LIFE10 NAT/DK/000102

FINAL Report
Covering the project activities from 01/09/2011 to 30/06/2020
20/10/2020

Lille Vildmose
Restoration of active raised bog – Lille Vildmose

Project Data

Project location	Denmark, North Jutland, Aalborg area: Natura 2000 site DK00FX125 Lille Vildmose, Tofte Skov og Høstemark Skov (pSCI no. H 18 and SPA no. F 7)
Project start date:	01/09/2011
Project end date:	31/12/2016 **Extension date granted: 30/06/2020**
Total Project duration (in months)	106 months
Total budget	€ 5.592.528
Total eligible budget	€ 5.592.528
EU contribution:	€ 4.194.396
(%) of total costs	75%
(%) of eligible costs	75%

Beneficiary Data

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1 List of contents

List of keywords and abbreviations

AAK: Municipality of Aalborg
AVJF: Aage V. Jensen Nature Fond
LVNF: Lille Vildmose Nature Fond
NST: Danish Nature Agency

2 Executive summary

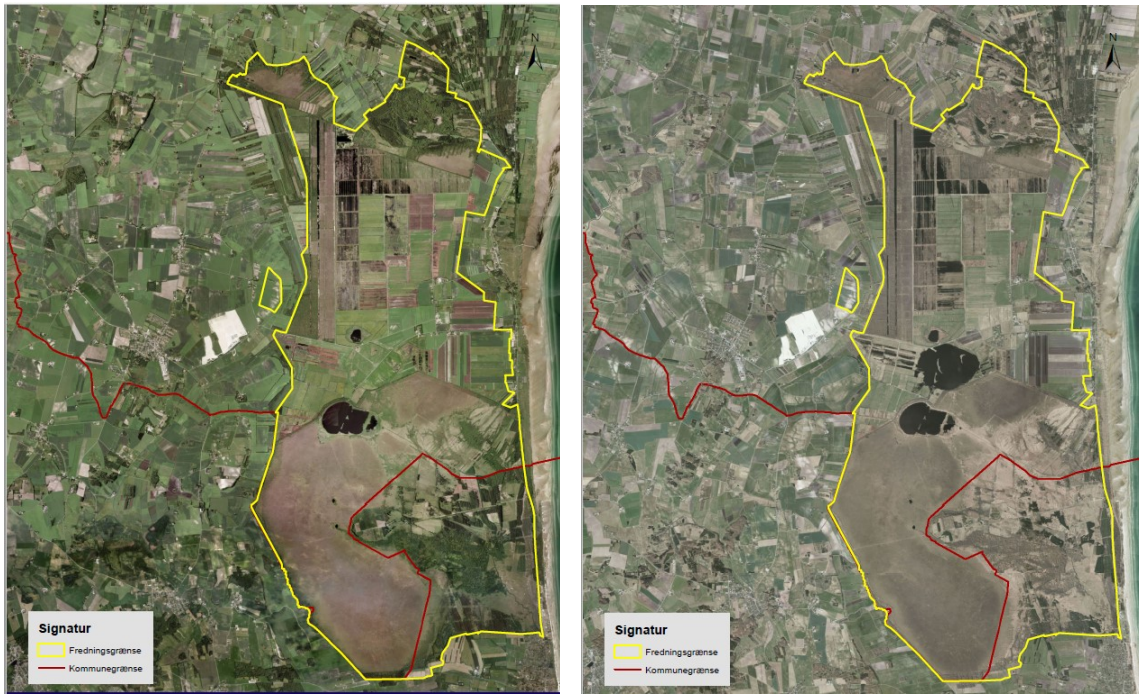
Active raised bogs (7110*) are a priority habitat for conservation and are included in Annex I of the Habitats Directive. This habitat has suffered a steep decline in Europe in recent years. In Lille Vildmose (and in Denmark overall) active raised bogs have an unfavourable conservation status. This is mainly due to drainage, the invasion of trees, in particular birch, and deposition of airborne nitrogen from agricultural use and long-distance transport.

Exploitation of the bog peat over the last 200 years for agricultural and industrial purposes has more than halved the area of the habitat type active raised bog 7110* in Lille Vildmose – from 5500 ha to 2068 ha today.

Key numbers of sizes and targeted area in the Life project.

Original surface of raised bog 7110* (ha)	5500
Surface of raised bog 7110* today (ha)	2068
Total targeted area, Mellemområdet (ha)	2100
Water level raised in earlier projects (ha)	615
Water level raised in LIFE project (ha)	927
Total area of raised water level (ha)	**1542**
Area of raised water level in % of targeted area	73

The project is in accordance with the national conservation plan for the management of the Natura2000 site and has served to implement the EU Habitat and Birds Directive in Lille Vildmose.The main objective of this project is to restore the largest remaining raised bog in lowland northwest Europe, Lille Vildmose. The many actions will improve the conservation status of this priority habitat by facilitating re-growth of sphagnum moss and raising the water table in areas of degraded raised bogs or in areas where peat has been excavated. These actions have resulted in a significant enlargement of the habitat area. As shown in in the two aerial photos below, other wetland habitat types, such as natural dystrophic lakes and ponds (3160), transition mires and quaking bogs (7140) have increased in size and number since the beginning of the project. All in all more than 900 ha have during the project period changed status to more wet conditions.



Aerial photo of the project area from 2010 and 2019, respectively, showing the increased area with raised water levels.

The re-establishment of natural hydrological conditions in the overall project area is expected over time to enhance the ecological coherence and reconnect the present fragmented areas of active raised bog. The changes in habitat types due to the project actions are summarized in the table below.

Habitat types in project area		Mapped area in 2011, ha	Mapped area in 2020, ha
7110*	Active raised bog	2022	2068
7120	Degraded raised bog still capable of natural regeneration	252	405
91D0*	Bog woodland	192	361

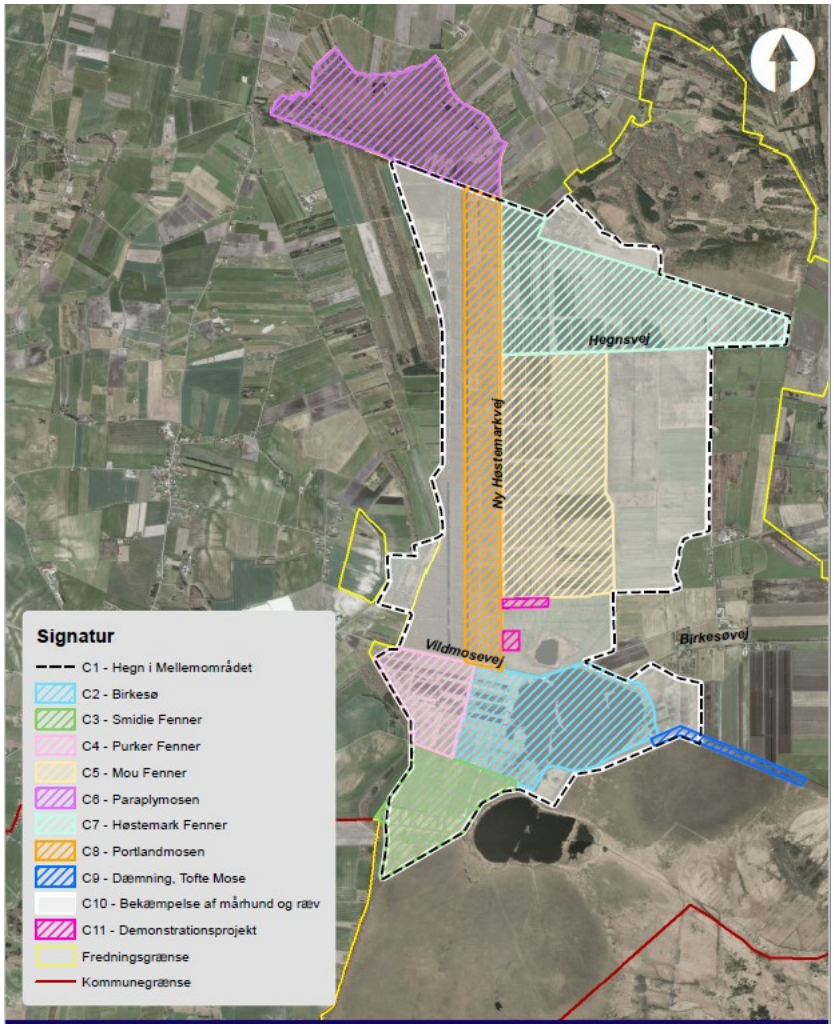
The rather large increase in the area of degraded raised bog (7120) and bog woodland (91D0*) is partly due to an updated mapping of the habitat types but is also an indication of how fast raised bog degrades when drained.

As an appreciation of the large effort in protecting and improving the conditions of one of the most vulnerable habitat types in Europe, the Life project in Lille Vildmose has for the second time (2018 and 2020) been nominated as one of the finalists for the Nature 2000 Award in the category Conservation.

2.1 Deliverables and outputs

Through the many actions, the Life project has achieved to protect and improve the conservations status of active raised bog. Enhancement of the ecological coherence and green infrastructure, resulting in improved conservation status of the entire Nature 2000 site, as a result of the combined effect of the actions in the project. The effects of the project measures are expected to unfold over a long span of years, as the ecological dynamics of the raised bog gradually respond to the improved and restored hydrological systems. However, in many areas the response have been immediate and visible already within the project period.

The range of actions and their target areas cover the whole project area, as shown in the map below.



With significant improvements of the hydrological conditions in particular in the impacted edge areas, where areas of active raised bog borders farmland areas, the project has achieved to protect and enlarge the conservation status of active raised bog. With large-scale clearance of tree growth and the introduction of grazing by large herbivores on 2100 ha mapped as 7110* in unfavorable conservation status mainly due to birch invasion the conservation status of 7110* is expected to be significantly enhanced.

Restoration and improved conservation status of raised bogs on degraded areas (7120) as well as larger areas with natural dystrophic lakes and ponds (3160), transition mires and quaking bogs (7140) have been established on more than 900 ha as a result of the improved hydrology in the overall project area.

Due to the significantly enlarged wetland areas, including lakes (Birkesø and minor lakes and ponds) combined with a specific predator-controlling programme for securing breeding sites for ground-nesting birds, the living conditions for the annex I-species black stork, wood sandpiper, hen harrier, white-tailed eagle, crane, short-eared owl have been improved. However, since the target species all are very rare and their breeding population on a national scale is very low or lacking, it takes time beyond the project period to expect a positive response on the improved conditions. Furthermore, has the predator-controlling actions revealed that even with a large effort to keep the

populations of predators down, especially the population of Racoon dog, the population seems to increase in size. This development are seen in the rest of the country as well as in our neighbor countries.

Finally, the Life project has achieved to raise a widespread local, regional and national understanding of and interest in raised bog ecology and conservation. Lille Vildmose Naturfond (LVNF) has funded the production of a drone film showing the many activities from the various actions implemented in the Life project. The film has been shown to the public at several occasions and is also available on the project website.

With the designation as a wetland of international importance through the Ramsar Convention in 2013, the awareness of Lille Vildmose today reach out globally and is used as a case in how to restore peatland areas. The overall Nature 2000-area, appears today as one of the largest, coherent nature sites in Denmark, with unique opportunities for experience of vast areas of a unique type of natural wetland.

The table below summarizes in numbers the results achieved in the Life project towards the improvement of the targeted habitat type active raised bog (7110*)

Name of action	Nature management	Lake Birkesø	Raised waterlevel Smidie/Tofte	Raised waterlevel Purker Fenner	Raised waterlevel Mou fenner	Raised waterlevel Paraplymosen	Raised waterlevel Høstemark Fenner	Clearance of trees Portlandmosen	Dike, Northeast of Tofte Mose	Demonstration project	
Results	C1	C2	C3	C4	C5	C6	C7	C8	C9	C11	Total
Raised water level effeectively targeted 7110* (ha)		12	20	0	0	90	15		35	0	172
Raised water level on degraded bog area (ha)		118	90	165	170	135	65		0	12	755
Raised water level in total (ha)	**0**	**130**	**110**	**165**	**170**	**225**	**80**	**0**	**35**	**12**	**927**
Filled canals/ditches effecively targeted 7110* (m)			0				1500				1500
Filled canals/ditches on degraded raised bog (m)			7				0				7
Filled canals/ditches in total (m)	**0**	**0**	**7**	**0**	**0**	**0**	**1500**	**0**	**0**	**0**	**1507**
Blocked ditches effectively targeted 7110* (quantity)		0	0			70	2				72
Blocked ditches on degraded raised bog (quantity)		1	4			0	0				5
Blocked ditches in total (quantity)	**0**	**1**	**4**	**0**	**0**	**70**	**2**	**0**	**0**	**0**	**77**
New dikes, dams effectively targeted 7110* (m)			1640	0		1000		170	1500		4310
New dikes, dams on degraded raised bog (m)		1300	0	500		0		0	0		1800
New dikes, dams in total (m)	**0**	**1300**	**1640**	**500**	**0**	**1000**	**0**	**170**	**1500**	**0**	**6110**
Cleared from trees and bush effectively targeted 7110* (ha)						15			5		20
Cleared from trees and bush on degraded raised bog (ha)						0			0		0
Cleared from trees and bushes in total (ha)	**0**	**0**	**0**	**0**	**0**	**15**	**0**	**0**	**5**	**0**	**20**
Protected edge of 7110* effectively targeted 7110* (m)			8			3600	1200		1500		6308
Protected edge of 7110* on degraded raised bog (m)			0			0	0		0		0
Protected edge of 7110* (m)	**0**	**0**	**8**	**0**	**0**	**3600**	**1200**	**0**	**1500**	**0**	**6308**
Grassed by large herbivores effectively targeted 7110* (ha)	233							170			403
Grassed by large herbivores on degraded raised bog (ha)	1836							0			1836
Grassed by large herbivores in total (ha)	**2069**	**0**	**0**	**0**	**0**	**0**	**0**	**170**	**0**	**0**	**2239**
Weirs, riffles, pumps effectively targeted 7110* (quantity)		0	0			2					2
Weirs, riffles, pumps on degraded raised bog (quantity)		1	7			0					8
Weirs, riffles, pumps in total (quantity)	**0**	**1**	**7**	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**12**

2.2 Problems encountered

A smaller group of landowners decided to appeal on every permit and dispensation given by the authorities. Their unwillingness to cooperate goes back to the time before the LIFE project and has in most cases nothing to do with the conservation and restoration project as such.

None the less, the persistence in their appealing has been highly time consuming and slowed down the process on every ongoing technical action in the project. The consequence has been a delay in all actions included and resulted in a 4 year prolongation of the project period. More details are emphasized in the description of action A1.

3 Introduction

Active raised bogs 7110* have declined significantly in area and number in north-western Europe as a result of large-scale exploitation of peat. Peat has been used extensively as fuel in the preceding centuries and later peat gained a significant commercial importance as a garden soil improvement component. Lille Vildmose is the largest raised bog in lowland Northwest Europe but has been exploited heavily for the production of peat mulch. The area of the habitat type active raised bog 7110* has been reduced from 5500 ha before the exploitation to 2068 ha today. As early as in late 1700 attempts were made to drain four lakes in the area. Subsequently a widespread lowering of the groundwater table has led to large-scale invasion of trees, especially birch in the bog areas. In addition to the altered hydrological conditions deposition of ammonium has facilitated the invasion of grasses, scrubs and herbs in the bog areas. Still, Lille Vildmose has more than 2000 ha of the priority habitat type active raised bog (7110*) and holds an important flora and fauna characteristic of large bogs, including species of sundew, cloudberry, Sphagnum etc. Breeding birds include crane, curlew, golden eagle, white-tailed eagle, eagle owl, short-eared owl, most likely wood sandpiper and occasionally black stork. Linked with the two forests, Høstemark Skov and Tofte Skov, the area also holds large herds of red deer. As a result of man-made impacts, the project area comprehends 250 ha with degraded raised bog (7120) and 400 ha with bog woodland (91DO*), where the latter primarily has developed on drained and degraded raised bog in a secondary succession.

Project objectives:
The aim of the project is to restore the largest remaining raised bog in lowland Northwest Europe, Lille Vildmose, which holds more than half of the total area of active raised bog in Denmark. Active raised bogs represent a priority habitat type (7110*) in recognition of the large-scale decline in their numbers and size in Europe in recent times. In Denmark and in Lille Vildmose active raised bogs (7110*) have an unfavourable conservation status. With a range of specific actions such as restoring a natural hydrological system for the drained bog areas, supporting the hydrological conditions for active raised bogs and optimizing conditions for sphagnum re-growth, clear-cutting of shrubs and trees and grazing by large mammals the project will improve conservation status of the active raised bog (7110*). This has been obtained during the project period.

The long-term effect of the project will be an increase of the priority habitat type 7110* by facilitating re-growth of Sphagnum and raising the water table on areas of degraded raised bogs (7120) or exploited areas. By re-establishment of the natural hydrology in exploited central part of Lille Vildmose, called “Mellemområdet”, the Sphagnum-dominated active raised bog areas (Tofte Mose, Portlandmosen, Høstemark Mose and Paraplymosen) will be tied together in a comprehensive and connective landscape ecological context thereby enhancing the green infrastructure of the area significantly.

These actions will result in a significant enlargement of the area covered with the habitat type active raised bog. Other wetland habitat types like natural dystrophic lakes and ponds (3160) and transition mires and quaking bogs (7140) will also increase in size and numbers within the project area. Bog woodland (91D0*) will decrease in extent on areas planned for active raised bog (7110*) restoration but will increase on other areas, which will be restored from their present state as peat exploitation areas.

Besides the actions targeting the habitat types specifically an important group of activities aims at establishing public awareness and public facilities such as paths, boardwalks, info points, places for bird watching etc. The project will focus on communication, dissemination and public awareness of raised bogs and the on-going and long-term conservation efforts.

4 Administrative part

4.1 Description of the management system

The Danish Nature Agency (NST) has the overall responsibility for the project. This includes the overall project administration, co-ordination and implementation of activities in all phases of the project.

The project comprises actions in Lille Vildmose, involving Aage V. Jensen Naturfond (AVJF) and Municipality of Aalborg (AAK) as coordinating beneficiary. The Partnership agreements have been submitted to the Commission with the Inception Report dated 31/05/2012.

Management structure is presented in the organigram below.

As project manager Peter Hahn is employed and specifically seconded to the project by the Nature Agency and located at the NST, Himmerland unit. The project manager is in charge of the overall project administration, co-ordination and implementation of activities in all phases of the project. The project manager is also responsible of the project reporting.

The project manager furthermore being responsible for all financial issues, including all financial accounting, financial analysis of the actions, financial reporting and annual budgets, including budgetary control.

Since the start of the project there has been a turnover of the coordinating project manager of the project group. The EU - LIFE secretary as well as the monitoring team has been informed about the turnover. **The project-group** now consists of the coordinating project manager from NST Peter Hahn and the local project-managers Jacob P. Andersen, AVJF and Anne Marie Overgaard, AAK. Other project workers from the partners have participated in the working group on an ad hoc basis. The project group meetings have until 2018 been held approximately once every month. However, the project management decided to cut down the number of project group meetings to every second to third month in the final project period, where more actions have been closed or are laying still.

Since the start of the project 59 meetings in the project group have been held and minutes have been produced. At the meetings the overall project implementation plan detailing the actions has been talked over – the site specific as well as the general activities - as well as the accounting and budget of the site-specific actions have been followed up.

The steering committing consists of the Chief Foresters from NST Bendt Egede Andersen, Head of department from AAK Kirsten Lund Andersen, Anne Marie Overgaard, AAK and the Managing Director of AVJF Anders Skov. The steering group meets 2-4 times a year. Since the start date 24 meetings have been held specially to discuss and agree on issues relevant for the partnership agreement. But also, the project

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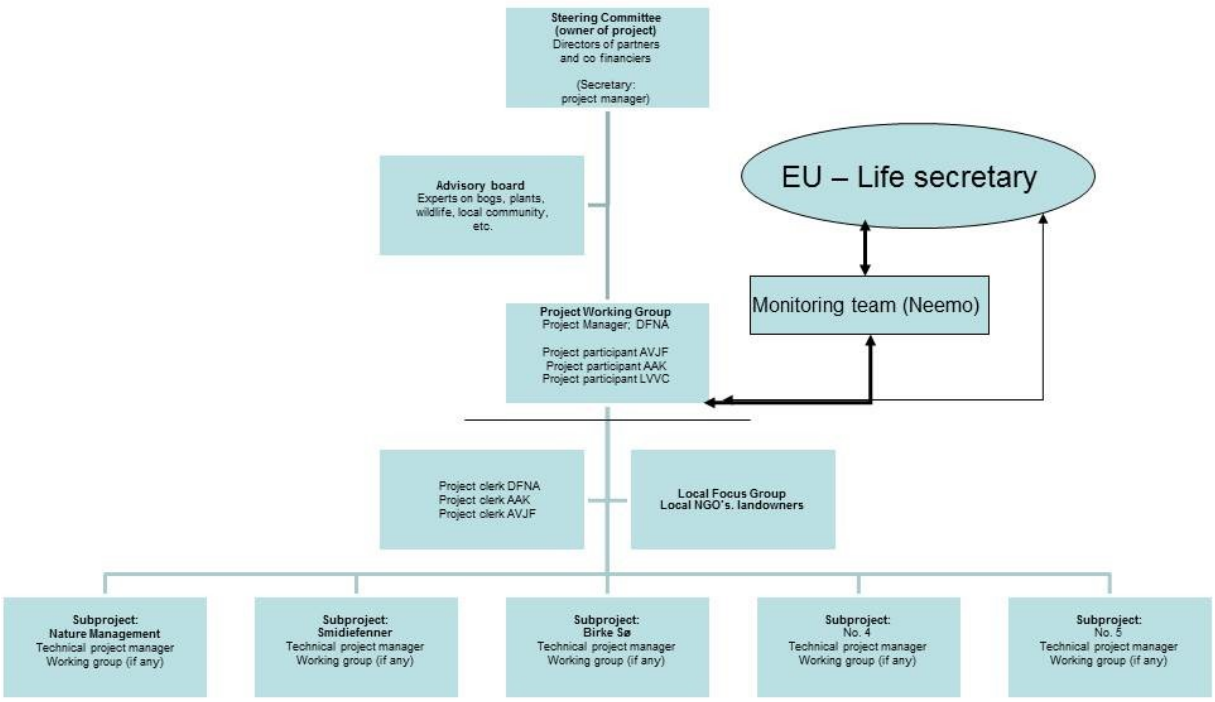
implementation plan, the budget and the necessary resources has been presented, discussed and agreed upon. The members of the Steering Committee are all very engaged and committed to collaborate in relation to this project. Minutes from the meetings held after the last reporting are attached as annex 7.1.1a-c.

The advisory board consists of approx. 12 experts on bogs, wildlife, plants etc. Seven meetings have been held (07/06/2011 (before the LIFE – start date); 31/10/2012; 15/05/2013; 14/05/2014; 12/05/2015; 12/05/2016 and 26/10/2017). The members were also present at the LIFE Kick-Off meeting that was held 31/01/2012. There is an agreement with the members upon that as technical reports are produced, hearings by e-mail should be used as swift tool to involve the advisory board and get important input to the project as a supplement to physical meetings. It is important that the expertise in the advisory board is used actively to comment on and give inputs to the technical parts of the actions. In between the annual meetings the advisory board has been kept updated on the progress in the LIFE+ project by mail. The board has not been gathered since the presentation of the draft management plan for Lille Vildmose in October 2017.

The local focus group with 14 members from local NGO's and landowners have been invited twice a year to get information of the different actions in the LIFE+ project. During the project period 10 meetings have been held. Since the construction work was facing a stand-still period while the appeals were processed by the Board of Appeal, the scheduled meetings with the local focus group were paused. The half-annual meetings were continued in 2018.

The local focus group will continue as a stakeholder group after the end of the LIFE project. Inputs and needs from the stakeholders to the development of the area will be discussed in the group and the group will be used as a platform for informing about future operational and management actions.

Organ gram of project management



4.2 Evaluation of the management system

The partnership agreement has been followed and the managerial process between the partners in the project worked well. Besides the official meetings with agendas and minutes in writing the responsible persons from the three partners have had a day to day communication by phone, mail etc. The project manager has been in continuously dialog with the local project managers to secure project progress.

The project manager has visited the partner's offices several times during this reporting period, discussing project progress and activities with the local project managers and accounts clerk. Procedures for reporting and accounting of the site-specific actions have been talked over.

The project manager had a one-day meeting on 12/10/2011with the National Audit Office agreeing in accounting routines and follow-up schedules. The National Audit Office has annually been informed about the project progress and the expected end date to facilitate a more efficient financial audit of the project.

Communication with the Commission and Monitoring team.
The project management has received a number of letters / instructions from the Commission following visits by the Monitoring team as well as following delivering misc. papers to the Commission. Furthermore, the management has participated in platform meetings etc., there having the opportunity to meet and discuss issues with representatives from both the Commission and the Monitoring team. The advice and support have been very helpful and the team always contactable, thus the project management is very happy with the cooperation.

The project management also appreciates the understanding from the Commission to the challenges encountered during the project.

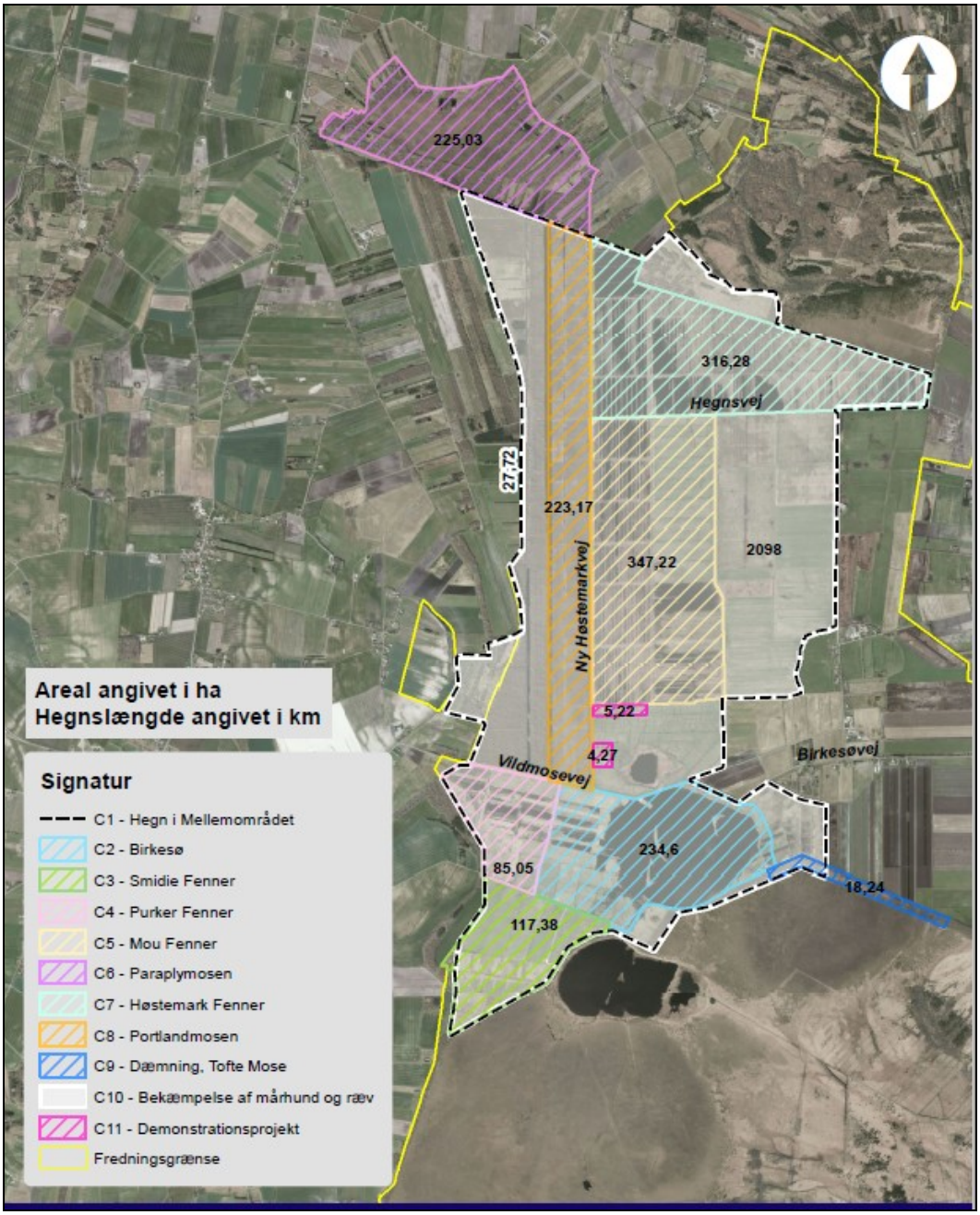
5 Technical part

The description of the technical details of each action in the project covers the period from the start of the project in September 2011 to May 31, 2020. The progress of every action has been compared to the time schedule listed in the Grant Agreement and any changes in time schedules has been described according to this.

5.1 Technical progress, per task

All actions take place in the Natura 2000 areas SCI DK00FX125 and SPA DK00FX007

The map below shows where each C-action took place and the coverage of the target area for each action, respectively.



5.1.1 Action A.1: Permits to carry out conservation actions:

The conservation actions carried out in this project have in most cases required a notification according to the Departmental Order on EIA (Environmental Impact Assessment) in order to examine the need for a screening of the impact of the conservation actions at the environment.

Methodology
Meetings with national experts on EIA have been held. Based on the conclusions of these meetings action C2, C3, C4 and C9 needed a call for a complete EIA procedure. EIA has in September 2013 ended a period of public hearing and the permission to carry out the actions has been given. Two landowners have appealed the permission. A meeting with one of the appealing landowners resulted in a compromise in the detail planning of C2. The landowners withdrew afterwards his appeal. The Environmental Board of Appeal has on July 27th, 2015 dismissed the other appeal.

For the concern of actions C11 and C6 a screening of the impact of the action on the environment has been carried out in June 2013 and April 2014, respectively. The screenings concluded that a complete EIA was not necessary. The decision given for C6 has been appealed. The appeal has been dismissed by The Environmental Board of Appeal.

Dispensation from the Nature Conservancy Board for the nature restoration of Action C6 was given June 30, 2014, but was appealed by a few landowners to The Environmental Board of Appeal. The Board confirmed the decision given by the Nature Conservancy Board on November 24, 2014.

Actions C1, C2 and C9 have been submitted to the Nature Conservancy Board in the beginning of 2014. All of these have been finally confirmed by The Environmental Board of Appeal.

According to the Nature Conservation Act the conservation actions will in most cases also require a notification or permission from the municipality as the competent authority (and not as partner in the LIFE-project). A few landowners consequently appeal all notifications and permissions given by the municipality in order to delay matters. The appeals were pointed at action C2, C3, C4, C6 and C9 and have been treated together by The Environmental Board of Appeal. The board dismissed all appeals.

Planned output and schedule
Action A1 has been delivered according to the Grant Agreement, but has been delayed due to appeals from a handful of landowners. The consequence of the many appeals and following the processing time in the Environmental Board of Appeal led to three extensions of the project period of in all 3½ years granted by the Commission on February 15, 2016, October 17 2018 and November 13 2019, respectively.

Indicators used
N/A

Problems/drawback
A few landowners consequently appeal all notifications and permissions given by the municipality in order to delay matters. The appeals have been pointed at action C2, C3, C4, C6 and C9 and have been treated together by The Environmental Board of Appeal. The consequence of the many appeals and following the processing time in

the Environmental Board of Appeal led to a 3½ extension of the project period granted by the Commission. There has been no further delay regarding finishing this action.

Complementary action outside LIFE
None

Continuation following LIFE Lille Vildmose
N/A

Tables, photographs, etc.
N/A

5.1.2 Action A.2: Preparation of projects, call for tenders for detailed project work

Preparatory actions/management plans
This action is allocated to work on preparation of background reports and analyses in order to obtain the permissions in Action A1 and for preparation of calls for tenders, preparation of contracts with advisors and entrepreneurs etc. Water level data from previous years from existing water loggers in the area are essential background data that is needed to make reliable and up-to-date water level scenarios and to make precise project descriptions about dimensions and construction of weirs etc. in dams and ditches.

Activities undertaken and outputs achieved
Detailed plans, tender documents and contracts have been delivered and signed for most of the actions. Summarized it includes:
A sketch project for the actions C2, C3 and C9 has been produced in order to prepare for a call for tender for a detailed planning.

Subsequently, contracts have been signed with advisors to produce detailed projects for actions C2, C3, C4, C5, C6, C7 and C9. For Action C1 a specialist advisor has been signed to the project throughout the entire project period from 2013 onwards.

Calls for tenders with detailed plans for the physical work have been carried out for actions C1, C2, C3, C5, C6, C7, C8 and C9.

Contracts with entrepreneurs have been signed to conduct the actual physical work for action C1, C2, C3, C5, C6, C7 and C9.

Contracts have been made with a consultant in order to coordinate the calls for tenders for action C4 and C6.

A background report on management of red deer, food availability etc. in the Mellemområde where the fence is expected to be placed, was produced by a specialist from University of Copenhagen in May 2013 (Title: “Anbefalinger vedrørende naturpleje i Mellemområdet, Lille Vildmose”).

A management plan for red deer has been produced during the third and fourth quarter of 2016. The management plan has been presented to the advisory board in 2017.

Methodology
In relation to action C2, C3 and C9 work has been undertaken to gather water level data from different sources and to make them available to the consultant, who will do the detailed project planning.

Work has also been carried out to prepare contracts with the consultants, who will be engaged to produce detailed project plans for action C5 and C7. These actions have been finished in 2013.

In relation to action C1 some preliminary research has also been carried out. This has mainly consisted of gathering information and reading through reports from other similar projects. This work has been necessary in order to be able to write up the necessary applications for the fence, the cattle grates, the release of red deer etc. later in the project period.

There have been conducted preliminary efforts for localizing, organizing and designing of C11 – actions "Demonstration of re-growth of Sphagnum".

Planned output and schedule
All calls, tenders and preparatory actions have been carried out as described in the section above

Indicators used
N/A

Modifications
No modifications conducted for this action

Problems/drawbacks
A few landowners consequently appeal all notifications and permissions given by the municipality in order to delay matters. The appeals have been pointed at action C2, C3, C4, C6 and C9 and have been treated together by The Environmental Board of Appeal. The consequence of the many appeals and following the processing time in the Environmental Board of Appeal led to a two-year extension of the project period granted by the Commission on February 15, 2016. Furthermore, a physical blockade of a group of landowners resulted in a stand-still period of the construction work in the summer 2018. This led to a request for an extension of the project period in order to finish the C3 action. The request was granted by the Commission in October 2018. A consequence of the physical blockade was a transfer of the remaining construction work of C3 to another contractor. In 2019 the construction work was again delayed due to a physical blockade by landowners as well as a period of extreme rain.

Complementary action outside LIFE
N/A

Continuation following LIFE Lille Vildmose
N/A

Tables, photographs, etc.
N/A

5.1.3 Action A.3: Kick-off workshop

Preparatory actions/management plans
The kick-off seminar was held 31/01/2012. The event took place in Lille Vildmose at the Lille Vildmose Visitor Center. The workshop was held together with another Danish raised bog project LIFE10 NAT/DK/000099 SMOTH. A total of 60 persons attended the seminar. The participants background where very broad; scientist, landowners, administrators, volunteers, etc. The topics discussed where: Aims and

goal in the LIFE-project, general issues regarding raised bog and the restoration of such, local knowledge about birds and historical life in Lille Vildmose. The atmosphere at seminar was relaxed and there was no negative comment against the project. Afterwards there was an article in the LIFE newsletter and in a regional newspaper. Program, list of participants and minute from the seminar has been produced and attached in the Inception Report.

5.1.4 Action B.1: Purchase of 3 ha arable land outside the northeast edge of Tofte Mose

This action has previously been rated necessary for accomplishing Action C9. Discussions with the landowners have been held without luck. In the meantime, an alternative solution has been found to avoid purchase of land. The alternative placement has been proved according to the criteria in the Habitat Directive and has been accepted. As described under section 5.1.13 the dike will be placed on land owned by AVJF, but along the outer edge of the bog. The alternative solution will be more expensive due to the higher dike than included in the budget for this action. This, as well as the transfer of budget from B1 to External Assistance in Action C9 has been granted by the Commission in letter dated 03/09 2015 Ares(2015)3635111.

5.1.5 Action C.1: Nature management, grazing by large herbivores

Preparatory actions/management plans
Preparatory work like identifying the exact fence line as well as describing the proper type of fence has been undertaken and reports on fence type and placement of the fence have been prepared. Furthermore, methods and plans for how to catch the red deer from the two existing fenced areas in Lille Vildmose has been undertaken including plans for smaller fenced areas for acclimatization of the red deer before they are released into the new fence.

In order to gain experience and in order to qualify the tender documents two short fence lines 100 meters each were put up by two different entrepreneurs in January 2015. This gave valuable information that was included in the tender documents that were prepared afterwards.

Our dialog with the local community has exposed that this particular action has a high need for awareness, as the fence will be a noticeable feature in the area. In order to meet these concerns a public meeting was arranged on April 13th, 2015 at the local school where the plans for the coming fence were laid out.

To raise the level of knowledge about best-practice to prevent overgrowth of trees and shrubs in Mellemområdet AAK and AVJF have had national experts, with the help of international expects, to work out a report with recommended “tools” on how to carry out nature management in the future as a supplement to the red deer described in action C1. The experts recommend that the optimal grazing result will be achieved by a combination of red deer and moose. Since the report is related to nature management in Mellemområdet in general and contains valuable descriptions and recommendations, the report will become an important part of the future nature management specific for Mellemområdet. The report is available for download from the project website. The report has been attached as annex to the Progress Report 30/11/2013 as annex 7.1.a.

Activities undertaken and outputs achieved
During 2015 the entire fence line has been cleared for trees and made ready for the construction of the fence.

In March 2015 a call for tender for setting up the fence has been completed and contract signed with an entrepreneur in May. The fencing has been initiated in June 2015 and has been finished in April 2016. Hereafter the first 28 red deer were introduced to the area after first being immobilised. In the Grant Agreement it was planned to introduce 50 red deer during the project period. However, with a natural breeding success, the population was expected to reach 50 animals within the project period. At the end 2019, the population was estimated to be between 80 and 160 animals.

During 2017 the fence was subject to a final quality check and an inspection the following year.

Methodology
The activities in this action are divided into two categories:

- Clearance of fence line. Along the 30 km of fence line trees and shrubs has been removed to make space for the fence and for a working area for the continuing control of the fence in the future.
- Raising the fence. Specialized machinery has been used for raising the fence.

The tasks with clearing the fence line and raising the fence has been separated and offered in two different tenders.

Planned output and schedule
By the end of April 2016 more than 27 km fence has been raised surrounding 21 km^2. A smaller fence was raised and used for acclimatization of the red deer before they were released into the large fence.

Indicators used
The success of this action is 2.100 fenced hectares and a buildup of a population of between 80 and 160 red deer. The grazing pressure will be monitored continuously and at least once every second year. The monitoring method will be a combination of counting by drone, reports from the inspection authority and coordinated total counts. It is expected that the area of degraded raised bog will develop into bog areas with a higher level of biodiversity compared to the present state.

Modifications
The report on how to carry out management in the future in Mellemområdet made by a panel of experts has not been a part of the output outlined in the Grant Agreement. The Commission has in their letter dated 03/09 2015 granted, that the report becomes a part of the eligible material from this LIFE project. The report is available for download from the project website.

Problems/drawbacks
The process of preparing the detailed project and receiving all relevant permits was complicated and prolonged the action period with 9 months compared to the time schedule proposed in the GA.

Complementary action outside LIFE

The panel of experts has in their report recommended that the population of red deer should be supplemented by a small population of moose in order to optimize the management of Mellemområdet. Moose prefer wooden feed such as birch and willow and is specialized to wet and swampy areas. The Municipality of Aalborg and Aage V. Jensen Naturfond have in a joint effort released a small population of 12 moose into the area.

In the recently initiated Life project LIFE Open Woods (LIFE18 NAT/DK/000747) Aage V. Jensen Naturfond will introduce visent in the forest Tofte Skov in Lille Vildmose as a 'tool' to keep the grass vegetation down and to create a more dynamic and variated nature in the forest.

The costs attached to moose will not be a part of the finances of the LIFE project and the project manager has assured to keep invoices attached to moose separated from LIFE + invoices. The financial model for C1, based on two tenders for a moose fence and a red deer fence, respectively, has been presented to the Commission and accepted as eligible, cf. letter from the Commission (Ares(2015)5144257 - 17/11/2015).

Continuation following LIFE Lille Vildmose

The management of the Mellemområdet will continue after the LIFE project because the need for keeping down trees and shrubs will be a continuously threat to the raised bog. The Municipality of Aalborg will have the responsibility of the fence and the management of the population of red deer and moose after the LIFE project. A more detailed description of the continuation of the action and the monitoring of the effects is outlined in the After LIFE plan.

Tables, photographs, etc.

Photos from fence action

Fence is raised

Red deer in fenced area

5.1.6 Action C.2: Re-establishing natural hydrology in north central Tofte Mose by restoring Lake Birkesø

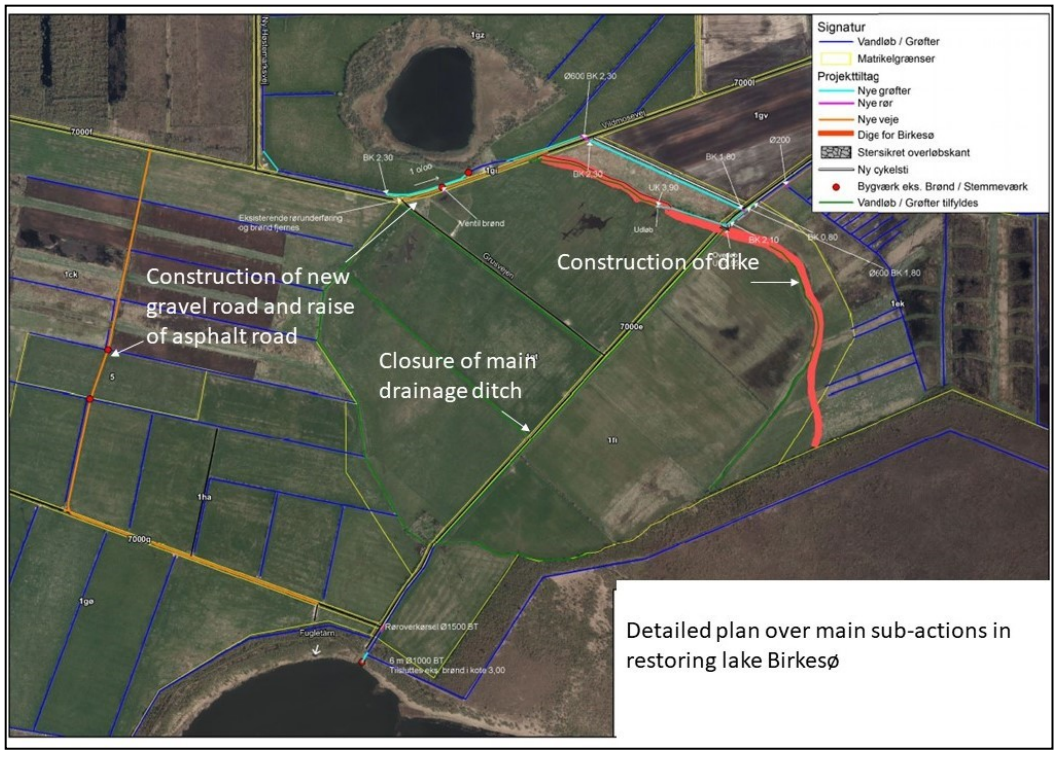
Preparatory actions/management plans

The preparatory work was initiated with a EIA covering the restoration of lake Birkesø, the hydrological changes in Purker Fenner (action C4) and the construction of the two dams (C3 and C9) along the intact raised bog, Tofte Mose. The EIA made the basis for the subsequently preparatory work regarding all permissions, all sketches, detailed reports and all tenders. A detailed design of the project has been delivered and has made the basis for a call for tender for the construction work.

Our dialog with the local community has exposed that this particular action has a high need for awareness since many people have had a strong wish the last 25 years to see the lake restored. It has therefore been a focus point for the project group to keep the public as well informed of the progress of the action as possible. The public has been invited to an information meeting about the restoration project at Mou School on March 26th, 2015 and several guided visits to the site during and after finishing the action has contributed to disseminating information to the public.

Activities undertaken and outputs achieved

Restoration of the 130 ha large lake Birkesø covered a range of specific sub-actions that were necessary to implement before letting the water into the lakebed. These sub-actions included the construction of a new access road to Langelinie and Lake Tofte Sø, the raise of the main asphalt road Vildmosevej and building of a dike along the north and northeastern rim of the lake. Some of the sub-actions are shown in the map below. The construction work was started in May 2015. As the final action, a stretch of the main drainage ditch was closed in 2017 hereby letting the water into the lakebed.



Map of Lake Birkesø showing main sub-actions for restoring the lake

The activities undertaken and the output have been achieved as follows:

Sub-action	Output achieved
Dike	1,400 meters
Raising main road	500 meters
Construction of new gravel road	1,000 meters
Raise of existing gravel road	780 meters
Construction of bird island	3 islands of in all appr. 3 ha
Closure of main ditch	1,300 meters
Restored lake	130 ha

Methodology
Raising the water level in the lakebed was relatively straightforward. The main action here was to close a stretch of the main drainage ditch that ran through the lakebed. However, since the original lake has been drained for more than 200 years, infrastructure has developed and agricultural use of the surrounding land has subsided the soil layer. It has therefore been necessary to raise part of the main asphalt road to prevent it from being flooded by the lake water as well as it has been necessary to build a dike on the northern rim of the lake to prevent the lake water to flood the neighboring fields and to keep the lake in its original shape.

To ensure a continuity in supervision of and follow-up on the construction work, the same consulting company, who made the detailed project report, also followed the construction work. This was done by meetings between consultant, members of the LIFE project team and leading staff from the construction company every other week, where the progress of the work was discussed and emerging challenges and problems were taken. However, another consultant company was involved in the final part of the action to bring in a second opinion and a quality check on the construction work.

Planned output and schedule
On December 6., 2017 the restoration of Lake Birkesø was celebrated at a public opening ceremony with speeches by the council member from the Municipality of Aalborg and Chief Forester from Nature Agency. Within two months the area developed into a 130-ha shallow lake as expected.

Indicators used
The success of this action is the immediate development of a 130-ha shallow lake.

A continuing monitoring of the birdlife will indicate the success of the restored lake as breeding and feeding site for the Annex-I species mentioned above.

Modifications
The risk of appeals on the regulatory work has been realized.

Problems/drawbacks
Two landowners have appealed the EIA permission. A meeting with one of the appealing landowners resulted in a compromise in the detail planning of C2. The landowners withdrew afterwards his appeal. The Environmental Board of Appeal has on July 27th, 2015 dismissed the other appeal.

In late January 2018 Denmark experienced more days with strong wind resulting in high water pressure and waves on the dyke. A stretch of the dike that was new

established didn't have the grass covering necessary for withstanding the exposure to the increased water level. That resulted in erosion damages to that part of the dyke. Since the dyke is build up around a watertight plastic membrane, there was no risk that the water uncontrolled would run out of the lake. However, an effort was made to prevent further damages to the dyke by covering the dyke with straw mats and by lowering the water level in the lake.
Inspection of the dike has revealed a fine recovery of the grass cover and the water level in the lake has returned into its normal stage.

Complementary action outside LIFE
Lake Birkesø has been selected among 50 new established lakes in Denmark to be included in a research project run by universities of Copenhagen, Aarhus and Southern Denmark and sponsored by Aage V. Jensen Naturfond. The aim of the project is to get a better understanding of the development of biodiversity in new lakes and a best practice in establishing lakes. The project is based on scientific surveys as well as citizen science contributions. The project can be followed here: www.nyedanskesøer.dk

Lake Birkesø has in this study contributed with valuable data on especially the issue concerning phosphorus release from new lakes. The data will be presented in a paper (in preparation) published in an international journal in 2020.

Continuation following LIFE Lille Vildmose
Monitoring water levels and maintaining dikes and weirs will be carried out by the Municipality of Aalborg after the end of the LIFE project.
The Nature Agency and the Aage V. Jensen Naturfond will inspect the dike regularly over the next years to follow the condition of the dike and the grass cover.

The vegetation on the three small bird islands in the lake will continue to be managed and kept down by the Aage V. Jensen Naturfond to ensure a proper breeding biotope for birds.

Tables, photographs, etc.
Photos here below shows aerial photos of the lake before (2014) and after the restoration (2019).


Location of Lake Birkesø in 2014


Location after restoring the lake (2019)

5.1.7 Action C.3: Re-establishing natural hydrology in Tofte Mose and Smidiefenner

Preparatory actions/management plans
The preparatory actions have been made together with action C2 and C9 because all three actions have been put together in the same tender and contract for the construction work.

Activities undertaken and outputs achieved
In 2017 clearance of birch trees was done as preparatory work for the construction of the dam/dike towards Tofte Mose.

According to the GA a total of 20 ha of raised water level has been achieved on the raised bog Tofte Mose as a result of the construction of in total 1640 meter long dam/dike and 90 ha of raised water level has been achieved on the degraded, former raised bog areas in Smidie Fenner by the construction of weirs etc.

Methodology
The action consists of two parts:

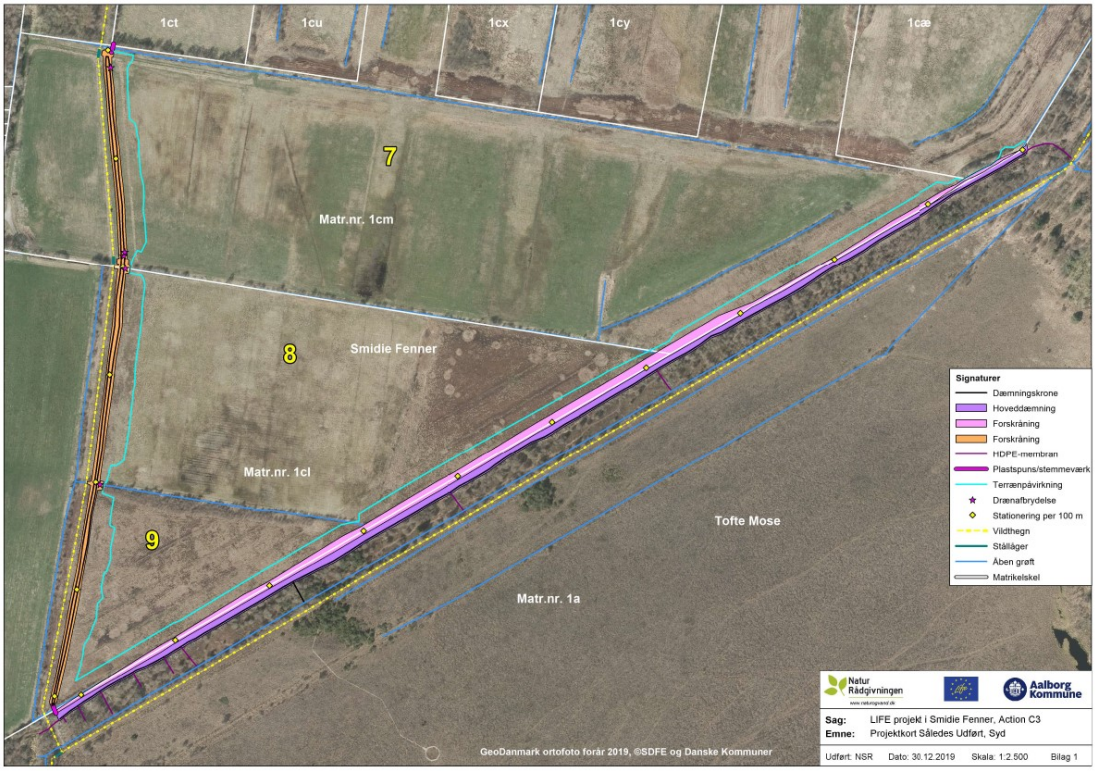
1. Construction of a large dam/dike towards the Tofte Mose raised bog in order to gain optimal hydrological conditions on the raised bog. This sub-action is referred to as the Southern part of Smidie Fenner. Since the large dam along the Northeastern rim of Tofte Mose (action C9) was constructed prior to this action, the contractor has gained valuable knowledge on how to handle large membranes and how to prepare the site for construction. The incorporation of the watertight membrane was in that way eased.
2. Raising of the water level on formerly excavated raised bog areas in order to establish optimal conditions for regrowth of sphagnum and in the long term for redevelopment of raised bog habitats. The methodology involves construction of weirs, peat dams and closing of old drainage systems. This sub-action is referred to as the Norther part of Smidie Fenner.

Planned output and schedule
The concrete physical work was scheduled to begin in 2nd quarter of 2016 and continue throughout 2016. However, due to appeals from the landowners and very wet conditions the construction work was not finalized before end of October 2019. In the last period of the construction work, Aalborg Municipality, who was responsible for carrying out this action, put in more labor to increase the workflow in order to finish the work without any further delay.

In the northern part of Smidie Fenner the main activities have been to close ditches and prepare for a raise in the water level. The map below shows where ditches have been closed and drain pipes disconnected.

Closure of ditches (yellow markings)

In the sourthern part of Smidie Fenner the main activity has been to build a watertight membrane into the rim of the bog.



Membrane in broad purple color. Small perpendicular dams are shown as narrow purple lines

Indicators used

To verify the effect of the constructed dam on the retention of water in the bog, a visual detection of open water areas on the bog side of the dam will be used as indicator. This indicator has been used with success in the similar action C9. Over time, the coverage of bog vegetation on the rewetted area will also indicate the success of the effort in this action. However, since the action was finished late in the project, changes in vegetation has not been possible to observe.

In the northern part og Smidie Fenner changes in vegetation and observations of sphagnum moss development along with a visible raise in the water level on the site will be used as indicators for achieving the expected results. As mentioned above, the late finish of the action has not made it possible to detect any changes yet. However, spreading of sphagnum moss species into rewetted areas in other locations of Lille Vildmose gives the expectation to the same development in the rewetted areas in Smidie Fenner.

Modifications
Minor modification has been made throughout the project period in order to protect the areas outside the project area better and to adapt the construction details to the physical conditions in the field. This has been done as a result of extensive dialogue with a number of the landowners.

Opening the boundary ditch on the west side of the project area was skipped. The ditch did not have any impact on the water level in the project area, neither on the agricultural areas outside the project area. Furthermore, a weir in a small ditch between Fenne 5 and Tofte Mose and a dam between Fenne 6 and 7 are not included in the permission from the Water Course Law and therefore not performed. Additionally, has it not been possible to localize and disconnect 7 drainage pipes as planned. None of these elements are assessed to influence the quality or output of the action.

Finally, as a protection against erosion and lack of peat soil, all smaller cross dams perpendicular to the large dam were constructed with a HDPE membrane instead of only the first and the last cross dam.

The crosses on the map below indicates the changes mentioned above.

Problems/drawbacks
All permits issued in relation to this action have been appealed by a number of the landowners in the project area. The long processing in the Board of Appeal resulted in a delayed decision and consequently a delay in the initiation of the construction work. Furthermore, staged the landowners a physical blockade in 2018 as well as in 2019 with a further delay of the construction work as a consequence. The project management has on that background submitted three prolongation requests to the Commission. The project management thank the Commission for its goodwill in granting the project the prolongations.

Complementary action outside LIFE

Establishing a watertight membrane in the dam towards the bog hasn't been conducted on such a large scale or under such conditions as seen in Lille Vildmose. Similar projects in raised bogs on other Danish locations has gained from the experiences achieved in this project. Latest, the LIFE project Raised Bogs in Denmark (LIFE14 NAT/DK/00012) asked for details on economy and construction methods prior to submitting the application.

Continuation following LIFE Lille Vildmose

The future maintenance of the dam and monitoring of water levels will be carried out by the Municipality of Aalborg.

Tables, photographs, etc.

Transect of membrane under construction

Same transect after construction

5.1.8 Action C.4: Re-establishing natural hydrology in Purker Fenner

Preparatory actions/management plans
All permits were issued by 30/06/2017

Assessment of the impact of the activities in this action on the environment has been carried out in a common EIA together with the actions C2, C3 and C9. The EIA made the basis for a tender assignment regarding a detailed project description and, which again made the basis for a tender assignment regarding the construction work.

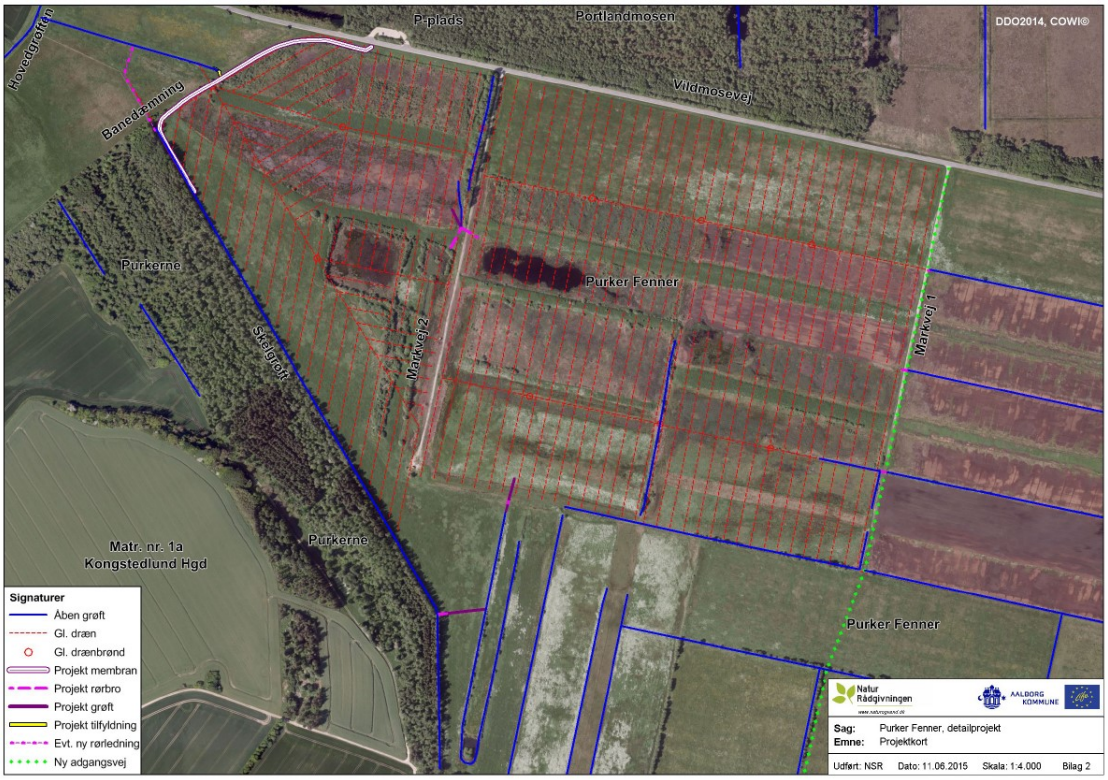
Activities undertaken and outputs achieved
Part of the construction work in this action were carried out during 3rd quarter of 2013. This includes removal of most of the topsoil depots in the area and filling some of the larger depressions in the area in order to prepare for optimal ground levels before the water level is raised. Because the new gravel road as access to Lake Tofte Sø will cross Purker Fenner, this part of the action C4 has been connected to the establishment of Lake Birkesø (Action C2) and was carried out parallel to the construction work in action C2. The gravel road was finished in October 2015 with a following check and re-levelling in 2019.

According to the GA a total of 165 ha of raised water level has been achieved on the degraded, former raised bog areas in the project area in Purker Fenner by the construction of weirs, dams etc.

Methodology
The action consists of two main parts:

1. Removal of nutritious topsoil from the most vulnerable areas in the project area and filling of depressions with peaty topsoil in order to optimize future water levels for sphagnum growth
2. Closing of ditches and construction of a weir in order to raise the water level in the area to optimize sphagnum regrowth and in the long term to optimize conditions for creation of raised bog habitat.

The map below is part of the detailed project description and shows the activities carried out in Purker Fenner.



Project plan of Purker Fenner

Planned output and schedule

The schedule for the concrete physical work was integrated in the schedule for action C2 Lake Birkesø. The final work regarding raising the water level by building in a watertight membrane and closing ditches was carried out and finished in September 2018.

Indicators used

Purker Fenner has been pointed out as one of the locations where the development of bog vegetation as a result of the changes in hydrology is monitored during the project (action E2). However, because the action was completed rather late in the project period, the monitoring transect in Purker Fenner was closed since it didn't made sense to continue monitoring on a location with no changes.

However, aerial photos of Purker Fenner reveals the changes in visible water level before and after the construction work indicating that these objectives have been achieved.


Summer 2010


Spring 2019. Dark areas is open water

Modifications
In order to make sure that cultivated areas outside the project area wouldn't be affected by the project a membrane impermeable to water has been placed on the western boarder of the project area. This was not foreseen in the GA.
Also mentioned in the GA the nutrient rich topsoil in the project area should be either used for filling of ditches or large depressions in the eastern part of the project area or removed from the area altogether. Most of the nutritious topsoil has been removed from the eastern part of the project area where the most optimal and thus nutrient poor conditions exist for recreating active raised bog in the future. In addition, large depressions have been filled in both in the eastern and western part of the area. Thus, a larger part of the topsoil has been used for filling depressions in order to gain more optimal water levels in the future than expected in the GA where it was expected that most of the topsoil would be removed from the area. It is our assessment that this approach will make better framework conditions for future sphagnum regrowth compared to a situation where all the topsoil depots were removed from the area leaving deeper water levels on large parts of the project area consequently.

Problems/drawbacks
The permit from the Watercourse Act was appealed and delayed the completion of this action. The action was completed in September 2017.

Complementary action outside LIFE
Restoring natural hydrology is a well-known and tested method in NST as well as in AAK and AVJF and is taking place on several locations outside the LIFE project. The knowledge obtained from this action will be used to improve the methods and performance in future nature restoration projects.

Continuation following LIFE Lille Vildmose
The future maintenance of the project site including control of water levels will be carried out by the Municipality of Aalborg. Development of the bog vegetation will be followed by the national monitoring program NOVANA carried out by the Environmental Protection Agency.

More thorough description of the future management of the area is given in the After-LIFE plan.

Tables, photographs, etc.

Construction of watertight membrane on north-western border of Purker Fenner.

5.1.9 Action C.5: Raising water level in Mou Fenner

Activities undertaken and outputs achieved

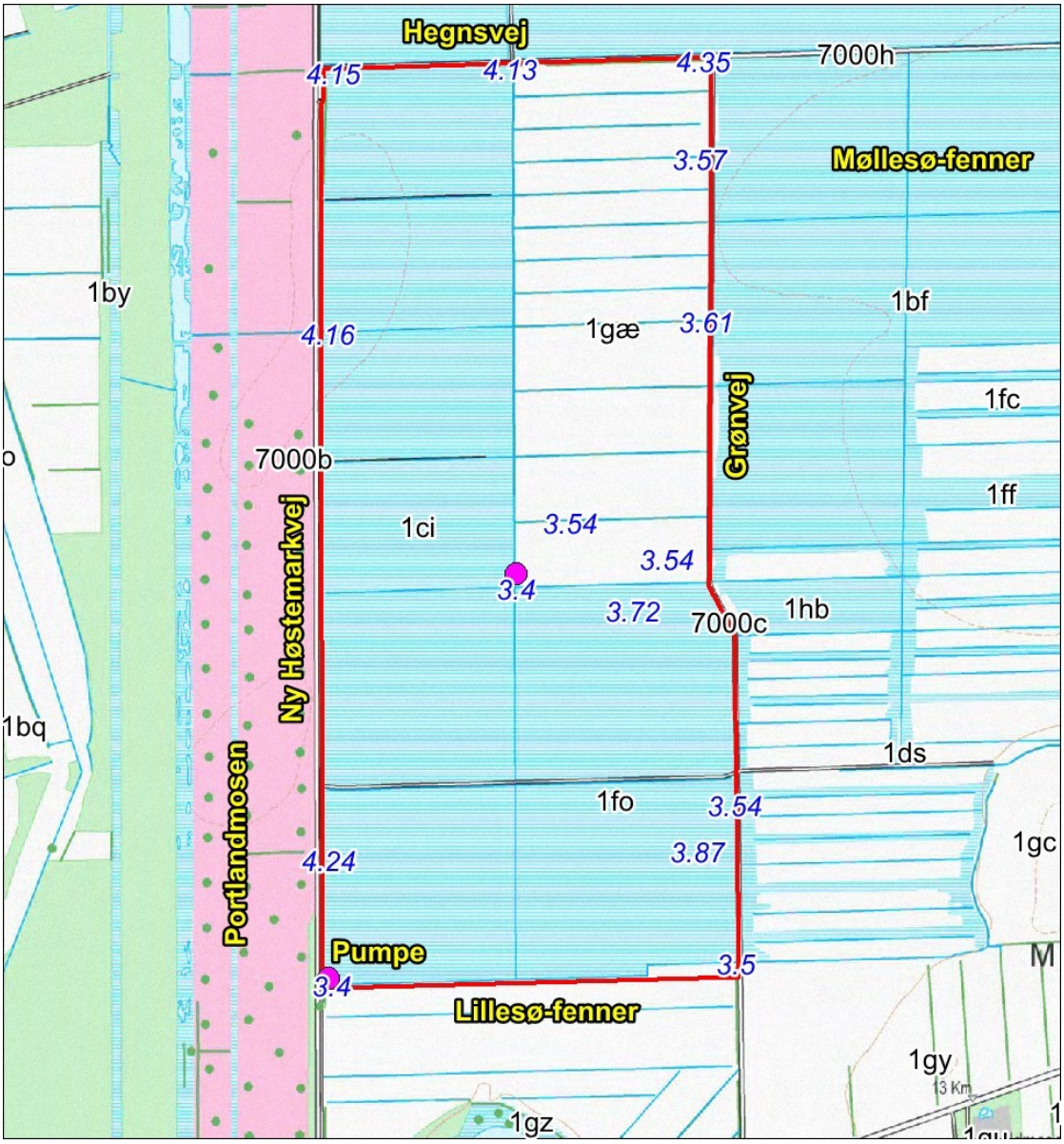
The actions taken include the dismantlement of a pumping station and the establishment of two adjustable weirs in order to raise the general water level in the area. The result is raised water level on approx. 170 ha of former peat excavation areas.

Methodology

In order to raise the water level in Mou Fenner a pump has been dismantled and replaced by a weir to regulate the water level.

Planned output and schedule

A detailed description plan outlined the activities needed to complete the action. The map here below shows the location. The pump to be dismantled is placed in the southwestern corner of the project area and has been replaced by a adjustable weir. Another weir to control the water level has been placed central in the area. Both weirs are marked with pink dots in the map.



Location of activities in Mou Fenner. Established weirs are shown with pink dots

This action has followed the proposed time schedule and was completed in 4th quarter of 2012.

Indicators used
The water level in Mou Fenner is controlled by a single weir and the water level in the entire Mou Fenner can be adjusted here if needed.

Modifications
No modifications made in this action

Problems/drawbacks
No problems encountered

Complementary action outside LIFE
N/A

Continuation following LIFE Lille Vildmose

The future maintenance of the project site including control of water levels will be carried out by the Municipality of Aalborg.

Tables, photographs, etc

Old pumping station

New weir replacing the pump

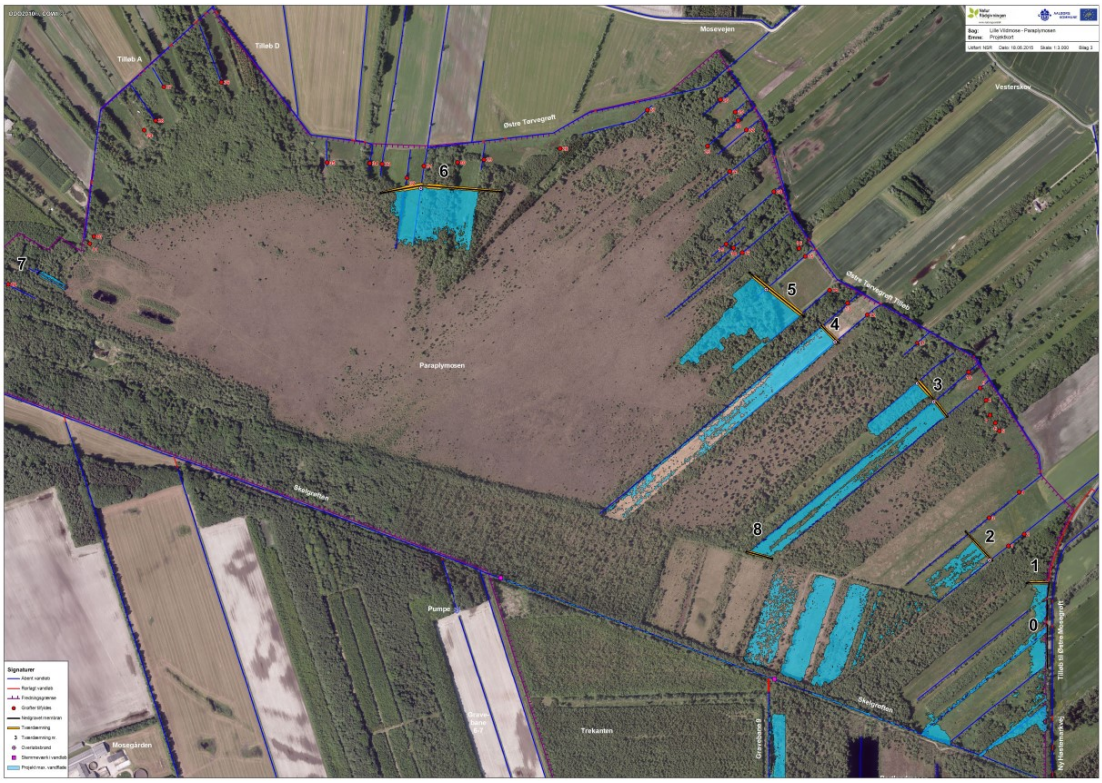
5.1.10 Action C.6: Re-establishing natural hydrology in Paraplymosen

Preparatory actions/management plans

Like the other project areas in the LIFE-project the area of Paraplymosen is covered by an act of conservation. Therefore an application to the competent authority in relation to the conservation act was submitted prior to the initiation of the construction work. A detailed plan describing the intended activities to complete the action was developed and made the background material for the application and the following tender procedure. Five landowners complained about it, and subsequently a final approval was given in November 2014. After further negotiations with the landowners a screening for an EIA was conducted in May 2015 which concluded that an EIA should not be carried out. Two stakeholders have appealed. The appeal was upheld by The Natural and Environmental Appeal Board on April 18, 2017.

Activities undertaken and outputs achieved

The action comprised a raising of the water level on formerly excavated raised bog areas in order to establish optimal conditions for regrowth of sphagnum and in the long term for redevelopment of raised bog habitats. The methodology involved 6 peat dams, closure of old drainage systems and clearance of undesirable tree growth. The map here below is taken from the detailed plan and shows where the drainage systems has been closed and the consequently effect.



Detailed plan of activities in Paraplymosen. Dots are planned closed drainage systems

The results achieved counts 225 ha with raised water level and 1000 meter of watertight membrane build into dams. Furtermore, 15 ha of trees have been cleared.

Methodology
To protect the raised bog from degradation due to drainage on the outskirts, weirs and dams are built in strategic places in the bog. The methodology is well known and has been used by the contractor elsewhere in Lille Vildmose as well as in other projects outside this Life project.

Trees have been cut down motor manually and left on site for natural decay.

Planned output and schedule
The original plan was to complete this action in 3rd and 4th quarter, 2016. However, due to landowner appeals the completion was delayed with one year and finished oin 2017. The action was closed with the completion of tree clearance in 3rd quarter 2018.

Indicators used
Like all actions involving construction work, the contract with the contractor includes an inspection and quality control immediately after the construction work has finished. The work is planned to be followed up 1 and 5 years after finishing the work. This gives the project owner an insurance for the stability in the construction work and the opportunity to have errors and shortcomings repaired.

Modifications
During the preparation of the detailed project a number of adjustments have been made compared to the project description in the GA. First of all, a total of 1000 meters of dams has been constructed instead of only 410 meters as expected in the GA. This

change was necessary in order to secure optimal water levels on the remaining areas of raised bog. Also, the number of ditches that has been blocked are less than the expected 85, partly because the extra dams are doing their job.

The doubling of the total length of dams consequently gave a larger effect on the raised water level than expected, why a part of the trees planned for clearance could be reduced. The Commission accepted this modification in letter 25/05/2018 and the area of clearance was consequently reduced from 30 ha to 15 ha.

Problems/drawbacks
As for the other projects involving local landowners in Lille Vildmose, all permissions have been appealed. This prolonged the project period accordingly resulting in a closing of the action October 2018.

Complementary action outside LIFE
N/A

Continuation following LIFE Lille Vildmose
The future maintenance of the project site including control of water levels will be carried out by the Municipality of Aalborg.

Tables, photographs, etc.
Photos here below shows the construction of one of the smaller dams in Paraply-mosen. Peat to be used as topsoil on the dam was collected locally creating small deeper pools. The photo to the right shows the construction of the long watertight membrane along the main road.


Removal of topsoil created small ponds

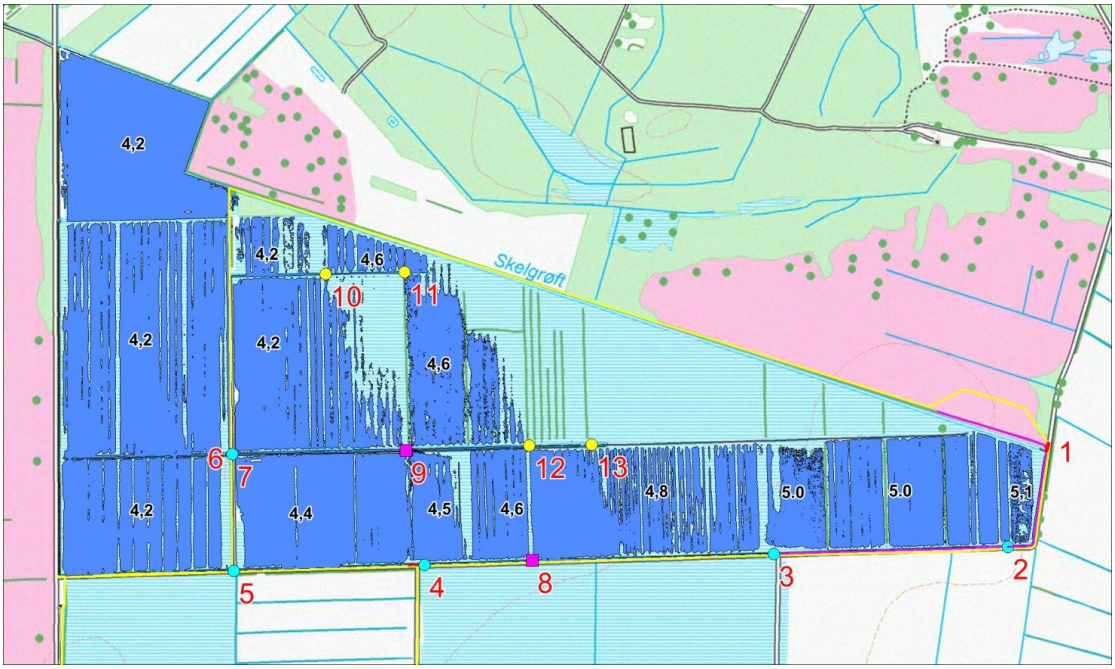

Construction of watertight membrane

5.1.11 Action C.7: Re-establishing natural hydrology in Høstemark

Activities undertaken and outputs achieved
This action has been more straightforward than expected

The action included the establishment of a bentonite membrane along approx. 1200 meters of the eastern boarder of Høstemark Fenner in order to keep the water inside the formerly excavated area. It also included placing a PE-membrane along an approx. 400-meter-long transect along the southern border of the active raised bog in Høstemark Mose situated on the northern edge of the project area in order to avoid the water from seeping out of the raised bog. In addition, a number of internal ditches have been closed either by adjustable weirs or by turf in order to raise the general water level in the area.

The result of the activities is 80 ha with raised water level

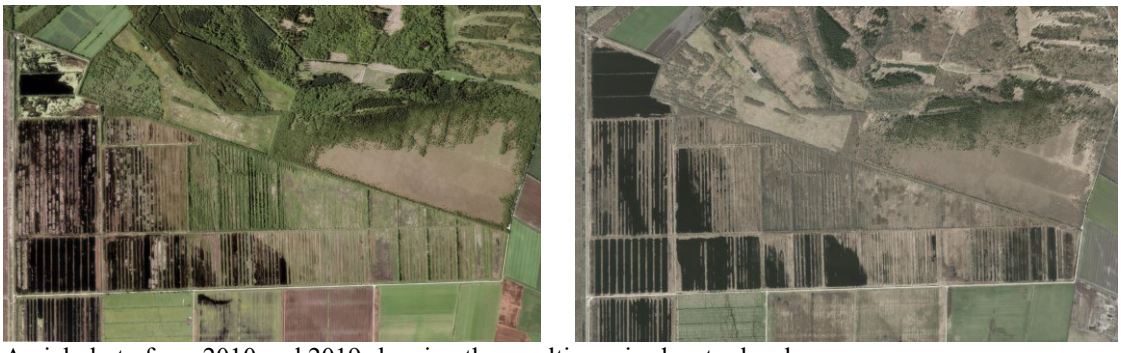


Methodology
This action was the first in the Life project to use bentonite as a watertight membrane. However, bentonite is often used in construction of landfill sites to prevent seepage from the landfill into the groundwater.

The incorporation of the PE membrane was handled with a home-constructed box to control the long roll of plastic membrane. Photo of the special box is shown below.

Planned output and schedule
The re-establishment of the hydrology in Høstemark Fenner and Høstemark Mose has been carried out in 2012 and 1st quarter of 2013 and in accordance with the GA.

Indicators used
To verify the implementation of the action and the results obtained aerial photos before and after the implementation can be used to show the hydrological changes.


Aerial photo from 2010 and 2019 showing the resulting raised water level

Furthermore, changes in vegetation in the area monitored across the project period has been used as an indicator for improving the conditions for regrowth of sphagnum species and other plant species indicative of succession towards raised bog. The plant vegetation as well as the hydrology has been monitored along a fixed transect during the project period. The results are described under action E2 and more thoroughly in

the monitoring report in annex 7.2.10 a + b, but shows a spontaneous development of sphagnum mosses in areas with raised water level.

Modifications
During the preparation of the detailed project 2 weirs were added to the project and 400 meters of PE-membrane was placed towards the edge of the active raised bog in Høstemark Mose at the northern edge of the project area in order to better protect the still intact raised bog area in Høstemark Mose. These are minor changes with the same objective, to reach the goal of the action in the most effective way.

Problems/drawbacks
No serious problems were encountered.

Complementary action outside LIFE
The action was kick-started by the former minister of environment Ida Auken and EU Commissioner for Environment Janez Potočnik as part of the celebration of the 20-years anniversary for the Habitats Directive and the LIFE programme.

EU Commissioner for Environment Janez Potočnik giving a speech

Continuation following LIFE Lille Vildmose
The future maintenance of the project site including control of water levels will be carried out by the Municipality of Aalborg.

Tables, photographs, etc.

Box to control PE roll

Bentonite membrane is in place

5.1.12 Action C.8: Clearance of tree growth in Portlandmosen

Preparatory actions/management plans
In autumn 2011 the project made a small workshop were some of the experiences from LIFE05 NAT/DK/000150 were discussed. The workshop also included small demonstration sites with different techniques to do manual cuttings.

Since the cutting activities were planned to take place over two rounds, the contracting of the work was also split into two tender procedures. That gave the opportunity to use the knowledge and experiences gained from the first round of work to refine the frame for the following task.

Activities undertaken and outputs achieved
Based on the findings from the workshop as well as the small demonstration site, clearance started in the 2nd quarter of 2013. An evaluation report in Danish has been made for the hardware cutting attempt and was attached as annex 7.1.d in the Progress Report 30/11/2013. The evaluation concluded that the hardware cutting with machinery was too tough for the bog vegetation and left behind open peat spots as perfect seedbeds for birch germination.

In the GA 170 ha of birch clearance should be achieved on active raised bog. This goal has been achieved.

Methodology
The clearance technique was based on an intensive model by hand, where the trees are cut twice a year and two years in a row. On a smaller area the cutting was tried with machinery, but the result was more time- and euro consuming than the cutting by hand.

Planned output and schedule
According to the project timetable, this action was expected to start in the 2nd quarter of 2014 but was already initiated/partly implemented in 2013.

The action has been ahead of the time schedule and was finished in September 2014.

Indicators used
To evaluate the effect of the clearance activities, documentary photos have been taken during the project period. The photo series reveal that the cutting method is effective on the short run but has to be followed up by either grazing or a raise in the water level or a combination.

Modifications
None

Problems/drawbacks
None

Complementary action outside LIFE
Cutting trees and shrubs are an often-used method to create clearings and the experiences gained in this project will contribute to a better management of similar areas elsewhere.

Continuation following LIFE Lille Vildmose
The regrowth will be assessed on a regularly basis, but it is expected that the population of red deer (and moose) by time will be able to keep the regrowth of birch and the willow down. However, the regrowth of birch has lately been assessed as critical and at this moment there seems to be a need for an extra clearance. AAK has included in the management plan for Portlandmosen, that the water level in the area will be raised to the highest possible level and supplemented with motor manual clearance of trees to the extent needed for an optimal development of raised bog vegetation.

Tables, photographs, etc.

Photo showing Portlandmosen (from North to South) before initiating cutting activities

Photo showing Portlandmosen (from South to North) after finishing cutting activities

5.1.13 Action C.9: Protect existing raised bog in the northeast part of Tofte Mose

Preparatory actions/management plans

This action has been planned together with action C2 and C3 and is a part of the call for tender that had run from 5th November to 4th December 2013 (see section 5.1.6).

The preparatory design of the action included two scenarios. In one scenario, a narrow band of arable land along the edge of the bog should be purchased (action B1) in order to build the dike with a built-in watertight membrane. In the second scenario, the dike was built directly into the bog edge.

Activities undertaken and outputs achieved

The construction of the dam was started in July 2015 and finished in 2nd quarter 2016. The result was a 1500 meters long and 4 meters high dike. The dike resulted in an immediate damming up of water on the bog-side of the dike. Approximately 35 ha of raised water level appeared along the dike, which was according to the GA.

Aerial photo of dike along the edge of Tofte Mose

The aerial photo shows the result of the dike, leading to an immediate raised water level of 30-40 ha on the bog-side of the dike.

Methodology

It was the first time in Denmark where a watertight membrane on a 1500 meters long stretch should be built into a dike in order to protect a raised bog from desiccation. The construction work challenged the contractor and valuable knowledge was gained during this action. A knowledge used afterwards in the construction of a similar dike in Smidie Fenner (action C3) as well as outside the Life project.

Due to the wet conditions in the bog, it was necessary to construct a temporary road for the dumpers and excavators to drive back and forth along the dike. The mineral soil used for the temporary road was simultaneously used as material for the dike to keep the membrane in place. All in all 14 m^3 of mineral soil was used per running meter of dike.

A temporary road was needed during the construction

Damming up water along a 1500 meters stretch, resulting in 30-40 ha of open water on the bog-side of the dike, increased the risk of creating a continuous flow of water along the dike a the downstream direction. To halt the water flow, small peat dams were built perpendicular to the large dam into the bog.

Photo showing the watertight bentonite membrane ready to be covered and kept in place by the mineral soil.

Planned output and schedule

Working in a bog area is often challenged by wet conditions and construction works are controlled by the weather. It is only possible to count in the summer month as suitable for construction work and even then it can be necessary to stop working in September due to rainy weather. The dike was delayed due to severe weather conditions and finalising the last 200 meters of the dam might was postponed to the spring of 2016.

In 2017, a 1-year inspection was completed to follow up on the construction work and to detect any damages.

Indicators used
Aerial photos revealed an immediate damming up of water on the bog-side of the dike and the area of raised water has been used as an indicator for the success of the action.

Furthermore, a transect perpendicular to the dike running into the raised bog has been established as part of the monitoring of changes in bog vegetation in action E2. With the increased water level inside the bog, it has, however, not been possible to continue the monitoring of the vegetation along this transect. The development of bog vegetation has instead been observed from the dike.

Modifications
Two alternatives for placing the dike along the edge of Tofte Mose have been presented in the EIA and afterwards given permission to. One of them was to place the dike just inside the bog area. This part of the bog is degraded and can no longer be characterized as active raised bog. By placing the dike here compared to on the purchased land, it will be possible to achieve a higher water level inside the bog than foreseen and create better conditions for improving the conservation status of the active raised bog. Thus, we expected a positive effect on at least 30-40 hectares of raised bog instead of the foreseen 10 hectares.

This alternative, though more expensive, was selected and the budget from action B1 – land purchase – has been transferred to action C9, External Assistance. The Commission accepted this modification in the 2nd progress report (Ares(2015)3635111 - 03/09/2015)

Problems/drawbacks
Appeals from the landowners postponed this action. The action was finished in May 2016.

Complementary action outside LIFE
Establishing a watertight membrane in the dam towards the bog hasn't been conducted on such a large scale or under such conditions as seen in Lille Vildmose. The knowledge and lessons learned from the action have been used in action C3, where a similar dike is constructed. Furthermore, lessons learned have been transferred to other projects on other Danish locations with a need for protecting raised bog from desiccation.

Continuation following LIFE Lille Vildmose
The future maintenance of the dam and monitoring of water levels will be carried out by the Municipality of Aalborg.

Tables, photographs, etc.

Photo of small perpendicular dam.

After 1½ years the areas of open water were covered by vegetation.

5.1.14 Action C.10: Control of invasive carnivores and red fox

Preparatory actions/management plans

All permits for controlling foxes by capture or shooting has been given from the local nature conservation authority. AAK applied the conservation board (Fredningsnævnet) and AVJF applied the local nature conservation authority. The terms were to report back to the authorities on a yearly basis which has been done during the entire project period.

Activities undertaken and outputs achieved

20 wooden traps were built and mounted with sms-modules and placed in the project area, where the carnivores were expected to pass by. Personnel from AVJF has been checking up on the traps, checking the bait on a weekly basis and the signal from the sms-modul every day and checking the traps when the traps were triggered.

Wooden trap with sms module

Wooden trap with sms-module giving an alert sms when the trap has been activated

15 smaller traps for American mink have been set up in the project area in the fall 2012 and keeps active for a few months every year when the mink was in the rut and on the move during the spring months.

5 fox dens have been established in 2012. The dens are made of plastic tubes and dug in the ground (circa 0,5 meter under the surface). The dens were checked every second week during the months of November to February.

During the project the raccoon dogs were controlled the first years by monitoring GPS-collared raccoon dogs that were sterilized. During the latter years in the project

the raccoon dogs were culled on fixed bait/feeding-stations, which were fitted with trail cameras. With this set-up the man hours spend were very focused.

All work done with this action has been carried out by AVJF-staff.

Methodology
Best practices on controlling foxes and invasive carnivores is a combination of trapping, seeking the foxes in their dens, seeking foxes using rifles in their mating season (January-February for the foxes), using GPS-collar-techniques and trail cameras on bait-/feeding stations for raccoon dogs. The know-how on controlling raccoon dogs has been evolved nation wide during the last five years in Denmark, as the species has spread even more all over Jylland/Jutland.

Planned output and schedule
This action was up and running from the first day and is still being focused on to the very last day in the project. The action consists of several above-mentioned methodology.

./.

The result has per March 25, 2020 been 58 raccoon dogs, 10 mink and 71 foxes. The control effort and results are discussed in status report attached in annex 7.2.1. The report has been published in the annual report of bird observation in North Jutland and will as well be available on the project website as well.

Local birders are monitoring carnivores in the project area and are registering their observations in the DOFbasen (www.Dofbasen.dk).

Indicators used
Number of animals taken out, gender, weight and date has been collected for all the culled animals. The local birder caretaker group registers observations of fox, mink and raccoon-dog in the project-area. Mink and raccoon dogs are very seldom observed thus the mink is now very common and the raccoon dog is most active during nighttime. The number of observations of foxes has been going down since 2012, which is an expression for a lower number of foxes in the area – and therefore a success for the project. The number of observations varied in the following years, where foxes were observed here and there in the project area during the entire year even though foxes were culled.

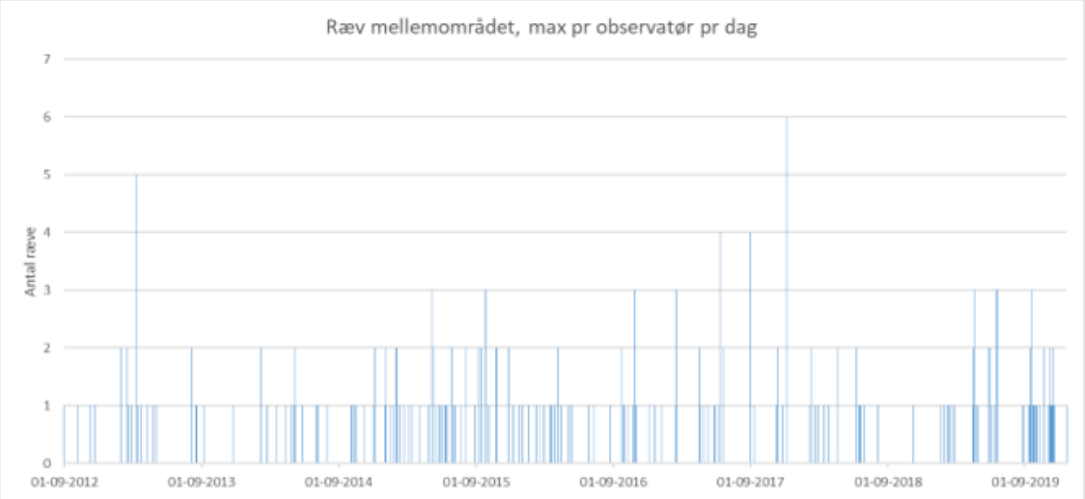
Modifications
Best practice has changed during the project-period for controlling raccoon dogs. In the first years of the project it was recommended to trap them, but now the recommendations are to maintain bait-/feeding stations fitted with trail cameras. This follows the overall recommendations in the country. Therefore, there has been some modifications to the methodology for this action in the project.

Problems/drawbacks
Two problem/drawbacks have been encountered in this action:

1. The fox density has been difficult to monitor. We did not succeed with monitoring by lamping the foxes thus this monitoring was part of a hare-monitoring program which fell to the ground after a few years in the project period. The second method was not consistent; thus, the numbers of observers has been varying during the years. Foxes are a natural part of the Danish wildlife and the project only planned to reduce the numbers, not to eradicate them all, but it has been difficult to

determine how many to cull each year. See figure below for all registered observations in the project area during the years.

2. The overall population of raccoon dog has risen during the project. The first years only a very few animals were culled, but the latter years the numbers has increased dramatically. The action therefore has to continue for the coming years to have any effect. This was not foreseen back in 2012!



The figure shows that the number of registered foxes vary a lot over the years; from 17 to 59 with the lowest number registered in 2018 and highest number in 2019. The average number of registered foxes over the project period is 35 per year.

Complementary action outside LIFE
The traps for mink are part of another NST-project but contribute to this LIFE-project without costs for the LIFE-project.

Raccoon dogs are also targeted in the LIFE09NAT/SE/00034-project, which contributes to this LIFE-project in the first 3-4 years of the project.

AVJF and Lille Vildmose Naturfond have bought and lent equipment (feeders, trail cameras, high seat, etc.) to the local Mou Hunting Association and Als Hunting Association - and are in ongoing dialogue with neighboring hunters to the project area, who have also created feed/bait stations to control raccoon dogs.

Continuation following LIFE Lille Vildmose
Decision has been taken to keep controlling both foxes and raccoon dogs. All equipment from action C10 will therefore be reused in the following years. This is a focus point for both AVJF and AAK.

Several Facebook-groups are spreading best practice on the control of raccoon dogs as this has turned into a new focus point for Danish hunters almost nationwide.

Recently, the use of night vision binoculars has been authorized at national level, which increases the possibility of regulating the dogs by the feeding/bait stations.

Tables, photographs, etc.

Raccon dog caught

5.1.15 Action C.11: demonstration project for re-growth of Sphagnum

Preparatory actions/management plans

Mette Risager, a top 3 expert in sphagnum and raised bog in Denmark, was hired to prepare the design of the demonstration project (Progress Report 30/11/2013 as annex 7.1.n) and has also carried out the final evaluation of the project.

Activities undertaken and outputs achieved

On the basis of the design report made in 2013, the excavation of the demonstration plots has been carried out in two steps from autumn 2013 to autumn 2014. Pindstrup Mosebrug, a peat excavator in Denmark, found interest in participating in the project as they could gain experiences on re-growth of sphagnum. Pindstrup has contributed with machine power and skills.

The work in this action was more aimed at an operational approach than a scientific approach, giving space for adjustments during the project period.

The final report reveals that the conversion of grass fens to peat areas dominated with sphagnum species and simultaneously lowering the risk of overgrowth with birch, willow,Typha, reed or Bulrush needs a very precise control of the water level in the test areas. It can be concluded that keeping a water level 10-15 cm above the peat surface halt the massive germination of birch and willow. If birch and willow take root, they are very difficult to get rid of later on. However, a water level 10-15 cm above ground is very difficult to combine with a simultaneously spreading of small fragments of sphagnum. The small sphagnum fragments drown. Adding straw mats to the area gives sphagnum the opportunity to attach to the mats improving the growth conditions for the sphagnum in situations with high water levels.

It can be concluded from the demonstration project that it is difficult to reach a thick “carpet”-like dominance of sphagnum on former grass fens within a few years if the conversion has to be operational and replicable to larger areas. However, it is clear that aiming at a result with a successive step towards a habitat dominated by bog

vegetation including sphagnum mosses, it is possible with this method and reachable within a few years.

Methodology
The methodology for the practical implementation of this action is thoroughly described in the test design that was enclosed in annex in the first progress report.

Construction of demonstration site

The demonstration project has been monitored midterm by field biologist from the Danish Nature Agency and finally by Mette Risager as part of the final reporting. The monitoring program is based on the monitoring program used in the national nature survey program. This gives the opportunity to compare the results from this project with other similar surveys.

Planned output and schedule
Parts of the demonstration project were already completed in 2013 and the experiences and results from the first year have been used to adjust the design for the rest of the project area. This has revealed a need for more precise control of the water level in the parts of the demonstration site in order to control the growth of willow and birch.

The action has since then been up and running and has been followed regularly to control water level and to document the development of the sphagnum growth. Observations from the regular control visits have been recorded in a log book as background material for the final evaluation.

A report evaluating the process, the technical execution and the outcome of the demonstration project was conducted by Mette Risager in autumn 2019 and supplemented with observations made by the Nature Agency (annex 7.2.2 and 7.2.3).

Indicators used
The indicators used are:

- Water level
- Presence and coverage of plant species including sphagnum mosses
- An overall assessment of the physical conditions of the demonstration beds including unwanted plant species.

Modifications
As described in the Inception Report, the budget in this action has been difficult to estimate. To make an economically realistic set-up, the total area of the demonstration project has been adjusted. This modification was accepted by the Commission by the 1st Progress Report. The modification did not influence the aim and goals of the action.

Problems/drawbacks
As described above, the project was in the beginning challenged by the germination and spreading of Typha, birch and willow – undesirable species in a sphagnum re-growth experiment. However, the two-step construction of the demonstration sites made it possible to adjust the sites with a better control of water and introduction of new ideas to improve sphagnum growth simultaneously with combating undesirable species. This process has given valuable knowledge that has been transferred to re-growth experiments outside LIFE.

Complementary action outside LIFE
Attention from outside Denmark has been given to the demonstration project. The project manager and the Danish top expert in raised bogs, Mette Risager, gave an introduction to the demonstration site for Herman Oosterkamp, who had shown a high interest in our project. Additionally, scientists from CINDERELLA, a joint project between universities in Germany, The Netherlands, Sweden and Denmark have specifically visited the demonstration site, where the project manager gave a presentation of the project design and the first preliminary results.

In September 2014 Lille Vildmose hosted a workshop with members from the Ramsar Norbalwet initiative group funded by the Nordic Council of Ministers and the participants were introduced to the LIFE project and especially action C11. This workshop kick-started the elaboration of a resolution adopted by the Ramsar Conference of the Parties in June 2015 and a policy brief explaining the importance of bogs and peatlands in climate change mitigation with Lille Vildmose as example.

The results and knowhow gained from this demonstration action is now used to develop new plots in another area to demonstrate new methods and to improve the knowledge on how to kick-start the regeneration of the bog in Lille Vildmose. These new activities are funded by the EU Interreg North Sea programme under the European Regional Development Fund and a clear example on how new projects are building on results obtained from the LIFE project.

Continuation following LIFE Lille Vildmose
The demonstration project has already produced valuable knowledge that is used in a new sphagnum re-growth experiment in Lille Vildmose funded by the EU Interreg programme

(https://naturstyrelsen.dk/naturbeskyttelse/naturprojekter/interreg-canape/).
This project will add more knowledge how to expand the regrowth of sphagnum mosses to other grass fens, when the right conditions are there.

There is also an interest outside Lille Vildmose to use the experiences gained here to start regrowth projects on former excavated peatland areas.

Tables, photographs, etc

./. Photos for comparing development and changes in vegetation in the demonstration sites are compiled in annex 7.2.4.

Spreading of sphagnum on demonstration site

Photo of area with sphagnum growth

For an overview of all results achieved in the project are summarized per C-action in the table below.

Name of action	Nature management	Lake Birkesø	Raised waterlevel Smidie/Tofte	Raised waterlevel Purker Fenner	Raised waterlevel Mou fenner	Raised waterlevel Paraplymosen	Raised waterlevel Høstemark Fenner	Clearance of trees Portlandmosen	Dike, Northeast of Tofte Mose	Demonstration project	
Results	C1	C2	C3	C4	C5	C6	C7	C8	C9	C11	Total
Raised water level effeectively targeted 7110* (ha)		12	20	0	0	90	15		35	0	172
Raised water level on degraded bog area (ha)		118	90	165	170	135	65		0	12	755
Raised water level in total (ha)	**0**	**130**	**110**	**165**	**170**	**225**	**80**	**0**	**35**	**12**	**927**
Filled canals/ditches effecively targeted 7110* (m)			0				1500				1500
Filled canals/ditches on degraded raised bog (m)			7				0				7
Filled canals/ditches in total (m)	**0**	**0**	**7**	**0**	**0**	**0**	**1500**	**0**	**0**	**0**	**1507**
Blocked ditches effectively targeted 7110* (quantity)		0	0			70	2				72
Blocked ditches on degraded raised bog (quantity)		1	4			0	0				5
Blocked ditches in total (quantity)	**0**	**1**	**4**	**0**	**0**	**70**	**2**	**0**	**0**	**0**	**77**
New dikes, dams effectively targeted 7110* (m)			1640	0		1000		170	1500		4310
New dikes, dams on degraded raised bog (m)		1300	0	500		0		0	0		1800
New dikes, dams in total (m)	**0**	**1300**	**1640**	**500**	**0**	**1000**	**0**	**170**	**1500**	**0**	**6110**
Cleared from trees and bush effectively targeted 7110* (ha)						15			5		20
Cleared from trees and bush on degraded raised bog (ha)						0			0		0
Cleared from trees and bushes in total (ha)	**0**	**0**	**0**	**0**	**0**	**15**	**0**	**0**	**5**	**0**	**20**
Protected edge of 7110* effectively targeted 7110* (m)			8			3600	1200		1500		6308
Protected edge of 7110* on degraded raised bog (m)			0			0	0		0		0
Protected edge of 7110* (m)	**0**	**0**	**8**	**0**	**0**	**3600**	**1200**	**0**	**1500**	**0**	**6308**
Grassed by large herbivores effectively targeted 7110* (ha)	233							170			403
Grassed by large herbivores on degraded raised bog (ha)	1836							0			1836
Grassed by large herbivores in total (ha)	**2069**	**0**	**0**	**0**	**0**	**0**	**0**	**170**	**0**	**0**	**2239**
Weirs, riffles, pumps effectively targeted 7110* (quantity)		0	0			2					2
Weirs, riffles, pumps on degraded raised bog (quantity)		1	7			0					8
Weirs, riffles, pumps in total (quantity)	**0**	**1**	**7**	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**12**

5.1.16 Action E.2: Monitoring of impact of targeted habitat type and bird species

Active raised bog (7110*) has been the main habitat type in Lille Vildmose before the exploitation of the central part of the area (Mellemområdet) and comprises today approximately 2000 ha of the project area. With the exploitation of the central area, parts of the former raised bog has changed to the habitat type 7120 'Degraded raised bog still capable of natural regeneration' and habitat type 91D0* 'Bog woodland' as a consequence of increased desiccation due to drainage, airborne N-deposition and a subsequent invasion of birch on areas of active raised bog. Fragmentation of the intact areas of raised bog is also one of the main threats to the conservation status of the habitat type raised bog.

These habitat types are the main targets in the project, with a specific focus on changing the conditions of degraded bog in Mellemområdet towards more favorable conservation status for the habitat types referred to above.

Birds on Annex I and included on the list of Special Protected Area (SPA) no. 7 are all species targeted by the project. Of these can be mentioned Golden Eagle, Wood sandpiper, Short-eared Owl, Crane and Black stork. A complete list is shown in the GA.

In a 6-year cycle, all habitat areas are visited and the habitat types are mapped assessed regarding conservation status and threats. These data are presented in a basis analysis report that compare the changes in conservation status of the targeted habitat types and species with similar basis reports 6 and 12 years ago, respectively.

At the time of writing this final report, the next basis report is under preparation. The preliminary results from this basis report indicate a change of habitat type 7110*, 7120 and 91D0* towards a better conservation status. Even though there is a tendency towards a better conservation status for these targeted habitat types, the effect of the many measures and actions in the Life project might not give a breakthrough within such a relative short project period. It takes longer time for active raised bog to increase in size. However, the many measures in the project will undoubtedly have a positive effect on the existing raised bog and halt the further degradation of the habitat type.

The following chapters describes the many elements in the project monitoring
./. programme and summarize the man results obtained through the monitoring.

Activities undertaken and outputs achieved

- Effect on population on bird. This is based on volunteer work done by Birdlife Denmark, North Jutland Chapter. A monitoring program based on linearly assessment by distance sampling has been made. Annual reports on monitoring results have been made and a summarizing status report on the bird monitoring and a table showing observations from 2015-2019 are available on the project website as well as attached in annex 7.2.5a-d.
- The annual reporting from the Birdlife Denmark as well as the many voluntary observations recorded in the national birdlife database, DOFbasen, reflect the improved hydrologic conditions in Lille Vildmose. Especially the restored Lake Birkesø has many records of breeding and roosting birds. A report on the bird observations connected to Lake Birkesø is attached in annex 7.2.6 and is also available on the project website.

- Species composition and vegetation structures. A monitoring of the baseline composition of species and the vegetation structure has been conducted in 2012. The baseline monitoring has been followed up by a monitoring in 2014 and an end monitoring of the same transects in 2019. The results have been compiled and discussed in a monitoring report on the change in vegetation structure as a result of the Life project actions. The report is attached as annex 7.2.7a-f and is available on the project website.
- The species composition, vegetation structure and regrowth success of sphagnum mosses in the demonstration project has been monitored and compiled in an evaluation report and a supplementary note with observations. These reports are attached as annex 7.2.2 and annex 7.2.3 and are also available on the project website.
- Water level logging. The description of the program was detailed in a baseline report and baseline data was collected from 6 loggers placed in the project area. These data have primarily been used in the preparatory phase for the detail planning of actions in the project. An additional water level logger has been mounted in the Hovedkanalen to register water levels and flow as required in the EIA for C2, C3 and C9. The logger submits on a daily basis hourly-recorded data by email of the water level and temperature in the Hovedkanal. The data will be used to follow and document the water level before, during and after the re-establishment of Lake Birkesø.
- Birch cover and regeneration. The first part of the cutting project has been evaluated. Photo documentation before and after cutting has been made.
- Effects of grazing by large herbivores. This monitoring program will be carried out in relation to C1, Nature management by grazing and will consist of a monitoring of the development of vegetation, insects and deer including animal welfare. The monitoring will be ongoing and will be conducted the first time in 2021. For a more thorough description of the monitoring programme, see annex 7.2.8.
- The results of controlling carnivores are published in a local yearly report. The culling of foxes and raccoon dogs is an ongoing action, which is needed for keeping the level of ground predation on nesting birds down. For a thorough description of the method and the results during the project period, please see chapter 5.1.14. Results are compiled in a status report available on the project website and in annex 7.2.1.

Modifications
A part of the botanical monitoring program is to follow the changes in composition and structure of the vegetation. Since the construction work in Purker Fenner and Smidie Fenner was delayed, it did not make sense to do a mid-term monitoring on these sites. A monitoring transect placed perpendicular to the dam at Tofte Mose (action C9) was omitted at the end monitoring in 2019 due to very wet and swampy conditions as a result of the raised water on the bog side of the dam. The registration of vegetation was instead done from the dam looking in to the bog. These changes are all described in the monitoring report.

Planned output and schedule
All monitoring actions have followed the planned schedule with the modifications mentioned above and the collection of data has benefitted from the extension of the

project period. This has given a better data basis to conclude on changes as a result of project measures. All monitoring actions have delivered data to reports that are available for download on the project website. A short summary of the monitoring results are given here below.

Birds

Of the species directly targeted by the project, Golden eagle seem to have a stable population of 2 breeding pairs, with a third pair in a breeding attempt in 2019. The population of White-tailed eagle has been doubled within the project period – from 1 to 2 pairs. Crane has benefitted significantly on the increased area of raised water level with a population increasing from 4 pairs in 2011 to 8 pairs in 2019. The numbers of overwintering Bean goose seems to fluctuate around 1600 individuals with a maximum number of 2300 in 2016.

The increased area of raised water level in the project area have had a positive effect on the population of birds – breeding as well as roosting species. After reestablishing the hydrological conditions in Mellemområdet, the area is expected to become the core area for the population of Bittern in Lille Vildmose. In 2019 29 booming individuals were observed.

Also the restoration of Lake Birkesø have had a positive effect on birds – highlighted by a high number of roosting species and a close to doubling of the number of breeding pairs of Black-headed gull in Lille Vildmose.

Vegetation

The monitoring activities during the project period reveals that it takes time to be able to observe visible changes in vegetation because of the efforts in the project. Spontaneous occurrences of sphagnum mosses has been observed in Høstemark Fenner – one of the first locations in the project to have reestablished its hydrology. This is a very positive result and shows that the raised bog can recover over time if the right conditions are in place. In other areas changes in hydrology have favored the development of more bog-like vegetation in succession towards raised bog.

Combating the regrowth of trees in Lille Vildmose is dependent on the population sizes of the introduced large herbivores. Over time, it is expected that they will be able to control the regrowth. In the meantime it will be necessary to supplement with manual clearance activities.

Problems/drawbacks

No problems encountered

Complementary action outside LIFE

Lake Birkesø has been included in a project run by three Danish universities that will follow the development of biodiversity in 11 new established lakes. The project can be followed here: http://www.nyedanskesøer.dk/.

Lake Birkesø has in this study contributed with valuable data on especially the issue concerning phosphorus release from new lakes. The data will be presented in a paper (in preparation) published in an international journal in 2020.

The results and knowhow gained from this demonstration action is now used to develop new plots in another area to demonstrate new methods and to improve the knowledge on how to kick-start the regeneration of the bog in Lille Vildmose. These new activities are

funded by the EU Interreg North Sea programme under the European Regional Development Fund and a clear example on how new projects are building on results obtained from the LIFE project.

Continuation following LIFE Lille Vildmose
The effects of grazing by large herbivores will be followed on a regularly basis after the LIFE project.

The experiment with sphagnum regrowth will be followed after the LIFE project to obtain knowledge and donor material for expanding the regrowth sites in other similar places.

./. **Tables, photographs, etc**
Status report summarizing bird observations throughout the project is attached in annex 7.2.5c+d
Bird observations at Lake Birkesø is attached in annex 7.2.6
Summarizing report on vegetation monitoring is attached in annex 7.2.7a-f
Reports about demonstration of sphagnum regrowth are attached as annex 7.2.2 and 7.2.3.
Annual reports in bird observations since last progress report are attached as annexes 7.2.5a and 7.2.5b.

5.2 Dissemination actions

5.2.1 Objectives

The project shall establish a website, publish a folder, provide information boards, establish facilities for visitors, establish a co-operation with landowners and the local communities and attend conference(s) in nature management and provide guided visits. At project end also a Layman's report, a report on best management practice and restoration of raised bogs and a final seminar must be delivered.

The overall objectives being too promote the project including the background and create understanding and acceptance for the project. Furthermore, the above sources of information must convey the findings / experiences of the project.

Beside the above-mentioned sources of information a number of meetings of informative nature has been held, the local press has been used as frequent as possible as has other specialized publications.

5.2.2 Action D.1: Mounting of information boards

./. Map tables/information boards have so far been placed on 6 key localities:

- Høstemark Mose and Mou Fenner. Information about re-establishing natural hydrology.
- Portlandmosen. Information about control of Racoon Dog.
- Portlandmosen, at the board walk. Information about clearing of trees.
- Demonstration site. Information about the demonstration project.
- Portlandmosen and Mou Fenner by the fire tower. An information board with information on the LIFE-project and about the cultural heritage in the project area has been placed adjacent to the watch tower.

- Birkesø. Two information boards are placed near the bird watching pavilion at Lake Birkesø. One board describes the technical details of restoring the lake. The other board describes what flora and fauna you can expect to find in and near the lake. A third information board will be placed at the new parking spot at the west side of the lake. Sketch of information board is attached in annex 7.3.1.
- Tofte sø. Information board will be raised here to inform about the project actions in Smidie Fenner and Purker Fenner. The production of the information board is in process and at the time of writing this end report no sketch of the board is available.

All information boards are available as pdf files from the project website

5.2.3 Action D.2: Facilities for visitors

The increasing number of visitors to Lille Vildmose put a pressure on the facilities in the area. It has therefore been an important part of the Life project to raise a number of different facilities to meet the requirements of the many visitors and to create a good experience for them.

The facilities raised during the life projects counts:

The old fire tower. The tower was raised in May 2014 and is one of the most popular sites for visitors in Lille Vildmose.

The foot path to Kællingebjerg was finished and the final part in December 2013. The 1700 meters long path consists primarily of a marked foot path. On 25-30 places along the path a wooden boardwalk has been built to cross the moistest areas.

8 **benches** has been placed at

- P-pladsen ved Rovfugletårnet
- P-pladsen ved Brandvejen
- P-pladsen ved Brandvagttårnet
- P-pladsen ved Kællingbjergstien, Vildmosevej
- P-pladsen ved Kællingbjergstien, Sigsgårdsvej
  Høstemarktårnet.

In addition, 3 sets of benches have been transformed into a **special arrangement/picnic place** called “the cranes nest” adjusted into the landscape in the northern part of Portlandmosen.

A **bird watching platform** has with co-funding from a national grant scheme for local green partnerships been upgraded to a bird watching pavilion and raised on the northern edge of Lake Birkesø. Aage V. Jensen Nature Foundation has supplied the pavilion with two fixated binoculars for public use. The pavilion is decorated with drawings of the most common birds and animals to find around the lake and two large TV screens inform about the project, the area in general and gives the opportunity to use the pavilion for educational purposes.

Counters placed at the entrance of some of the facilities reveal a remarkable increase in numbers of visitors during the Life project period. In 2014 around 77.000 people visited Lille Vildmose. This number increased to 177.000 visitors in 2016, which corresponds with the introduction of large herbivores in Mellemområdet as part of action C1. In 2019 the number

of visitors reached as high as 240.000 people, which is a clear sign of the general increasing interest in nature among people and in Lille Vildmose in particular.

5.2.4 Action D.3: Project website

The website was launched 09/12/2011 on the www-domain www.lifelillevildmose.dk. It has a complete review of the nature project in Danish and in English language. It is hosted at NST and will be active years after the end of the project. The website has ongoing been updated with news, progress and reports.

Reports and other relevant material will be available on the website after the end of the project.

5.2.5 Action D.4: Layman's report

The Layman's report is a folder in A5 size describing in pictures, maps and short texts the historical as well as the project development of Lille Vildmose. The Layman's report has been produced in Danish 2.000 copies for distribution. The report has furthermore been translated into English that will be available as PDF version on the website. The report in the English version is attached in annex 7.3.2.

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5.2.6 Action D.5: Co-operation with landowners and the local communities

Five **public meetings** have been held during the project period. The meetings have been open to everybody and have been announced in local newspapers. The venue for the meetings has been close to Lille Vildmose at Mou Skole (a local school).

The first meeting was held 04/04/2011 before the official start date of the LIFE-project. The purpose of this meeting was to prepare the local community on the scope of the Natura2000 – plan and to inform that one of the tools for financing could be LIFE+.

A second public meeting was held 13/12/2011. About 60 persons were present. The purpose of this meeting was to inform about the actions in details and the time schedule. But another important purpose was to tell that the process for this project is forthcoming and that we would use every opportunity to inform about the coming plans for nature restoration. There was a positive atmosphere at the meeting and the proposal wasn't met with opposition. To some extent the cause to that might be that not all the landowners, that will be affected, were present at the meeting.

The third meeting was held 19/06/2013 where approximately 80 people primarily were informed about the action C1 and the fencing of the Mellemområdet in Lille Vildmose.

The 26/03/2015 and 13/04/2015 the fourth and fifth public meetings were held with information about the construction work on C2, C3, and C9 and the fence project, respectively.

Seven meetings in the Focal group have been held throughout the project period to inform local stakeholders about the project progress and to give the stakeholders a platform to ask questions and discuss issues directly with the project management group.

Beside the public meetings there have also been short meetings with landowners. These meetings have a more informal approach and are typical arranged by phone with short notice and without agenda in writing.

One to two public work-days have been held annually – 13 in all - with the collaborator "Lille Vildmose Foreningen" (Friends of Lille Vildmose) as organizer. The purpose was to inform about the LIFE-project, to involve the local community in an active way and to carry out concrete nature restoration. Overall result: 40 ha raised bog (Høstemark Mose) with small sitka spruce plants where cleared by manual volunteer work, birch trees (up to 2-3 meters) where cleared from an upcoming raised bog surface (Mou Fenner Vest og Syd) and sphagnum material (growing) has been spread to a few ha in the area south of the Høstemark Mose. In average 20-35 persons have participating each day. The press has covered the events and the first event was featured in the radio and in local television.

The public work-day on October 1.,2016 was made more special. A public known person and his family were invited to take part in the work-day to promote the project. 80 people participated that day – many of them children.

During the project period, people involved in dissemination activities and guides connected to the visitor center have been informed through newletters about the project activities and the progress of the construction works. This effort has been important to ensure that the right information is communicated out to a broader audience on the many visitors passing through Lille Vildmose.

In November all people, who have contributed to the project throughout the whole project period, were invited to an informal get-together to celebrate the ending of the project.

LIFE logo cake for the final celebration

5.2.7 Action D.6: Attendance of conference in nature management

The collaborative work between the LIFE project and the Norbalwet initiative under the Ramsar Convention and the fact that Lille Vildmose has been designated as a Ramsar site, resulted in an invitation to present the LIFE project at a side event at the Ramsar

COP12 in Uruguay in June 2015. The side event focused on peatlands and their importance for biodiversity and for climate change mitigation and on a resolution concerning peatlands. The resolution was later on adopted at the conference as one of the most important results at the conference.

In October 2015 the project manager attended the international conference *Wetlands in Agricultural Landscapes* and gave a presentation of the LIFE project under the title **Restoring a raised bog – a view from a biodiversity and climate perspective.** The programme can be seen at the conference website:
http://conference2015.wetlands.cz/?page_id=29

The project manager participated in a workshop on the island Vilm in northern Germany in September 2016. The workshop was arranged by the German environmental agency as a follow-up on the tasks set out by the Ramsar Conference of the Parties in Uruguay in 2015. Lille Vildmose is in the Ramsar context a lighthouse and is used as an example of an area designated as an important wetland for its ability to sequester carbon and as an area, where an effort is made to restore the bog. One of the tasks was to prepare a technical report on best restoration practices in bogs and peatlands. The report on restoration practices from the LIFE+ project RERABOG (LIFE05NAT/DK/000150) has been used as template for the work on the technical Ramsar report, hereby spreading the awareness of the LIFE programme further out in the world. The report has been adopted by the Scientific and Technical Review Panel (STRP) under the Ramsar Secretariat. The STRP has decided to extend the report with a section about restoration methods in tropic peatlands. Since this decision includes contributions from other experts, the completion of the report has been delayed.

Karen Poulsen, Danish Nature Agency, represented LIFE Lille Vildmose as keynote speaker at an international conference about conservation and management of wetland habitats in Riga 11-12th July 2017. Her presentation had the title "Restoration of a 5,000 ha raised bog – an example from Denmark".

The project management has also made an effort to disseminate the LIFE+ project and its results at events, as for example at an event about biodiversity and at the public meeting about nature (Naturmødet) with 30.000 visitors in Hirtshals 23.-25. May 2019 (https://naturmoedet.dk/gense-debatter-fra-2019/). This dissemination effort was in collaboration with 9 other active Life+ projects in DK.

Life stand at event

5.2.8 Action D.7: Guided visits

The project has a close collaboration with the visitor centre in Lille Vildmose, who arranges many of the guided visits for the LIFE project. The project management is well aware of the centre as the key dissemination centre in the area. The project management put a lot of effort in informing the centre and its employees about the LIFE project, so they can disseminate the progress and the objectives of the LIFE project to visitors.

./. More than 80 guided visits with in all 5,700 participants have been carried out during the project period and a list of these is included in the annex 7.3.3. It is no secret that the number of guided visits and the number of participants by far have exceeded the expected goal.


Presentation of Lake Birkesø


Guidet tour on “the bottom” of lake Birkesø

5.2.9 Action D.8: Project folders

As we came aware that project folder was in demand from many sides, we decided to expedite the process in order to be able to make precise information about the project at a very earlier stage. The first edition (2012) was printed in 16,000 Danish copies and 4,000 English copies. The stock of folders in Danish was used faster than expected and a second (2013) and third edition (2016) has been printed in 8,000 and 6,000 copies, respectively.

The fourth and final edition (2019) of the project folder has been printed in 40,000 copies ending up with a total production of 70,000 copies of the project folder. Because the turnover over the English version of the folder was very low in contrast to the Danish version, it was decided just to print the final edition in a Danish version. However, the English version is still available in print and on the project website, The latest edition in Danish is attached in annex 7.3.4.

./.

5.2.10 Action D.9: Publications

A code of best management practice has been produced as an extract of the Ramsar STRP report on best bog restoration methods mentioned in chapter 5.2.7. The Ramsar report is part of a deliverance from the Ramsar secretariat and consists of a description of peatland restauration methods covering peatlands from the Northern hemisphere as well as tropic peatlands. Since the Ramsar secretariat has decided to include tropic peatlands in the report, finishing the report has been delayed. When finished, it will be available on the Ramsar website, www.ramsar.org. The code of best practice is attached as annex 7.3.5.

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5.2.11 Action D.10: Final seminar on restoration of raised bog habitats

The final seminar was held as a two-day event from 12.-13. September 2018 with 75 participants. The seminar included two sessions about After-LIFE plans and After-LIFE management and ecosystem services, respectively as well as a field trip to the project area. Keynote speakers from other Life projects (ECOCOLIFE, LIFE13 BIO/UK/ 000428; LIFE Peat Restore, LIFE15 CCM/DE/000138; Cumbria BogLIFE, LIFE13 NAT/UK/000443) were invited to give a talks within the topics.

The Commission accepted via a mail correspondence with the project monitor that the topics of final seminar could focus on After-LIFE and how to manage a nature area after ending a LIFE project instead of bog restoration practices as originally described in the GA.

Photos and seminar material including presentations from keynote speakers are available on the project website. Seminar programme is attached in annex 7.3.6.

5.2.12 Action E.3: Networking with other projects

This action is relevant to conduct in the entire project. Collecting and exchanging experience with other Nature – projects, in particular LIFE - projects is important.

As an introduction to the "LIFE-Community" and to ensure the exchange of experiences from other LIFE projects the project manager and two local project managers participated in the LIFE Platform meeting at Västerås, Sweden, 11-13 September 2011.

The project manager participated in the LIFE10 Regional Kick-off Meeting in London, 23/11/2011.

The project manager, NST and a project worker from AAK participated 24-25 May 2012 in a platform meeting for bog restorations projects in EU arrange by Coillte, Ireland in connection to their LIFE – project LIFE09/NAT/222 "Demonstrating Best Practice in Raised Bog Restoration in Ireland".

The project manager and local project managers and project workers participated 16-18 September 2012 in a platform meeting at Ringsted, Denmark.

A best practice workshop was held 18 May 2013, where experts from the University of Greifswald were invited to exchange experiences on re-growth of sphagnum. From Denmark participated project managers from the LIFE+ project in Lille Vildmose and LIFE Sølsted Mose together with project workers from AAK, AVJF and Pindstrup Mosebrug A/S. The output of the workshop was know-how for carrying out re-growth of sphagnum in our demonstration project, C11.

The project manager, local project managers from AAK and AVJF and two project workers from AAK participated in a platform meeting 24-26 September 2013 in Östersund, Sweden.

On the 8 October 2013 a group of bog restoration experts from Coillte, Ireland paid the LIFE+ project Lille Vildmose a visit. Their focus was primarily on handling re-growth of birch and re-growth of sphagnum. Annex has been enclosed in the Progress report 30/11/2013 as 7.2.n.

There has been taken initiative to organize a national group of project managers, project workers and other with specific interest in bog restoration. First of all the aim of the initiative is to gather names and mail addresses of all, who work with bog restoration in Denmark. The next step is to arrange a workshop where experiences are exchanged.

There has been taken initiative to organize a national group of LIFE project managers from NST with the purpose of exchanging experiences in managing LIFE+ projects. An agenda for the first meeting has been attached in Progress Report 30/11/2013 as annex 7.3.5.

The coordinating project manager participated in a platform meeting in Rovaniemi in Finland 10-13/06/2014.

Denmark hosted a platform meeting on September 15-17 2015. The venue was Aalborg and the LIFE project in Lille Vildmose was paid a visit during the meeting. The meeting was held as a themed platform meeting with stakeholder involvement as topic. Approx. 60 participants from Sweden, Finland and Denmark participated. The program for the platform meeting is enclosed as annex 7.1.b.

Representatives from the project participated in study trip to England and Scotland 18th-22nd September 2016 arranged by the LIFE project "Raised bogs in Denmark (LIFE14 NAT/DK/000012). The purpose of the trip was to exchange knowledge on techniques in restoring degraded bogs. The trip included visits to bogs in Hatfield and Thorne in the Humberhead Peatlands LIFE project, Bolton Fell Moss in Cumbria and Flanders Moss near Sterling. A trip report (in Danish) has been attached as annex to the progress report from 2016.

On September 12 2017 a delegation from the LIFE project Wetlands (LIFE 13 NAT/LV/000578) visited LIFE Lille Vildmose to see restoration methodologies in raised bogs.

On March 20 2018 a delegation from a Bulgarian Capacity building project (LIFE14 CAP/BG/00013) visited LIFE Lille Vildmose to discuss and see nature restoration. At the same visit they were introduced to the Danish Integrated LIFE project LIFE IP NATUREMAN (LIFE16 IPE/DK/000006).

5.2.13 Action E.4: After-LIFE Conservation Plan

./. An After-LIFE conservation plan has been produced as a separate document to the final report and is attached as annex 7.3.7. The After-LIFE plan sets out how the management of the project sites will continue after the end of the Life project.

The After-LIFE Conservation plan is available at the project website.

5.3 Evaluation of Project Implementation

In this section the following aspects of the project has been evaluated:

– Methodology applied
– Comparison of the results achieved against the objectives
– Indication of which project results have been immediately visible and which results will only become apparent after a certain time period.
– Indication of how a project amendment led to the results achieved and what would have been different if the amendment had not been agreed upon.
–Indicate effectiveness of the dissemination and comment on any major drawbacks

5.3.1 Action A.1: Permits to carry out conservation actions

As AAK is the authority responsible for the Nature Protection Act, The Watercourse Act and the Departmental Order on Environmental Impact Assessment (in collaboration with NST) have been applied for permission for the conservation actions that regards these regulations. Other authorities e.g. the Nature Conservancy Board and Fishery Directorate have also been asked for permissions.

Cost-efficiency
The resources acquired to grant permissions are not included in the budget as this task is a regularly task for the municipality. Apart from the managerial time no direct costs are involved.

	A1 Permits to carry out conservation actions
Targeted in the GA	Permissions in all project sub sites are given
Achieved of targeted	Delivered in allocations
Evaluation	A handful of landowners continuously complained on any permission given resulting in a delay in the project. The project was for that reason granted an extension of the project period of in all 3 ½ years.
Achieved instantly	Most permissions followed a normal time flow
Achieved after time	N/A
Amendment leading to	N/A
Objectives met	Yes. All permissions necessary for carrying out the planned actions have been given

5.3.2 Action A.2: Preparation of projects

As AAK is the authority responsible for the Nature Protection Act, The Watercourse Act and the Departmental Order on Environmental Impact Assessment (in collaboration with NST) have been applied for permission for the conservation actions that regards these regulations. Other authorities e.g. the Nature Conservancy Board and Fishery Directorate have also been asked for permissions.

Cost-efficiency

The resources acquired to grant permissions are not included in the budget as this task is a regularly task for the municipality. Apart from the managerial time no direct costs are involved.

	A2 Preparation of projects
Targeted in the GA	Signed contracts with advisors Establishment of a clear basis to produce applications Tender documents Draft contracts with entrepreneurs
Achieved of targeted	All targets mentioned in the GA have been met
Evaluation	Working well in general, but a handful of landowners continuously complained on any permission given resulting in a delay of the project by 3½ years. All complains have been treated in the Environmental Board on Appeal.
Achieved instantly	Signed contracts with advisors Establishment of a clear basis to produce applications Tender documents Draft contracts with entrepreneurs
Achieved after time	N/A
Amendment leading to	N/A
Objectives met	Yes.

5.3.3 Action A.3: Kick-off workshop

Cost-efficiency.

	A3 Kick-off workshop
Targeted in the GA	20 participants at the workshop
Achieved of targeted	Workshop
Evaluation	The kick-off seminar was held 31/01/2012. The workshop was held together with another Danish raised bog project LIFE10 NAT/DK/000099 SMOTH. A total of 60 persons attend the seminar. The participants backgrounds where very broad; scientist, landowners, administrators, volunteers, etc. The topics discussed where: Aims and goal in the LIFE-project, general issues regarding raised bog and the restoration of such, local knowledge about birds and historical life in Lille Vildmose. The atmosphere at seminar was relaxed and there was no negative comment against the project
Achieved instantly	N/A
Achieved after time	N/A
Amendment leading to	N/A
Objectives met	Yes

5.3.4 Action B.1: Purchase of land

This action has previously been rated necessary for accomplishing Action C9. Discussions with the landowners have been held without luck. In the meantime, an

alternative solution has been found to avoid purchase of land. The alternative placement has been proved according to the criteria in the Habitat Directive and has been accepted. As described under section 5.1.13 the dike will be placed on land owned by AVJF, but along the outer edge of the bog.

Cost-efficiency.
Since the action has been closed and the budget transferred to action C9, the cost-efficiency cannot be evaluated.

	B1 Purchase of land
Targeted in the GA	Purchase of app. 2000 m long and 15 m wide strip of land along the northeast edge of Tofte Mose
Achieved of targeted	None
Evaluation	Difficulties in getting an agreement with the landowners led to implementation granted by the Commission of an alternative solution where the dike along the edge of the raised bog is placed inside the bog. This solution led to a request for a transfer of B1 budget to action C9 External Assistance. The budget change was accepted by the Commission.
Achieved instantly	N/A
Achieved after time	N/A
Amendment leading to	Closing action B1 and budget transfer to action C9
Objectives met	No

5.3.5 Action C.1: Nature management, grazing by large herbivores

A pilot project for testing fence type and fencing conditions gave valuable knowledge and experiences before calling for the tender for raising the large fence.

In March 2015 a call for tender for setting up the fence has been completed and contract signed with an entrepreneur in May. The fencing has been initiated in June 2015 and was finished in April 2016.

Cost-efficiency
Dividing the fencing work into sub sections gave an opportunity to offer each sub section individually and to go for the cheapest and most skilled entrepreneur. The task for setting up the fence was, however, won by one single entrepreneur. The task concerning the construction of the cattle grids was run as a separate tender procedure.

The project hired in the consultant company Faunaforst with the most experienced advisor in large fences in Denmark. His experiences brought valuable knowledge in to the action and added a confidence in the running security checks of the fence work.

	C1 Nature management, grazing by large herbivores
Targeted in the GA	The fence is set up and a minimum of 50 red deer will be released in the fence for nature management of the birch and general vegetation.
Achieved of targeted	30 km fence line has been put up by December 2015 and 28

	red deer released into the area. The population of red deer has within the project period increased to 100 animals.
Evaluation	The process of preparing the detailed project and receiving all relevant permits was complicated and had prolonged the project period. A good quality fence is crucial for the success of keeping the red deer in the project-area. Dimensioning a couple of the cattle grids gave some challenges but was corrected.
Achieved instantly	Well-functioning fence
Achieved after time	Control of birch trees in the project area
Amendment leading to	Postponed time schedule for the action
Objectives met	Yes, but with delay due to the complexity of the action

5.3.6 Action C.2: Restoration of Lake Birkesø

The action has resulted in a 130 ha shallow lake behind a dike along the northern part of the lake. The action also includes the construction of a new gravel road and raise of a bird watching platform. The lake is expected to develop into a rich and important breeding and feeding site for the Annex I-species crane and wood sandpiper. Lake Birkesø will also turn into an important staging area for migratory birds such as bean goose.

The start-up of this action was challenged by complaints by landowners to the EIA delaying the finish of the sketch project and thereby the call for tender for the construction works. Also, the permission to the Watercourse Act was met by a complaint and was treated by the Environmental Board of Appeal. Therefore, the end date for finishing the action was postponed.

On December 6., 2017 the restoration of Lake Birkesø was celebrated at a public opening ceremony with speeches by the councilman from Aalborg Municipality and Chief Forester from Nature Agency. The lake was filled within 2 months – faster than expected. In late January 2018 Denmark experienced more days with strong wind resulting in high water pressure and waves on the dyke. A stretch of the dyke that was new established didn't have the grass covering necessary for withstanding the exposure to the increased water level. That resulted in erosion damages to that part of the dyke and consequently a need for lowering the water level in the lake to be able to restore the dike. The dike was restored and the water level in the lake was back to it's normal in autumn 2019.

It has been agreed between the owner of the lake, Aage V. Jensen Nature Foundation and the Nature Agency that the Nature Agency continue the inspection of the dike until summer 2021. Hereafter is the maintenance of the lake and the dike handed over to the foundation.

Cost-efficiency.
The type of public procurement run for this action together with action C3 and C9 gave the opportunity to filter out entrepreneurs without expertise and specific skills in working wet areas such as bogs and concentrate the final offer on a handful of identified entrepreneurs. The final invited tender did only have the lowest price as criteria, giving the most cost-efficient offer.

Furthermore, a meeting between entrepreneur, project managers and consultant every second week keeps track on the construction work and gives the ability to handle at once on any problems encountered.

	C2 Restoration of Lake Birkesø
Targeted in the GA	The lake is restored in September 2015
Achieved of targeted	Restoration work initiated in May 2015 and finished with an opening ceremony in December 2017.
Evaluation	Meetings with a complaining landowner resulted in a compromise regarding designing the outflow from the lake and a withdrawal of the complaint. The process from a complaint to the final decision from the Board of Appeal is very long and time consuming and might lead to a substantial delay in the progress. Lessons learned is also to ensure a proper grass/vegetation cover of a new established dike *before* raising the water level in a restored lake. Especially in areas with strong wind exposure. On the biodiversity site is has been surprising to watch how fast many different species of birds found their way the lake immediately after the restoration of the lake.
Achieved instantly	Alternative road and raise of Vildmosevej, Dikes and constructions concerning outflow from lake. Full water coverage of the lake within 2 months having an instant positive influence on the water level on Tofte Mose.
Achieved after time	minor works in the adjacent areas to the lake, like the construction of a stem and setting up a water level marking as required by the Watercourse Act
Amendment leading to	No amendments have been introduced.
Objectives met	Objectives have been met

5.3.7 Action C.3: Re-establishing natural hydrology in Tofte Mose and Smidie Fenner

.**Cost-efficiency**.

As for 5.3.6

	C3 re-establishing natural hydrology in Tofte Mose and Smidie Fenner
Targeted in the GA	Raising the water level on 110 ha of degraded and raised bog.
Achieved of targeted	The construction work has been conducted in the period June to October 2019
Evaluation	The large number of appeals from the landowners has prolonged the process and been the main reason for an extension of the project period
Achieved instantly	1040 meter of dike and watertight membrane. Construction of weirs, 600 m peat dam and closing of old drainage systems.
Achieved after time	Raised water level on approx. 110 ha
Amendment leading to	Minor modification has been made throughout the project period in order to protect the areas outside the project area better and to adapt the construction details to the physical conditions in the field. None of these changes influence the objectives.
Objectives met	Yes

5.3.8 Action C.4: Re-establishing natural hydrology in Purker Fenner

Cost-efficiency
A call for tender was held for the construction work in January 2015 to get the most value for money.

Furthermore, a meeting between entrepreneur, project managers and consultant every second week keeps track on the construction work and gives the ability to handle at once on any problems encountered.

	C4 re-establishing natural hydrology in Purker Fenner
Targeted in the GA	Raising the water level on 165 ha of degraded raised bog, and removing the nutrient rich topsoil from the most vulnerable nature areas
Achieved of targeted	The removal of nutrient rich soil has been completed. The construction work was completed in 2017
Evaluation	Most of the permits for the project have been appealed by the landowners. This has prolonged the process.
Achieved instantly	Better conditions for the regrowth of sphagnum because of removal of nutrient rich topsoil. Visible raised water level on lower parts
Achieved after time	With the raised water level optimal conditions for sphagnum regrowth have been achieved.
Amendment leading to	In order to make sure that cultivated areas outside the project area wouldn't be affected by the project a membrane impermeable to water has been placed on the western boarder of the project area. This was not foreseen in the GA.
Objectives met	Yes

5.3.9 Action C.5: Raising water level in Moufenner

Cost-efficiency.
Since only a few simple actions were needed to fulfill the objectives, the action has all the way been quite cost-efficient.

	C5 Raising water level in Mou Fenner
Targeted in the GA	Raising the water level on 170 ha of degraded and raised bog
Achieved of targeted	All objectives have been achieved
Evaluation	This action has been fully implemented according to the GA. This is mainly since only one landowner was involved in this action, The Aage V. Jensen Nature Fond that is also partner in the LIFE-project.
Achieved instantly	Raised water level on 170 hectares of degraded raised bog
Achieved after time	It is expected that sphagnum growth will begin during the next few years.
Amendment leading to	N/A
Objectives met	All objectives have been met.

5.3.10 Action C.6: Re-establish natural hydrology in Paraplymosen

Cost-efficiency.
Time spend on the detailed project has led to a solution, where the total length of dams has been prolonged, and the total number of ditches closed has been reduced. This might in the long run give a more cost-efficient solution, where time used for maintaining ditches will be lowered. Furthermore, the resulting raise in the water level as a consequence of the increased length of dams has led to a less need for clearance of trees.

	C6 Re-establish natural hydrology in Paraplymosen
Targeted in the GA	225 hectares of raised water level on degraded raised bog and active raised bog. 410 meters of dams are constructed. 85 ditches are blocked. 30 hectares of trees are cleared.
Achieved of targeted	The construction work was conducted in the period 2017-2018
Evaluation	Due to appeals and the large number of landowners, the process has been prolonged.
Achieved instantly	1000 meter of dams, 15 hectares of trees cleared
Achieved after time	The raise of water level on 220 hectares
Amendment leading to	A total of 1000 meters of dams has been constructed which is more than the double of the target according to GA. The increase in the total lengths of dams has resulted in an immediate raise of the water level in the bog. The more wet conditions have has resulted in a less need for clearance of trees, why the area of tree cutting has been reduced with 15 ha.
Objectives met	Yes

5.3.11 Action C.7: Re-establish natural hydrology in Høstemark

Cost-efficiency.
The development of a special tool for "plowing down" the PE-membrane by the entrepreneur resulted in a less time-consuming process for the construction work. The same tool has been used in action C9.

	C7 Re-establish natural hydrology in Høstemark
Targeted in the GA	1200 m of PE-membrane is established 1500 m of drainage canals is filled 2 ditches blocked Rise of water level in app. 80 ha
Achieved of targeted	1200 m of bentonite membrane is established 400 PE-membrane is established along the southern border of Høstemark. 1500 m of drainage canals is filled 2 ditches blocked Rise of water level in app. 80 ha
Evaluation	This action has been more straightforward than expected and the re-establishment of the hydrology in Høstemark has been carried out in 2012 and 1st quarter of 2013. The fast implementation of this action is mainly due to very cooperative landowners.
Achieved instantly	Establishment of membranes and filled ditches
Achieved after time	Raising water level on 80 ha. The monitoring of the site revealed a spontaneous appearance of *sphagnum* mosses in the area, showing that the action has fulfilled its purpose and improved the conditions for raised bog to recover
Amendment leading to	No amendments
Objectives met	Yes

5.3.12 Action C.8: Clearance of tree growth in Portlandmosen

The action has been ahead of the time schedule and was finished in September 2014.

The regrowth of birch has been assessed as minimal and at this moment there seems no need for an extra clearance.

Cost-efficiency
An instant evaluation of a hardware cutting in the beginning of the action period revealed that cutting by hand was far more time- and cost-efficient than by machinery. That led to the decision of only using cutting by hand for the rest of the action period.

	C8 Clearance of tree growth in Portlandmosen
Targeted in the GA	Clearance of 170 ha
Achieved of targeted	Clearance of 170 ha
Evaluation	The clearance technique is based on an intensive model by hand, where the trees are cut twice a year and to years in a row. On a smaller area the cutting was tried with hardware, but the result was more time- and euro consuming than the cutting by hand
Achieved instantly	Clearance of 170 ha.
Achieved after time	Reduced or delayed re-growth of birch.
Amendment leading to	No amendments made
Objectives met	yes

5.3.13 Action C.9: Protect existing raised bog in the northeast part of Tofte Mose

Cost-efficiency.
The type of public procurement run for this action together with action C3 and C9 gave the opportunity to filter out entrepreneurs without expertise and specific skills in working wet areas such as bogs and concentrate the final offer on a handful of identified entrepreneurs. The final invited tender did only have the lowest price as criteria, giving the most cost-efficient offer.

Furthermore, a meeting between entrepreneur, project managers and consultant every second week keeps track on the construction work and gives the ability to handle at once on any problems encountered.

	C9 Protect existing raised bog in the northeast part of Tofte Mose
Targeted in the GA	10 hectares of raised water level on the active raised bog. 1500 meters of dams constructed.
Achieved of targeted	1500 meters of dam has been constructed resulting in at least 10 hectares with raised water level on the active raised bog
Evaluation	Due to landowner appeals the project has been postponed. The dam was originally expected to be constructed outside of the raised bog on land purchase by the landowners. But the landowners did not want to sell the land. Therefore the dam was placed on the margin of the raised bog instead.
Achieved instantly	1500 meters of dams and instant raising of the water level
Achieved after time	A large improvement of the hydrology on the active raised bog Tofte Mose to the south of the dam
Amendment leading to	Apart from the amendment mentioned above no large amendments have been made
Objectives met	All major objectives have been met.

5.3.14 Action C.10: Control of carnivores and red fox

Cost-efficiency.
The work has been undertaken by the staff of AVJF who has the expertise on the controlling of foxes and staff working in the area all year round. The use of SMS-warning-systems keeps the time consuming day to day work on controlling the traps on a very low level. The change in methodology with trail cameras on feeding stations keeps the numbers of hours to a minimum.

	C10 Control of carnivores and red fox
Targeted in the GA	Reducing the predation of the nests of the ground nesting birds
Achieved of targeted	The number of foxes, American mink and raccoon-dogs has been reduced, which has reduced the predation, but it is unknown if the predation pressure is low enough to ensure a successful breeding for all the birds.
Evaluation	The action has been successful in the case of bringing the number of carnivores down.
Achieved instantly	Thus AVJF made their own traps available from the very first day in the project a good number of foxes was taken out the first year.
Achieved after time	The overall number of carnivores in the project area has been brought and kept down.
Amendment leading to	Knowledge of the number of accepted carnivores in the area for successful bird breeding with minimum effort of control/trapping.
Objectives met	Yes

5.3.15 Action C.11: Demonstration project for re-growth of Sphagnum

The first two years of the demonstration project revealed a need for controlling the water level to reach the optimal conditions for sphagnum growth. The deviation of the original designed experimental setup has been appropriate.

Cost-efficiency
Pindstrup Mosebrug, a peat excavator in Denmark, found interest in participating in the project as they could gain experiences on re-growth of sphagnum. Pindstrup contributed with machine power and skills, thereby reducing the cost for construction of the demonstration site.

	C11 Demonstration project for re-growth of Sphagnum
Targeted in the GA	Removal of topsoil on 5-10 hectares of pastures Construction of weirs to control the water level Spreading sphagnum mosses on appr. 20 hectares of test sites Detailed project plan and site supervision
Achieved of targeted	Removal of topsoil on 12 hectares of pasture. Construction of weirs Spreading sphagnum mosses on 12 hectares of test sites including working area. Detailed project plan and site supervision Visible growth of sphagnum and other bog vegetation Valuable knowledge on converting grass fens to bog restoration areas.
Evaluation	The construction work has run well, though it has to be divided between to dry seasons. The experiences gained from the constructing the first part led to re-design of the second part. It can be concluded from the demonstration project that is difficult to reach a thick "carpet"-like dominance of sphagnum on former grass fens within a few years if the conversion has to be operational and replicable to larger areas. However, it is clear that aiming at result with a successive step towards a habitat dominated by bog vegetation including sphagnum mosses, it is possible with this method.
Achieved instantly	Demonstration sites for spreading sphagnum mosses. Weirs for controlling the water level.
Achieved after time	Visible growth of sphagnum in a number of demonstration sites.
Amendment leading to	To make an economically realistic set-up, the total area of the demonstration project has been adjusted to 12 hectares instead of 20 hectares with an effective size of demonstration plots covering 9,5 ha. The reduction of project area has not affected the results.
Objectives met	Completed demonstration site with a range of different experimental set-ups. A detailed project plan as well as an evaluation report has been conducted

5.3.16 Environmental benefits

5.3.16.1 Direct/quantitative environmental benefits

Lille Vildmose consists of the largest coherent area of lowland raised bog in North-western Europe and with a total area of active raised of 2,000 ha Lille Vildmose comprises the main part of raised bog in Denmark. With its considerable size, Lille Vildmose is of major importance for protecting the vulnerable habitat nature and the specific biodiversity related to raised bog in Europe.

The 2,000 ha large central part of Lille Vildmose (Mellemområdet) has with its many years of exploitation been the main target for the Life project and the many actions have been focused on restoring and protecting the raised bog and its biodiversity in this area.

The many actions with raising the water level has immediate changed the drained areas to wet and swampy areas initiating the succession towards bog. The intention of the 770 ha new established wet areas in Mellemområdet was to establish a more coherent bog that over time will bind together the fragments of existing raised bog. The conservation status of habitat types targeted in the Grant Agreement, especially the prioritized habitat type active raised bog (7010*), will definitely be improved.

The changes in habitat types due to the project actions are summarized in the table below.

Habitat types in project area		Mapped area in 2011, ha	Mapped area in 2020, ha
7110*	Active raised bog	2022	2068
7120	Degraded raised bog still capable of natural regeneration	252	405
91D0*	Bog woodland	192	361

The rather large increase in the area of degraded raised bog (7120) and bog woodland (91D0*) is partly due to an updated mapping of the habitat types but is also an indication of how fast raised bog degrades when drained.

The preliminary results from the national survey of habitat nature indicate a change of habitat type 7110*, 7120 and 91D0* towards a better conservation status. Even though there is a tendency towards a better conservation status for these targeted habitat types, the effect of the many measures and actions in the Life project might not give a breakthrough within such a relative short project period. It takes longer time for active raised bog to increase in size. However, the many measures in the project will undoubtedly have a positive effect on the existing raised bog and halt the further degradation of the habitat type.

The table above also shows an increase in the area of active raised indicating that the actions towards raising the water level have a positive effect on the restoration of raised bog that is visible within few years. Especially the two dikes established along the edge of Tofte Mose have instantly resulted in a raised water level on the bog side of the dike improving the conditions for a more robust raised bog.

Evaluation of raising the water level in Høstemark Fenner (action C7) resulted an increasing population of *sphagnum* mosses spontaneously appearing in the former peat excavation sites, revealing the right conditions for a succession towards a raised bog vegetation.

Targets related to species, such as White-tailed eagle, Golden eagle and Crane have benefitted immediately because of their current presence in the area. The benefits on the other species targeted (Hen harrier, Black Stork, Avocet, Wood sandpiper and Short-eared owl) will, however, be more difficult to assess presently. This is primarily due to the species needing time to respond to the improved habitat conditions. A number of moths and butterflies have their only Danish occurrence in the area including Scarce Vapourer *Orgyia recens* and *Idaea pallidata*. In addition a number of rare butterflies are recorded for the central parts of the raised bog areas including the Cranberry Fritillary *Boloria aquilonaris*, Large Heath *Coenonympha tullia* and the Cranberry Blue *Vacciniina optilete*.

5.3.16.2 Relevance for environmental significant issues or policy areas

The project is relevant for implementing the following European policies:

- EU's Biodiversity Strategy to 2020 in terms of Target 1 *Protecting species and habitats* and Target 2 M*aintain and restore ecosystems*.
  Both targets in the Biodiversity Strategy have been the main focus in this Life project and have been implemented with success.
- EU's 2030 Biodiversity Strategy in terms of curtailing biodiversity loss and preserving and restoring its ecosystems as expected to be adopted in Kunming, China in October 2020. As a large nature restoration project in the Life programme targeted vulnerable habitat types and ecosystems, the results of the project in Lille Vildmose will contribute to raise awareness on the importance of restoring ecosystems and curtailing biodiversity losses in vulnerable habitat nature in Europe.
- EU Climate Change and Energy Policy by reducing the emission of greenhouse gases from drained peatlands. The intact raised bog consists of huge amounts of CO_2 stored in peat. The estimated carbon content in the organic soil (peat) of Lille Vildmose is approximately 7.4 million ton or approximately 10% of the Danish peat carbon volume.
  Calculation of emissions made by Greifswald Mire Center using the default values for tier 1 (IPCC Wetlands Supplement 2014), arrived at net GHG emissions of 17,780 CO2-eq. per year before the major restoration activities started in 2011 reduced to 7,294 CO2-eq. per year after restoration. Thus a reduction of approximately 10,500 tons CO2-e per ha per year, due to the rewetting.
- Ramsar Convention regarding raising awareness to peatlands as important for maintaining the biological diversity and for combating climate changes.
  In August 2013 Lille Vildmose was the first wetland site ever in the history of the Ramsar Convention to take into account a Ramsar criterion on climate regulation. Read more here: http://www.norbalwet.org/our-wetlands/denmark/. The LIFE-project was used as a case at a peatland side event at the Ramsar COP12 in Uruguay in June 2015. A film with live footages from Lille Vildmose has been made to focus on the importance of securing and restoring peatlands for climate change mitigation. The film has been launched at a side event at UNFCCC COP21 in Paris in December 2015 and is now available on Youtube and on www.norbalwet.org.

The Ramsar Convention specifically promotes the importance of peatlands to mitigate climate change and Lille Vildmose is used as a global model for Ramsar site designation in this regard and has been promoted at several international meetings by the Nordic countries and supported by the Nordic Council of Ministers.

5.3.17 Long-term benefits and sustainability

5.3.17.1 Long-term/qualitative environmental benefits

Many of the activities carried out in this project have already revealed results of improved conditions for the target habitat types and species. However, it is expected that the actions all together will lead to further improve conditions for the targeted species and for the targeted habitat to increase in area.

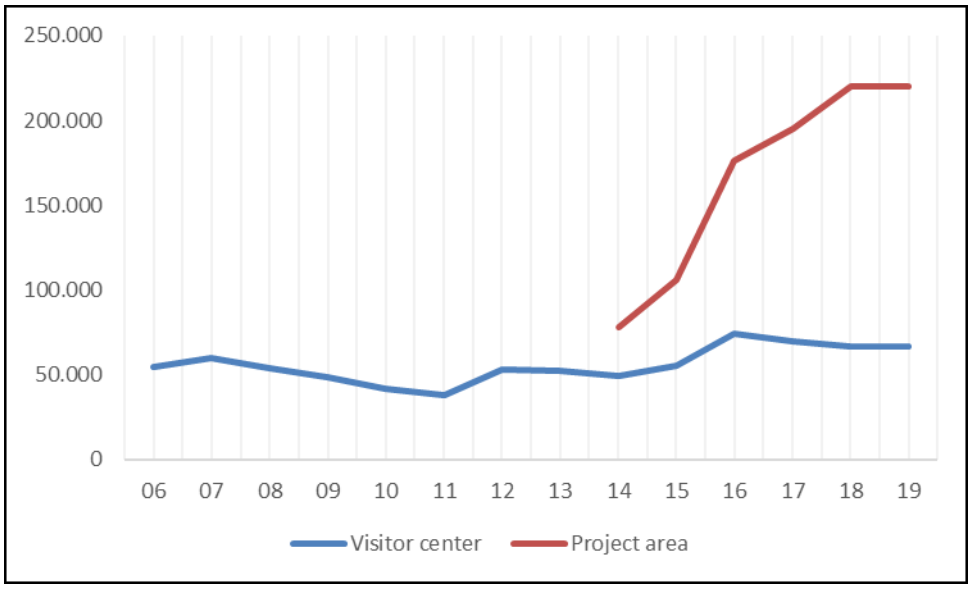
The main threat to the active raised bog after completing the LIFE project will still be re-growth of birch and willow leading to overgrowth and desiccation of the bog. The re-growth has been halted by the clearance activities in the project, the raised water level and the ongoing grazing of large herbivores in the Mellemområdet. To assure a future management of the area in accordance with the Nature 2000 management plan for Lille Vildmose and the Conservation Act, the Municipality of Aalborg has developed a management plan for Mellemområdet The management plan is a central element in securing an open landscape and the development towards favourable conditions for the habitat types and will be evaluated after 4 years. The management plan commits the municipality once a year to check maintain dams, weirs and other hydrological installations. The management also includes tasks that focus on the monitoring of vegetation in order to adjust the specific management of certain areas.

Finally, the municipality has taken initiative to set up a group of interests and users linked to Lille Vildmose to continue the open, public dialogue.

Aage V. Jensen Nature Fund has initiated activities in Tofte Skov where sitka spruce is removed and replaced by deciduous trees and where the natural hydrology of the forest area is restored. These actions together with the restoration of lake Birkesø and the raised water levels elsewhere in Mellemområdet will undoubtedly further improve the conditions of the raised bog by creating a more natural hydrology.

5.3.17.2 Long-term/qualitative economic benefits

The figure below shows the development in visitors to the project area in Lille Vildmose as well as paying visitors to the visitor centre over. The counting of numbers of visitors to the project area was initiated in 2014 while there exists data for visitors to the visitor centre back to 2006. It is without doubt that the LIFE project and the improvement of nature conditions has increased the interest from the public. Especially the restoration of Lake Birkesø, the public facilities and the large grazing project have had a lot of attention from the public and the number of visitors has increased significantly over the years as a direct result of the restoration project. The steep increase in number of visitors from 2015 to 2016 is without doubt due to the high interest on the large herbivores introduced to Mellemområdet – specially the moose.



With the increasing number of visitors to the area, the visitor centre in Lille Vildmose has raised additional funds for improving and expanding the facilities for visitors. A project initiated in 2019.

An increase in the number of visitors because of the LIFE project will gain the tourism business in the local area with more overnight stays and visits to other tourist attractions. The economic benefit of Lille Vildmose has been estimated by the visitor centre. With the assumption that of the 200,000 visitors to Lille Vildmose, the 50,000 are tourists and that they each spent 30 euro per vacation day, the revenue will be around 1.4 million euros per year. Research studies concludes that the increased economic flow in Lille Vildmose and local surroundings generates 16 to 18 new jobs. Interview with the manager of the local campsite underlines the increased interest of the nature in Lille Vildmose.

5.3.17.3 Long-term/qualitative social benefits

The report on visitors to the LIFE project website shows that the numbers of visitors top during the summer month, revealing that more visitors from abroad and outside the neighbourhood are visiting the area.

Furthermore, visiting a calm nature area in the size as Lille Vildmose is in general important for the public health.

In general, it is very difficult to measure the impact of the nature and the dissemination effort of the visitor centre on the social behaviour and well-being of people. This is due to the difficulty in collecting valid measurements that isolate the impact alone from a visit to the centre compared to the many other parameters that can affect human behaviour and well-being. However, measurements exists that demonstrates the positive effect of experiences in nature on the general well-being of people.

The high interest in Lille Vildmose is reflected in the high number of members of the Facebook group “Vild med Lille Vildmose” [“Crazy about Lille Vildmose”] that in 2019 exceeded 10.000 members!!

5.3.17.4 Continuation of the project actions by the beneficiary or by other stakeholders.

Maintenance of the project website (action D3) will be continued by the Nature Agency after the end of the project and will consists of relevant documents, reports and pictures/videos for download. All other actions will be continued and managed by the Municipality of Aalborg as the local authority and Aage V. Jensen Naturfond as the main landowner in Lille Vildmose. The management plan developed by Municipality of Aalborg will ensure a maintenance of the area in accordance with the Nature 2000 requirements and the charter of the fund will ensure a forward focus on biodiversity and nature management of the areas owned by the fund.

As mentioned in previous chapters the monitoring of the status of habitats and habitat species will continue to be carried out by the Environmental Protection Agency as part of the national monitoring programme NOVANA. The authorities in Denmark have developed a quality assessment system for species and habitats covered by the two EU directives (Habitat and Birds), which cover Lille Vildmose. This system is based on detailed mapping of species habitats and nature types in the field and evaluating the area quality according to a scale going from poor (5) to very good (1). The system is based on the assumption that category 1 and 2 meet the directive standards and 3-5 are of a quality, which does not meet the directive demands. The system consists of parameters in a structural index (such as e.g. drainage, grazing etc.) as well as a species index (providing a score to all species in that nature type) and giving each parameter a weight and a score. The overall purpose of the government system is to assess and monitor whether the field condition of these areas are satisfactory from an EU nature directive perspective as well as to implement management activities when demanded. Together with this assessment, the management plan developed by the Municipality of Aalborg will target the effort specifically towards areas with a need for improving their conservation status.

Monitoring birds in Lille Vildmose will continue as a citizen science activity with voluntary reporting of birds species and numbers in the national bird database Dofbasen.

5.3.17.5 Replicability, demonstration, transferability, cooperation

Restoring a nature area in the size of Lille Vildmose gives valuable knowledge to disseminate to other projects in Denmark and abroad. Furthermore, action C1 – nature management by grazing sets a new perspective to large-scale nature management, which is transferable to a national discussion on managing large coherent nature areas.

The demonstration project with inoculation of *sphagnum* mosses on former grass fens has given a valuable knowledge on how to design, prepare and maintain a site that has to be converted from grass fen to bog. The knowledge gained from this action has been transferred to a new project funded by the EU Interreg programme. Furthermore, the prolonged project period has given us the opportunity to follow the development of the demonstration site over longer period and to conclude even better on the observations made. Participants form other projects dealing with the same issues as in Life Lille Vildmose have visited the demonstration site to learned how to manage or not to manage an inoculation project.

AVJF has directly used the know-how and best practice obtained from the large dam constructions in action C3 and C9 in a similar action under the LIFE project Raised Bogs in Denmark (LIFE14 NAT/DK/00012), were 3,3 km of a 5 meter high (!) PE membrane is built in to a dam to protect the raised bog Aaby Mose from further desiccation and decomposition.

5.3.18 Best practice lessons

- A1. The project has been met by a handful of landowners, who complains massively to every permission or dispensation given. An incorporation of all necessary permissions in the conservation order for the area would have saved a lot of time.
- C1. Large-scale grazing and introduction of large herbivores is expected to develop new methods to and gain insight in management of nature areas. It has been important for the development of the final population structure to have an assessment of the sustainable grazing pressure by national and international experts.
- C2. Restoring Lake Birkesø has given valuable knowledge about how new established dikes react when exposed to wind and the importance of ensuring a proper vegetation coverage of the dike before raising the water level in the lake. Furthermore, this action has shown how fast especially birds acknowledge the new lake with a colony of black-headed gull already breeding the first season.
- C3-C6, C9. Different methods for holding back water have been tested and gives a range of possible and useful measures to use. Raising the water level shows that over time the *sphagnum* species will appear if the right conditions are in place.
- C8. New clearance techniques developed in this action have been crucial for finishing the action before scheduled. Furthermore, the action revealed that the use of machinery for clearance was too expensive and time-consuming compared to clearance by hand.
- C10. This action was on the forefront of developments on methodology on controlling raccoon dogs in the first years of the project and therefore build experience which came in handy later in the process. We are now distributing knowledge on how to set up efficient bait stations sharing this knowledge with neighbour hunters and local hunting associations.
- C11. Kick-starting *sphagnum* regrowth with the attempt to create a community towards raised bog within a few years is difficult. Lessons learned is that a carefully adjustment of the water level and a control of sprouting of birch and willow is crucial for a successful experiment. However, the demonstration project showed that it is possible within a few years to create a composition of bog vegetation including *sphagnum* species in succession towards a bog habitat. Contact with a peat extraction company and landowner in the area have given a fruitful cooperation between the company and the Nature Agency in constructing the demonstration site. This cooperation is expected to be continued in another peat extraction site outside Lille Vildmose. The outcome of action C11 will by itself give valuable information about kick-start of sphagnum growth on pastures or in former excavated areas.

5.3.19 Innovation and demonstration value

Demonstrating kick-start of sphagnum growth has never before been carried out on such a large scale as in C11. The project has been subject to awareness from Danish as

well as German and Dutch scientists and from the local peat excavation company. Demonstrating the ability to "grow" sphagnum gives valuable knowledge on conditions, physical as well as financial scale for use on other pastures in Lille Vildmose or other degraded bogs. Results and lessons learned have been used to design another demonstration project funded by the EU Interreg program.

The construction of large dams like in actions C3 and C9 has never before been performed in Denmark leading to innovation of new tools such as the metal box for incorporation of the watertight PE membrane in the peat soil. These tools are no being used and reproduced in other bog restoration projects around in Denmark. Furthermore, has the work with the dams had a high demonstrational value.

5.3.20 Long-term indicators of the project success

The concrete output of the project is summarized in table below. It shows where our action areas are geographically overlapping the designated habitat type 7110*. Indirect positive impact of reduced defragmentation and a general lower water gradient in the areas are not calculated in favour of 7110* as it is not possible to quantify at least in a short term (5-10 years). However, one of the most urgent threats against raised bog 7110* is the inappropriate hydrological regime caused by drainage. By raising the groundwater level gradient out of the bog in this project the leaking through the peat layers will decrease and this re-establishment of natural hydrology will gradually prevent the bog from being overgrown with woody species and grass. It could in a sense be argued that measures done in the areas adjacent to existing raised bog often will have a more positive effect on re-establishing natural hydrology in the bog, than measures done in the bog itself.

Name of action	Nature managemnet	Lake Birkesø	Raised waterlevel, Smide/Tofte	Raised waterlevel, Purker	Raised waterlevel, Mou	Raised waterlevel, Parablymosen	Raised waterlevel, Høstermark	Clearence of trees, Portland	Dike, Northeast of Tofte	Demonstration-project	
Expected results	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C11**	**Total**
Raised water level effectively targeted 7110* (ha)		12	20	0	0	90	15		10	0	147
Raised water level on degraded raised bog (ha)		118	90	165	170	135	65			20	763
Raised water level in total (ha)	**0**	**130**	**110**	**165**	**170**	**225**	**80**	**0**	**10**	**20**	**910**
Filled canals/ditches effectively targeted 7110* (m)							1500				1500
Filled canals/ditches on degraded raised bog (m)							0				0
Filled canals/ditches in total (m)	**0**	**0**	**0**	**0**	**0**	**0**	**1500**	**0**	**0**	**0**	**1500**
Blocked ditches effectively targeted 7110* (Quantity)			0			85	2				87
Blocked ditches on degraded raised bog (Quantity)			4			0	0				4
Blocked ditches in total (Quantity)	**0**	**0**	**4**	**0**	**0**	**85**	**2**	**0**	**0**	**0**	**91**
New dikes, dams effectively targeted 7110* (m)		0	1000			410			1500		2910
New dikes, dams on degraded raised bog (m)		1300	0			0			0		1300
New dikes, dams in total (m)	**0**	**1300**	**1000**	**0**	**0**	**410**	**0**	**0**	**1500**	**0**	**4210**
Cleared from trees and bush effectively targeted 7110* (ha)						30		170			200
Cleared from trees and bush on degraded raised bog (ha)						0		0			0
Cleared from trees and bush in total (ha)	**0**	**0**	**0**	**0**	**0**	**30**	**0**	**170**	**0**	**0**	**200**
Protected edge of 7110* effectively targeted 7110* (ha)		1200				3600	1200		1500		7500
Protected edge of 7110* on degraded raised bog (ha)		0				0	0		0		0
Protected edge of 7110*	**0**	**1200**	**0**	**0**	**0**	**3600**	**1200**	**0**	**1500**	**0**	**7500**
Grassed by large herbivores effectively targeted 7110*(ha)	233										233
Grassed by large herbivores on degraded raised bog (ha)	1836										1836
Grassed by large herbivores in total (ha)	**2069**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2069**
Weirs, riffles, pumps effectively targeted (quantity)		0	0	0	0	2					2
Weirs, riffles, pumps on degraded raised bog (quantity)		1	9	1	1	0					12
Weirs, riffles, pumps in total (quantity)	**0**	**1**	**9**	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**14**