

Taking carbon rich soils out of production in Denmark

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Imprint

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Executive summary

This plan describes the Danish national plan to reduce CO2 emissions by taking 100.000 hectares of carbon rich soils and adjacent areas out of production, by re-wetting the areas and thus support peatland restoration in Denmark.

The majority in the Danish Parliament agreed upon the political deal regarding the green transition of the Danish Agricultural sector in October 2021. This agreement stated that the Danish agricultural sector must reduce their emissions with 55-65 percent by 2030. An effective measure to help achieve this goal is to take a 100.000 ha of carbon rich soils and adjacent areas out of agricultural production by 2030. This specific plan, Taking carbon rich lowland soils out of production in Denmark, describes the ongoing work, considerations and conceivably obstacles to reach this national goal.

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1 For the reader

Taking carbon rich lowland soils out of production in Denmark.

This plan describes the Danish national determined effort to reduce CO2 emissions by taking 100.000 hectares of carbon rich soils and adjacent areas out of production, by re-wetting the areas and thus support peatland restoration in Denmark.

The majority in the Danish Parliament agreed upon the political deal regarding “The green transition of the Danish Agricultural sector” in October 2021 (The green transition). This agreement states that the Danish agricultural sector must reduce their emissions with 55-65 percent by 2030. An effective measure to help achieve this goal is to take 100.000 ha of carbon rich soils and adjacent areas out of agricultural production by 2030. This specific plan, “Taking carbon rich lowland soils out of production in Denmark”, describes the ongoing work, considerations and conceivably obstacles to reach this national goal demonstrated by the presentation of the Merlin case study 1, climate-lowland project Kvorning.

The green transition is a result of an agreement between a majority of political parties and the Danish government. The agreement is addressed specifically to the Danish Agricultural sector and it aims to find solutions to reduce emission and engaging the agricultural sector in taking carbon rich lowlands out of production. The green transition therefore relies on the farmers and landowners in areas with a high percentage of carbon rich soils and their engagement in especially climate-lowland projects. The green transition is also on a greater perspective addressed to the citizens of Denmark and the planet earth that benefits from the reduction of emissions to the atmosphere.

Furthermore, several domestic stakeholders are affected by the outcome from the green transition. The Danish Nature Agency, The Danish Environmental Protection Agency and The Danish Agricultural Agency does all manage the overall task with taking out carbon rich lowland soils and restore peatland in Denmark, by facilitating climate-lowland projects and similar wetland- and lowland projects.

The green transition, is a direct outcome from the mutual agreement between the politicians after the ended political agricultural negotiations in 2021. Numerous stakeholders have furthermore played a role in in the preliminary work with technical reviews by presenting different topics to the politicians in the national negotiations. Among others the Danish Agriculture & Food Council, Aarhus University, The Danish Agricultural Agency, The Danish Nature Agency, The Danish Society for Nature Conservation, NGO’s and other domestic stakeholders such as companies with climate and energy as their main focus.

Since this specific plan, “Taking carbon rich lowland soils out of production in Denmark”, represents a presentation of one of the action points in the green transition the plan aims to summarize and share the Danish work on taking lowlands out of production, with any interested institutions abroad. Re-wetting the carbon rich areas and thus ensure peatland restoration is one of the most cost-efficient ways to reduce emission in the agricultural sector. Thus, the plan hopefully can contribute as an inspiration on how to reduce carbon emission to the atmosphere on a national level.

2 Focus of the RSP

2.1 Regional characteristics

Merlin case study 1, project Kvorning, is one of the many projects in Denmark to help reduce CO_2 emissions nationally, by taking carbon rich soil out of production through climate-lowland projects and similar wetland- and lowland soil projects.

Project Kvorning is situated in the river valley Nørreådalen in a rural part of the middle Jutland and is managed by the Danish Nature Agency. The carbon rich soils have been drained and cultivated for decades because of the historical agricultural development in Denmark. The project area is 505 hectares. The project area is very much representative for the project areas and future projects within the national goal of taking out 100.000 carbon rich lowland soils and adjacent areas by 2030, throughout Denmark.

The fields along the stream Nørreåen, in the River valley, is increasingly hard to cultivate. The lowlands have become even more low-lying, due to peat decomposition, flooding from the stream, more downpour and rising ground water tables in a difficult combination.

In this plan we describe the national efforts – i.e. the geographic area is defined as Denmark. However, the carbon rich soils (river valleys, bogs etc.) are mainly found in Jutland, Funen and Zealand. The smaller islands have very limited potential in this context.

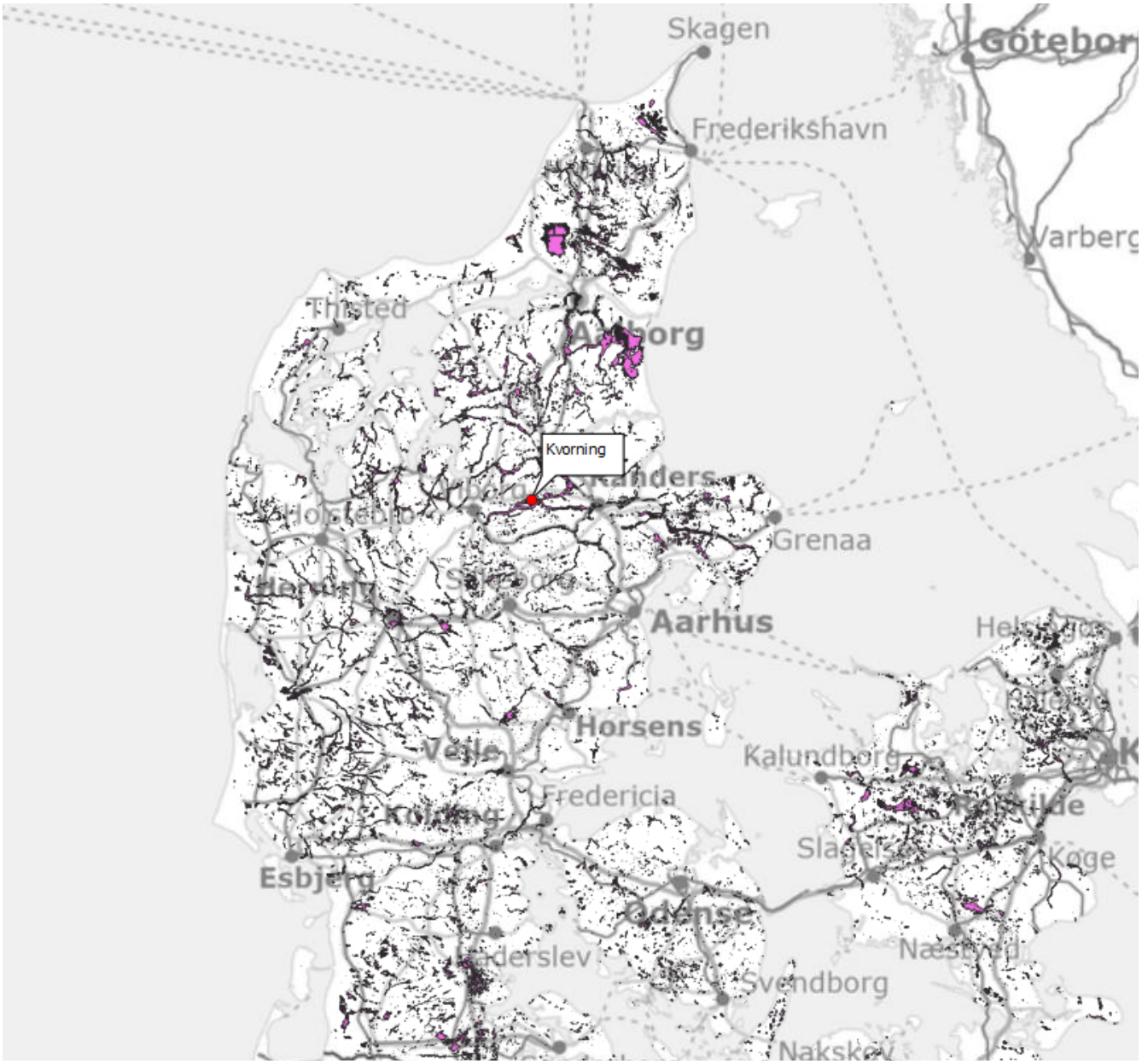


Figure 1 The pink and black, in the above map of Denmark, shows the occurence of carbon rich soils/peat – namely in the river valleys.



Figure 2 Peat soils in the river valley by Kvorning



Figure 3 Drone view of the Kvorning Project area (taken from north-east towards south-west)

2.2 Justification for the region

The green transition states national action across Denmark by introducing the possibility for climate lowland projects managed by The Danish Nature Agency and The Danish Environmental Protection Agency. Approximately 537.000.000 € (4 mio. DKK) has been reserved in the Finance Act, to acquire carbon rich soils, compensate landowners, carry out land consolidation etc.

The justification for the boundaries of the different projects relating to re-wetting of lowland soil are set by analysing information from a national map, peat2022, that illustrates the levels of peatland in specific areas in Denmark. In the map the amount of peatland is classified in two groups: 6-12 percent and > 12 percent of organic carbon. Kvorning is a climate-lowland project and therefore the project complies with the project criteria stated in the national political notice, amendment number 1206 26/09/2023. A project area must include at least 60 percent carbon rich soils with a minimum of 6 percent of organic carbon, the project area must at least 10 ha in size and must be cost-efficient with maximum 8.533 DKK. per. ton CO_2 equivalents (1,147 € per t. CO2 reduction).

2.3 Linkages and synergies with other initiatives

Denmark has been working with similar projects, e.g. lowland and wetland projects, on a smaller scale, in EU schemes, for decades, Projects aiming to reduce nutrient loss to the aquatic environment, Nature restoration etc. Thus Denmark builds on existing knowledge, and is now scaling up immensely with the nationally funded climate-lowland projects.

When taking carbon rich soils out of production it not only reduces carbon emissions, but also reduce nutrient loss to the aquatic environment, aim to improve biodiversity, mitigate flooding downstream etc. and in some cases – like in Kvorning – public access is also improved.

Prior to implementing the climate-lowland project in Kvorning, biomass harvesting has been carried out. The harvesting (without fertilising) has contributed to removing nutrients from the areas prior to re-wetting. This is expected to improve the biodiversity potential. The harvested biomass has been used for biogas production i.e. green/renewable energy.

In some project areas, where nutrient content is high and/or continue to flow to the area from surrounding areas, and where the water table will not be too high after implementation, it is possible that biomass harvesting, with special machinery for wet areas, will still be an option after re-wetting.

All types of lowland- and wetland projects in Denmark are established by dialogue between the authorities and the private landowners. The projects are voluntarily for the landowners and there is no coercion of any landowner to engage in a project. But opposing interests sometimes appear. The landowners can be reluctant to give up the land. It may be for example because of sentimental value, resistance towards the authorities or that the authorities cannot accommodate their wishes and expectations regarding compensation in the projects.

Other opposing interests/competition on land could also be energy companies offering the landowners higher prices for areas where they wish to establish e.g. solar energy parks.

2.4 Relevant materials

For each project area in Denmark, where The Danish Nature Agency is working, there is a website that is updated on an ongoing basis. Here every one can find information on technical investigations, reports, maps etc. For the Kvorning project the website is: https://naturstyrelsen.dk/ny-natur/klimalavbundsprojekter/klima-lavbundsprojekt-ved-kvorning-i-noerreaadalen

You can find information on all climate-lowland projects managed by the Danish Nature Agency through this link: https://naturstyrelsen.dk/ny-natur/klimalavbundsprojekter

3 Stakeholders of the RSP (who)

3.1 Main stakeholders

Stakeholders involved in the national plan to take carbon rich soils out of production in Denmark are:

- The Danish Government (political decision, financed by the Danish Government)
- The majority of the political parties in the Danish parliament.
- Aarhus University (scientific data, models for calculating potential for CO2- and N reduction etc.)
- The Danish Environmental Protection Agency (administrating a scheme where Municipalities and private landowners can apply for financing of climate-lowland projects. Also, authority in regards to environmental screening of e.g. Natura 2000 areas, protected species etc.)
- The Danish Agricultural Agency (performing land consolidations in the different projects)
- The Danish Nature Agency (Project leads on many of the Climate-lowland projects)
- Municipalities (local project partners and authorities on e.g. protected nature, where dispensations for any changes in the landscapes would be needed. In some cases municipalities are also project owners themselves)
- The agricultural sector (The Danish Agriculture and Food Council supporting the political agreement from 2021 and, acting as an ambassador – encouraging members to participate in the projects. A corps of local consultants throughout the country, offering consulting/guidance, free of charge, to farmers/landowners in relation to participating in a project, and supporting municipalities and the Danish Nature Agency in the dialogue with the landowners)
- Private landowners participating voluntarily



Figure 4 A stakeholder meeting held online, with professional setup, during Covid-19.

The green transition is dependent on engagement of the private landowners. There are already many stakeholders engaged in the national aim because a lot of wetland and lowland projects are in process across Denmark. The ambition is to keep on engaging the landowners so it is possible to take out carbon rich lowland soils in the future.

The national aim to reduce CO2 emissions relies on the engagement from the private landowners that either wish to sell their lowland areas to the project or choose to receive a compensation for the land getting more

wet. The private landowners are therefore highly affected by the projects but are not actively involved in the specific establishment of the project and the specific re-wetting of the area. This is managed by the state authorities such as The Danish Nature Agency and furthermore entrepreneurs

The Danish state authorities such as the Danish Government, the Danish Nature Agency, the Danish Environmental protection agency, the Municipalities, the Agricultural sector etc. does all in some way manage the overall task with taking out carbon rich lowland soils and restore peatland in Denmark by legislating, implementing and facilitating climate-lowland soil projects and similar wetland- and lowland soil projects. They are therefore the main stakeholders because they all collaboratively deliver on this enormous and ambitious national task.

4 Green deal goals

The primary goals are the following:

Climate regulation: Reducing greenhouse gas emissions from the carbon rich soils by taking them out of production and re-wetting (re-establishing near natural hydrology to the furthest possible extend)

Biodiversity: Improving habitats and natural values by taking areas out of production and re-establishing near natural hydrology.

Zero pollution: Reduction of nutrient loss to the aquatic environment by taking areas out of production (often in river valleys alongside the rivers), and letting drainage water from adjacent, cultivated areas infiltrate the meadows (meadows of less nature value) resulting in denitrification.

In cases where remobilization of Phosphorus is considered a risk to the aquatic environment, biomass harvesting, in the project areas prior to implementation, might be a tool to reduce this risk (minding any existing nature, accessibility etc.). Biomass harvesting will also remove N from the areas, and thereby also mitigate any risk of Methane emissions from the areas.

Removing nutrients prior to implementation is also expected to provide a better starting point for developing a more divers composition of habitats, flora, fauna etc.

Inclusivity: As participating in a project is voluntary for the landowners, it is essential for succeeding, that the landowners feel included, well informed and of course sufficiently compensated.

Additional goals, that the regional scalability plan contributes to are the following:

Health and wellbeing: Supporting public access to the areas by e.g. securing tracks and paths to/through the areas, providing benches, picnic tables, maybe establishing a spot for pulling canoes in/out of the river etc.

In Kvorning existing paths and tracks will be secured (some stretches raised) and additional walking paths will be established. These will be secured for the future, by a declaration, when land consolidation is conducted. A parking space and benches at a lookout point is also a part of the plan.

Flood resilience: Water “parking” in the river valleys

4.1 SMART Green Deals relevant for the region: primary goals

Climate regulation

The primary aim is to reduce CO2 emissions from draining and cultivating the carbon rich/peat soils, typically in river valleys and former bogs/marshes.

The before mentioned green deal goals can be pursued within the frame of cost effectiveness. Values/frame for cost effectiveness has been set to a maximum of 1,147 € per t. CO2 reduction. This amount can only be exceeded (and only by a maximum of 2 times the initial maximum) if several GD goals are targeted (on nature, environment and climate adaptation). I.e. CO2 is the main target, and lower cost effectiveness on the CO2 reduction can only be accepted if e.g. the project will also significantly improve biodiversity and stimulate a reduction in nutrient loss to the aquatic environment

Biodiversity

As we often work in- or adjacent to protected nature and/or Natura 2000, the aim is to improve habitats as we take land out of agricultural production end re-establish as close to natural hydrology as possible. We work closely together with the local Municipality, who has the local insights and knowledge about the areas, protected species etc.

To re-establish the wetlands, we are obliged to let the projects undergo an environmental screening to assess the scope of the environmental impact on flora and fauna. In Natura 2000 areas, this will typically result in a thorough environmental impact assessment, describing all planned measures, all species that are basis for the specific designation and further examinations on the environmental and biological impact.

Zero pollution

For Kvorning, and all other projects throughout the country, a calculation of expected N reduction is conducted. The model also calculates expected P loss or reduction in loss. The model is developed by Aarhus University

and takes into consideration “before” land use/crops and N quota as well as soil types, average yearly downpour locally etc.

We consider biomass harvesting (minding any existing nature, accessibility etc.) in the project areas prior to implementation to mitigate any calculated P loss to the aquatic environment. This will also remove nutrients with the biomass (N as well as P), and is also expected to improve the potential for biodiversity net gain, reduce any risk of future methane emissions from the areas and contribute to biogas production.

Inclusivity

When conducting land consolidation, we do our best (minding the projects being voluntary for the landowners to participate in) to support grazing of the project areas upon implementation, and thereby production of “nature meat” and/or “nature conservation” as a way of “farming”.

The stakeholder engagement is expected to help create a feeling of “ownership” to the project, in the local communities. It will also help incorporate local knowledge and ideas into the project, as well as keep the stakeholders updated on the project. I.e. information goes both ways.

By creating and supporting stakeholder engagement locally, this may also stimulate the willingness at a more regional scale to participate in these kinds of projects.

Success is measured by the voluntary participation in the projects.

4.2 SMART Green Deals relevant for the region: secondary goals

Projects are evaluated primarily on the calculated cost effectiveness and on the calculated reduction of CO2, N and P.

Some actual monitoring in the field (before/) after implementation would also be desirable.

4.3 Relevant materials

All models/calculations (N, P, CO2), guidance’s, laws and amendments etc. can be found here (in Danish): https://mst.dk/erhverv/tilskud-miljoeviden-og-data/tilskudsordninger/tilskud-til-vand-og-klimaprojekter/klima-lavbund

5 From general goals to actions

Climate Goal

-action 1) Pre investigations of project areas, with involvement of consultants and collaboration with the Municipality

-action 2) Detail project planning, with involvement of consultants and collaboration with the Municipality

-action 3) Environmental screening and permissions, with involvement of consultants and collaboration with the Municipality

-action 4) Project agreements with landowners involving the Danish Agricultural Agency

-action 5) Implementation/restoration

Biodiversity Goal

-action 1) Pre investigations of project areas, with involvement of consultants and collaboration with the Municipality

-action 2) Detail project planning, with involvement of consultants and collaboration with the Municipality

-action 3) Environmental screening and permissions, with involvement of consultants and collaboration with the Municipality

-action 4) Project agreements with landowners involving the Danish Agricultural Agency

-action 5) Implementation/restoration

Inclusivity goal

-action 1) Joint landowner meeting in project area including representatives from the Municipality, the Danish Agricultural Agency and the agricultural sector

-action 2) Individual meetings with all landowners in project area

-action 3) Involvement of local citizens and other stakeholders (when/where relevant compared to project size and impact locally)

Zero pollution

-action 1) Pre investigations of project areas, with involvement of consultants and collaboration with the Municipality

-action 2) Detail project planning, with involvement of consultants and collaboration with the Municipality

-action 3) Environmental screening and permissions, with involvement of consultants and collaboration with the Municipality

-action 4) Project agreements with landowners involving the Danish Agricultural Agency

-action 5) Implementation/restoration

5.1 The responsible stakeholders and their roles

- The Danish Government - political decision, plan and measures are financed by the Danish Government
- The majority of the political parties in the Danish parliament.

- Aarhus University - scientific data, models for calculating potential for CO2- and N reduction etc.
- The Danish Environmental Protection Agency - administrating a scheme where Municipalities and private landowners can apply for financing of climate-lowland projects. Also, authority in regards to environmental screening of e.g. Natura 2000 areas, protected species etc.
- The Danish Agricultural Agency - performing land consolidations in the different local projects
- The Danish Nature Agency - Project leads on the majority of the Climate-lowland projects
- Municipalities - local project partners and authorities on e.g. protected nature, where dispensations for any changes in the landscapes would be needed. In some cases municipalities are also project owners themselves
- The agricultural sector - The Danish Agriculture and Food Council being part of the political agreement from 2021 and, acting as an ambassador – encouraging members to participate in the projects. A corps of local consultants throughout the country, offering consulting/guidance, free of charge, to farmers/landowners in relation to participating in a project, and supporting municipalities and the Danish Nature Agency in the dialogue with the landowners
- Private landowners participating voluntarily

5.2 Relevant materials

Links in Danish:

Information about Kvorning climate-lowland project:

https://naturstyrelsen.dk/ny-natur/klimalavbundsprojekter/klima-lavbundsprojekt-ved-kvorning-i-noerreaadalen

All Climate-Lowland projects in the Danish Nature Agency:
https://naturstyrelsen.dk/ny-natur/klimalavbundsprojekter

Information on all current Danish lowland-/ wetland project schemes (also with EU funding):

https://mst.dk/erhverv/tilskud-miljoeviden-og-data/tilskudsordninger/tilskud-til-vand-og-klimaprojekter

All models/calculations (N, P, CO2), guidance's, legal stuff etc. can be found here:

https://mst.dk/erhverv/tilskud-miljoeviden-og-data/tilskudsordninger/tilskud-til-vand-og-klimaprojekter/klima-lavbund

The first report from the expert group, with 12 recommendations:

https://fvm.dk/fileadmin/user_upload/FVM.dk/Dokumenter/Foerste_delrapport_fra_ekspertgruppen_for_udtagning_af_lavbundsjorder.pdf

The second report from the expert group, with 12 more recommendations:

https://fvm.dk/fileadmin/user_upload/FVM.dk/Dokumenter/Landbrug/landbrugspolitikken/Ekspertgruppens_delrapport_2.pdf

Status of the efforts (by November 2023):

https://lbst.dk/tvaergaaende/udtagning-af-lavbundsjorder/status-paa-fremdriften-i-udtagningen-af-lavbundsjorder

6 Timeline

The green transition deal was made in October 2021, to take 100.000 hectares of carbon rich soils out of production by 2030.

Status May 2024 is:

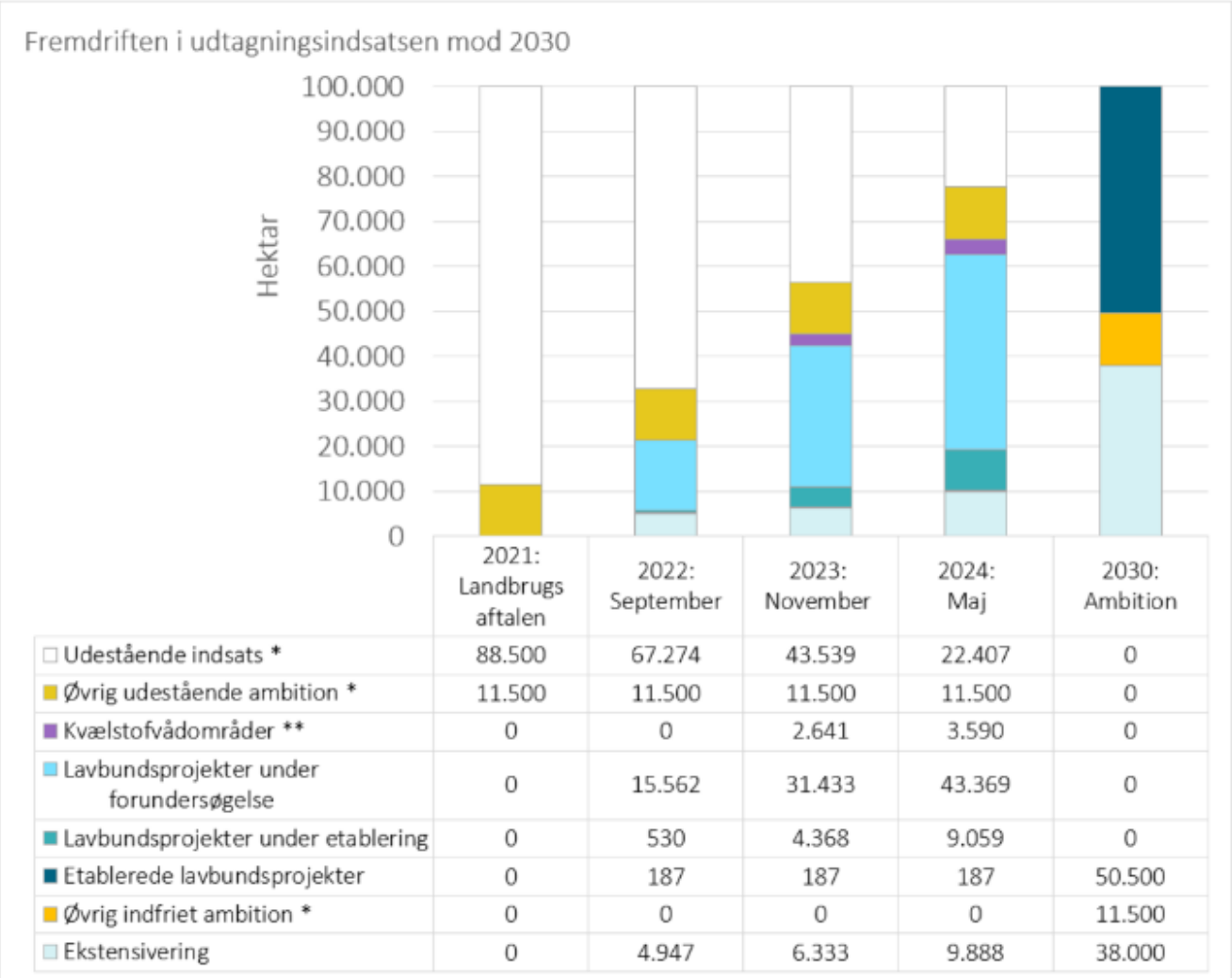
43.369 hectares of potential Climate-lowland project area is currently under pre-investigations (is it possible to re-wet the areas and what is the effects)

3.590 hectares of potential wetland project area (with the main aim of reducing nutrient loss to the aquatic environment, but situated on carbon rich soils) are currently fully implemented, in process or under pre-investigations.

9.059 hectares are currently in the phase of implementation (land consolidation, detail project planning, necessary permissions are processed etc.)

187 hectares are fully implemented

56.205 hectares are thus in total are either fully implemented or in process.



	2021: Landbrugs aftalen	2022: September	2023: November	2024: Maj	2030: Ambition
Udestående indsats *	88.500	67.274	43.539	22.407	0
Øvrig udestående ambition *	11.500	11.500	11.500	11.500	0
Kvælstofvådområder **	0	0	2.641	3.590	0
Lavbundsprojekter under forundersøgelse	0	15.562	31.433	43.369	0
Lavbundsprojekter under etablering	0	530	4.368	9.059	0
Etablerede lavbundsprojekter	0	187	187	187	50.500
Øvrig indfriet ambition *	0	0	0	0	11.500
Ekstensivering	0	4.947	6.333	9.888	38.000

7 Budget

A total budget of approximately 537.000.000 € (4 mia. DKK) has been reserved in different national Finance Acts, to acquire carbon rich soils, compensate landowners, carry out land consolidation, restoration etc. with the purpose of taking 100.000 hectares out of production.

For each individual project area, throughout the country, the funding is reserved as follows:

The Danish Nature Agency: Each project lead on a climate-lowland project will write a “mandate paper”, describing the specific project area, the initial screenings of the local support, CO2- and nutrient effects, budget for comprehensive preliminary studies (conducted by external consultants), own time/hours etc. The same, if preliminary studies come out positive, a mandate paper with a description, budget for land consolidation, compensation, construction work, advisors, own time/hours etc. is written.

The mandate papers are sent to the head quarter/management, who keep the overview of the national progress and overall budget. The management of the Danish Nature Agency will give the mandate to proceed, i.e reserve the money for the project.

The Danish Environmental Protection Agency: The municipalities and private land owners can apply for funding of “Climate-lowland projects” during two yearly rounds of applications, via the national scheme administrated by The Danish Environmental Protection Agency.

The Danish Agricultural Agency: A third option is for municipalities, private landowners and The Danish Nature Agency, to apply for EU funding of “Lowland projects” og “Wetland projects” in schemes under the rural development programme, via yearly rounds of applications, administrated by The Danish Agricultural Agency.

8 Uncertainties and assumptions/ boundary conditions

A national task force and a national expert group representing the governmental agencies, municipalities and the agricultural sector, has been established to help address and overcome obstacles.

The expert group published two reports containing 12 recommendations each. The reports can be found here (in Danish):

1st report (2023):
https://fvm.dk/fileadmin/user_upload/FVM.dk/Dokumenter/Foerste_delrapport_fra_ekspertgruppen_for_udtagning_af_lavbundsjorder.pdf

2nd report (2024):

https://fvm.dk/fileadmin/user_upload/FVM.dk/Dokumenter/Landbrug/landbrugspolitikken/Ekspertgruppens_delrapport_2.pdf

The expert group consists of 12 members

- Universities
- The Danish Nature Agency (government)
- The Danish Environmental Protection Agency (government)
- The Danish Agricultural Agency (government)
- Municipalities
- SEGES Innovation (Agro innovation)
- Limfjordsraadet (political organization representing 18 municipalities around Limfjorden)
- Energiakademiet (association working with renewable energy and consequences of climate change)

More information about the Expert group and Task force can be found here (in Danish):

https://lbst.dk/tvaergaaende/udtagning-af-lavbundsjorder/arbejdsgrupper-i-indsatsen-for-udtagning-af-lavbundsjorder#c99989

A corps of (currently) 26 agri consultants (“udtagningskonsulenter”), nationally, has been established to support farmers in the process and thereby supporting the efforts of reaching the goal of 100,000 hectares.

https://udtagningskonsulenterne.dk/kontakt/