trees and shrubs. For the rest of the groups, the number of species is almost constant. A general feature is that all recorded species occur frequently in Denmark and most of them are common inhabitants on sandy, nutrient poor soils.

The number of taxa is only a numeric value that conceals a much greater divergence in the species composition. A number of species recorded in 2011 and 2013 have not been recorded in 2015 and vice versa. Vascular plant species recorded in 2013 and not in 2015 are *Atriplex patula*, *Solanum nigrum*, *Sonchus asper*, *Viola arvensis*, and *Juncus bulbosus*. The first four species are all annuals that occur occasionally on disturbed soil. The perennial rush *J. bulbosus* was recorded in 2013 in a moist track caused by a vehicle at sample plot 86. The track has now been flooded by a newly established lake (Tables 2 and 3).

New taxa recorded in 2015 are the perennial sedges and rushes *Carex panicea*, *C. pilulifera*, *Juncus effusus* and *J. squarrosus*, and the broad-leaved herbals *Jasione montana* and *Pilosella officinarum*. Annual species have been recorded as newcomers in 2015, too, such as *Aira praecox*, *Conyza canadensis*, *Poa annua*, and *Tripleurospermum inodorum*. Besides, a number of species have improved in frequency compared to 2011 and 2013, when the number of recordings in either the pin point frame or in the documentary circle are taken into consideration. The five most conspicuous species are *Calluna vulgaris*, *Hypochaeris radicata*, *Luzula multiflora*, *Lysimachia europaea*, and *Rumex acetosella* (Table 6).

Table 6. Six native species in alphabetical order that have improved in frequency and two exotic tree species below the bold line that have decreased in frequency from 2011 to 2013 and 2015 in the sample plots.

International species name	Vernacular name – English/Danish	Frequency 2011 %	Frequency 2013 %	Frequency 2015 %
<i>Calluna vulgaris</i>	Heather/Hedelyng	45 %	20 %	60 %
<i>Hypochaeris radicata</i>	Cat's-ear/Almindelig kongepen	5 %	5 %	70 %
<i>Lysimachia europaea</i>	Chickweed-wintergreen/ Skovstjerne	20 %	15 %	35 %
<i>Luzula multiflora</i>	Heath Wood-rush/ Mangeblomstret frytle	0	5 %	20 %
<i>Molinia caerulea</i>	Purple Moor-grass/Blåtop	15 %	20 %	55 %
<i>Rumex acetosella</i>	Sheep's Sorrel/Rødknæ	5 %	45 %	55 %
<i>Picea sitchensis</i>	Sitka-Spruce/Sitka-gran	50 %	45 %	20 %
<i>Pinus mugo</i>	Mountain Pine/Bjerg-fyr	95 %	45 %	25 %

The occurrence of species not recorded in, or that have improved in frequency, since 2013 might be caused by spreading to the clear cut dune areas, as especially many annuals are able to spread quickly to newly opened soil, but vanish when the vegetation cover becomes denser. On the other hand, the above mentioned perennials are all native species that inhabit sandy, nutrient poor, open soils. They might originate from either the seed bank or be spread from neighbouring populations, as there are many suitable habitats in the surroundings of the Østerild plantation complex. Another explanation might be that some of the sample plots were not located exactly on the same spot as in 2013, as there is a margin of error when using hand-held GPS to recover the centre of the sample areas.

4.2 Invasive species

Clear cutting of trees, removing the trunks, branches, and stumps has led to a lot of disturbance to the top soil layer. One consequence may be the release of nutrients accumulated in the soil. When released, they can change the composition of the vegetation cover. The area may have been invaded by species that prefer a higher nutrient level in the soil than that present in the *Pinus mugo* plantation, e.g. species like *Epilobium angustifolium*, *Galeopsis bifida*, *Rubus ideaus*, and *Urtica dioica*. Such a development has not been observed in the deforested area, probably because the amount of nutrients released after the cutting of the pine trees is too low. Of the quoted species, *E. angustifolium* has been recorded in two sample plots in 2011, seven in 2013 and ten in 2015, solely as single plants or seedlings, but with an improving frequency.

Another consequence of the deforestation may be the possible spread of invasive species like *Amelanchier spicata*, *Prunus serotina* and *Rosa rugosa*, which together with seedlings of pine and spruce trees are recorded in the Østerild

plantation complex as well. *Rosa rugosa* was recorded in sample plot 84 in 2011. Neither of the quoted invasive species were recorded in the twenty sample plots in 2013 or in 2015. The number of annual species may also indicate great changes of the growth conditions. But it is only at the sample plots near road construction and establishment of telecommunications masts that a high number of annual species like *Senecio sylvaticus*, *S. viscosus* and *Spergula arvensis* has been recorded, e.g. at sample plots 85 and 87 (Annex 1).

4.3 Change in the vegetation composition

Cutting the pine trees changed the stable woodland climate of the *Pinus mugo* plantation and exposed especially lichens and bryophytes to more open terrestrial conditions. This might be the reason for the amounts of withered or dead tussock of especially bryophytes that, in part, have dominated the former forest floor of the plantation. The deforestation and the more prominent vegetation cover have caused a decrease in the amount of bare sand and naked litter layer (Figures 3 and 4, Table 5).

The altered growing conditions give way to more light demanding, strongly competitive broad-leaved herbals and grasses. Vegetation cover dominated by grasses, especially *Avenella flexuosa* and *Molinia caerulea*, and more drought resistant dwarf shrubs like *Calluna vulgaris* and *Empetrum nigrum* – species that have been recorded in the sample plots in 2015 in increasing frequencies – may be expected. Other light and drought demanding species like *Hypochaeris radicata*, *Luzula multiflora* and *Rumex acetosella* have also become more frequent in the sample plots (see Table 6). The species were barely recorded in the dense vegetation cover of the *Pinus mugo* plantation in 2011.

5 References

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Appendix 1

Note: In the 2013 report (Wind 2013) some errors occur. The light penetration value should be the reverse value, e.g. 0 should be substituted by 96, and especially in sample plot 92 the values are N: 25, E: 35, S: 34 and N: 28. The 'more than' sign > should be substituted by the 'less than' sign <.

Sample plot 0

Date of monitoring: 28-07-2015

Height of vegetation in cm	20	25	25	25
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	10	0	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
0		<1	5	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 0.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	14	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	13	-	-
<i>Carex arenaria</i>	Sand Sedge	-	+	-
<i>Betula pubescens</i>	Downy Birch	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Cladonia chlorophaea agg.</i>		-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Erica tetralix</i>	Cross-leaved Heath	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Holcus lanatus</i>	Yorkshire-fog	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Luzula multiflora</i>	Heath Wood-rush	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Polypodium vulgare</i>	Polypody	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Vaccinium uliginosum</i>	Bog Bilberry	-	-	+
<i>Cladonia sp. s.s.</i>		-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 0. A species is only registered in the table the first time it is recorded in the field.

Sample plot 1

Date of monitoring: 28-07-2015

Height of vegetation in cm	15	3	15	15
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	<1	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
14°	SW	2	5	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 1.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Carex arenaria</i>	Sand Sedge	13	-	-
<i>Avenella flexuosa</i>	Wavy Hair-grass	9	-	-
<i>Cytisus scoparius</i>	Broom	1	-	-
<i>Lysimachia europaea</i>	Chickweed-wintergreen	1	-	-
<i>Senecio sylvaticus</i>	Heath Groundsel	-	+	-
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Polygonum aviculare</i>	Knotgrass	-	-	+
<i>Polypodium vulgare</i>	Polypody	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Senecio viscosus</i>	Sticky Groundsel	-	-	+
<i>Cladonia</i> sp. s.s.		-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 1. A species is only registered in the table the first time it is recorded in the field.

Sample plot 2

Date of monitoring: 29-07-2015

Height of vegetation in cm	30	30	30	30
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	<1	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
12°	SW	<1	<1	<1

Vegetation and ecological parameters in Sample plot 2.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	10	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	4	-	-
<i>Dicranum scoparium</i>	Broom Moss	3	-	-
<i>Galium saxatile</i>	Heath Bedstraw	1	-	-
<i>Carex arenaria</i>	Sand Sedge	-	+	-
<i>Betula pubescens</i>	Downy Birch	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Dryopteris dilatata</i>	Broad Buckler-fern	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypogymnia physodes</i>	Tube Lichen	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Parmelia saxatilis</i>	Salted Shield Lichen	-	-	+
<i>Picea sitchensis</i>	Sitka Spruce	-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Lysimachia europaea</i>	Chickweed-wintergreen	-	-	+
<i>Cladonia</i> sp. s.s.		-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 2. A species is only registered in the table the first time it is recorded in the field.

Sample plot 3

Date of monitoring: 29-07-2015

Height of vegetation in cm	20	20	20	20
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	<1	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
8°	S	10	2	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 3.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	9	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	4	-	-
	Litter	3	-	-
	Sand	2	-	-
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	1	-	-
<i>Cladonia portentosa</i>		-	+	-
<i>Carex arenaria</i>	Sand Sedge	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Cladonia chlorophaea</i> agg.		-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Hypogymnia physodes</i>	Tube Lichen	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Polypodium vulgare</i>	Polypody	-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Cladina</i> sp.		-	-	+
<i>Cladonia</i> sp. s.s.		-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 3. A species is only registered in the table the first time it is recorded in the field.

Sample plot 84

Date of monitoring: 28-07-2015

Height of vegetation in cm	10	25	15	10
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	<1	0	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
0		25	<1	<1

Vegetation and ecological parameters in Sample plot 84.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Carex arenaria</i>	Sand Sedge	15	-	-
<i>Avenella flexuosa</i>	Wavy Hair-grass	8	-	-
	Litter	1	-	-
	Seedling, dicot	-	+	-
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Carex pilulifera</i>	Pill Sedge	-	-	+
<i>Chenopodium album</i>	White Goosefoot	-	-	+
<i>Cytisus scoparius</i>	Broom	-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Dryopteris dilatata</i>	Broad Buckler-fern	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Juncus squarrosus</i>	Heath Rush	-	-	+
<i>Luzula multiflora</i>	Heath Wood-rush	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Persicaria laphathifolia</i> ssp. <i>pallida</i>	Pale Persicaria	-	-	+
<i>Polypodium vulgare</i>	Polypody	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Salix repens</i> var. <i>repens</i>	Creeping Willow	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Lysimachia europaea</i>	Chickweed-wintergreen	-	-	+
<i>Cladonia</i> sp. s.s.		-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 84. A species is only registered in the table the first time it is recorded in the field.

Sample plot 85

Date of monitoring: 28-07-2015

Height of vegetation in cm	5	30	5	25
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	2	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
0		1	10	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 85.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	15	-	-
<i>Empetrum nigrum</i>	Crowberry	11	-	-
<i>Lysimachia europaea</i>	Chickweed-wintergreen	5	-	-
<i>Carex arenaria</i>	Sand Sedge	3	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	3	-	-
<i>Ammophila arenaria</i>	Marram	-	-	+
<i>Cirsium arvense</i>	Creeping Thistle	-	-	+
<i>Cladonia portentosa</i>		-	-	+
<i>Conyza canadensis</i>	Canadian Fleabane	-	-	+
<i>Corynephorus canescens</i>	Grey Hair-grass	-	-	+
<i>Elytrigia repens</i>	Common Couch	-	-	+
<i>Epilobium montanum</i>	Broad-leaved Willow-herb	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Holcus lanatus</i>	Yorkshire-fog	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Hypogymnia physodes</i>	Tube Lichen	-	-	+
<i>Jasione montana</i>	Sheep's-bit	-	-	+
<i>Lotus corniculatus</i>	Birdsfoot-trefoil	-	-	+
<i>Pinus mugo</i>	Mountain-pine			+
<i>Pinus sylvestris</i>	Scots Pine	-	-	+
<i>Salix repens</i> var. <i>repens</i>	Creeping Willow	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Senecio viscosus</i>	Sticky Groundsel	-	-	+
<i>Taraxacum</i> sect. <i>Taraxacum</i>	Common Dandelion	-	-	+
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	-	-	+
<i>Cladina</i> sp.	Reindeer Lichens	-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 85. A species is only registered in the table the first time it is recorded in the field.

Sample plot 86

Date of monitoring: 29-07-2015

Height of vegetation in cm	1	20	1	15
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	2	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
12°	S	2	25	25
Remarks	The pinpoint frame and the documentary circle were probably placed approx. 8-10 m to the vest as in 2013.			

Vegetation and ecological parameters in Sample plot 86.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	6	-	-
	Other lichen species	3	-	-
<i>Cladonia chlorophaea</i> agg.		2	-	-
<i>Cladonia macilenta</i> ssp. <i>floerkeana</i>		2	-	-
<i>Dicranum scoparium</i>	Broom Moss	1	-	-
	Litter	1	-	-
<i>Betula pubescens</i>	Downy Birch	-	-	+
<i>Carex arenaria</i>	Sand Sedge	-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypogymnia physodes</i>	Tube Lichen	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Picea sitchensis</i>	Sitka Spruce	-	-	+
<i>Pinus mugo</i>	Mountain-pine	-	-	+
<i>Pinus sylvestris</i>	Scots Pine	-	-	+
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Lysimachia europaea</i>	Chickweed-wintergreen	-	-	+
<i>Cladonia</i> sp. s.s.		-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 86. A species is only registered in the table the first time it is recorded in the field.

Sample plot 87

Date of monitoring: 29-07-2015

Height of vegetation in cm	20	10	15	10
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	2	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
20°	NE	15	<1	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 87.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	14	-	-
<i>Vaccinium uliginosum</i>	Bog Bilberry	5	-	-
<i>Chiloscyphus profundus</i>		1	-	-
<i>Dicranum scoparium</i>	Broom Moss	1	-	-
	Litter	1	-	-
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	+	-
<i>Agrostis capillaris</i>	Common Bent	-	-	+
<i>Aira praecox</i>	Early Hair-grass	-	-	+
<i>Aulacomnium palustre</i>	Bog Bead-moss	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Carex arenaria</i>	Sand Sedge	-	-	+
<i>Carex panicea</i>	Carnation Sedge	-	-	+
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Holcus lanatus</i>	Yorkshire-fog	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Hypogymnia physodes</i>	Tube Lichen	-	-	+
<i>Juncus effusus</i>	Soft Rush	-	-	+
<i>Juncus squarrosus</i>	Heath Rush	-	-	+
<i>Luzula multiflora</i>	Heath Wood-rush	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Picea sitchensis</i>	Sitka Spruce	-	-	+
<i>Poa annua</i>	Annual Meadow-grass	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Lysimachia europaea</i>	Chickweed-wintergreen	-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 87. A species is only registered in the table the first time it is recorded in the field.

Sample plot 88

Date of monitoring: 28-07-2015

Height of vegetation in cm	15	15	0	20
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	1	> 1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
9°	SW	20	<1	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013. Tracks from vehicle in the plot area have been made after 2013.			

Vegetation and ecological parameters in Sample plot 88.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	10	-	-
	Sand	5	-	-
<i>Dicranum scoparium</i>	Broom Moss	1	-	-
<i>Carex arenaria</i>	Sand Sedge	-	+	-
<i>Bryopsida</i>		-	+	-
<i>Betula pubescens</i>	Downy Birch	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Cladonia chlorophaea</i> agg.		-	-	+
<i>Cladonia macilenta</i> ssp. <i>floerkeana</i>		-	-	+
<i>Cladonia portentosa</i>		-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Sorbus aucuparia</i>	Rowan	-	-	+
<i>Cladina</i> sp.	Reindeer Lichens	-	-	+
<i>Cladonia</i> sp. s.s.		-	-	+

Species recorded in Sample plot 88. A species is only registered in the table the first time it is recorded in the field.

Sample plot 89

Date of monitoring: 29-07-2015

Height of vegetation in cm	2	20	15	30
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	<1	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
0		0	25	<1
Remarks	The pinpoint frame and the documentary circle were not placed approx. at the same spot as in 2013 as the 2013 photo was missing. A new photo has been taken.			

Vegetation and ecological parameters in Sample plot 89.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	12	-	-
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	2	-	-
<i>Dicranum scoparium</i>	Broom Moss	1	-	-
<i>Empetrum nigrum</i>	Crowberry	1	-	-
	Branch	2	-	-
	Litter	1	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	-	+	-
<i>Bryopsida</i>		-	+	-
<i>Betula pubescens</i>	Downy Birch	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Carex arenaria</i>	Sand Sedge	-	-	+
<i>Cladonia portentosa</i>		-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Hypogymnia physodes</i>	Tube Lichen	-	-	+
<i>Juncus effusus</i>	Soft Rush	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Pilosella officinarum</i>	Mouse-ear Hawkweed	-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Rhytidiadelphus triquetrus</i>	Shaggy Moss	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Vaccinium uliginosum</i>	Bog Bilberry	-	-	+
<i>Cladonia sp.</i>	Reindeer Lichens	-	-	+

Species recorded in Sample plot 89. A species is only registered in the table the first time it is recorded in the field.

Sample plot 90

Date of monitoring: 29-07-2015

Height of vegetation in cm	20	20	7	15
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	<1	0	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
0		0	10	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 90.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	16	-	-
<i>Carex arenaria</i>	Sand Sedge	-	+	-
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	-	+	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	-	+	-
<i>Bryopsida</i>		-	+	-
<i>Cladonia portentosa</i>		-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Hypogymnia physodes</i>	Tube Lichen	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
	Seedling, gymnosperm	-	-	+
<i>Cladina sp.</i>	Reindeer Lichens	-	-	+

Species recorded in Sample plot 90. A species is only registered in the table the first time it is recorded in the field.

Sample plot 91

Date of monitoring: 29-07-2015

Height of vegetation in cm	25	1	30	1
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	5	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
8°	SW	<1	10	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 91.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	11	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	7	-	-
<i>Carex arenaria</i>	Sand Sedge	-	+	-
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	-	+	-
<i>Bryopsida</i>		-	+	-
<i>Betula pubescens</i>	Downy Birch	-	-	+
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Galium saxatile</i>	Heath Bedstraw	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Hypogymnia physodes</i>		-	-	+
<i>Pinus mugo</i>	Mountain-pine	-	-	+
<i>Vaccinium uliginosum</i>	Bog Bilberry	-	-	+

Species recorded in Sample plot 91. A species is only registered in the table the first time it is recorded in the field.

Sample plot 92

Date of monitoring: 29-07-2015

Height of vegetation in cm	0	30	1	1
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	0	0	0	0
Light penetration	N: 30	E: 26	S: 24	W: 36
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
36°	NNW	<1	50	1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 92.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	4	-	-
<i>Dicranum scoparium</i>	Broom Moss	1	-	-
<i>Hypnum jutlandicum</i>	Heath Plait-moss	3	-	-
	Litter	8	-	-
<i>Picea sitchensis</i>	Sitka Spruce	-	+	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	-	+	-
<i>Bryopsida</i>		-	+	-
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Holcus lanatus</i>	Yorkshire-fog	-	-	+
<i>Hypogymnia physodes</i>		-	-	+
<i>Parmelia saxatilis</i>		-	-	+
<i>Pinus mugo</i>	Mountain-pine	-	-	+
<i>Polypodium vulgare</i>	Polypody	-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+

Species recorded in Sample plot 92. A species is only registered in the table the first time it is recorded in the field.

Sample plot 93

Date of monitoring: 29-07-2015

Height of vegetation in cm	10	10	0	15
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	0	0	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
0		65	0	0
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 93.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Carex arenaria</i>	Sand Sedge	11	-	-
	Sand	5	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	-	+	-
<i>Avenella flexuosa</i>	Wavy Hair-grass	-	-	+
<i>Agrostis capillaris</i>	Common Bent	-	-	+
<i>Aira praecox</i>	Early Hair-grass	-	-	+
<i>Corynephorus canescens</i>	Grey Hair-grass	-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Lotus corniculatus</i>	Birdsfoot-trefoil	-	-	+
<i>Molinia caerulea</i>	Purple Moor-grass	-	-	+
<i>Persicaria laphathifolia</i> ssp. <i>pallida</i>	Pale Persicaria	-	-	+
<i>Pinus mugo</i>	Mountain-pine	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Senecio viscosus</i>	Sticky Groundsel	-	-	+
<i>Spergula arvensis</i>	Corn Spurrey	-	-	+
	Seedling, gymnosperm	-	-	+

Species recorded in Sample plot 93. A species is only registered in the table the first time it is recorded in the field.

Sample plot 94

Date of monitoring: 28-07-2015

Height of vegetation in cm	12	25	10	5
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	0	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
10°	SW	10	<1	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 94.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	9	-	-
<i>Carex arenaria</i>	Sand Sedge	5	-	-
	Litter	2	-	-
<i>Cytisus scoparius</i>	Broom	-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Cladina sp.</i>	Reindeer Lichens	-	-	+
<i>Cladonia chlorophaea agg.</i>		-	-	+
<i>Bryopsida</i>		-	-	+

Species recorded in Sample plot 94. A species is only registered in the table the first time it is recorded in the field.

Sample plot 95

Date of monitoring: 28-07-2015

Height of vegetation in cm	1	0	1	3
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	0	0	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
23°	SW	25	<1	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 95.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	6	-	-
<i>Cladonia portentosa</i>		1	-	-
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	1	-	-
<i>Hypochaeris radicata</i>	Cat's-ear	1	-	-
	Litter	4	-	-
	Sand	2	-	-
	Lichen 95.1	1	-	-
<i>Dicranum scoparium</i>	Broom Moss	-	+	-
	Lichen 95.2	-	+	-
	Lichen 95.3	-	+	-
<i>Bryopsida</i>		-	+	-
<i>Aira praecox</i>	Early Hair-grass	-	-	+
<i>Carex arenaria</i>	Sand Sedge	-	-	+
<i>Corynephorus canescens</i>	Grey Hair-grass	-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Cladina sp.</i>	Reindeer Lichens	-	-	+
<i>Cladonia sp. s.s.</i>		-	-	+

Species recorded in Sample plot 95. A species is only registered in the table the first time it is recorded in the field.

Sample plot 96

Date of monitoring: 28-07-2015

Height of vegetation in cm	30	30	40	30
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	0	0	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
11°	NE	2	5	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 96.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	16	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	6	-	-
<i>Senecio sylvaticus</i>	Heath Groundsel	-	+	-
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Carex arenaria</i>	Sand Sedge	-	-	+
<i>Cladonia chlorophaea agg.</i>		-	-	+
<i>Cladonia portentosa</i>		-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Hypnum cupressiforme</i>	Cypress-leaved Plait-moss	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Luzula multiflora</i>	Heath Wood-rush	-	-	+
<i>Ptilidium ciliare</i>		-	-	+
<i>Cladina sp.</i>	Reindeer Lichens	-	-	+
<i>Cladonia sp. s.s.</i>		-	-	+
<i>Bryopsida</i>		-	-	+
<i>Marchantiopsida</i>		-	-	+

Species recorded in Sample plot 96. A species is only registered in the table the first time it is recorded in the field.

Sample plot 97

Date of monitoring: 28-07-2015

Height of vegetation in cm	20	4	15	20
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	0	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
0		10	<1	<1
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 97.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	15	-	-
<i>Carex arenaria</i>	Sand Sedge	10	-	-
<i>Empetrum nigrum</i>	Crowberry	-	+	-
<i>Cladonia sp.</i>	Reindeer Lichens	-	+	-
<i>Cladonia sp. s.s.</i>		-	+	-
<i>Bryopsida</i>		-	+	-
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Cladonia chlorophaea agg.</i>		-	-	+
<i>Cladonia portentosa</i>		-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Senecio viscosus</i>	Sticky Groundsel	-	-	+
<i>Vaccinium uliginosum</i>	Bog Bilberry	-	-	+

Species recorded in Sample plot 97. A species is only registered in the table the first time it is recorded in the field.

Sample plot 98

Date of monitoring: 28-07-2015

Height of vegetation in cm	25	0	25	20
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	0	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
7°	SW	1	20	2
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 98.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	9	-	-
<i>Avenella flexuosa</i>	Wavy Hair-grass	8	-	-
<i>Dicranum scoparium</i>	Broom Moss	1	-	-
	Litter	3	-	-
	Other lichen species	-	+	-
<i>Bryopsida</i>		-	+	-
<i>Carex arenaria</i>	Sand Sedge	-	-	+
<i>Cladonia chlorophaea</i> agg.		-	-	+
<i>Cladonia portentosa</i>		-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Hypogymnia physodes</i>		-	-	+
<i>Polypodium vulgare</i>	Polypody	-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Rumex acetosella</i>	Sheep's Sorrel	-	-	+
<i>Senecio sylvaticus</i>	Heath Groundsel	-	-	+
<i>Cladina</i> sp.	Reindeer Lichens	-	-	+
<i>Cladonia</i> sp. s.s.		-	-	+

Species recorded in Sample plot 98. A species is only registered in the table the first time it is recorded in the field.

Sample plot 99

Date of monitoring: 28-07-2015

Height of vegetation in cm	25	25	30	30
	Dwarf shrub	Trees and shrubs below 1 m	Trees and shrubs over 1 m	Free water surface
Cover in m ²	2	<1	0	0
Light penetration	96	96	96	96
Inclination	Direction of inclination	Cover of bare soil in m ²	Cover of bryophytes in m ²	Cover of lichens in m ²
30°	NE	0	10	5
Remarks	The pinpoint frame and the documentary circle were placed approx. at the same spot as in 2013.			

Vegetation and ecological parameters in Sample plot 99.

International name	Vernacular name	No. of pins	Supplementary species	Additional species
<i>Avenella flexuosa</i>	Wavy Hair-grass	15	-	-
<i>Pleurozium schreberi</i>	Red-stemmed Feather-moss	14	-	-
<i>Carex arenaria</i>	Sand Sedge	1	-	-
	Lichen 99	1	-	-
<i>Cladonia</i> sp. s.s.		-	+	-
<i>Bryopsida</i>		-	+	-
<i>Calluna vulgaris</i>	Heather	-	-	+
<i>Cladonia chlorophaea</i> agg.		-	-	+
<i>Cladonia portentosa</i>		-	-	+
<i>Cladonia rangiferina</i>		-	-	+
<i>Dicranum scoparium</i>	Broom Moss	-	-	+
<i>Dryopteris carthusiana</i>	Narrow Buckler-fern	-	-	+
<i>Empetrum nigrum</i>	Crowberry	-	-	+
<i>Epilobium angustifolium</i>	Fireweed	-	-	+
<i>Erica tetralix</i>	Cross-leaved Heath	-	-	+
<i>Hypnum jutlandicum</i>	Heath Plait-moss	-	-	+
<i>Hypochaeris radicata</i>	Cat's-ear	-	-	+
<i>Pinus contorta</i>	Lodgepole Pine	-	-	+
<i>Pinus mugo</i>	Mountain-pine	-	-	+
<i>Pinus sylvestris</i>	Scots Pine	-	-	+
<i>Polypodium vulgare</i>	Polypody	-	-	+
<i>Ptilidium ciliare</i>		-	-	+
<i>Quercus robur</i>	Pedunculate Oak	-	-	+
<i>Salix repens</i> var. <i>repens</i>	Creeping Willow	-	-	+
<i>Lysimachia europaea</i>	Chickweed-wintergreen	-	-	+
<i>Vaccinium uliginosum</i>	Bog Bilberry	-	-	+
	Microlichen	-	-	+
<i>Cladina</i> sp.	Reindeer Lichens	-	-	+
<i>Marchantiopsida</i>		-	-	+

Species recorded in Sample plot 99. A species is only registered in the table the first time it is recorded in the field.

MONITORING THE VEGETATION RECOVERY IN ØSTERILD PLANTAGE 2015

Part 2

The trees in a part of Østerild Plantage have been cut down to give room for a national test center. Before the afforestation DCE has performed a baseline monitoring in the summer of 2011. DCE has in summer 2015 re-monitored the recovery of the vegetation cover in the northernmost part of the afforested area that was covered by plantation of *Pinus mugo*. The results from the re-monitoring are presented in the report.