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BUFFER+



FEASIBILITY STUDY FOR SUSTAINABLE VALUE CHAINS IN PEATLANDS

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List of study contributors

Coordination of the Joint Feasibility Study: Yann MATHIAS and Clara DIEBOLT (AC3A)

Authors of the regional studies:

- ▶ **Belgium:** Tine BOMMAREZ and Remi VANHEE (Provincie West-Vlaanderen)
- ▶ **France:**
 - Véronique CHAUVIN (Chambre d’agriculture de Pays de la Loire),
 - Charlotte QUENARD (Chambre d’agriculture de Bretagne),
 - Perrine VITTECOQ (Chambre d’agriculture de Normandie)
- ▶ **Germany:** Frank GAUPELS (Ökowerk Emden)
- ▶ **Ireland:** Freya CONNOLLY (The Rivers Trust)
- ▶ **Netherlands:**
 - Nanoek WIERSEMA (Municipality of Westerkwartier),
 - Julia BRINK (Municipality of Midden-Groningen),
 - Hetty MATHIJSSSEN (Provincie Groningen),
 - Katerina MELIOU (Hanze University)

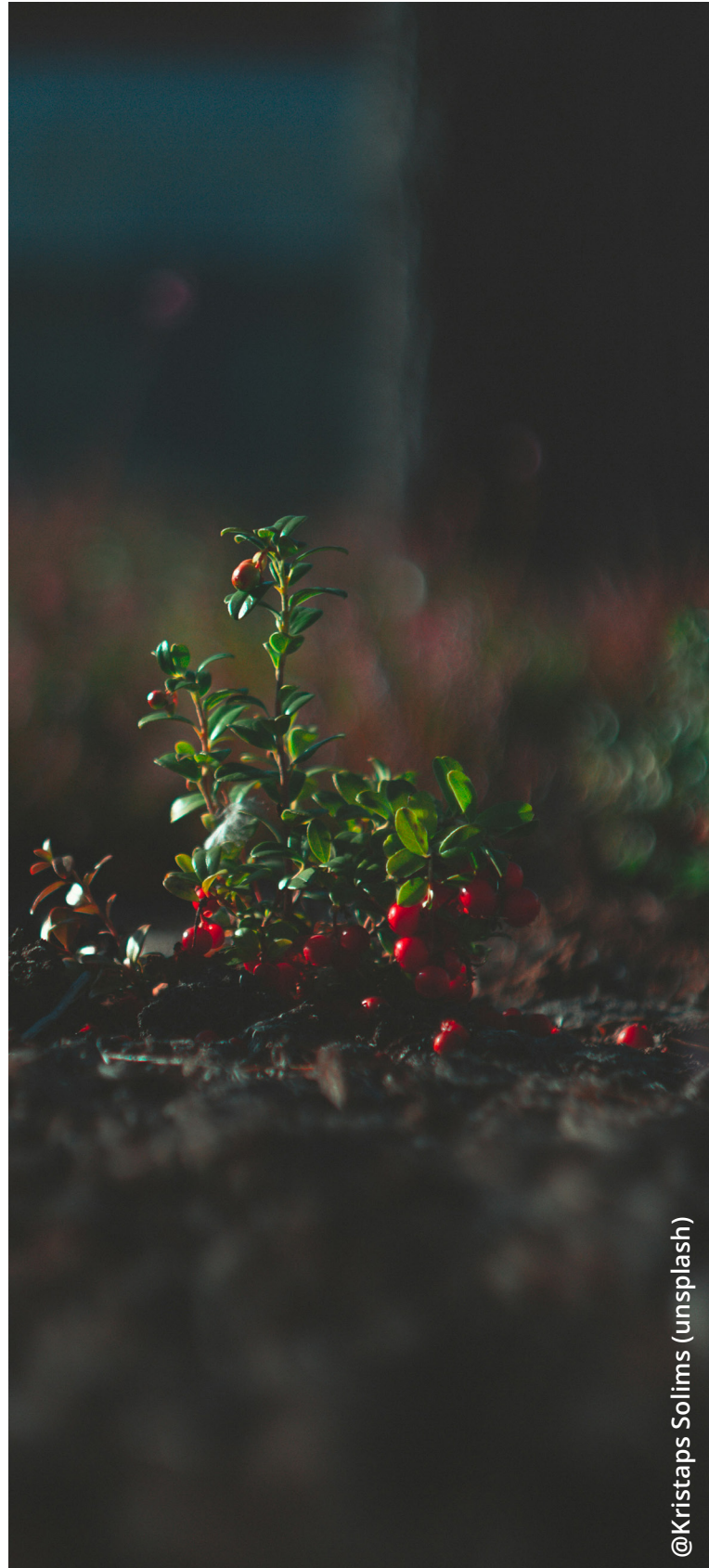
Executive Summary

This study, conducted in the framework of the BUFFER+ project, aims to **assess the level of feasibility** of different business models which could have good potential for generating income in **peatland areas** while respecting their ecosystem functions (carbon and water buffer capacity and biodiversity richness).

It is based on a **method called "CALLTEST"** from Sam MacLeod (2021) which allows us to target 7 sub-areas of study that can **reveal the various strengths and barriers** associated with the deployment of these economic models. These areas of study include a review of the players and laws involved and their stance on the business model, an examination of its technical, economic, and environmental performance, the strengths and weaknesses of the value chain, and a forward-looking assessment to identify future risks and opportunities.

The following models have been studied: **extensive grazing** (for both dairy and meat production), **paludiculture** (berries, cattails, reeds...), **payment for ecosystem services** and **peat-free potting soil production**. The results of the study demonstrate that all these business models have an acceptable to high level of feasibility.

However, significant barriers were identified for each of them. Extensive grazing faces a lack of attractiveness in a context of high retirement rates of livestock farmers, which is causing the sector to shrink. Paludiculture is in its infancy and suffers from the absence of remunerative and structured value chains. Payments for environmental services are highly dependent on the willingness of stakeholders to commit. Peat-free soils are generally less effective in agronomic and economic terms than peat.



Glossary

Important definitions:

- ▶ **Carbon Farming:** practices or processes carried out over a period of at least five years, related to terrestrial or coastal management, that result in the capture and temporary storage of atmospheric and biogenic carbon into biogenic carbon pools or the reduction of soil emissions.
- ▶ **Carbon credits:** financial instruments that represent the reduction, removal, or avoidance of one tonne of CO₂ or equivalent greenhouse gas emissions. In this study, they are to be understood in the sense of carbon credits of the voluntary market and not of the compliance market (EU Emissions Trading System). This means that those credits represent emissions avoided or removed by a project that can be traded voluntarily by companies or individuals.
- ▶ **Payment for Ecosystem Services (PES):** A variety of arrangements through which financial incentives are offered to actors to encourage them to improve their environmental impact. These payments are designed to reward landowners, farmers, or forest managers for maintaining or enhancing ecosystem services.
- ▶ **Paludiculture:** a form of wet agriculture that involves the productive use of wet or rewetted lands.



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Abbreviations and translations

AECP

Agro-environmental and climate project

Agence de l'eau Seine Normandie (AESN)

Seine Normandy Water Agency

Association syndicale autorisée de gestion hydraulique (ASA)

Authorised water management association

C

Carbon

CALLTEST

Capacity, Acceptability, Long term, Life cycle, Technical, Economic, Sustainability, Time

CAP

Common Agricultural Policy

CO₂

Carbon dioxide

CSRD

Corporate Sustainable Reporting Directive

CSR

Corporate Social Responsibility

Coopérative d'utilisation de matériel agricole (CUMA)

Agricultural equipment cooperative

Dairy cow P

Dairy cow with poor muscle development

DM

Dry matter

Etats généraux de l'alimentation (Egalim)

French National Food Conference

ERDF & EAFRD

European Regional Development Fund and European Agricultural Fund for Rural Development

ESG goals

Environmental, Social and Governance goals

GAEC

Good Agricultural and Environmental Conditions

GHG

Greenhouse Gases

Groupe ornithologique Normand (GON)

Normandy Ornithological Group

HTC

Hydrothermal carbonisation

Indemnité compensatoire de handicap naturel (ICHN)

Natural disability compensation allowance

The German Garden Industry Association (IVG)

Industrieverband Garten e.V. represents the interests of manufacturers of consumer goods and consumables in the gardening sector for the hobby and professional markets

LCA

Life Cycle Assessment

Ligue de protection des oiseaux (LPO)

Bird Protection League

LU

Livestock Unit

N

Nitrogen

NGO

Non-governmental organization

NSP

National Strategic Plan

PDO

Protected Designation of Origin

PNRMCB

Cotentin and Bessin Marshes Regional Nature Park

R+ beef cows

Beef cows with at least good muscle development

SDG

Sustainable Development Goal

TRL

Technology Readiness Level

UAA

Utilized agriculture area

WTO

World Trade Organisation

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Introduction

Functional peatlands are unique ecosystems capable of providing a **wide range of ecosystem services** such as carbon sequestration, water purification and storage (flood buffer zone, drought resilience...), microclimate stabilisation and support a rich and remarkable biodiversity.

Yet, they face **alarming levels of degradation**. Recent research from the Greifswald Mire Centre reveals that approximately 5% of Europe's peatlands are degraded, a figure that rises to 50% within the European Union.

This degradation is primarily driven by land-use changes (urbanisation, drainage...) and different economic activities (intensive agriculture, turf cutting, forestry...). It transforms peatlands from carbon sinks into significant sources of greenhouse gas emissions. The **feasibility of developing sustainable business models** in peatland areas is therefore a strategic issue.

The goal of this study is to identify value-creating activities that strike a good balance between environmental footprint and business viability. It also needs to address the needs and concerns of local stakeholders.

It aims to identify which business models have the **most potential** and to explore how they can be supported and scaled up in the different pilot regions of the BUFFER+ project. Conversely, this study can help discern **insurmountable barriers** for certain business models, rendering short-term pursuit impractical.

This study is in line with the objectives of **the BUFFER+ project**: restoring the capacity to buffer carbon and water in peatlands, while at the same time restore biodiversity and create new revenue streams. BUFFER+ is an **Interreg North West Europe** project co-funded by the European Union bringing together a consortium of 21 partners in Belgium, France, Germany, Ireland, and the Netherlands.



Materials and Methods

A| Scope and definition

This feasibility study is based on the definition proposed by Sam MacLeod (2021), who describes these types of studies as “applied research projects that aim to establish whether and how a proposed project could be successful if implemented.” It specifically focuses on sustainable business models (BM) adapted to the specific context of peatland areas in Northwestern Europe. It aims to evaluate:

- ▶ **Existing business models** with a focus on those that demonstrate positive environmental, social, or economic impacts and present potential for upscaling.
- ▶ **Potential new business models.** BUFFER+ partners explored the following business models:
 - extensive grazin
 - paludiculture
 - payment for ecosystem services
 - peat-free potting soil production.

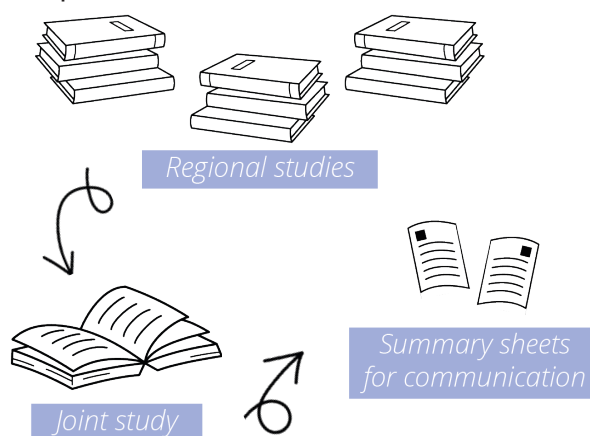
They all show good potential for compatibility between business viability and respect for the ecological functionality of peatland areas.

The geographical scope includes the different peatland pilot regions of the partners including Northwestern France (Pays de la Loire, Brittany and Normandy), West Ireland, West Flanders and the North of the Netherlands (Groningen).



▲ Figure: Map of the different European pilot sites involved in WP2 of BUFFER+

Each region conducts its own study that considers its **specific local characteristics** (pedoclimatic and hydrological context, national and local regulations, stakeholders, value chain actors, infrastructures and market...). These different regional studies are then **analysed cross-sectionally** to identify commonalities and differences. Barriers may enable certain business models to emerge in some territories but not in others. Solutions in one region can also inspire another.



▲ Figure: From core study towards communication

The conclusion of this study assesses the **most promising business models** of the different pilot regions, the **barriers** that should, as a priority, be tackled and the **solutions** devised. This feasibility study was conducted using the CALLTEST framework from Sam MacLeod (2021), a structured and multi-criteria methodology designed to assess the feasibility of different kinds of projects.

The study was structured around a **series of workshops** and collaborative sessions with the BUFFER+ European partners, following a phased approach aligned with the CALLTEST dimensions. Each dimension of the CALLTEST framework was addressed through targeted research questions, supported by qualitative and quantitative data collection, literature review, stakeholder consultations, and technical assessments.

B| CALLTEST framework application

The CALLTEST method evaluates feasibility across eight dimensions:

1| Capability

This first dimension verifies the strategic coherence between the internal and external assets available for the potential business owner and the needs of the business model. As a result, it focuses on two sub-topics of study:

The capability of the potential business owner refers to how well the business model fits and synergizes with the proponent's current capabilities and activities. To define it, we list and verify the coherence of its various existing internal assets with the business model.

These assets can be:

- ▶ Human capital, such as expertise, experience, or a professional network.
- ▶ Physical capital, both immovable like infrastructure and movable like equipment.
- ▶ Financial capital, which determines the organisation's capacity to invest and absorb the risk of diversifying or changing its model.

The capability of the value chain: this part verifies the accessibility of external resources and outlets required to implement the proposed business model. These are provided by various key stakeholders and infrastructures that operate at local, regional, or international levels. Therefore, this part of the study analyses the territory and map the actors that may operate across the value chain, including:

- ▶ Upstream players such as suppliers of equipment and inputs.
- ▶ Downstream players such as the potential buyers, including processors, logistics providers, and distributors.

2| Acceptability

This second-dimension assess the level of support or opposition for the business model. It also focuses on:

Social acceptability is about verifying the stance of the different influential actors regarding the implementation and development of the business model. It also provides insight regarding the general level of tension and motivation in the pilot regions. Conflicts and synergies are identified during surveys and interviews. Some stakeholders can be either allies or opponents, others can be passive/hesitant and therefore be persuaded.

- ▶ These stakeholders are generally local, or regional. Some can be direct users of the space impacted by the business model (companies, farmers, recreational users, residents...). Others are more institutional like local authorities or specialized agencies.
- ▶ There can also be players operating on a larger scale such as NGOs or national and international authorities and companies.

The political and legal acceptability:

- ▶ The political stance regarding the activities involved in the business model is an influential factor. To clarify the legal/institutional level of support, we do a review of the laws and regulations from local up to european scale:
 - When practices are totally banned, making the BM impossible.
 - When different levels of regulations create more constraints and impact the technical and economic performance.
 - When some practices can be supported (e.g. through subsidies).

3| Long Term / Life Cycle

The long term/life cycle part studies how the context could differ in the future.

A forward-looking approach was adopted to explore possible future scenarios.

These scenarios describe the potential evolution of key factors of changes influencing the business model. These factors can be political, economic (supply and demand balance and its impacts), social (including demography evolution), technological, environmental or legal. This study should focus on the factors that have the biggest risk considering level of impact and probability.

Different types of scenarios can be made depending on their likelihood and impacts, for example:

- ▶ **Trend continuity:** continuous evolution with the recent past based on certain dynamics.
- ▶ **Seeds of change:** early signs of change that can grow significantly.
- ▶ **Potential breakthroughs:** a sudden paradigm shift often associated with crises.
- ▶ **Voluntarist alternatives:** a scenario that imagines a positive but probable dynamic.

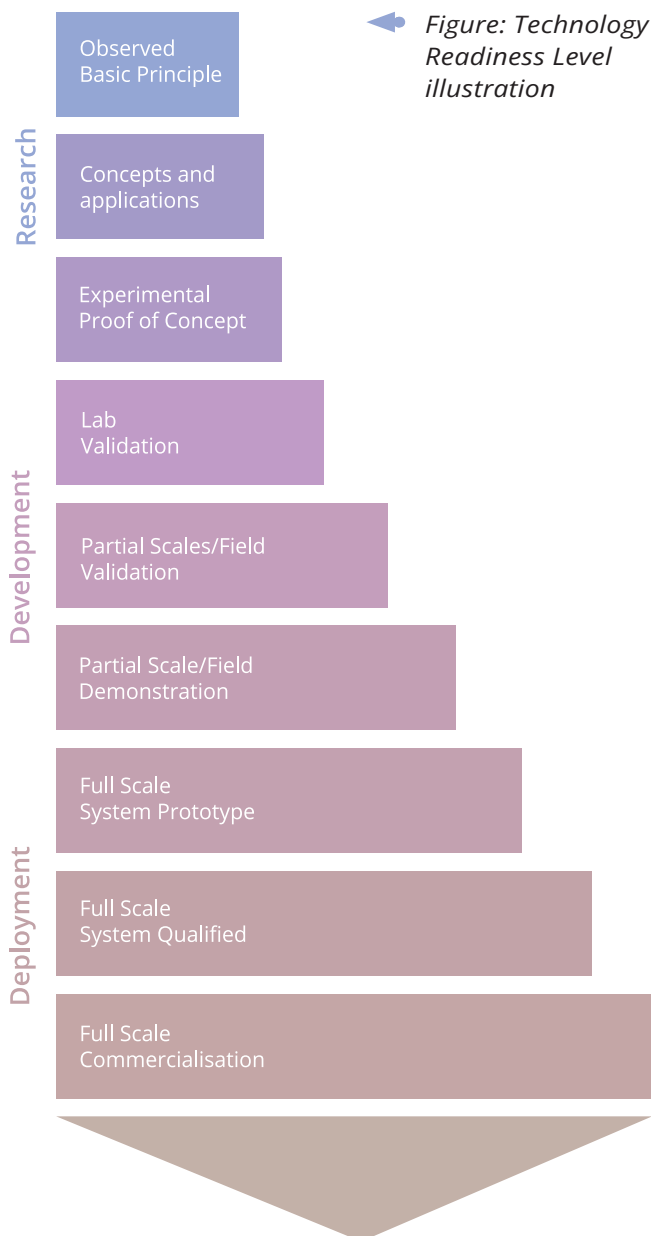
These scenarios can be **threats or opportunities** for the long-term viability of the business model. They help to anticipate risks and think about solutions.



4 | Technical Feasibility

The technical dimension is **assessing the strength and weaknesses** of the processes and products involved in the business model. It questions their physical feasibility, technological maturity and technical performance. As such it focuses on different sub-matters:

- ▶ **The physical and technical constraints** met in the processes involved in the business model are reviewed. Especially, these constraints include sensitivities to certain hazards (weather, fire, water level, invasive species, sanitary such as diseases...). Specific practical requirements that make the business model particularly complex, or resource intensive should also be addressed (special equipment or intervention...).
- ▶ **Possible solutions** to these constraints can be considered:
 - The overall **performance of the processes** involved in the business model is analysed. Technical performance indicators can be used such as the productivity level and its variability, the input needs like energy and other production factors... An important part is to compare this performance to the existing alternatives.
 - The physical **performance of the product** regarding relevant qualities to meet market expectations are evaluated (indicators such as nutritional quality, space requirement...). An important part is to compare these characteristics to those of the alternatives to identify the intrinsic competitiveness of the product. Potential ideas/solutions to improve the product can be considered.



Most of the time, promising new business models can be based on the use of innovative technologies. To assess their level of maturity, the **Technology Readiness Level** (TRL) scale is recommended. This scale ranges from fundamental research (TRL 1) to commercialization (TRL 9) and help to situate the project in its development cycle.

The **maturity of a technology** can be at a totally different level in one territory compared to another. The purpose of this joint feasibility study is also to promote transfers of knowledges including technical references. Like the technologies they're describing, these references can have various degrees of maturity and so of robustness/reliability.

5| Economic Viability

This part is a natural continuation of the technical feasibility part. Based on the technical performance levels, it describes the economic performance of the business model. The aim is to answer two specific questions:

Is this business model economically attractive for entrepreneurs?

To answer this question, we assess the level of economic efficacy in comparison to alternative business models:

- ▶ The first goal is to **measure a level of rentability**. The level of productivity studied in the last part combined with a study of the potential market prices for the products/services sold, makes it possible to calculate the potential income per factor of production. A review of the costs makes it then possible to quantify an expected margin for the business model. This margin needs at least to be positive and can already be compared to alternative business model. Public subsidies or taxes may affect this margin.
- ▶ The second part is to study the **investment needs** associated with the implementation of this business model. The **funding solutions** and their accessibility can be assessed. Then an important metric is to look at the rentability to investment ratio which must remain at least sustainable. The return for investment is an important factor in the attractiveness of the business model.

Is my product competitive enough to be attractive in the market?

To answer this question, we look at the market, benchmarking its different actors and products:

The demand: the objective is to identify the potential clients of my product/service. Then, we can study if my product meets their expectations and what is their willingness to pay.

The offer: the goal is to identify the different competing companies, practices and products involved in the market. We can also look at the factors that determine the price formation (transport or energy price, weather, geopolitical events, policies...). In this context, we can analyse the price and non-price competitiveness of the product of our business model compared to the alternatives.

6| Sustainability

- The sustainability dimension looks at both the environmental and social impacts of the business models. It was assessed through a dual lens:
- ▶ A horizontal/territorial perspective, inspired by the Doughnut Economics framework. Its goal is to assess the **pilot regions social and environmental challenges**. This involves identifying local social and ecological indicators, setting thresholds for planetary boundaries and social foundations. Beyond the thresholds, there is an exceedance of planetary boundaries or critical social deprivation.
- ▶ A vertical/value chain perspective, inspired by Life Cycle Assessment (LCA). Its goal is to assess the **environmental impacts of the various processes** involved in the value chain of the business model compared to alternatives. This includes a multi-criteria analysis of environmental impacts across the entire value chain, considering inputs (e.g., water, fossil fuels) and outputs (e.g., GHG emissions, nutrient pollution).

While full LCA or Doughnut modelling was not conducted to control the scope of this study, these frameworks were good inspirations. Combining these two approaches allows to verify if my business model and associated value chain processes help to tackle the various local social & environmental challenges of the pilot regions.

7| Time

This last part is about **scheduling** to estimate potential implementation timelines for the business model. Particular attention should be paid to whether this schedule is convenient. This level of timing feasibility can be negatively affected by different factors such as:

- ▶ A level of readiness of actors, technologies or other parameters that is too low. In this case, it may still be too early to implement the business model now.
- ▶ On the contrary, a favourable context can be quickly deteriorating. In this case, actions must be taken urgently.

8| Overall philosophy

The study aims to identify the associated with implementing business models in peatland areas. If at one step of the CALLTEST, a barrier is deemed insurmountable, the feasibility study can be concluded as negative without further investigations. This is also considered as a valid and informative outcome.

To feed the analysis were collected through stakeholder interviews, workshops, literature reviews, technical and economic benchmarking and regional pilot site results. Some external studies and inspired heavily this methodology. First and foremost is the review of Sam MacLeod *"Feasibility studies for novel and complex projects: Principles synthesised through an integrative review"* of 2021 which enabled us to choose the CALLTEST method. Other frameworks inspired targeted part of the CALLTEST such as the Doughnut Economics, LCA or SDGs for sustainability.

Belgium



INTRODUCTION

Actors and territory of action

The Province of West-Flanders is aiming to tackle several challenges:

- ▶ **The farmers** – especially those based in vulnerable areas – are seeking a future for their businesses through new, alternative, or supplementary earning models, but this is not a straightforward process.
- ▶ **The Flemish research institutions** are already working on alternative earning models (e.g., through the development of the «Verdienwijzer» tool which is a revenue guide,

support in carbon farming and farm diversification, research in the context of agri-environmental agreements, etc.), but further steps are needed toward smart combinations of earning models and translating these into practical applications at the farm level.

- ▶ **The nature organisations**, such as Natuurpunt and the Agency for Nature and Forests, as major landowners of natural areas, are seeking future-proof collaborations between agriculture and nature.

A | Extensive grazing *in wet grasslands with lower feed quality*

Business model

This business model focuses on the use of alternative cattle breeds that are well-suited to wet conditions and better able to utilize low-quality grass from nature reserves.

Objective of the feasibility study

We want to assess the feasibility of transitioning to alternative cattle breeds for four existing farms: two farms in the pilot region of Beverhoutsveld and two farms in the pilot region of Romboutswervepolder.

We will explore which circular systems, linked to ecosystem services, can offer them a profitable, sustainable future in harmony with the environment, while considering their knowledge, skills and interests.

Four different farms were invited to participate in this research (2 from the Romboutswervepolder area near Damme, and 2 from the Beverhoutsveld area in Beernem – Oostkamp) with diverse activities, each in their own way typical of similar choices that sector peers must make.

- ▶ Farm 1: dairy farm with most parcels inside a nature reserve
- ▶ Farm 2: mixed livestock farm with a minority of parcels inside a nature reserve, selling meat packages as well
- ▶ Farm 3: farm with grassland and arable land in a nature reserve, without animals
- ▶ Farm 4: dairy farm, active in a landscape of high conservation value.

1 | Capability

🚧 Barriers

- ▶ **Herds:** Some farmers keep highly productive dairy cows (Holstein Friesian), which have greater nutritional needs than what the extensive grasslands can provide. As a result, these cows are not well suited for grazing on such land and therefore the farmer cannot utilize the available area optimally.

🔗 Strengths and solutions

- ▶ **Access to land:**
 - Extensive grazing has been the dominant agricultural practice in the area for decades and is also preferred land use from the perspective of the two biggest landowners, a nature conservation NGO and a local government.
 - A substantial area of extensive grasslands is available in the pilot site.
- ▶ **Herds:** Some farmers own a herd of beef cattle or dual-purpose cows (Belgian red breed) that are well adapted to grazing on wet, extensive grasslands
- ▶ **Presence of customers:** There is growing awareness and demand for local products in nearby cities such as Damme and Bruges. Industrial actors specialized in milk transformation and cattle slaughter are also present within the province.



2| Acceptability

Barriers

Depending on the location (area, spatial planning), applicable agricultural and nature legislation, and contractual agreements between the owner and the user, **restrictions can be imposed on grass management** to promote species diversity (including plants — grasses and herbs — insects, meadow birds, and small mammals) and soil life. Common examples include:

- ▶ Delayed grazing and/or mowing dates for example, mowing a maximum of twice per year, with the first cut from June 15 (sometimes July 1) and a second cut in late summer. June 15 (sometimes July 1) and a second cut in late summer.
- ▶ Limits on livestock density or grazing pressure — typically two livestock units (LU) per hectare, no supplementary feeding.
- ▶ Prohibition of grazing — mandatory removal of cut material.
- ▶ Restrictions or bans on fertilization (other than direct excretion from grazing).
- ▶ Prohibition on ripping up or overseeding the grassland.

Obtaining **permits** to build new barns or to renovate old ones into more modern facilities with updated infrastructure is often not straightforward in areas designated as nature reserves on the regional zoning plan or as protected landscapes.

Switching to a different cattle breed or developing a farm based on a business model that primarily focuses on the valorisation of natural grasslands can be sensitive within the **farming community** because it deviates from more conventional practices.

Strengths and solutions

- ▶ There are **legal restrictions** in place (such as the Birds Directive and the prohibition on altering vegetation) that make grazing the most desirable form of land use.
- ▶ Active farmers may be eligible for **income support** for these grasslands, the grazing, and/or the type of livestock through premium rights (Common Agricultural Policy), provided certain conditions are met.
- ▶ There is a willingness on the part of the landowners to consider making extensive grasslands available for farmers the **long term** (over 10 years), compared to the current annual agreements. Long term & life cycle

3| Long Term / Life Cycle

Barriers

- ▶ The number of **active farmers** is decreasing, the average age is rising.

Strengths and solutions

- ▶ Consumers want to have clear visibility of the origin of their food in a transparent manner.
- ▶ The **bird directive areas and protected natural reserves** have been legally established for decades, and their boundaries are unlikely to change much in the future. However, some relaxations towards agricultural use in these areas may be introduced.

4| Technical feasibility

Barriers

- ▶ Attention must always be paid to the possible presence of toxic plants and/or an unsuitable mineral composition of the grassland.
- ▶ The **quality and quantity of the grass** are usually lower than in conventional pasture management.
- ▶ In more **extreme weather conditions** (drought or wetness), the effects on natural grasslands will also be greater than on conventional pastures. These nature meadows are often established in areas that serve as buffer zones against **flooding**. In adverse weather conditions (both drought and wet), it may be necessary to bring the animals in and provide supplementary feeding.
- ▶ On wetter plots, there can be a **higher infection pressure** from parasitic infections (for example, lungworm, liver fluke, gastrointestinal worms, as well as ticks and mosquitoes).
- ▶ As with the processing of farm dairy products, meat producers must comply with very strict **regulations on food safety**.
- ▶ Due to problems with the health of the dairy cows, not all the grasslands in the nature reserve are being grazed. One of the farm managers is looking for solutions to better utilize these grasslands. Dairy cattle do not seem ideal for this purpose. Because of the uncertain future (among other things due to the nitrogen regulations), the farmer is considering stopping the dairy farming branch in the long term.
- ▶ **Specialized machines** are needed for the management of wet grasslands, and they can be expensive to purchase.
- ▶ Sometimes it is necessary from a nature management perspective to let other types of livestock graze after cattle, such as sheep or donkeys, depending on the vegetation present in the plot.

Strengths and solutions

Extensive grazing is an effective way to manage natural grasslands

- ▶ A **joint purchase** of specialized machinery can lower the investment threshold for individual farms.
- ▶ The presence of **large areas** of extensive grasslands may potentially compensate for the lower grass yield per hectare.



5| Economic viability

🚧 Barriers

- ▶ The **profitability** of the beef cattle industry has faced difficult years. Additionally, the sector is sensitive to economic cycles.
- ▶ **Government subsidies** make an important contribution to the economic viability of the sector.
- ▶ A larger area is needed for a more extensive form of livestock farming than for intensive livestock farming.

🔗 Strengths and solutions

- ▶ Avoided costs due to manure deposited on the grasslands during cattle grazing (no costs for external processing at manure processor).
- ▶ Avoided costs of purchasing feed because the cattle graze on the grasslands.
- ▶ Since grazing of natural grasslands by livestock is commonly practiced, marketing the meat from these animals (cattle, sheep, goats) directly through **short supply chains** can be a profitable business model. This can be done directly to private customers or through (local) traders, such as butchers, wholesalers or the hospitality sector.

6| Sustainability

🚧 Barriers

- ▶ Some extensive grasslands are not grazed by the cattle of the farmer to whom the parcels were allocated, because the farmer does not have the appropriate type of cattle that is robust enough for this environment. Under-grazing leads to the encroachment of trees, causing the **habitat type to shift** from open meadow bird areas to a bocage landscape with trees and shrubs, in which meadow birds no longer feel at home. This poses a challenge for achieving the nature conservation targets.

🔗 Strengths and solutions

- ▶ Extensive, land-based livestock farming is a sustainable approach because it considers the **carrying capacity** of the environment.
- ▶ One advantage of extensive grazing by livestock is that historically permanent grasslands can effectively **remain grasslands**.
- ▶ Furthermore, when grass is used as livestock feed, there is no competition with food for humans.



@Clara Diebolt

7| Time

Barriers

- Currently, certain extensive grassland plots are used by farmers who cannot make optimal use of them. If you must **wait for their retirement** to allocate these plots to another farmer, we are talking about a transition period of several decades.

Strengths and solutions

- The transition can be accelerated by buying out farmers or by **offering exchange land**.



In a nutshell

Wet grasslands are overall more **technically challenging** for cattle breeders. Adjustments are necessary to compensate for greater exposure to health problems in herds and low fodder quality and productivity. Overall, the **beef cattle industry is also experiencing difficulties** in both renewing an aging population and remunerating its farmers.

Despite these, this business model offers promising solutions to these challenges. The transitioning to alternative cattle breeds is more **adapted to the carrying capacity of wet, low-quality grasslands**. It cuts costs on manure and feed and offers an opportunity for short-circuit outlets. It can also rely on **local assets specific of the pilot region** (Beverhoutsveld and Romboutswervepolde) such as land availability, consumer demand for local products from nearby cities like Damme and Bruges, and potential subsidies opportunities.

B | Payment for Ecosystem Services (PES)

INTRODUCTION

Business model

PES, or Payment for Ecosystem Services, is a system where farmers or landowners are financially compensated for managing their land in ways that provide ecological benefits. Examples are Carbon Farming, biodiversity protection, erosion control, etc.

PES remunerates farmers to protect nature, because their actions help the environment and benefit society. For this specific regional study, we will take a closer look at Carbon Farming. More specifically five types of Carbon Farming will be included in a framework agreement of Province West-Flanders to compensate our own CO₂ emissions and create an alternative revenue stream for farmers.

1 | Capability

Barriers

There is a need of searching public funding to start up PES schemes.

Strengths and solutions

The Province of West-Flanders has the capability to set up PES schemes, especially for Carbon. West-Flanders is an important agricultural region, with the most diverse variety of farms: dairy, beef cattle, vegetable, potato, pigs and niche farming methods such as CSA – Community Supported Agriculture. The Province of West-Flanders also houses 'Inagro', a research and advisory centre for all farmers within the province.

Next to farming, West-Flanders also has a flourishing high-tech, energy consuming (agro-)industry within its borders. Concerning Carbon Farming, there are a **lot of companies** in the region looking for opportunities to offset their carbon emissions, and a lot of farmland and farmers where carbon compensation can happen.

These five techniques are:

- ▶ The use of cover crops and crop rotation.
- ▶ Agroforestry.
- ▶ Organic matter input.
- ▶ Reduced tillage.
- ▶ Conversion of arable land to grassland.

Objective of the feasibility study

The study will assess the feasibility of organising PES schemes, specifically Carbon Farming, in the Province of West-Flanders and encourage our 62 local governments to join these efforts.

From a governmental perspective, the Province **already successfully experimented with PES schemes**. The Province has several regulations where farmers are remunerated, to take up some kind of «environmental work», for example: a regulation concerning planting trees around the farm buildings and domestic pastures; a regulation for farmers to build erosion dams on their arable farmland...

Overall, the Province can rely on experiences with PES schemes in the past and prerequisites of interested parties (enterprises and farmers) are available in West-Flanders. With all these different specialities and opportunities, the Province certainly has the capability to roll out a new PES scheme regarding Carbon Farming.

2| Acceptability

Barriers

The European Union has made **legislation** concerning CSRD and Carbon Farming (EU 2024/3012), but also the Flemish government acts in that regard. The Province of West-Flanders and its 62 local governments set up actions surrounding Carbon Farming. There is however a concern that those initiatives are not integrated into each other.

From the **farmers' point of view**, there are some **mixed feelings**. Firstly, because farmers want to farm independently, without too much government patronising. Secondly, because farmers feel that they, rightly so, should not be held responsible for the carbon emissions of industry and enterprises. Some farmers, however, are convinced of the long-term positive effects of Carbon Farming towards soil health and are immediately willing to co-operate in such a PES scheme.

Overall, the main barriers are that legislation is scattered on several policy levels and that farmers don't yet experience 'ownership' in current PES schemes.

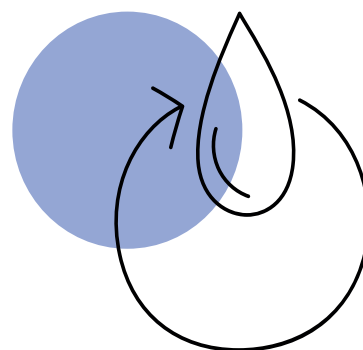
Strengths and solutions

In West-Flanders, there is **political support** for exploring alternative revenue sources for farmers, including Payments for Ecosystem Services (PES). This aligns with the region's high concentration of farmers and its extensive, interconnected agro-industrial sector.

From an **investor's perspective**, Carbon Farming offers a meaningful way to support climate action while contributing to the long-term sustainability of agricultural landscapes. Investing in practices that improve soil health, enhance biodiversity, and increase water retention not only strengthens the resilience of farms but also delivers clear environmental and social value.

For investors with a focus on sustainability and impact, **Carbon Farming represents a strategic choice** that aligns with broader ESG goals, supports rural economies, and contributes directly to tangible, nature-based climate solutions.

There is a lot of political will to work out alternative revenue models for farmers, there are clear social, economic and environmental advantages for external investors.



3 | Long term & life cycle

🚧 Barriers

The trend in the CAP – Common Agricultural Policy – seems to be more and more in favour of **more funds towards green** and blue measures on farmlands. This creates a risk concerning double financing of certain measures or policies. Smaller, local, governments don't have the information necessary to check whether a farmer already receives a certain amount of money for PES from another government. This relates to the previous statement under 'acceptability' concerning the integration of legislation on several policy levels.

Another trend is that more than half of the West-Flemish **farmers are over 55 years old**, with only a small number of farmers who have a successor for their farming enterprise. This means that an ever-smaller number of farmers will farm an increasing land area. There is however a pitfall: because the earning capacity of agricultural lands is bigger when it can be developed as a residential function than to keep it as agricultural land. The current legislation does not suffice to protect the agricultural land. This can increase the price of arable land and raise prices for all farmers who might want to start a farm or take over an existing farm but need more arable land to be profitable.

Overall, the main long-term threats are a bad integration of legislation, the demographic trend of the farmer population, and the arable land being used for residential purposes.

🌱 Strengths and solutions

With the ageing and low turnover, an ever-smaller number of farmers will farm an increasing land area. There are efficiency gains when the relative area of arable land per farmer raises.

This is also an opportunity for PES, since farmers will be able to work more efficient, there will be more margin to buy specialised equipment that is needed for Carbon Farming.



4| Technical feasibility

Barriers

A lot is depending on the farmer or landowner: most Carbon can be stored by agroforestry, but planting trees is a very long-term investment and has a lot of consequences for later land use. Also, conversion of arable land to grassland seems profitable for Carbon storage, with consequences for business operations of the farm. Organic matter input, reduced tillage and the use of cover crops give less Carbon sequestration than grassland and agroforestry but have less influence on land use and can be more easily adapted to the operations of the farm. A lot is dependent on the **willingness of the farmer** to introduce a certain PES scheme (Carbon Farming) on his/her farm, and if the farmer has a feeling of 'ownership' in the matter.

Moreover, current legislation does not give farmers the possibility to plant trees for, as an example, 30 years to do agroforestry and to thereafter cut down those trees. Trees located more than 15 metres from a building are generally protected under nature conservation laws and require a felling licence. Since **farmers count on selling their land as their 'pension fund'**, planting trees on arable land can mean a reduced value when the farmer sells his land at pension age. Here, there is a lack of legislation on 'short term nature' for agroforestry to allow farmers to cut down the trees they planted themselves to do agroforestry.

Once the Carbon Farming practices are introduced on the farm and are being implemented in the farming operations, yearly follow-ups need to happen to take soil samples from different fields (CF and non-CF as control group) and analysed to see how many net gains on Carbon storage have been booked.

Strengths and solutions

The diversity of farms in West-Flanders creates an opportunity for certain farmers to implement several carbon farming techniques, however it needs to be established that not every farmer can implement one or several techniques.

The West-Flemish research centre 'Inagro' calculated the averages for different Carbon Farming techniques in West-Flemish soil:

- ▶ **Cover crops and crop rotation** (e.g., cereals and grasses) can sequester between 0.30 to 0.90 t C/ha/year, especially when integrating straw or deep-rooting species.
- ▶ **Agroforestry systems**, such as rows of trees or full-field applications, offer varying potential depending on tree density and layout, with biomass storage reaching up to 4.30 t C/ha/year above ground and 0.55 t C/ha/year below ground.
- ▶ **Organic matter input**, like farmyard manure, compost, and harvest residues, significantly boosts soil carbon, with manure offering up to 0.75 t C/ha/year.
- ▶ **Reduced tillage** and improved soil structure help maintain existing soil carbon levels, though their net sequestration gains are modest (~0.10 t C/ha/year).
- ▶ **Conversion to grassland** and mixed grazing systems have high potential, especially in the initial years, reaching 2.00 t C/ha/year.
- ▶ **Landscape elements** like buffer strips, wetlands, and peatland restoration contribute to carbon retention, mainly by avoiding carbon losses.

All proposed carbon farming techniques are thus viable and proven in Province West-Vlaanderen. Other strengths are that farmers can choose one or several carbon farming techniques that fit best in their farming operations and the feeling of ownership on the efforts the farmer makes.

5| Economic viability

Barriers

The net, short term **financial gains** for the farmer implementing carbon farming strategies are rather limited. After some research about Flemish companies who facilitate a Carbon Farming platform, farmers generally receive around €70 for a ton of captured CO₂ through Carbon Farming. With a global average of 1,5 tons of captured CO₂ per hectare, a hectare of Carbon Farming techniques means the farmer earns €105 for their efforts.

This amount of money is low to compensate the farmers for the **extra effort and investment**, and the loss of crop **yields** this PES scheme requires.

Moreover, there is a **high cost involved** concerning sampling and monitoring, and coaching farmers, for long term soil benefits. This cost is carried by the government, or the PES paying organisation, in this case the Province of West-Flanders.

Strengths and solutions

However, this is where the **long-term gains** for soil, farmers and communities come into effect. But by integrating Carbon Farming into the farm, there are a lot of non-monetary, rather invisible, gains:

- ▶ Soil structure, organic carbon concentration and soil life in general improve with long term yield benefits as result.
- ▶ **Buffer capacity** of the soil improves meaning a long-term insurance on pluvial and fluvial floods for neighbouring buildings (farm + community).
- ▶ Enhancing the knowledge of the long-term effects of Carbon Farming, or any form of PES-scheme, is a key necessity to facilitate the transformation towards more sustainable farming practices.

6| Sustainability

Barriers

Greenwashing is one of the most prominent barriers to PES as an alternative revenue model for farmers. How do we make sure that all Carbon Farming practices are 'new' and 'innovative', and not yet part of regular farming practices. If long term benefits to soil structure are proven, and more farmers integrate carbon farming in their business, is it still the government's responsibility to pay them extra for it?

Moreover, there is a risk of double financing Carbon Farming techniques. Local governments can experiment with this PES scheme. If their efforts are fruitful and several techniques are implemented on a higher legislative level (national government, EU,...), than the PES scheme loses its purposes and is **no longer additional to regular farming practices**.

Strengths and solutions

However, a PES scheme for Carbon Farming can have a positive environmental and social impact on the rural society where it is implemented. It could work with or without government funding and monitoring.

- ▶ Environmentally, it contributes to **climate mitigation** by storing carbon in soils and vegetation, while improving soil health, water retention, and **biodiversity**. These practices also reduce erosion, enhance **resilience** to drought and flooding, and support cleaner water and air—addressing several urgent local environmental challenges.
- ▶ Socially, paying farmers for carbon sequestration provides an alternative revenue source, helping to stabilize farm businesses and support rural development. It encourages knowledge sharing, strengthens collaboration within farming communities, and builds long-term capacity for sustainable land management.

7| Time

Barriers

Real results, from the governments and farmers perspective, could take up to **20 years**. For the government, the most important long-term goal would be to sequester as much carbon into the soil as possible, so the soil could work as a buffer for flooding. For the farmers, in the long term, they would want to see definitive results on better crop yields by the improving soil structure on their lands. As no real results will be visible on the short term, keeping farmers motivated to keep carbon farming practices for more than 20 years without being sure of the results is a challenge.

Strengths and solutions

Starting up a PES scheme could be done within a year. It requires some personnel and professional, judicial advice, but can be done rather quick, for example through public procurement and with an external third party who is responsible for creating a network of farmers and does the monitoring that is required.

It would take around **5 years** to get a smooth-running PES scheme, like Carbon Farming, to act as an example to be copied by other governments and semi-governmental organisations.

By 5 years, all initial struggles and mistakes could be rectified, and it would be possible to share some short-term experiences with other interested parties. As such, inspiring others to start up a similar PES schemes in short term seems possible.



In a nutshell

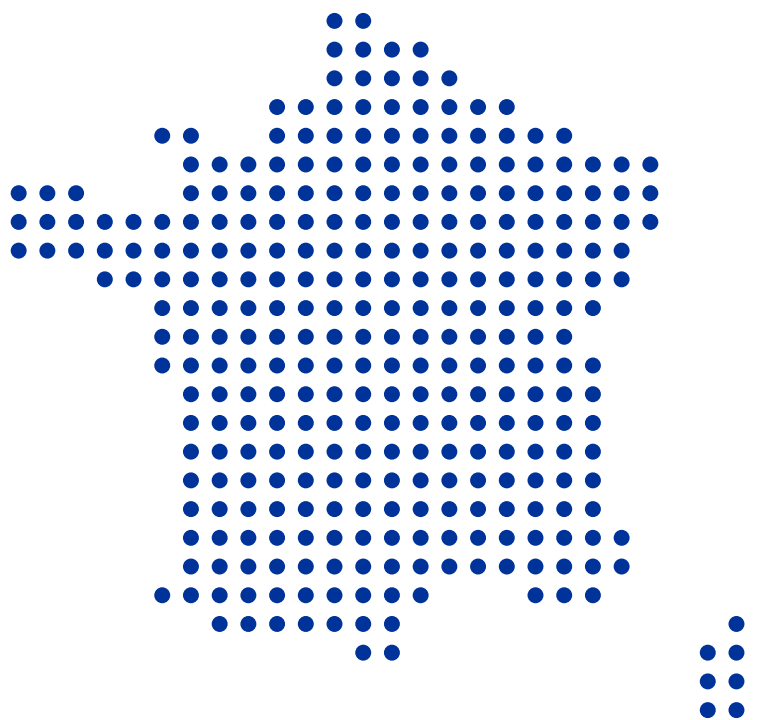
By aligning climate objectives with the practical realities of farming, Carbon Farming offers a cost-effective way to deliver on environmental goals while also supporting vibrant, resilient rural areas.

The PES business model in West Flanders presents strong potential due to the pilot region's agricultural diversity, **existing experience** with environmental compensation schemes, political support, and potential interest from investors (ESG). The funded Carbon farming practices offer **long-term benefits for both the agronomic and environmental performance** of farms.

In the long run, the perennity of those benefits can be at risk in the context of an **aging agricultural population**, which increases the risk of land being lost to other uses like residential. In the shorter-term transition cost involved in the administrative and technical build-up and follow-up of PES is also not negligible and need to be carried out with public money.

A key barrier is that the **willingness of the farmers is not always insured**. A fragmented and restrictive legislation, the existence of greenwashing, the possibility of losing additionality, technical constraints and limited short-term financial returns are creating risks for the farmers regarding PES. The challenge will therefore be to provide reassurance on these points.

France



Introduction

In France, marshes and peatlands are areas subject to significant technical and regulatory constraints. Nevertheless, these environments have seen the emergence of significant agricultural activity based on extensive livestock farming systems, which both create economic value and play an essential role in the preservation and sustainable management of landscapes. This study explores the feasibility of these models, which are in decline, and questions the advisability of extending them to new areas.

It also focuses on certain innovative levers for economic diversification and transition for livestock farmers, such as Agri-Environmental and Climate Measures (AECM), Payments for Environmental Services (PES) and paludiculture. Each of these sources of value is analysed from social, political, commercial, economic, technical and environmental perspectives to identify their strengths, weaknesses and potential to shape the future of a more resilient and environmentally friendly agriculture.

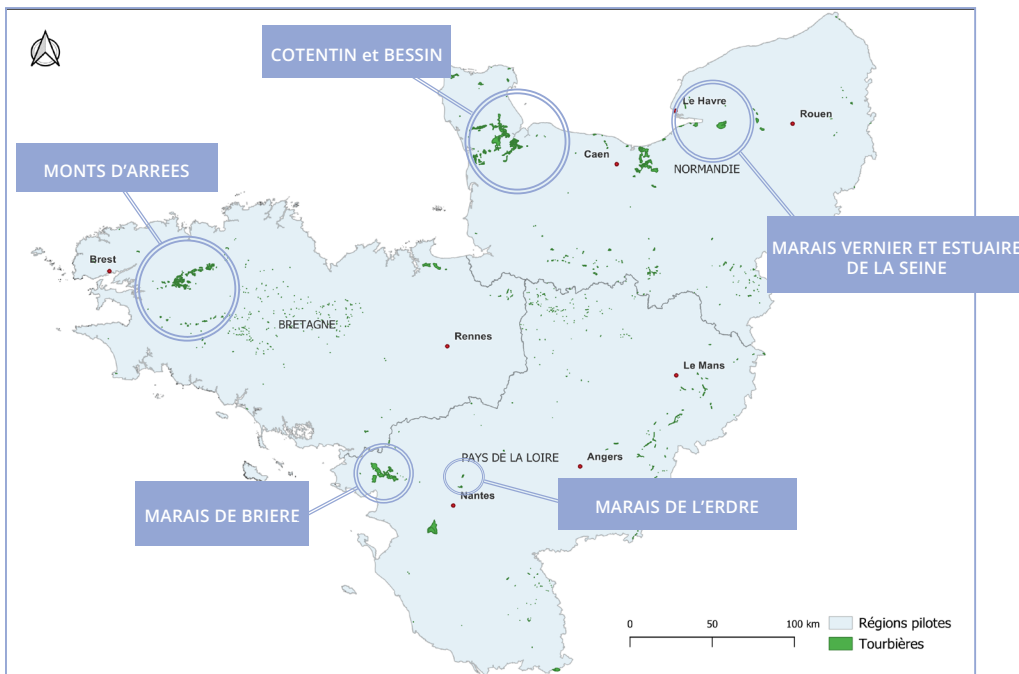


Figure: Mapping of peatlands and pilot sites for business modelling in Western France

Presentation of the study region

The French pilot region where the BUFFER+ pilot sites are located stretches across Normandy, Brittany and the Pays de Loire. AC3A carried out a mapping analysis in 2024 based on the most up-to-date inventories, which estimated the area of peatlands at approximately 38,650 ha, including 7,000 ha in Brittany, 10,759 ha in Pays de Loire and 20,807 ha in Normandy. Approximately 12% of these areas are under strong legal protection, 8% are under strong protection on the recommendation of the prefect, and 72% are under weak protection.

The area of cultivated peatlands varies greatly from one region to another. This agricultural activity is often located on the margins of peatlands, such as in the Monts d'Arrée or the Marais de l'Erdre. However, the heart of peatlands can also be exploited: this is particularly the case in the Sèves peatland in the Cotentin Bessin marshes in Normandy.

	Normandy	Pays de la Loire	Brittany
Peatlands areas (ha)	20 807	10 558	7 000
Cultivated ares in peatlands (ha)	12 625	10 172	2 390

The predominant agricultural use of peatland in the three regions is permanent grassland. In Brittany and, to a lesser extent, in Pays de la Loire, some of the permanent grassland on peatlands is moorland, but the vast majority remains grassland:

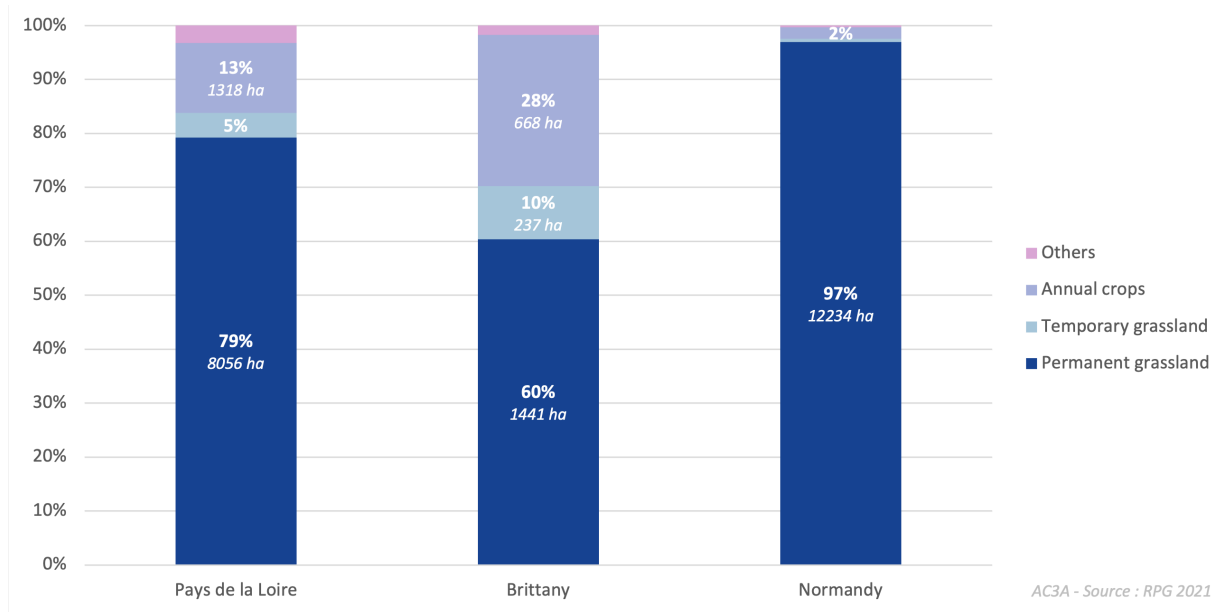


Figure: Declared agricultural use of peatlands areas

Analysis of CAP data (RPG level 2) has made it possible to estimate the number of farms with peatlands in each region in 2022:

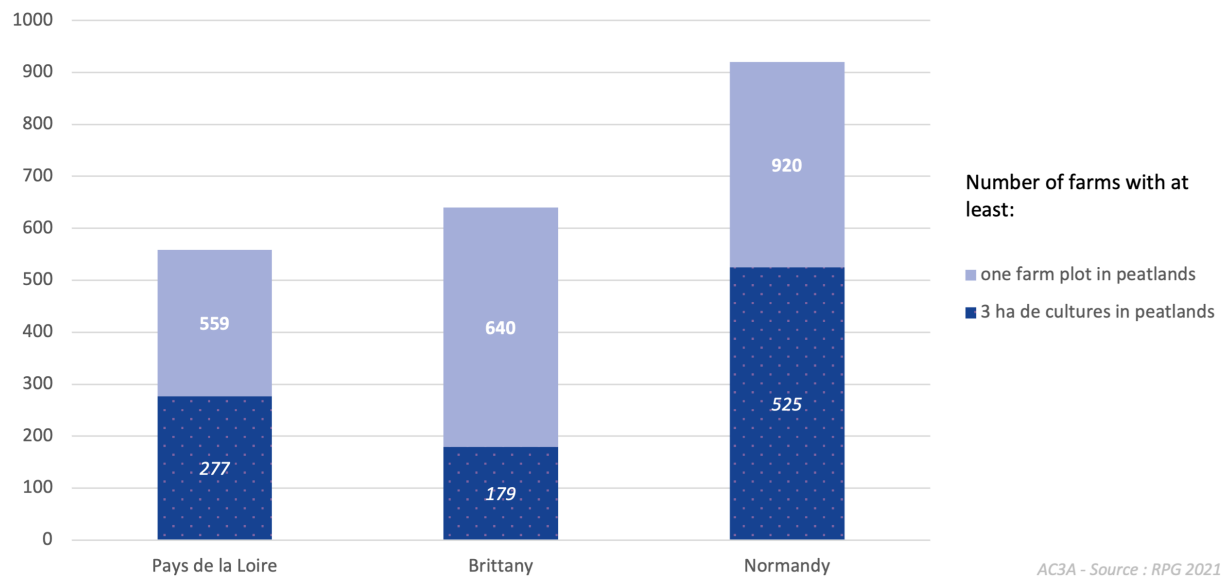


Figure: Number of farms with plots on peatlands by region

A | Extensive livestock farming in marshlands

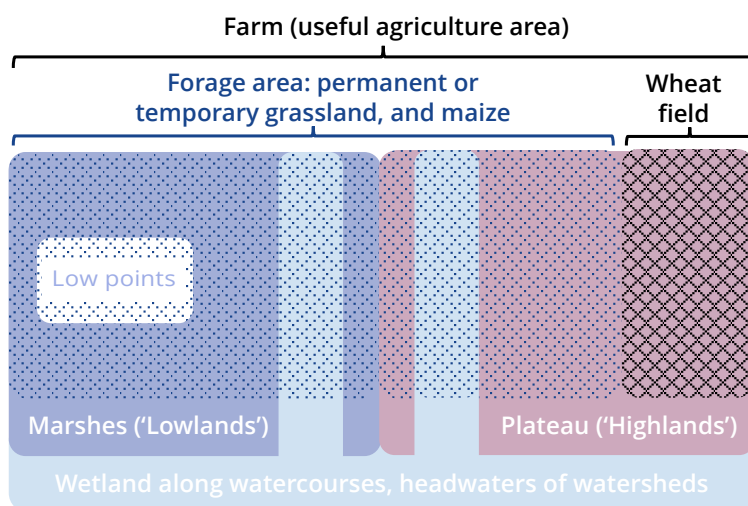
(Normandy and Pays de la Loire)

Introduction

Western France, characterised by its vast expanses of coastal and inland marshes, has long been home to a particular and ancestral form of cattle breeding: extensive livestock farming. This practice, which is closely linked to the specific hydrological and ecological characteristics of these wetlands, is characterised by the use of natural fodder resources and low animal density. It contrasts sharply with intensive farming models, placing animal welfare and environmental preservation at the heart of its principles.

Most farms that make use of marshland have based their overall operations on the complementary nature of the so-called «lowlands» and «highlands». The «lowlands», or marshlands, are defined by being completely flooded during the winter, unlike the «highlands», which are dry lands on the plateau bordering the marshes and can be farmed all year round.

Despite being used for only part of the year, the lowlands contribute to the balance of fodder resources and the needs of animals on all farms. They are an integral part of the farming system in place.



Historically, the marshes of the Atlantic coast, from the Loire-Atlantique to the Gironde, have provided favourable conditions for rearing hardy breeds such as the Parthenaise, Maraîchine and Nantaise. These animals, which are adapted to wet soils and a diet based on marsh vegetation, contribute through grazing to the maintenance of marsh landscapes, vegetation regulation and biodiversity in wetlands.

▲ Figure: Schematic representation of how a farm that makes use of marshes might operate

In Normandy, the Cotentin marshes are unique in that they are partly owned by the local community. They were developed in the 16th century with the construction of floodgates and a network of ditches to allow grazing. As a result, the lush meadows are accessible for more than six months of the year, generally from May to October.

Beyond its heritage and cultural value, extensive livestock farming in marshes is now of vital importance in the face of contemporary environmental challenges. It represents a resilient production model that consumes few inputs and contributes to carbon sequestration in wet soils. However, this practice also faces challenges, including water level management, land pressure, generational renewal and recognition of the added value of its products. This study will explore the specific features, strengths and prospects of this unique form of livestock farming, which is a pillar of the landscape and economy of the marshes of western France.

1 | Capability

Barriers

Any change in **water level management** in the marshes can have repercussions on the production capacity of all farming systems. Changes in water levels can therefore cause imbalances in all components of these systems: animal production (including the types of animals grazed), possible crops, forage balance, complementarity between highland and lowland areas, access to plots, land costs and therefore income, etc.

Strengths and solutions

■ Pays de la Loire

In this region, wetlands used for agriculture are mainly occupied by **cattle farming for meat, milk or mixed production**. This historical presence demonstrates the possibility to build viable agricultural models in these areas with their specific technical characteristics. The **expertise of farmers and their herds** are a valuable asset to be protected to ensure the sustainability of this activity in the marshes.

The **agri-food sectors** are well structured in the region and enable farmers to take advantage of both short and long supply chains.

■ Normandy

Agriculture in the Marshes of Cotentin and Bessin Regional Nature Park is predominantly **focused on dairy farming**. Beef production also plays an important role.

As for the marshes in the Cotentin region and more generally in Normandy, these areas are home to significant agricultural activity that contributes to their maintenance, particularly by combating scrub encroachment. They are also part of the Butter and Cream d'Isigny **PDO** and Camembert of Normandy PDO areas, with greater economic value added to milk production by dairies in the Cotentin sector. Whether or not they are in PDO areas, the marshlands contribute to milk production, which is collected by dairies such as Maîtres Laitiers du Cotentin, Isigny Sainte Mère, Lactalis and Mont Blanc.

- ▶ In dairy sector, several large collectors can be mentioned (Lactalis, Sodial, Eurial and Savencia) as well as independent collectors who play an important role in these marshlands (BIOLAIT, Laiterie de Port Saint-Père, etc.).
- ▶ In meat sector, the national leaders Bigard-Charal-Socopa and Elivia (Terrena) have numerous slaughtering and processing facilities in the region.

The marshes are maintained by farmers (there is no known decline in farming in the Cotentin). They have enabled numerous viable farms to be maintained, while being managed extensively through grazing. The agricultural practices implemented in the marshes are specific and require adaptation, know-how and the sharing of experience. Farmers are therefore engaged in a process of **mutual support**, which reinforces their sense of belonging to the area and shapes a unique identity.

For example, at the ISIGNY cooperative (internally), requests for milk quotas are subject to the following prerequisites:

- ▶ A minimum of 10% of Normandy breeds.
- ▶ 10 acres/milking cow, directly accessible for grazing.
- ▶ 10,000 Liters of milk/ha of UAA maximum after allocation.

2| Acceptability

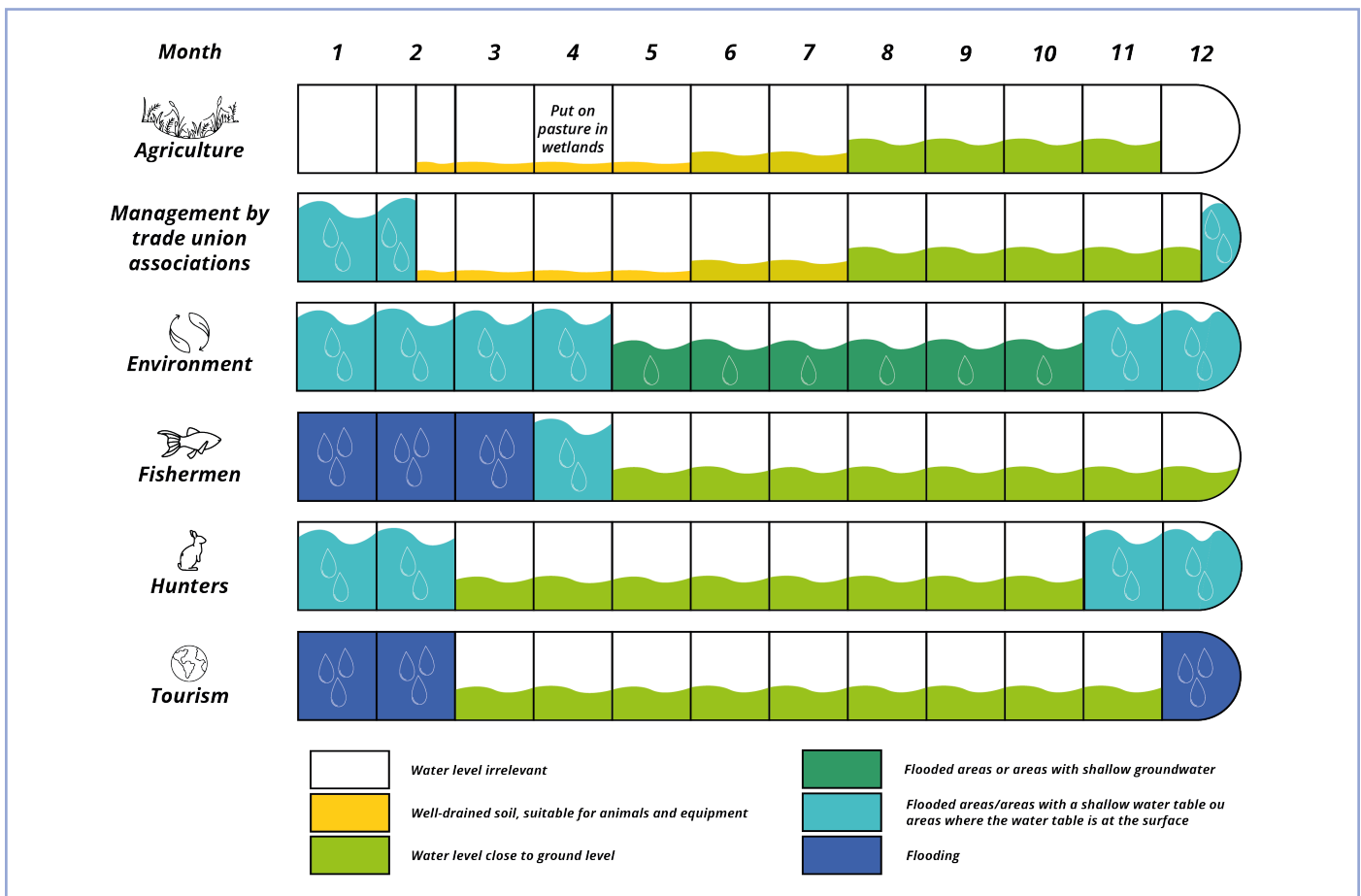
🚧 Barriers

Wetlands are areas of high heritage value, particularly due to their remarkable biodiversity. They also have a variety of users: farmers, fishermen, hunters, residents, environmental associations (LPO, etc.), tourism, etc. Each of these **stakeholders** has their own interests, which may **conflict**, particularly when it comes to defining joint management arrangements and water level control. The social acceptability of livestock farming in these marshes must therefore be considered on a case-by-case basis, depending on the local stakeholders involved.

The **Common Agricultural Policy** requires the maintenance of permanent grassland (GAEC 1) and the protection of wetlands

and peatlands (GAEC 2). It is therefore prohibited to plough up land and grow crops in marshes. Ruminant farming therefore generally remains the only agricultural use. **Numerous standards** also protect wetlands at national level. Other specific local regulations may apply. Some of these may impact the technical and economic performance of farms (mowing dates, water levels, use of inputs, etc.).

In terms of social acceptability, **water level management is key** to the value of extensive livestock farming in marshes. This is illustrated by the table on the next page, which summarises the sometimes-conflicting expectations of different users regarding water levels in marshes.



📌 Figure: Usual expectations of the different marshes' users regarding water level

 Strenghts and solutions

In France, ruminant farming is one of the few legally and technically viable productive uses of marshlands (peat or otherwise). As crop cultivation is impossible, these areas are generally left as **permanent grassland** and used for **fodder production**.

In some areas, particularly marshes, where livestock farming faces technical and economic constraints and/or a crisis of renewal, certain stakeholders are choosing to **cooperate** in order to support this activity. This is the case, for example, with the Normandy Chamber of Agriculture, the Cotentin and Bessin Regional Nature Park (PnrMCB) and the Seine-Normandy Water Agency (AESN). These public stakeholders have been co-organising an action programme to maintain and enhance livestock farming in wetlands since 2019.

Technical working groups meet to discuss various topics related to the enhancement of the marshes, such as parasite management, rush control, generational renewal, the image of the marshes, and links with secondary schools and agricultural training organisations.

Many partners contribute to this programme and help to ensure the acceptability of this economic model, which is now well established in the Cotentin and Bessin marshes: cooperatives, ASAs, agricultural colleges, the GON, the University of Caen, SCOPELA, the FMA, farmers, advisory bodies, banks, the replacement service, local authorities and other structures that can help maintain extensive farming activities and their transmission.



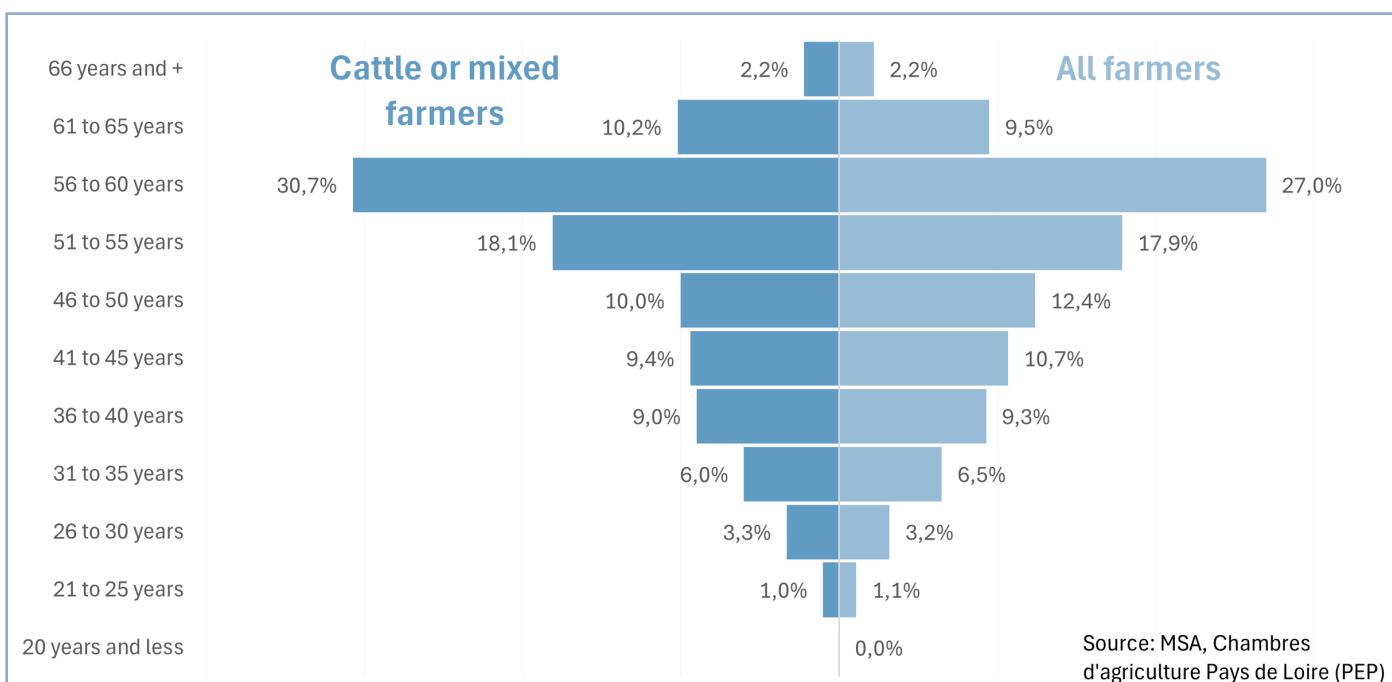
@Agrobjectif

3| Long term & life cycle

🚧 Barriers

The cattle industry is amid a **wave of business closures**:

- ▶ In Loire-Atlantique department, this trend is likely to remain strong over the next 15 years, as more than 60% of cattle farmers in the region are over 50 and therefore **approaching retirement**.
- ▶ In Normandy, 15,125 farmers are over 50 (including 5,889 over 60), meaning that half of all farm managers will have to cease their activity within the next 15 years.



▲ Figure: Age pyramid of farmers and beef cattle or mixed livestock farmers in Loire-Atlantique in 2023

Retirement age is not always the reason for ceasing activity; it may be linked to career change, economic or family reasons, etc.

Furthermore, new farms are not being set up in off, which means that the working population cannot be maintained, and farms and livestock cannot be passed on. This trend, which can be observed across all regions of western France, is leading to a gradual decline in livestock numbers. This **problem of generational renewal** is even more acute in the marshlands, which are considered difficult for young farmers to enter. Working in **wetlands requires specific skills**. However, traditional agricultural education does not provide the theoretical tools needed to fully understand farming in these environments.

Knowledge is therefore passed on mainly through family transmission, a model that is currently in decline. People from non-agricultural backgrounds may find it **difficult to integrate** into the communities of livestock farmers already established in the marshes.

Added to this is the unfavourable relationship between the **moderate profitability** of cattle farming and the **high capital investment** required to take over a livestock farm. This is particularly true in wetlands, where land prices are supported by subsidies.

Strengths and solutions

However, it seems that extensive systems are attractive models for future farmers who do not come from an agricultural background. This type of system meets several expectations: **income security** through subsidies, low investment, environmentally friendly practices and a manageable workload.

Despite the crisis in the attractiveness of farming and marshland areas, several avenues can be explored to improve the situation. First, the **profitability of systems can be improved** through optimisation and the development of viable diversification opportunities (tourism, PES, etc.), but also

through a favourable price environment for production. In this regard, the Egalim laws aim to secure the cost of agricultural raw materials in the future by developing contracts. These contracts could help facilitate **access to bank financing**. New financing solutions could also be developed to support setting up (endowment funds, crowdfunding, etc.).

Some stakeholders are firmly committed to **supporting generational renewal**. This is the case, for example, in Normandy with the Livestock & Marshes programme, co-run by the Normandy Chamber of Agriculture and the PNRMCB.



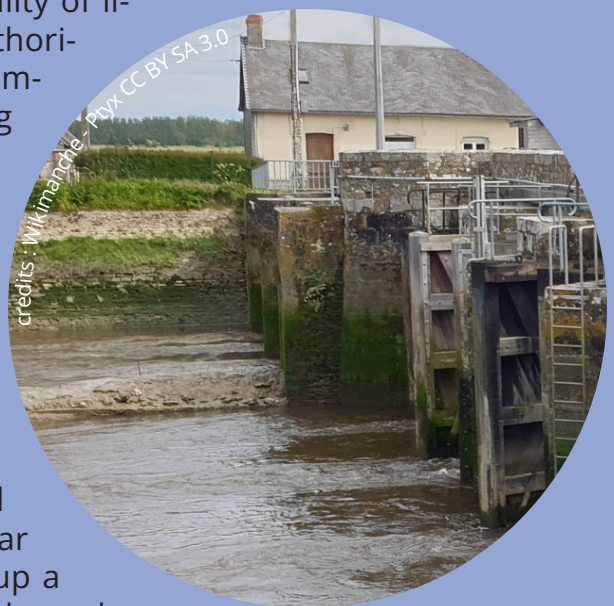
Focus on Normandy flooding risks

Barriers

In Normandy in particular, the **long-term viability of floodgates** and dykes is another short-term challenge for the sustainability of extensive livestock farming. The wear and tear of the floodgates on the Vire river and the critical condition of the dykes in the Saint Fromond marshes (which **threaten to flood** 2,400 hectares of marshland) are among the major challenges to the sustainability of livestock farming in marshland areas. The local authorities concerned, with the support of the farming community and the ASA union, are currently working on the financial aspects of repairing the defective floodgates.

Strengths and solutions

With regard to the work to be carried out to ensure the long-term future of the flood gates, a **multi-year financing agreement** between three inter-municipalities and two municipalities concerned (Carentan and Isigny-sur-Mer) would enable the Syndicate of la Vire to take out a 12-year loan to quickly start work on the gates and free up a small amount of financial capacity for interior works and dykes.



4 | Technical feasibility

🚧 Barriers

■ Pays de la Loire

The wetland offers hydromorphic conditions that involve numerous technical constraints. First, there is the low **productivity of the grasslands**, averaging 1.8 tDM/ha for grazing and 2.7 tDM/ha for mowing, according to the APEX study in the Pays de la Loire region (compared to an average of 7 tDM/ha outside the marshes). The development of certain **invasive species** such as water primrose can further reduce the forage value of wet grasslands.

Added to this are problems accessing pastureland when excess water reduces soil bearing capacity. The result is often delayed access to plots. **Transferring animals** can be particularly difficult in certain conditions, with cows sometimes having to swim to be moved. There is also a risk of plots **being submerged**, which requires adaptations (e.g. the need for embankments in grazing islands). Marshes are also conducive to the development of livestock **parasites** (flukes, strongyles, paramphistomas, etc.), which require preventive or curative treatment. This increases veterinary costs for these farms.

■ Normandy

In Normandy, according to farmers surveyed as part of the «low point» study, the proportion of low-lying plots with a forage yield of less than 6 tDM/ha is 74% for the Taute River and 20% for the Douve river in the Cotentin and Bessin marshlands. Yields depend primarily **on soil type**. They are much higher on mineral alluvial soils than on peat soils or soils consisting of a layer of alluvium over peat. Yields are also influenced by the weather conditions during the year and by farming practices.

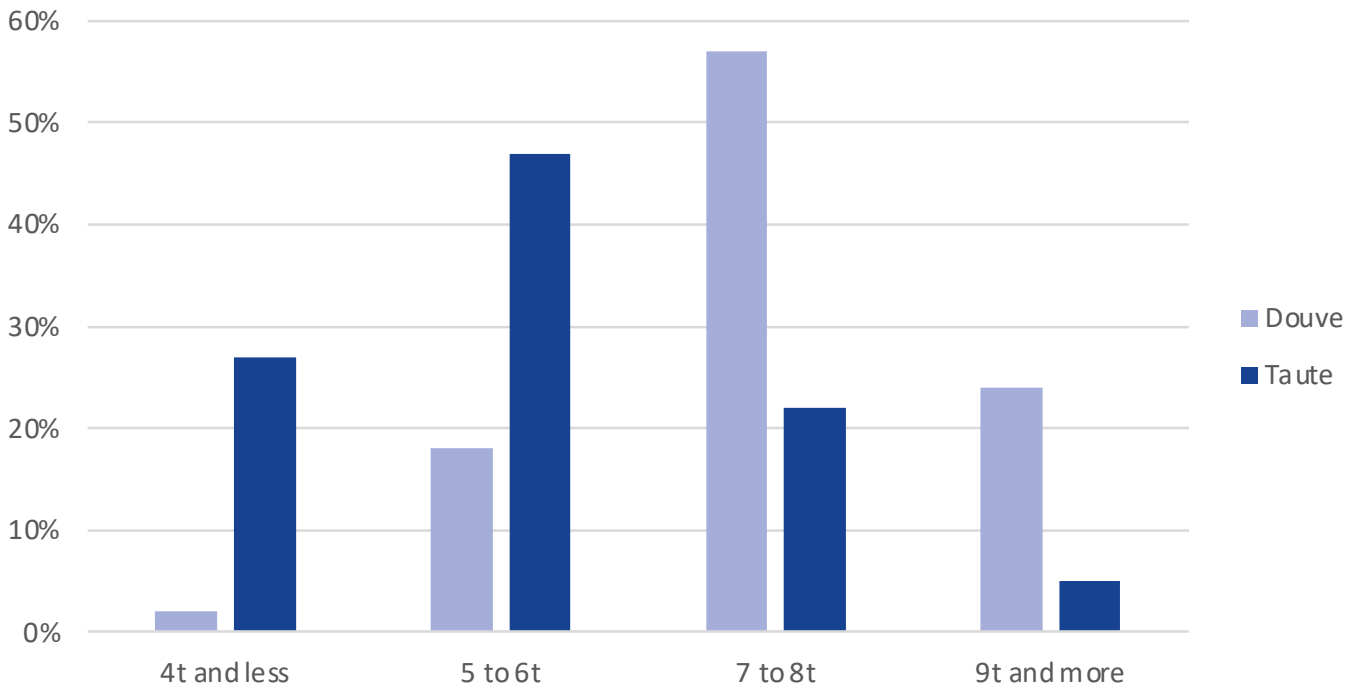
Fodder yields are much higher in the Douve, where 24% of the land has a fodder yield of 9 t/ha or more, which is higher than the yield in the highlands.

In the Taute valley, due to the predominantly peaty soil, the yield potential is much lower, except in the upper part of the study area. Grazing is also less common there (43%, less than half of the area).

The presence of **rushes** and the emergence of **invasive species**, in areas that are currently very limited, are a problem because this vegetation is unpalatable to livestock. These are issues that farmer in Normandy, and more specifically in the Cotentin marshes, wish to address with the support structures involved in the Livestock and Marshes Programme.

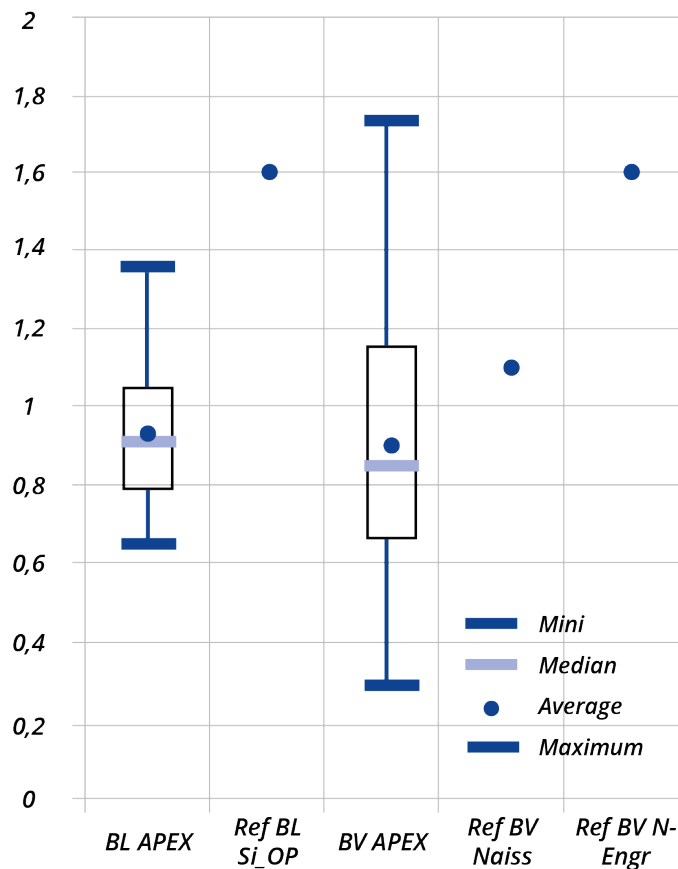
Figure: Map of the different watersheds of the Cotentin-Bessin marshes





▲ Figure: Forage yields for two watersheds of the Cotentin-Bessin marshes

Strengths and solutions



■ Pays de la Loire

Farms are adapted to low forage productivity with higher UAA and main forage area per UAA ratios. This results in particularly low **stocking densities** (0.9 LU/ha on average in the APEX study), which characterises extensive livestock farming in these marshland areas.

Although the raw potential of marshlands is lower, they are particularly suited to **long grazing periods**. They offer good potential for summer and autumn grazing during periods that are usually unproductive in drained areas. As a result, farms with marshland and drained land can take advantage of the complementary nature of their forage production depending on the season and weather conditions throughout the year. The marshland farms in the APEX study enjoy a very high level of forage self-sufficiency (73% are 100% self-sufficient).

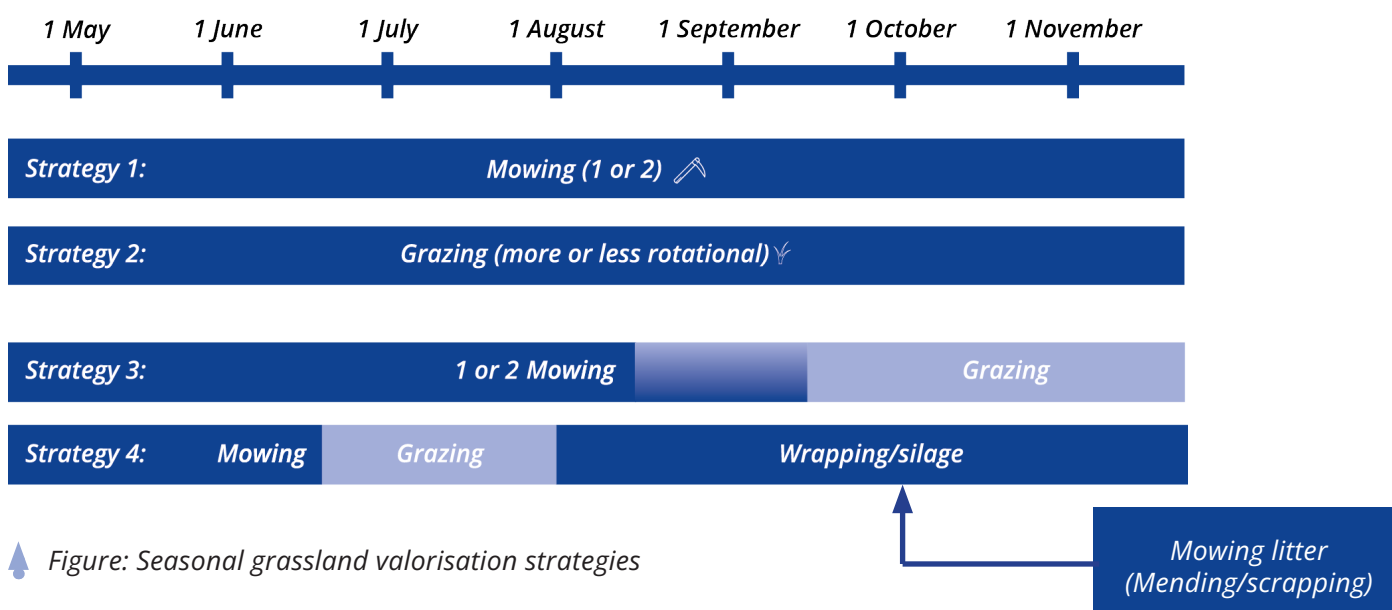
▲ Figure: Moustache boxes for livestock loading of APEX farms and local references (in LU/ha of main forage area) - Source : study APEX (Idele and Chambre d'agriculture Pays de la Loire)

- Normandy

Despite limited use over time, the lowland grasslands of Normandy generally have more than satisfactory productivity levels. They contribute to the balance of forage resources and the needs of animals on all farms. They are an integral part of the farming systems in place. They can fulfil several functions for farmers:

- ▶ **Producing grass** for productive animals (dairy cows, suckler cows, beef cattle/heifers) or less productive animals (dairy farming: heifers, dry cows). Plots are selected according to criteria of suitability for grazing: forage productivity, early growth and regrowth of grass, palatability, nutritional value, carrying capacity, ease of access, plot size, effectiveness of fencing, ease of watering, risk of drowning, etc.
- ▶ **Produce fodder stocks** for feeding the farm's animals or for sale according to criteria of unsuitability for grazing or suitability for building up reserves: ability to produce palatable hay with high nutritional value, silage and silage wrapping, suitability for haymaking, possibility of rapid harvesting in the event of flooding, or optimisation of proposed agri-environmental contracts.
- ▶ **Serve as animal storage areas**, providing flexibility in a forage system focused on the productive use of other parts of the farm.
- ▶ **Provide a stock of bedding** for wintering animals in buildings.

In Normandy, marshes have various levels of productivity. Farmers have adapted by using different practices and methods of exploitation depending on the time of year:



▲ Figure: Seasonal grassland valorisation strategies

Since 2021, the Cotentin and Bessin Regional Nature Park and the Normandy Chamber of Agriculture have been running a **programme to support farmers** in maintaining grazing practices that are conducive to the management of these environments, ecological diversity and the integration of marshes into agricultural production systems.

A good dozen farmers have signed up to the initiative. Specific objectives have been set for farmers, such as **reducing the presence of rushes**. The Regional Nature Park and the Chamber of Agriculture are benefiting from the Patur'ajust initiative run by the national organisation SCOPELA.

5 | Economic viability

🚧 Barriers

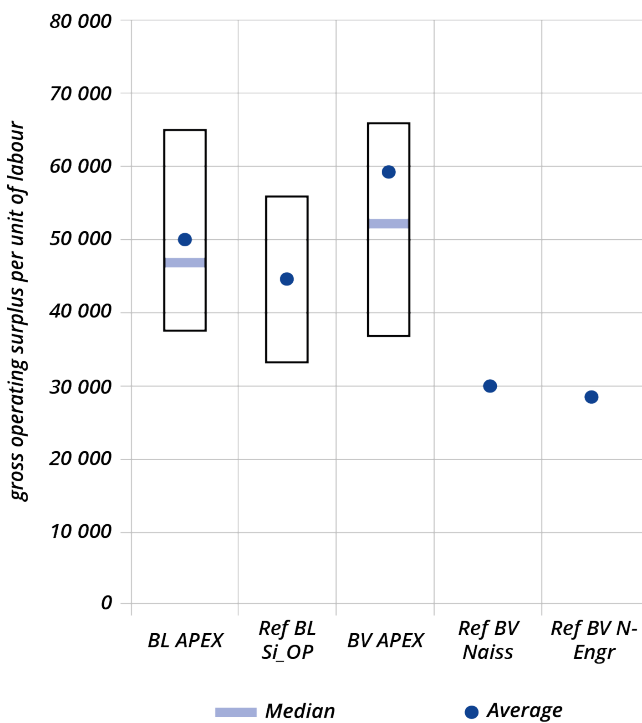
Cattle farming is particularly **dependent on public subsidies** (AECM, ICHN, etc.). Some meat farms even operate at a loss without these subsidies. This level of dependence is even higher in marshland areas. Firstly, because marshland farms have a particularly high UAA, which allows them to benefit from substantial per-hectare subsidies under the first pillar of the CAP. Secondly, most of these farms are committed to **quality initiatives** (45% in the APEX study, mainly organic). They also benefit from additional environmental funding, particularly from **AECM** (88% of the areas studied in APEX).

However, some farmers feel that they are not adequately remunerated given their role in managing the environment. AECM are merely compensation and do not truly reward farmers for their efforts and the environmental services they provide. They are also sometimes criticised for being allocated late and for the very strict controls they impose on farmers.

🔗 Strengths and solutions

■ Pays de la Loire

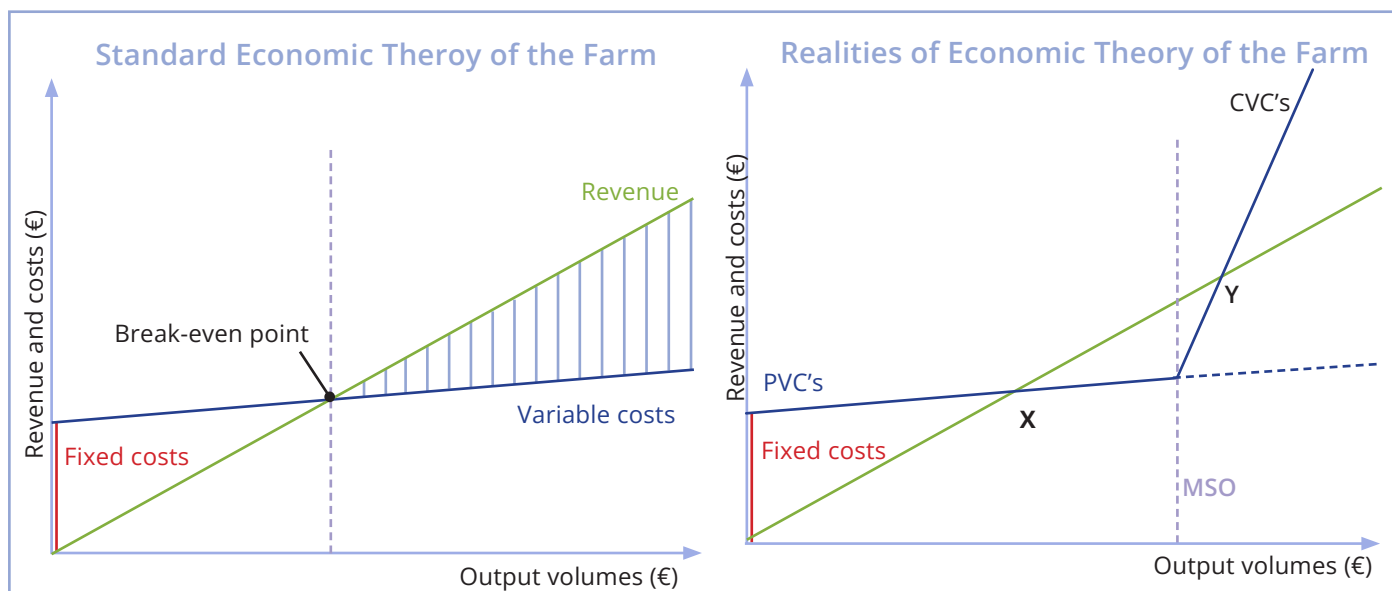
The sample of farms in wetlands studied in the APEX study showed **good technical and economic results**, with gross operating surplus per unit of labour (gross operating surplus per labour unit) often higher than local benchmarks.



▲ Figure: Boxes showing the economic performance of APEX farms and local benchmarks (in gross operating surplus per unit of labour) - source study APEX - Idele and Chamber of agriculture PDL)

Similarly, the gross operating surplus per product ratio, which is slightly higher than these benchmarks, demonstrates a certain economic efficiency. This efficiency of the systems is a consequence of their low building and input requirements and the low cost of grazing. In this respect, these farms apply the concept of «maximum sustainable production» effectively, i.e. they reduce their operating costs by limiting themselves to the capacity of the environment without the need to purchase additional inputs.

Beef cattle systems established in marshlands have historically been mainly oriented towards the sale of weaned calves. The advantage of this model is that it makes use of grass and has provided access to substantial coupled beef subsidies. With the 2023 CAP reform, these subsidies are no longer offered based on the number of births but on the number of adult cattle units. The aim is to **shift production towards fattening**. However, fattening young bulls is not the most compatible practice with extensive farming, as it requires a high level of concentrate supplementation (and therefore feed purchases).



▲ Figure: The principle of maximum sustainable output

Conversely, fattening steers makes it possible to make use of grass and appears to be a promising alternative given the changes to the CAP and the lack of domestic meat supply, which allows for higher and less volatile prices.



■ Normandy

Marshy plots have **production rights**, just like other plots, which are necessary for farm income. These plots can also be used for contract farming and agri-environmental measures, which can represent a significant source of diversification for the financial balance of the farm.

Agriculture in the Cotentin-Bessin Marshes Regional Nature Park is predominantly focused on dairy farming. Beef production also plays an important role. As a result, farms are part of relatively **undiversified sectors**: dairy and beef.

In this area, the Manche department, and more generally the Greater West, is characterised by collection mainly carried out by **cooperatives**. A dozen dairy companies are in Normandy, on 48 different sites. Among them, two cooperatives are geographically close to the Peatland of Sèves and work with the affected farmers. These are the regional cooperatives Les Maitres Laitiers du Cotentin and Isigny-Sainte-Mère. The farmers also work with the world's leading private operator, Lactalis, and some of them work in organic farming with Biolait, which is unique in that it collects milk throughout France without any factories, working with other dairy companies.

In addition, the project is in a **Protected Designation of Origin** (PDO) area for dairy products: PDO Camembert de Normandie, PDO Pont-l'Évêque and PDO Beurre et Crème d'Isigny. Although these products are still produced in limited volumes (2.2% of the dry matter of milk sold in Normandy, including the three PDOs mentioned above as well as Livarot and Neufchâtel), they are often more lucrative and more easily destabilised markets that could be affected.

It should be noted that for Camembert and Pont L'évêque PDO, 25 Ares per cow must be available for grazing behind the barn. This criterion is non-compressible and more restrictive than for Butter et Cream d'Isigny PDO, where part of the feed can be substituted.

On the "Installer et Transmettre en Normandie" platform, a typical case study entitled «Specialised grass-fed cattle, Normande breed and PDO» has been established.

The description of the case study is as follows:

- ▶ This is a PDO system with barn drying.
- ▶ The herd of 97 Normande cows has 40 hectares of pasture
- ▶ Calving is spread out, with 50% calving at 24 months and the rest at 36 months
- ▶ This type of system is common in PDO cream, butter and cheese areas (Neufchâtel, Camembert, Pont-l'Évêque, Livarot, Isigny)
- ▶ Milk production is 526,718 litres, equivalent to 5,487 litres per cow
- ▶ In terms of herd feed:
 - 2.87 tonnes of dry matter feed distributed per livestock unit, of which 0% is purchased
 - 1,048 kg of concentrates per cow, of which 55% is purchased

This case study shows that for an UAA of 89 ha, including 80 ha of main forage area and 9 ha of arable crops, with a herd of 77 dairy cattle (1 LU/ha of main forage area), the gross operating surplus is around €140,000 with an **income per labour unit** of €35,000.

6| Sustainability

Barriers

Cattle farming is the leading agricultural sector in France in terms of **greenhouse gas emissions**. Ruminants are significant producers of methane from enteric fermentation. In general, meat is often singled out for its **higher environmental footprint** compared to plant-based products.

Strengths and solutions

Extensive farming allows **carbon** to be stored in grassland soils. In peatlands, grazing and maintenance by farmers are even more important as they help to keep the **landscape open**. The decline in livestock farming increases the risk of these environments becoming closed and wooded, which would drain the peat, creating conditions conducive to its mineralisation and therefore the emission of large quantities of CO₂.

Through this management, farmers also prevent the development of invasive species such as water primrose and promote species diversity and distribution.

Livestock farmers also often play an important role in **managing water infrastructure** (e.g. canals) that promotes good water flow.

Marshy livestock farming is characterised by grass-fed herds, which, unlike other systems, does not create competition between animal and human food.

These systems also have the capacity to supply meat for the domestic market from male animals (steers rather than young cattle), making use of grass and contributing to food sovereignty.

Extensive livestock farming is an essential part of national landscape management, particularly in wetlands. As a result, the political framework tends to favour the presence of these farms in the territories. For example, the CAP offers several opportunities for subsidies: coupled aid for cattle, aid per hectare, MAEC, ICHN, etc.

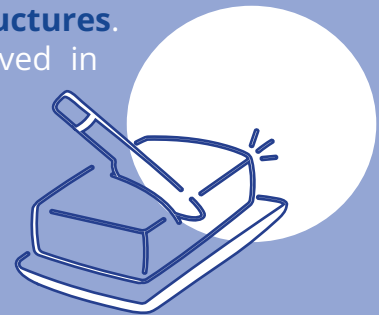
Livestock farming as a source of value creation, jobs and vitality for rural areas in Normandy



The **agri-food industry** is a striking feature of the Cotentin marshlands. It accounts for **nearly 9% of jobs in the area**, or 2,280 jobs (Source: INSEE 2015). Its main sectors (dairy, vegetables, fish, etc.) have a long history in the region.

The **most important is the milk processing industry**, which is mainly made up of local companies and employs nearly 1,000 people. It is represented by two large groups based in the area, Lactalis and Mont-Blanc. At the same time, cooperatives are dynamic and innovative drivers of the sector, increasingly focused on international exports. The best known are the Isigny-Sainte Mère cooperative, which produces milk, butter and infant milk, and the Maîtres laitiers of Cotentin cooperative. Since 2016, this cooperative has invested in new production sites, notably the Réo cheese dairy. Located in Lessay, it specialises in traditionally made products with PDO status, such as Camembert de Normandie. Since 2017, it has also had a second production centre in the heart of the study area, in Méautis. This factory is dedicated to large-scale exports, particularly to Asia.

It is recognised that the sustainability of livestock farming in this sector is essential for **maintaining local jobs and economic structures**. The local dairies mentioned above are therefore involved in the programmes we run at the Normandy Chamber of Agriculture (including the Livestock and Marshes programme).



7. Time

Barriers

Given the crisis in generational renewal, the ruminant sectors are at a crossroads. Their **sustainability in marshland areas is particularly at risk**. To prevent this decline, the **timetable is tight**. Indeed, it is now and over the next 10 years that the wave of retirements among farmers will peak.

The future of these industries is therefore at stake, with one key challenge if we want to maintain them: making farming in marshlands an attractive profession.



In a nutshell

The relationship between profitability and investment requirements in the beef and dairy sectors is generally quite unfavourable. The feasibility study did not identify any additional technical or economic barriers that would significantly hinder extensive farming in wetland areas.

Farms in marshlands have adapted their practices to their environment. They enjoy **good economic performance** compared to other farmers in their sector. Ultimately, it is **more of a societal barrier** that limits the recovery of farms in these fairly closed environments with their **specific technical requirements and know-how that is not easily accessible**.



B | Extensive livestock farming in moorlands (Brittany)

The available socio-economic data concern the EPCI (public establishments for inter-municipal cooperation) area. The data presented here therefore relate to the **Monts d'Arrée Community**, where most of the pilot site is located. A small part of the site is administratively located in the Morlaix Community, where agriculture is less homogeneous (11% of the area is used for vegetables).

In 2020, there were **213 farms**, down 45% from 2020, of which 15% had at least one farm manager over the age of 60 and about half over the age of 50. These trends are comparable to those for the entire Finistère department.

This inland area of Brittany (as opposed to its coastal region) is characterised by low population density, a landscape of **moors and peat bogs**, and its legendary 12,000-year-old history.

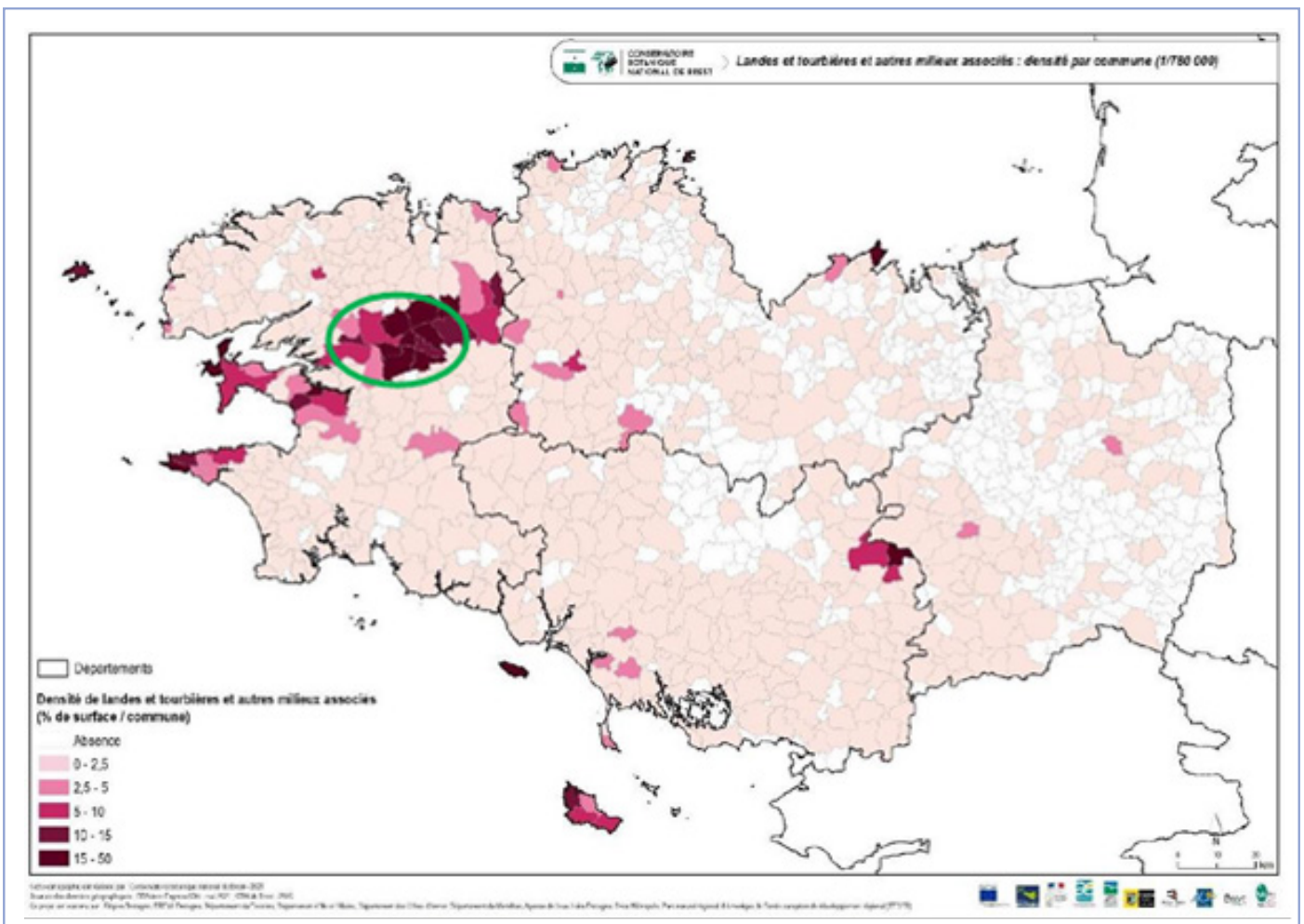


Figure: Density of moors and peat bogs by municipality across Brittany

Farms here are smaller than the department average. As in the rest of the region, milk is the main product. However, there is a higher proportion of **beef cattle, sheep and other herbivores**. At the same time, grassland and organic farming are more developed.

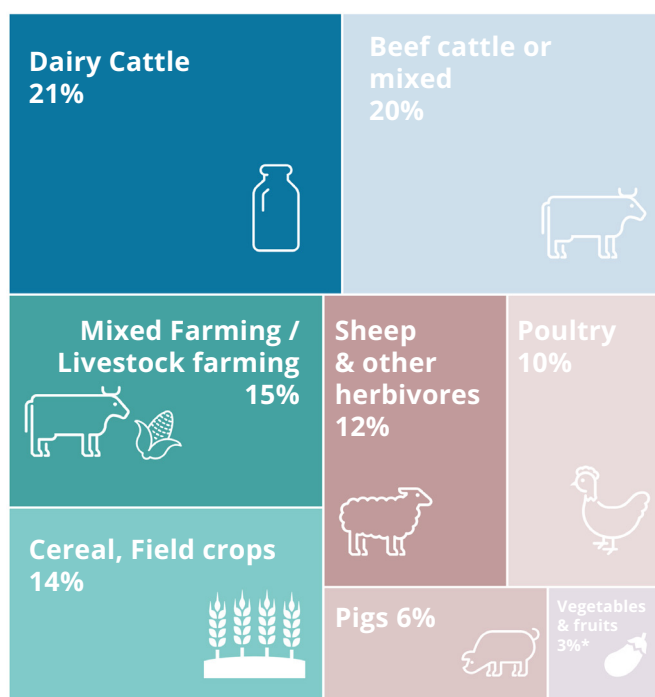
These characteristics reveal the presence of **extensive livestock farming**, fodder resources and low animal density. This practice is linked to the specific characteristics of poor land with the largest area of moorland in Brittany, consisting

mainly of gorse and heather, peat meadows and a much steeper slope than elsewhere in Brittany.

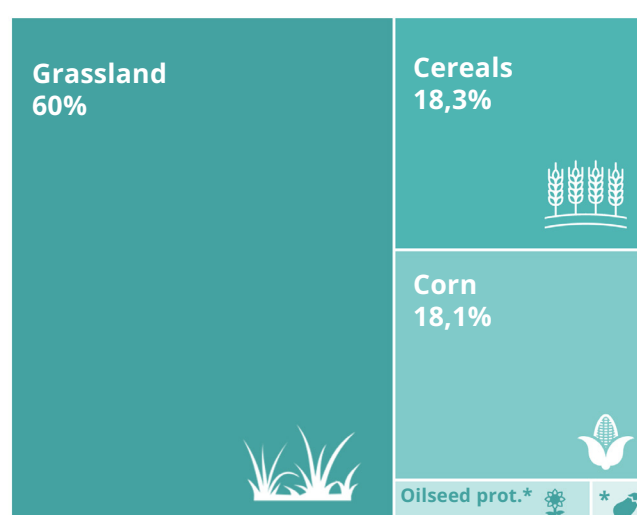
As regards the downstream agricultural production sector, **direct sales** are currently as developed as in the rest of the department (16-18%) but are significantly over-represented among young farmers. Furthermore, the area is characterised by the **absence of any agri-food industry** with 20 or more employees.

Table: Proportion of different types of farms in the Brittany pilot region

	Monts d'Arrée Community	Departement of Finistère
Small and micro-farms (standard gross production)	47%	34%
Dairy farming	21%	24%
Dairy farming	20%	9%
Sheep and other herbivore farming	12%	5%
Grassland in the UAA	60%	41%
Organic farms	24%	17%
Organic UAA	12%	10%
Installation 2017-2021 in direct sales	42%	28%



Farms by main production (Source: RA 2020)
*Field vegetables, market gardening and fruits

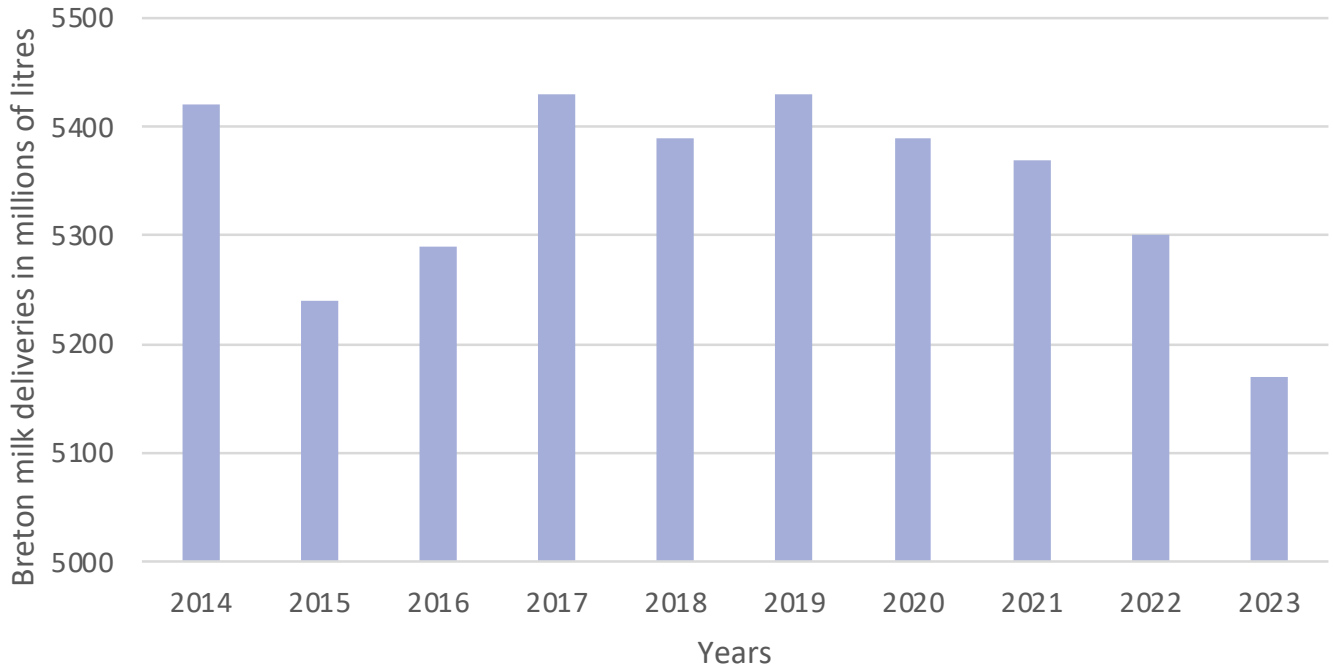


Use of agricultural land (Source: RPG 2021)
*Oilseed proteine crops 2.7%
*Vegetable 0.8%

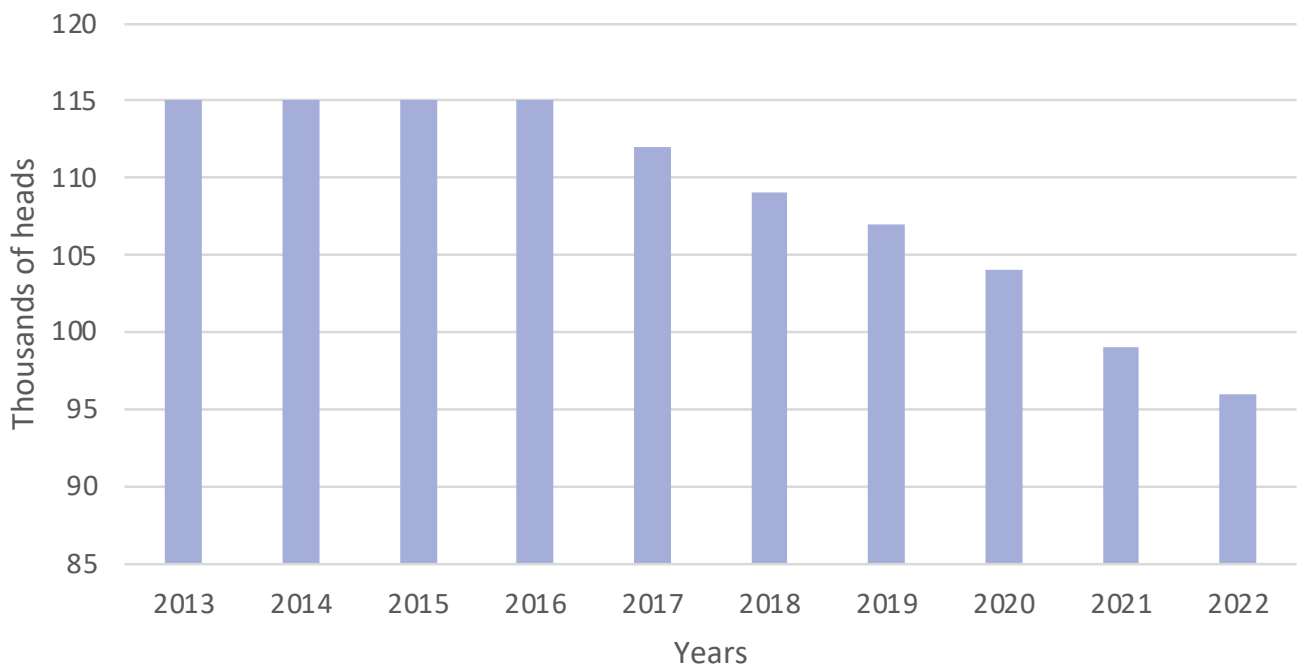
1 | Capability

Barriers

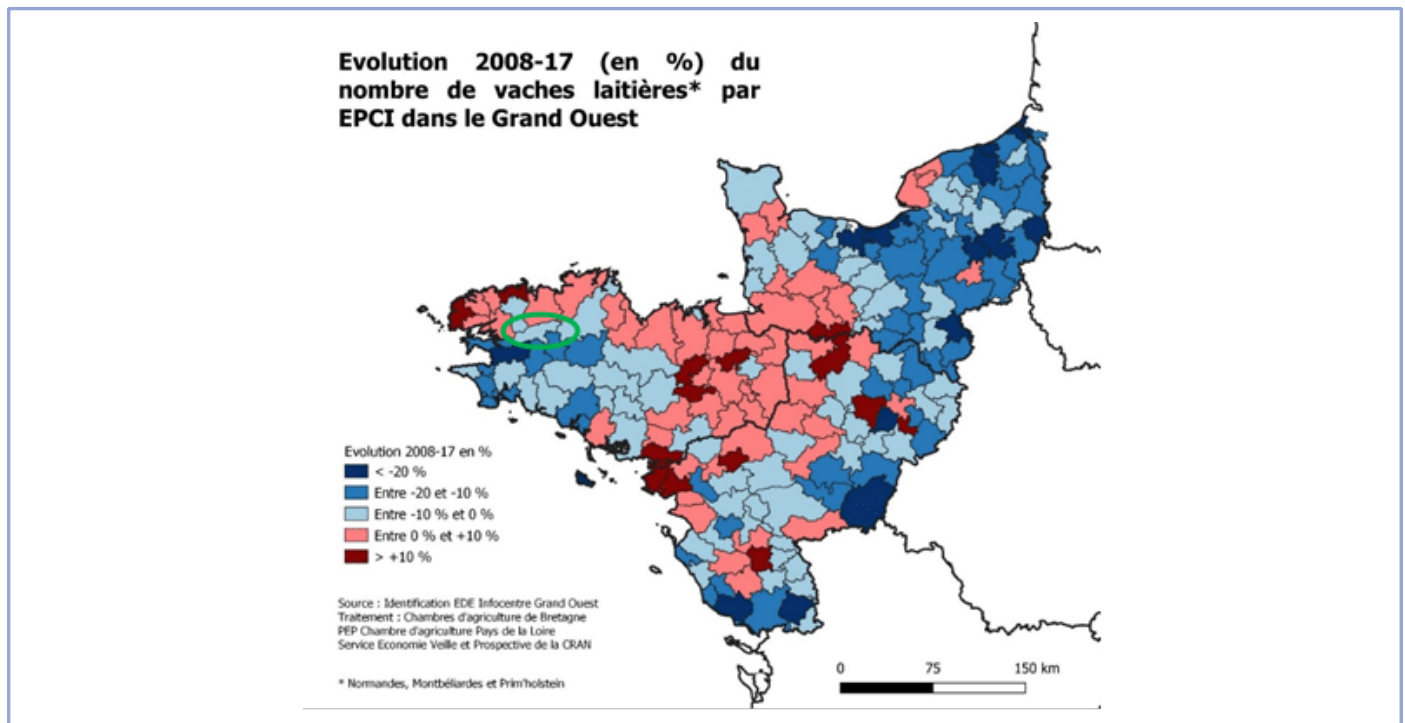
Brittany is a **historic livestock** farming region, with cattle making up most livestock. However, these sectors are currently facing a **sharp decline** in livestock numbers. This trend is evident throughout western France and is a cause for concern among economic stakeholders.



▲ Figure: Breton Milk delivery (Chambre d'Agric. Bretagne – Source: Agreste – France AgriMer- SAA, monthly dairy survey as of 13/03/2024)



▲ Figure: Changes in the number of meats producing cows in Brittany



▲ Evolution 2008-2017 (in %) of the number of dairy cows per EPCI in the Great West

The standard «**long**» dairy industry relies on cooperatives and companies whose scope extends well beyond the region. This trend is becoming more pronounced as the years go by and these companies undergo restructuring. They are therefore finding it increasingly difficult to adapt to local production specificities. Furthermore, the sector's geographical location and low density **isolate** it from collection channels.

🔗 Strengths and solutions

In Brittany, agricultural peatlands are used **exclusively for cattle farming for meat, milk or mixed production**. This historical presence demonstrates the possibility to build viable agricultural models in these areas with their specific technical characteristics. The farmers expertise and their herds are a valuable asset that must be protected to ensure the sustainability of this activity in the moors region.

Although the sector has no processing facilities, milk and meat production can rely on **well-structured regional economic players**. Brittany is a major dairy production region (23% of French milk deliveries) and several

processing players located in Brittany are international in scope. In particular, Lactalis is the world's leading dairy company in terms of turnover in 2023. Sodiaal and Savencia are both in the global top 20.

Beef produced in Brittany comes mainly from dairy herds (dairy cows and heifers account for 40% of volumes) and is therefore supported by this sector. Although the **meat specialised herd is in decline** (-17% of meat specialised cows in 10 years in Brittany), the market has been particularly buoyant since 2020. In addition, young farmers are betting heavily on short supply chains for beef sales.

2| Acceptability

Barriers

The moors and bogs of the Monts d'Arrée are areas of high heritage value, particularly due to their remarkable landscape and biodiversity. They are used by a variety of people: farmers, hunters, residents, environmental associations (Bretagne Vivante the reserve manager), tourists, etc. Each of them has their own interests, which may **conflict**, particularly when it comes to defining joint management arrangements. The social acceptability of livestock farming in these areas must therefore be considered on a case-by-case basis, depending on the local stakeholders involved.

Strengths and solutions

These poor soils are largely **unsuitable for arable farming**. Extensive management as grassland (grazing and mowing) is therefore imposed by natural conditions. Grassland accounts for 60% of the UAA in this sector, which is 50% more than the departmental average.

The Common Agricultural Policy requires the maintenance of permanent grassland (GAEC 1) and the protection of wetlands and peatlands (GAEC 2). However, France's National Strategic Plan only covers peatlands in **Ramsar-listed sites**, which is not currently the case for the peatlands in this pilot site. There are therefore no specific constraints.

However, within the Venec, Cragou and Vergam peatland nature reserves, there are already **loans for use** between farmers and the Finistère Department (under its jurisdiction over sensitive natural areas). These agreements contribute both to animal grazing and to the maintenance of these areas, with regulated mowing and grazing dates. They have also established a pattern of **collaboration** between these farmers and the association Bretagne Vivante, the NGO that manages these reserves.



The existence of the Armorique Regional **Nature Park**, created in 1969, also plays a role in these consultation practices between stakeholders. Its charter was developed with residents, elected officials, businesses, associations, farmers, tourism stakeholders, teachers, and others.

Finally, maintaining these grasslands is also a major solution for clearing brush, which is essential for **preventing the spread of fires**. All local stakeholders have been particularly sensitive to this issue since the fire in July 2022, which destroyed more than 2,208 hectares of heathland and forest. On that occasion, everyone was able to observe the role played by extensive grazing in keeping the area safe.

3| Long term & life cycle

🚧 Barriers

In France, the cattle industry is amid a **wave of closures**, with questions about its **competitiveness** and a crisis in its attractiveness.

This trend is likely to remain strong in this sector **over the next 10 years**, as 35 of the 213 farms have at least one manager over the age of 60. Their recovery is uncertain: for 9 of them, the farmer has no immediate plans to leave; for 13, a takeover is planned; for 10, nothing has been decided for the next 3 years.

On the other hand, new farms are not being set up, which means that the working population cannot be maintained, and farms and herds cannot be passed on. This trend, which can be generalised to all regions of western France, is leading to a gradual decline in livestock numbers.

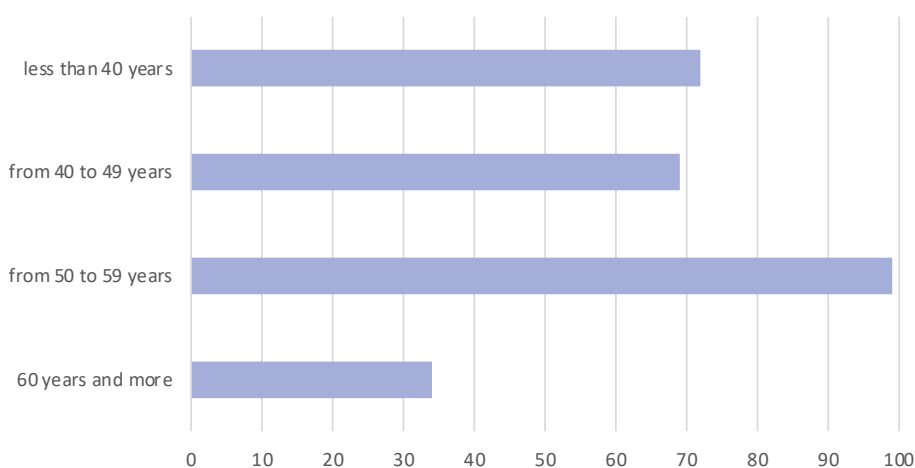


Figure: Number of farm managers by age group Monts d'Arrée Community (Source: RA 2020)

🔗 Strengths and solutions

French and Breton economic and political actors are now mobilised to halt the decapitalisation of cattle herds. In particular, the «Startijin Valait», a **regional demonstration project**, led by the Brittany Chamber of Agriculture and winner of the call for projects on agricultural and food transitions funded by France 2030 (2024-2031), is addressing this issue for the dairy sector in Finistère.

It aims to establish 50 to 60 new farmers per year on redesigned dairy production systems: carbon-neutral dairy systems, generating €3,000 per month for 35 hours of work and providing three weeks of holiday per year.

Although production conditions are particularly difficult in this region, the extensive farming methods is particularly suited for it and offer certain advantages: income security through subsidies, low investment, environmentally friendly agricultural practices and a manageable workload.

This helps to attract people from outside the agricultural sector to set up in the area. This is particularly true as **land pressure in this sector is low**, unlike in other sectors, and there are therefore few barriers to accessing land for this type of project.

4| Technical feasibility

Barriers

In the moors and peat bogs of the Monts d'Arrée, the natural conditions (poor soil and high rainfall) and therefore agricultural production conditions may seem **hostile**. In fact, it is often impossible to grow anything other than grass, and many of the meadows at the bottom of the valleys are difficult to farm because they are wet, have uneven ground (holes), limited load-bearing capacity and poor sanitary conditions for livestock (ticks).

Wetlands are conducive to the development of **parasites**: humidity promotes the development of strongyles and is an essential factor in the development of liver fluke and paramphistomas. These parasites can have serious consequences for cattle health in the event of massive infestations. Ideally, these plots should be reserved for mowing, but the load-bearing capacity of the soil does not always allow this.

Strengths and solutions

The constraints linked to waterlogging can prove to be an asset in the event of **drought**: even in a context of climate change, these moors and grasslands remain grazeable in summer, even in dry years. In general, this allows grazing periods to be extended.

In winter, the moors can also accommodate animals that are able to **graze on woody resources**.

Several farmers in the area have chosen **hardy breeds** (Nantaise, Pie Noire Bretonne, Black Angus). In addition to their size, these breeds are sure-footed, more resistant to disease and adapt well to temperature variations. They also have good maternal qualities and are easy to calve.

These **difficult access conditions** hinder the maintenance of sufficient herd numbers and can lead to the abandonment and closure of these areas. They also limit the weight of the animals that can graze there (heifers or hardy breeds). As a result, yields (3 to 6 TDM/ha) are well below the average yield (7 TDM/ha).

These conditions also encourage the **abandonment of farming**, in a general context of declining cattle numbers in this sector and throughout the Brittany region.



@Clara Diebolt

5 | Economic viability

🚧 Barriers

The management practices imposed by natural conditions are demanding in terms of **working time** (monitoring animals, maintaining fences, difficult access). They require a wide range of **equipment** to make the most of the grass in different forms, putting it under severe strain (breakage) without any hope of increasing the yield.

The profitability of this type of farming is highly **dependent on CAP subsidies**, particularly the agri-environmental component. This makes it vulnerable to changes in the CAP, for example if a decoupling from the Green New Deal were to be adopted, as recently proposed by the European Commission.

In addition, there is currently **local aid for mowing moorland**, reviving the practice that had virtually disappeared due to its low technical and economic relevance.

Strengths and solutions

The technical and economic benchmarks for dairy farming in Brittany published by Idele and the Chamber of Agriculture as part of the Inosys network present the economic results according to the forage system (2023-2025, published in May 2025):

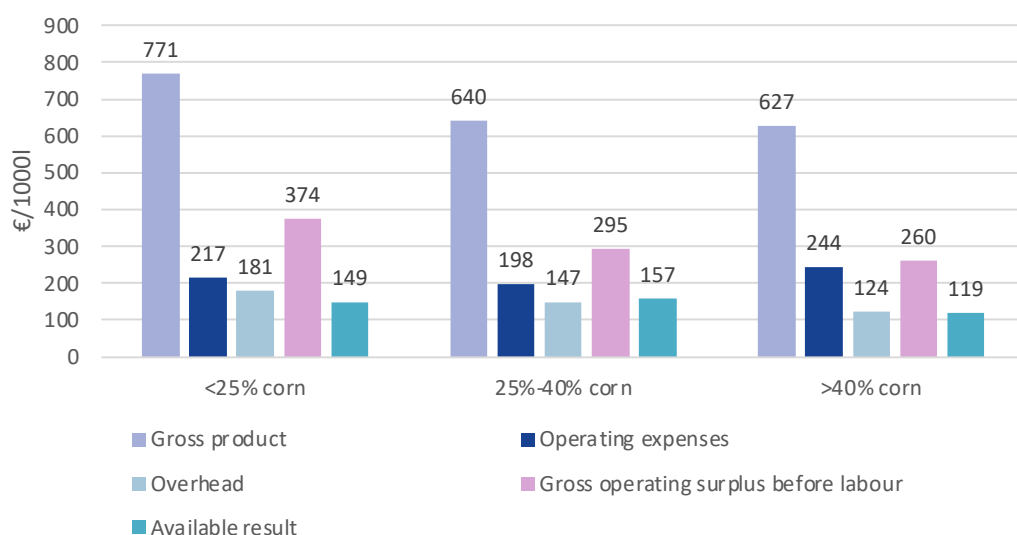


Figure: Economic results based on the forage system

The system with a higher proportion of maize has a total product that is €144/1,000 litres lower, including €40/1,000 litres in subsidies, €25/1,000 litres less in dairy cattle products and €55 less in crop sales. Operating costs are higher, mainly feed costs. However, lower overheads reduce the difference in earnings before interest and depreciation to €114/1,000 litres between systems with more than 40% maize and those with less than 25% maize.

Labour costs are lower in the system with more than 40% maize, at €64/1000 litres. Overall, the difference in disposable income is +€30/1000 litres in favour of the more grass-based system. However, when adjusted per labour unit of farmers, thanks to labour productivity, disposable income is comparable at around €53,000 between these two forage systems. On the pilot site, the share of maize in the forage system is generally less than 25%.

The key to the profitability of these farms is the control of feed costs based on self-sufficiency and the **use of grass**:

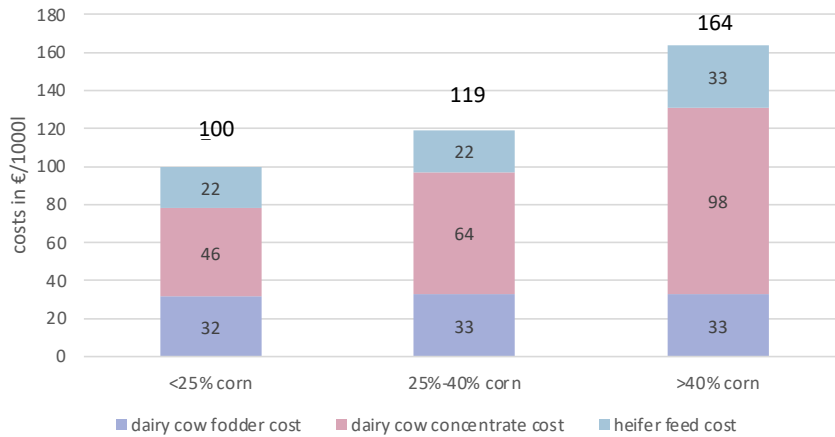


Figure: Detail of the feed costs for the dairy herd based on the forage system

The **feed cost** of the dairy herd increases by €64/1,000 litres with the share of maize in the main forage area. This difference comes from the weight of the dairy cow concentrate feed cost. Indeed, the higher share of maize in the main forage area implies a higher requirement for **nitrogen concentrates** to balance the ration. In addition, systems with more maize often use a greater quantity of production concentrates.

No such microeconomic data is available for beef. However, it should be noted that the **beef market has been particularly buoyant since 2020**. Between 2015 and 2020, the price of cull dairy cows P= fluctuated between €2.50 and €3.18/kg with an average of €2.78/kg over these six years.

The current price is therefore more than twice as high. The price of R+ beef cows averaged €4.00/kg carcass weight between 2015 and 2020. The current price is therefore 63% higher. The cattle market began to rise in 2021 and accelerated significantly in 2022. It was during this period that the decapitalisation of livestock began to materialise in terms of slaughtering. While prices for dairy cows fell slightly, those for meat specialised cows continued to rise gradually in 2023 and 2024.

Direct sales, chosen by nearly half of new entrants, also help improve farm profitability (control over selling prices).

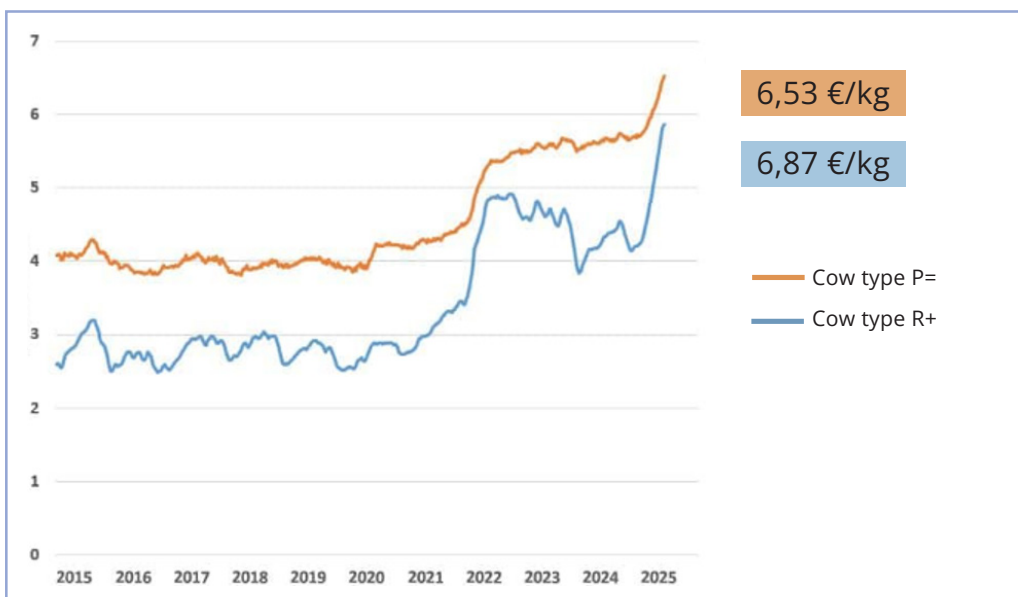


Figure: Cow prices are reaching record levels

6 | Sustainability

Barriers

The right balance between livestock development and environmental protection has been a topic of debate in Brittany for many years. Cattle farming is the leading source of **greenhouse gas emissions** in French agriculture, accounting for half of all emissions in Brittany. Ruminants are major producers of methane from enteric fermentation. Other issues facing farmers include **water quality** (nitrates and plant protection products).

Furthermore, this geographical area is facing a form of **socio-economic decline** that is reducing its attractiveness, including for farmers: few services, few jobs for spouses, difficulties in maintaining schools, etc.

Strengths and solutions

On the climate issue, it should first be noted that the large proportion of grassland, which is closely linked to extensive cattle farming, enables **carbon to be stored** in the soil, but also keeps the environment open and **reduces the risk of afforestation**. This would have the effect of draining peat, creating conditions conducive to its mineralisation and thus to the emission of large quantities of CO₂.

Through this management, farmers also help to **reduce the spread of fires**, which are becoming more frequent in the context of climate change. This was demonstrated during the exceptional fire of 2022, when mowing and grazing areas helped to stop the fire. Beyond their socio-economic impact, peat fires obviously also lead to the destruction of peatlands. It should be remembered that peat is still used as fuel today.

Furthermore, although meat is often criticised for its higher environmental footprint than plant-based products, there is **no competition** between animal feed and human food in this geographical area, unlike in other regions. Finally, extensive livestock farming is essential for managing these **iconic landscapes**. Their rich flora and fauna are well known and recognised by farmers. The role they play in preserving this biodiversity is essential, even if it is not yet fully recognised in economic terms.



7 | Time

Barriers

Given the **crisis in generational renewal**, ruminant farming is at a crossroads. Its future in the extensive farming areas of the West is particularly uncertain. The timetable for avoiding this decline is tight. The wave of retirements among farmers is concentrated in the present and the **next 10 years**. The future of these production sectors in these areas, with their agricultural, environmental and territorial challenges, is therefore being decided now.

Strengths and solutions

Settlement and transfer are at the heart of the strategy of Breton agricultural organisations and the Brittany Region. Many local authorities are taking up the cause and offering support to project leaders. Locally, the presence of the «Valeurs Parc naturel régional» (Regional Nature Park Values) label also reflects this support.

Many projects are addressing this issue, which fully justifies the commitment of the Brittany Chamber of Agriculture to the BUFFER+ project.

It is also worth mentioning the Startijin Valait project, a demonstration project in the Finistère led by the Brittany Chamber of Agriculture and co-piloted by the Departmental Council and the Institut de l'Élevage (Idele). It brings together 50 partners from different sectors (local authorities, economic actors, education and

research, farmers and citizens) and receives State support with a budget estimated at 14 millions euros. Its objectives are to:

- ▶ To support regions in transforming their agricultural and food production systems to meet the challenges of the **ecological and energy transition**.
- ▶ To develop **viable, liveable and sustainable** dairy systems to contribute to the renewal of generations of farmers and agricultural workers and to the economic vitality of the regions.
- ▶ Test, in real conditions, using a **systemic and multi-partner approach**, innovative solutions with potential for replication, with environmental performance requirements exceeding existing standards, involving the dairy sector and local areas.

In a nutshell



Cattle farms are amid a **wave of closures**, questioning their competitiveness and a lack of attractivity.

It raises questions about the feasibility to develop this activity in the Monts d'Arrée moorlands, that furthermore appears somewhat isolated from the major Breton industries. In addition, moorland conditions are **technically difficult** with low productivity and exposition to sanitary and weather risks.

However, positive signals could give this sector a new lease of life. Following the 2022 **peat fire**, the **importance of grazing** in the Monts d'Arrée moorlands is now more than ever recognized as being of public interest by local and regional stakeholders. Since 2020, the beef market has also been picking up. The land prices in this sector are also particularly low and there are therefore few barriers to accessing land.

Finally **extensive cattle breeding has several assets** which could boost its appeal in the years to come like income security through subsidies, low investment, environmentally friendly systems and a manageable workload.

C | Lever of transition: Agri-environmental and climate measures

Introduction

Under the CAP, Agri-Environmental and Climate Measures (AECM) are emerging as an essential tool for public agricultural policy. They aim to encourage farmers to adopt more environmentally friendly practices that go beyond basic regulatory requirements. By offering financial compensation for environmental services provided in defined areas, AECM help to reconcile agricultural production and ecosystem preservation across Europe.

In the Pays de la Loire region, almost all cultivated peatland plots are covered by area-based AECM contracts in 2022. In fact, approximately 10,157 ha are covered by AECM out of 10,172 ha cultivated in peatlands. Conversely, only a quarter of peatland plots are covered by area-based AECM contracts in Brittany in 2022, with 586 ha out of 2,390 ha covered. Finally, in Normandy, in 2022, approximately 6,773 ha are covered by area-based AECM out of 12,625 ha cultivated in peatlands, representing just over half of the agricultural area.

■ Pays de la Loire

In the Pays de la Loire region, in 2023, AECM contracts will be possible in 54 areas selected following a call for projects by the Regional Directorate for Agriculture, Food and Forestry. The contracts are defined for five years in a known context but are reviewed each time the CAP programme is changed. Technically, farmers are supported by field operators and have been required to undergo mandatory training since 2023. To be eligible, all applications must be accompanied by an agroecological assessment of the farm, carried out by the local operator or a partner organisation.

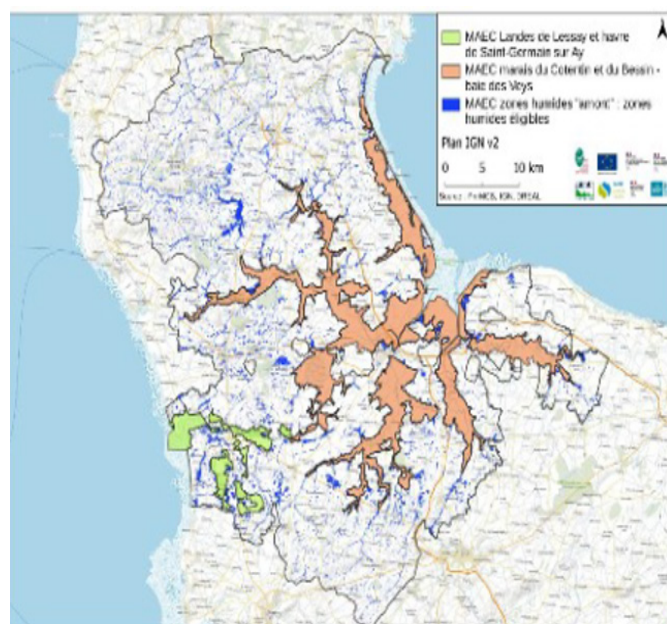
Figure: Territory of the AECM 2023-2027 in Normandy

■ Normandy

In the Cotentin region, there are AECM in the wetlands «upstream» of the Cotentin and Bessin Marshes Park and AECM in the wetlands «upstream» of the Douve and Taute basins.

These measures aim to preserve the fauna and flora typical of wetlands, some of which are rare and endangered, but also to protect water resources.

In the two years since 2023, 484 farms have signed up to the new AECM covering 15,600 hectares of grassland, confirming the importance of the scheme in maintaining good practices in the area. In the marshes, for example, 41% of agricultural land benefits from an AECM. These measures help to maintain the region's wet grasslands by supporting the maintenance of grassland areas and livestock farming. The main measures chosen by farmers are delayed mowing, maintaining grazing by limiting the number of animals and not using fertilisers. Support for ditch maintenance has also been widely welcomed, with more than 300 km of ditches to be maintained over the next five years thanks to this financial support.



1| Capability

Barriers

The scheme only covers certain predefined areas with specifications set for five years and little flexibility in terms of deadlines, measures and commitments.

The scheme is promoted annually and requires significant human resources within a short timeframe, as AECM contracts must be signed before CAP declarations (15 March - 15 May each year).

Strengths and solutions

In the Pays de la Loire region, wetlands used for agriculture are mainly occupied by cattle. The strength of the scheme lies in its **political backing**. It is a scheme derived from the Natura 2000 framework directives with European regulations implemented by the French government through European ERDF and EAFRD funding.

This scheme is essential for the balance of certain farms and for maintaining sustainable agriculture. It **finances the change in practices** necessary to preserve the environment.

2| Acceptability

Barriers

AECM are currently weakened by the lack of clarity of the scheme, **payment delays and ever-increasing constraints** on the agricultural sector. The ongoing agricultural crisis in France and the rest of Europe is fuelling mistrust and a desire for change (simplification) in a highly rigid regulatory environment that is ill-suited to the sudden changes that have occurred in recent years.

The reduction in **State and European subsidies** is a threat to the attractiveness of these measures in a context where the specifications for practices are becoming increasingly complex and restrictive for farmers.

In addition, this scheme has regularly experienced payment delays in the past, which has discouraged some farmers.

Strengths and solutions

This scheme is well known to farmers, who are therefore accustomed to seeking information about it. In addition, it is based in part on measures specific to different river basins: agri-environmental and climate projects (AECM). Although it is a national scheme, it can therefore be **adapted to local specificities**.

The contractualization of an AECM is based on an agroecological assessment of the farm and requires training for farmers. In addition to financial support, farmers therefore receive **real technical support** to implement the measures.



3| Long term & life cycle

Barriers

As AECM are linked to CAP programming, their existence is reviewed every three years. AECM have been maintained in the new CAP, with programming for the period 2023-2027. They are now governed by the National Strategic Plan (NSP) approved by the European Commission.

Difficulties have arisen for farmers involved in the old AECM (non-surface) who also wish to benefit from the eco-schemes. A circular issued in 2023 required them to choose between the two schemes, due to the principle of **no double funding**.

The risk of current programming is compounded by the fact that public funding is decreasing while **requirements are increasing**.

There is therefore a risk that the scheme will eventually disappear altogether or be refocused on large areas where results are expected to be more relevant.

AECM remain a central tool of the CAP for supporting the agroecological transition. However, their continuation will depend on:

- ▶ EU budgets allocated after 2027.
- ▶ The assessment of their environmental effectiveness.
- ▶ Their coordination with **eco-schemes**, which are becoming increasingly important.

There is therefore a tendency to concentrate AECM in areas with high environmental challenges, with more demanding specifications.

Strengths and solutions

AECM are developed by local authorities. This encourages local political actors to take an interest and get involved in these public policies.

4| Technical feasibility

Barriers

Increasingly restrictive specifications and slow and punitive enforcement mechanisms, with little flexibility in relation to climatic conditions, are partly responsible for the disengagement of some farmers. In Europe, this is also a lever for expressing the agricultural profession's dissatisfaction with public policies.

Strengths and solutions

In the Pays de la Loire region, in 2023, **contractual agreements** for AECM will be possible in 54 areas selected following a call for projects by the Regional Directorate for Agriculture, Food and Forestry. Food and Forestry. The contracts are defined for five years in a known context but are reviewed each time the CAP programme changes. Technically, farmers are supported by field operators and have been required to undergo mandatory training since 2023. To be eligible, all applications must be accompanied by an agroecological assessment of the farm, carried out by the local operator or a partner organisation.

Technically, farmers are **supported by field operators** and have been required to undergo mandatory training since 2023. To be eligible, all applications must be accompanied by an agroecological assessment of the farm, carried out by the local operator or a partner organisation.

5| Economic viability

Barriers

Agri-environmental and climate measures are exclusively intended for farmers and only apply to land declared under the CAP. They are remunerated on the basis of **additional costs or income** foregone compared to traditional practices. Indeed, certain practices considered more environmentally friendly can have a direct or indirect impact on the farm's economic activity (e.g., limiting inputs reduces the amount of forage harvested).

There is mistrust of this restrictive scheme, which is **poorly remunerated** and for which payments are sometimes very late after the contract is signed. Late payments jeopardise cash flows that are already weakened by the climate and epidemiological context.

Strengths and solutions

From an economic point of view, some farms, which are severely constrained by their environment, can only balance their budgets with this aid and by committing more than 80% of their land.

6| Sustainability

Barriers

From a strictly environmental point of view, the effects of the measures taken over a few years are sometimes not very relevant to the target species. It is also difficult to overcome the biases induced by the effects of climate change and the global context, particularly for animal species.

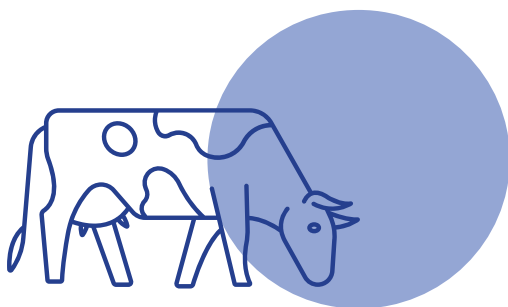
Strengths and solutions

Agri-environmental and climate measures (AECM) are one of the main tools of the second pillar of the CAP for:

- ▶ Support changes in agricultural practices to respond to **environmental pressures** identified at regional level.
- ▶ Maintain favourable practices that provide **environmental amenities** where there is a risk of their disappearance or modification in favour of less virtuous practices.

Targeting certain **umbrella species** makes it possible to assess the effectiveness of these measures. However, they need to be assessed more broadly, given that the entire ecosystem can benefit from the measures put in place.

- ▶ These measures aim to promote practices that are favourable to biodiversity and water quality preservation. They are mainly focused on agriculture in constrained areas (marshes and wetlands, natural grasslands, hillsides, mountain areas, etc).



7| Time

Barriers

This **fixed time frame** can present challenges. Payment delays can sometimes be long between the commitment and the receipt of aid, which can impact the cash flow of farms. It is therefore essential to ensure **smooth and rapid administrative management** of files. Furthermore, although these contracts are multi-year agreements, they should ideally be flexible enough to adapt to climatic uncertainties or developments in scientific knowledge, without compromising long-term environmental objectives.

Finally, in specific contexts such as wetlands, the timing of AECM must be **aligned with the biological cycles** of the target species, such as bird nesting. This may involve specific periods when mowing or harvesting is prohibited, adapted sowing or grazing dates, or adjustments to aid payments to compensate for the time constraints imposed by biodiversity conservation. The success of AECM therefore depends on a delicate balance between the necessary stability of commitments and adaptability to the ecological and economic realities on the ground.

Strengths and solutions

Typically, AECM involve **multi-year commitments** (often 5 years), which is essential for several reasons.

First, environmental benefits, whether habitat restoration, soil quality improvement or carbon sequestration, do not occur instantly but take time to materialise. Commitments that are too short would not allow these environmental objectives to be fully achieved.

Secondly, this medium-term visibility is crucial for farmers, providing them with financial security that encourages them to invest in appropriate practices and equipment, or even to make fundamental changes to their production system.



In a nutshell

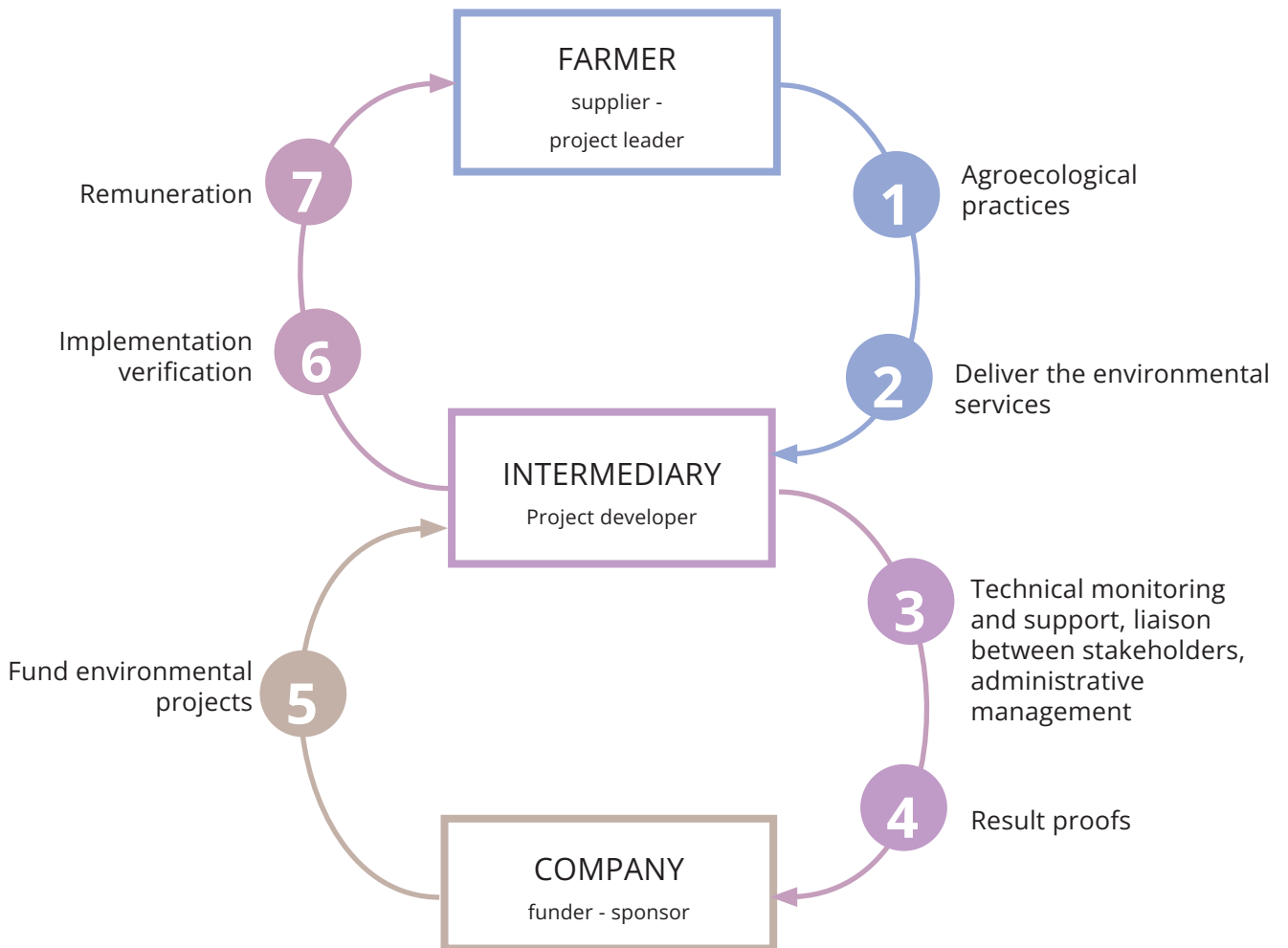
AECM are essential for supporting sustainable agriculture, but their effectiveness is hampered by rigid specifications, payment delays and **increasing complexity**. Their sustainability **depends on European funding**, their coordination with eco-schemes and their real environmental impact.

The scheme remains vital for some farms, particularly in wetlands, but suffers from a lack of flexibility in the face of climate hazards. In the long term, a refocus on high-stakes areas and administrative simplification are necessary to ensure their viability.

D | Lever of transition: Payments for Environmental Services

Introduction

Payments for Environmental Services (PES) are **economic incentives** designed to reward farmers for their virtuous agri-environmental practices. PES are financed by public funds (government, local authorities, etc.) or private companies/funds. Farmers are remunerated once a positive result has been achieved for an ecosystem, according to pre-established objectives. PES are a means of responding to societal, environmental, technical and economic challenges, while maintaining or developing the competitiveness of farms. There are different types of PES: carbon, biodiversity, water, fire risk, etc.



▲ Figure: Diagram showing how a private PES scheme works

1 | Capability

Barriers

PESs are new mechanisms that are still being tested in France. Feedback is just starting to come in. The concept of this new value chain (not linked to product volume) is often misunderstood by economic actors.

On the one hand, PES involve funders, who are in principle the direct beneficiaries of the advantages. They can be companies, individuals, sometimes represented by associations or public actors. These may include, for example:

- ▶ **Agri-food actors** who exploit natural resources: for example, many PES have been financed by industrialists who exploit drinking water sources with farmers in the watersheds of the sources.
- ▶ **Local authorities** wishing to protect landscapes in their territory for their cultural, recreational or other value.
- ▶ **Environmental managers** who wish to restore ecological continuity to promote biodiversity protection, etc.

PESs also engage farmers who are considered to be providers of an environmental service and who receive payment for this service conditional on the achievement of ecosystem outcomes.

The contract must therefore be drafted following negotiations between the

providers and beneficiaries, covering measures, amounts, specifications, etc.

Only when each party agrees on the principles for implementing the PES can it be tested and then rolled out on a larger scale. The basic principle is to find a **compromise** between everyone's expectations («what they are willing to give» and «what they are willing to receive»).

PES are therefore complex to develop and contractually agree upon because they involve various actors with sometimes divergent interests and rely solely on the **willingness of farmers and funders**. They cannot therefore succeed without demand from both sides. As an innovative financial framework, they are not yet suited to new practices requiring heavy investment.

Furthermore, **landowners** (in the case of agricultural land not farmed by its owner) can be an obstacle to the development of practices outside a framework set by the authorities. Convincing them requires the deployment of specific resources.

Finally, the production conditions set out in agricultural contracts, which correspond to the sector's strategy, must be compatible with the PES measures, which most often correspond to territorial issues.

Strengths and solutions

Regional associations have been set up, such as Symbiose (Normandy), Solenat (Pays de la Loire) and All'homme (Brittany) to support the roll-out of payment for environmental services markets.

Their goal is to promote and raise awareness of agricultural practices that provide environmental services.

The associations will develop the economic value of these environmental services so that participating **farms can benefit from the added value** of their practices.

The aim is to bring together as many stakeholders as possible, including farmers, funders and facilitators, around a common goal of rolling out Payments for Environmental Services.

The three regional associations work closely with the Chambers of Agriculture. They have both **detailed knowledge of the territory**, which is essential for carrying out a diagnosis to define a biophysical and socio-economic perimeter that is relevant to the existing data, and expertise in agroecological practices. The recent inter-chamber project «CAP'PSE» has enabled them to share their experiences with PES at the national level.

They also have experience in **developing and contracting PES in other regions** and on issues other than those addressed by the BUFFER+ project. What makes this project unique is that it is being carried out in regions with a strong identity and a deep attachment to their remarkable landscapes.

The Chambers of agriculture have been running **«progress groups»** for many years and therefore have real expertise in group dynamics. The innovative nature of the approaches proposed to them, such as PES, is a real driving force.



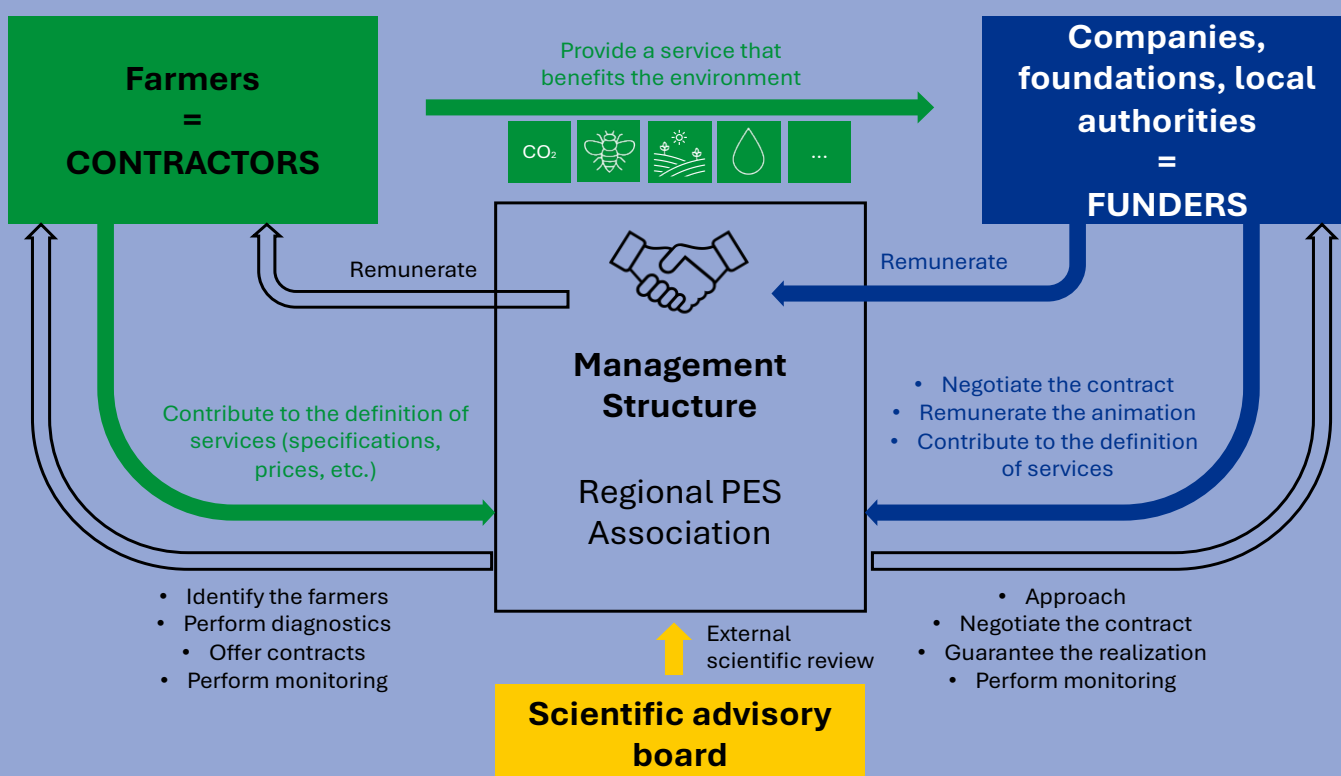
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FOCUS ON SYMBIOSE NORMANDY

A REGIONAL ASSOCIATION TO DEVELOP PES SCHEMES WITH FARMERS

Faced with the need to maintain and improve the environmental functionality of agricultural and rural areas, founding members decided to join forces within a regional association called Symbiose Normandie. The association operates as follows:



▲ Figure: Symbiose Association operating structure

Symbiose has multiple roles:

- ▶ Promote the complementarity of relationships between environment and agriculture.
- ▶ Communicate, inform, and train farmers.
- ▶ Define the implementation, monitoring, and evaluation methods of contracts between companies and farmers.
- ▶ Valorise the contributions of farmers in territories in terms of environmental amenities.
- ▶ Communicate, raise awareness, mobilize, and unite stakeholders.
- ▶ Valorise scientific and technical achievements.
- ▶ Search for companies willing to invest in PES (Payments for Environmental Services).
- ▶ Be the financial intermediary between farmers and funders.
- ▶ Develop a network of private and public actors.

2| Acceptability

Barriers

Initiatives implemented without prior consultation with farmers or businesses are doomed to failure. Similarly, companies wishing to finance projects solely to enhance their image or compensate for behaviour that is otherwise contrary to their activities may damage the image of PES. It is therefore necessary to be **vigilant about everyone's motivations** (particularly «greenwashing»).

Furthermore, other users of these areas may hinder these dynamics, either out of **mistrust or conflicting interests** (tourism, recreational users, hunters, fishermen, etc.).

A thorough analysis of stakeholders is necessary but unfortunately not sufficient

Strengths and solutions

PES are economic instruments that **do not refer to a specific legal regime**. However, PES are based on contracts, and the legal regimes governing contracts provide guidance on the general and specific rules applicable to PES. Private law contracts operate freely in a kind of supply and demand relationship. Public law contracts are subject to European law and WTO rules, which specify that these payments must **not distort competition**.

This translates into agri-environmental payments whose amounts cannot exceed the income foregone and additional costs incurred by the measures implemented by farmers (Pech, Jegou, 2019). In this context, there is little difference with AECM.

A guide entitled «PES for private operators» has been published online by the government. It is aimed at private actors, in particular agricultural enterprises, cooperatives, agri-food industries and associations wishing to set up PES. This guide is part of a set of three complementary guides

to secure their cooperation. Indeed, some may simply oppose the principle of assigning a market value to an environmental service.

Furthermore, PES should not compensate for **insufficiently remunerative** agricultural prices or replace public policies whose role is to guide agricultural practices in line with political decisions.

Finally, the principle of **additionality** may be difficult to respect in some cases, particularly if contractual criteria are already imposed by the sector: for the same measures implemented by farmers, a PES (additional remuneration) may be contracted or, conversely, market access criteria may be imposed.

aimed respectively at (1) private actors, (2) local authorities and (3) government departments. This demonstrates the public sector's involvement in this scheme. It has also recently been cited as a lever for action in public policies such as the National Low Carbon Strategy.

It should be noted that this scheme is much more widely accepted than other measures, as it is **simple, voluntary and coordinated**. The supplier and the beneficiary are therefore both involved in the process. A successful PES is one that creates a social bond between each of the stakeholders.

The main opportunity is to move away from the paradigm of «compensation, additional costs and lost income» towards promoting practices and a positive vision of agriculture's contributions to biodiversity, water, the landscape, the climate, etc. The path proposed to farmers is one of agroecological and profitable practices that contribute to environmental preservation and income for «viable» farms.

PESs can also help meet the needs of a region. To do this, it is necessary to consider the issues at stake and adapt the terms of the contract. The process must be carried out in a spirit of trust and consultation. This is why the partners in the BUFFER+ project have chosen to rely on a technical and scientific support group in which environmental stakeholders are invited to contribute.

- Pays de la Loire

The project to set up a pilot site in the Brière Marshes has been postponed due to **tensions in the area** between the various stakeholders: new water level regulations, tense relations between elected representatives of the Chamber of Agriculture and the Regional Nature Park, lack of support for the Biosphere Reserve project from elected representatives of the Chamber of Agriculture, a peatland restoration project that aims to compartmentalise and flood a larger area than anticipated, historical tensions between users, etc. Farmers in the area were preoccupied with other issues and problems and did not have time to devote to the Buffer + experiment. There was also a risk that discussions would further strain relations rather than ease them. It was therefore decided to choose another marsh, the Marais de l'Erdre, where **dialogue is possible** and more conducive to the project.

- Brittany

With the aim of preserving peatlands, nature reserves have been created in the Monts d'Arrée (Venec, Cragou, Vergam). In recent years, farmers have been concerned about plans to extend these reserves without sufficient financial resources to compensate for the production constraints imposed in this context. PES therefore appear to be an interesting option for both farmers and managers of these natural areas. They should make it possible to maintain extensive farming practices where difficult conditions (natural handicaps) impact profitability.

- Normandy

Through its **support** for the Livestock and Marshes programme, the AESN wanted to encourage reflection on the implementation of PES as a tool to support livestock farming, with the aim of remunerating agricultural practices that provide environmental services in a specific area. The preservation of wetlands, water quality and biodiversity in the Merderet river basin were therefore targeted as services that could be remunerated for farms (over five years, from 2022 to 2027).

The funder reiterated that this was an experiment involving the remuneration of environmental services for nearly 20 farms in the Cotentin marshlands.

Work now needs to be done on financing PES through private companies and understanding their needs and wishes in terms of implementing their CSR strategy and their willingness to pay for certain types of services. A series of meetings with companies in the sector is being planned to assess the types of services we need to work on with farmers and the criteria or even monitoring indicators that could be targeted for the implementation of private PES.

The project to convert the Sèves peat bog (Cotentin) has brought together the farmers concerned and the Normandy Chamber of Agriculture. An assessment of their situation was carried out in 2022. An update on their level of adaptation and the field observations of rising water levels was carried out in 2025. Their level of vulnerability (and how this has changed since 2022) to rising water levels, as well as their willingness to work on this PES development project, were discussed. A group of six volunteer farms could get involved in this work.

3 | Long term & life cycle

🚧 Barriers

The lack of involvement of companies that are often already invested in social rather than societal and environmental issues is a weakness. These contracts are based on voluntary approaches that are **not subject to regulatory obligations**. Their long-term viability is not guaranteed. Sellers are also reluctant to commit to the post-contract period (five-year contracts in most cases).

🔗 Strengths and solutions

It is therefore necessary to partner with local companies, which will naturally be long-term partners for farmers in their sector, and/or to secure significant and recognised funding that can provide **long-term support and visibility** for the initiatives. The role of communication should not be overlooked, which is why communication officers have been involved in the project in all three regions to develop and roll out communication tailored to the various target audiences (farmers, buyers/funders, the public).

It is also necessary to help maintain **strong societal demand** for companies non-financial performance so that it becomes part of their long-term strategy, beyond the opportunity of the moment. Regulation is, of course, a lever for this sustainability.

On the other hand, sustainability on the farmers' side can be part of a strategy to diversify **sources of income** as a lever for the economic resilience of farms, which are thus less exposed to market volatility.

Finally, presenting the results in educational institutions is essential for **raising awareness** of this innovative scheme.



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4| Technical feasibility

Barriers

PES differ from regulatory and fiscal policies in several ways (*Wunder, 2011; Muradian et al., 2010*):

- ▶ **Supplier freedom:** the supplier's commitment is voluntary.
- ▶ **Identification:** the scheme must have a clearly defined environmental objective, and the purpose of the payment must explicitly compensate for the preservation or restoration of an identified ecosystem service or bundle of services.
- ▶ **Conditionality:** payment is only made if the result in terms of preserving or restoring the environmental benefit is achieved.
- ▶ **Additionality:** the PES must go beyond the anticipated and deemed inadequate evolution of the ecosystem without intervention (baseline scenario), in particular the commitments of environmental service providers must go beyond regulatory requirements for environmental protection.
- ▶ **Incentive:** the voluntary commitment of providers requires a sufficiently high level of payment, bearing in mind that remuneration may take different forms and include benefits in kind and intangible benefits.

Consultation and fulfilment of each of these criteria are essential to the success of a PES. It is therefore a process that needs to be developed and cannot be delivered «off the shelf».

Furthermore, it is possible that there will be no **measurable indicators** for the service over the duration of the contract. This is because some ecosystem changes take place over a long period of time.

Strengths and solutions

Payment for Environmental Services contracts are established within a «contractual» framework and are therefore **based on an agreement** between the various parties concerned. It is therefore a simple, in system, financed in most cases by private funds.

This system **can be adapted** to a specific operation, territory or economic activity. It is based on the evaluation of the practices implemented through individualised support for each farm: diagnosis, management plan, monitoring and performance indicators. It requires the implementation of a monitoring system to provide innovative and sustainable indicators.

5 | Economic viability

Barriers

The main barrier is **financing**, from obtaining it to ensuring its sustainability. It is difficult to rely on public funding, which is often demanding, low-paying and not fixed over time (funding is reviewed annually). In the case of private financing, the difficulty lies in obtaining aid and ensuring its sustainability.

PES are often perceived by private actors as a means of positively impacting farmers' incomes. However, it is important to remember that PES contribute to income diversification but have limited effects on income growth (since part of the payment compensates for additional costs and lost income).

In addition, the **marketing costs** of PES are particularly high: drawing up tailor-made specifications, obtaining consent from farmers, finding buyers, contracting through an intermediary, periodic reviews, etc. These costs are difficult to pass on to the buyer and therefore frequently require public funding.

Finally, they cannot be an effective response to the issue of fair **remuneration for agricultural products**; in other words, they cannot be used to compensate for imbalances in the sector that result in undervalued agricultural prices.

The question of the effects of PES on income, and more generally on the balance within the sector, must remain a focus of attention, as PES can have significant indirect effects.

Strengths and solutions)

The question is therefore how to reconcile farmers' demands for fair remuneration with companies' financing capacities within the framework of Payments for Environmental Services (PES). An analysis of specific cases shows that several levers can be mobilised:

- ▶ **Conditionality of aid:** Introducing sustainability criteria and good practices for access to public aid makes it possible to reward farmers' efforts while directing fundings towards more responsible models.
- ▶ **Co-construction of PES:** Involving farmers, agri-food companies and local authorities in defining PES (workshops on the amounts allocated to each measure) helps align economic and environmental expectations. This strengthens the acceptability and relevance of commitments.
- ▶ Existence of regional associations capable of acting as **intermediaries** without seeking profit for themselves.
- ▶ **Valuation of positive externalities:** Companies can integrate PES into their CSR (Corporate Social Responsibility) strategy by remunerating farmers for services such as biodiversity preservation, water quality or carbon storage.
- ▶ **Hybrid financing:** Combining public funds (CAP, local authorities) and private funds (businesses, labels, environmental sponsorship) broadens the funding base and secures livestock farmers' incomes.
- ▶ **Stability and visibility:** Multi-year contracts (5yrs or more) with reliable payments are essential to enable farmers to make a long-term commitment, despite climate and economic uncertainties. Funds can be blocked by a managing body for the duration of the contract.

6 | Sustainability

Barriers

PSEs are based on the principle of additionality and are therefore dependent on changes in the **regulatory framework**. New rules could therefore undermine a PES schemes.

Furthermore, private actors may respond to environmental and agricultural transition challenges in different ways, with PES being just one tool among many.

Strengths and solutions

Payments for Environmental Services (PES) in agriculture compensate farmers for actions that contribute to restoring or maintaining ecosystems from which society derives benefits (water quality preservation, carbon storage, landscape and biodiversity protection, etc.). These benefits are referred to as **ecosystem services**. The actions of farmers, meanwhile, are referred to as environmental services.

PES are therefore economic mechanisms that aim to restore a system of economic signals that guide farmers towards more environmentally friendly behaviour.

To develop these schemes, **collaboration with scientists** is established to ensure that the impacts of the PES correspond to the desired objective: Pôle Relais Tourbière Scientific Council, BUFFER+ interregional technical and scientific support group, Atlantic Marsh Forum, Brest National Botanical Conservatory.

When the contract is drafted, **indicators are identified to monitor** the effectiveness of the measures prescribed. Care must be taken to ensure that these measures are compatible with other existing mechanisms (contractual or regulatory).

7 | Time

Barriers

The issue of the timing of payments for environmental services (PES) is crucial to the effectiveness and attractiveness of these schemes, particularly in the context of agricultural practices such as paludiculture or extensive livestock farming in marshlands. For farmers and land managers to commit to virtuous practices (non-use of fertilisers, respect for nesting periods, etc.) on a long-term basis, it is essential that the terms of payment for PES are **adapted to their economic and operational realities**.

Strengths and solutions:

Several aspects of this timeframe need to be considered:

- ▶ **Regularity of payments:** Annual or even multi-annual payments are generally preferable to provide visibility and financial stability for farmers. Payments that are too far apart or irregular may discourage commitment, as environmental constraints impose costs (loss of income, specific investments) that must be compensated in a predictable manner.
- ▶ **Implementation and collection times:** The period between committing to an environmentally friendly practice and receiving the first payment should be as short as possible. Excessively long delays can create cash flow problems for farmers, particularly those who are innovating and taking financial risks at the outset.
- ▶ **Duration of commitments:** Environmental services, such as carbon sequestration or biodiversity preservation, are often measured over the long term. PES contracts must therefore be long enough to allow these ecological benefits to be fully realised, while offering flexibility to adapt to changes in scientific knowledge and local needs. Commitments that are too short would not allow the positive effects of the practices to be sustained.

- ▶ **Adaptation to natural cycles:** In environments such as wetlands, the timing of payments should ideally be aligned with natural cycles (nesting, flooding and harvesting periods). This could take the form of payment adjustments or eligibility criteria that take these seasonal specificities into account, ensuring that financial incentives encourage practices that respect ecological rhythms.

In short, well-designed PES timing must balance the need to generate sustainable environmental benefits with the economic imperatives of local stakeholders. It is an essential lever for encouraging the adoption and maintenance of more environmentally friendly agricultural practices.



In a nutshell

PES are contractual incentive schemes designed to remunerate farmers for their environmental services, but their effectiveness depends on co-construction between stakeholders, **stable funding and appropriate timing.**

Their acceptability is based on trust, simplicity and the promotion of **virtuous practices.**

Major obstacles include the risk of greenwashing, lack of long-term funding and late payments. To be successful, PES must be part of a regional approach, with clear, measurable commitments that are compatible with agricultural realities.



E | Diversification opportunity: Common reed (*Phragmites australis*) as a paludiculture crop

Introduction

Paludiculture, or wetland farming, represents an innovative opportunity to reconcile **ecological restoration and the economic development of wetlands**. In France, this practice is emerging in a context of agroecological transition, the fight against climate change and the search for new sustainable sectors.

Several crops are being explored as part of the BUFFER+ project with a view to being cultivated in peatland areas, such as cattails, reeds, cranberries, blueberries, sphagnum moss and grasslands. These crops could enable farmers to diversify their activities, to reduce certain operating costs, for human consumption or to produce biomaterials.



▲ Figure: Description of the thatched roof industry that make use of reeds (Wichmann et al. 2021)

Common reeds (*Phragmites australis*) are the focus of this study. Abundant in marshes, it is mainly used in the thatching industry. In the past, reed harvesting was a common practice in marshlands. In livestock farming, it was used as bedding for livestock in buildings and, to a lesser extent, as roughage.

This feasibility study is based on bibliographic research on paludiculture and a survey conducted as part of the BUFFER+

project among stakeholders in the reed industry in north-western France, with a **particular focus on the Seine Estuary and Brière marshes**. It aimed to gain a better understanding of the dynamics of the sector, its stakeholders, challenges and prospects. In a context of ecological transition and the promotion of bio-based materials, reeds appear to be a strategic resource for sustainable construction and wetland management.

1 | Capability

Barriers

Between a lack of knowledge or manpower and the erosion of know-how:

Paludiculture is a recent and innovative concept that still lacks technical, economic and scientific knowledge. Field experiments are still needed to deepen knowledge and optimise new cultivation techniques.

In more traditional crops such as reeds for thatching, harvesting know-how is now threatened with extinction due to the rapid decline in the number of cutters, as in the Seine Estuary, where the demography of harvesters has fallen tenfold in 20 years. This know-how often remains confined to family dynamics, with the activity being passed on to children, creating a risk of irreversible loss of knowledge without new trained recruits.

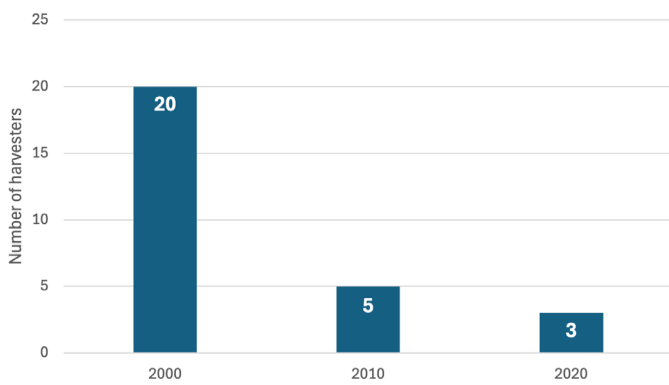


Figure: Change in the number of reed harvesters in the Seine estuary, taken from the report «Study and analysis of the development potential of eco-material sectors in the Normandy Seine Loops Regional Nature Park».

Lack of collective structure:

The reed industry is still largely informal. Cutters work in isolation, with little sharing of resources. There is no purchasing cooperative to secure supply, nor is there a CUMA (Cooperative for the Use of Agricultural Equipment) to share equipment. This limits their ability to invest in high-performance equipment, access wider markets, or have any influence in negotiations with institutions.

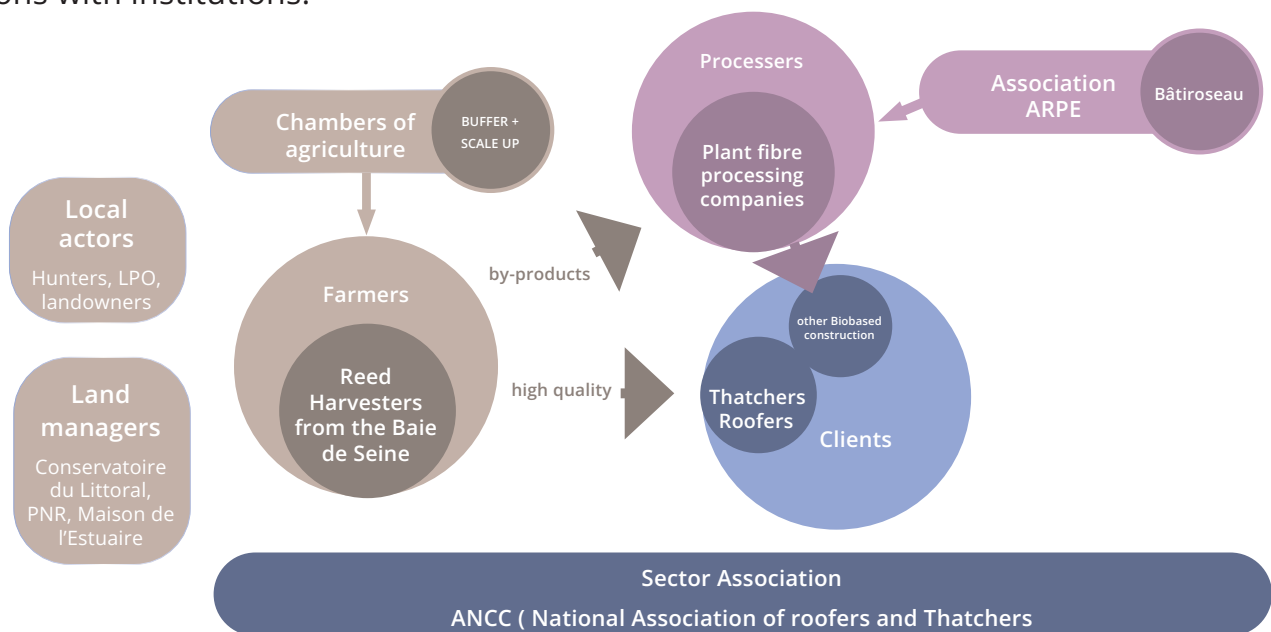


Figure: Mapping of the thatched-reed value chain in north-western France – credits: Yann Mathias, AC3A

► Lack of dedicated suppliers/equipment manufacturers:

Harvesting requires specific equipment adapted to the low bearing capacity of wetland soils. In the absence of a structured industry, cutters often must improvise their own machines, as they are unable to obtain equipment from specialist suppliers. For example, a modified snow groomer was used until 2024 in the Seine estuary.

► Lack of market opportunities:

Paludiculture lacks outlets, particularly for the most innovative crops such as sphagnum, cranberries or cattails. Reed can currently be used for thatched roofs, but there are still no outlets for its by-products.

🔗 Strengths and solutions

► A significant resource:

France has nearly 54,000 hectares of reed beds, much of which could be better exploited. The harvesting capacity for the thatching industry in France is estimated at:

- Morbihan: 30 ha per year, 25,000 bundles per year.
- Normandy: 100 ha per year.
- Camargue: 2,000 ha per year. In the Seine estuary alone, 300 ha still need to be maintained out of the 400 ha that could potentially be exploited, but this is not happening due to a lack of cutters or sufficiently long windows of opportunity for harvesting.

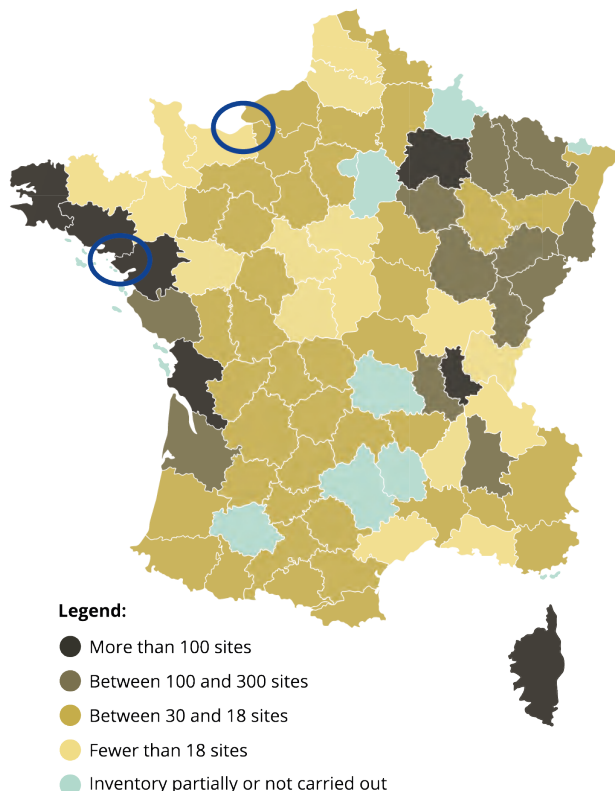


Figure: Map of estimated reed bed areas in France and number of sites per municipality (Le Barz et al, 2009). The BUFFER+ project pilot sites in Brière and the Seine estuary are marked with a red circle.

2| Acceptability

Barriers

► **Discrepancies in perceptions of the issues:**

In Normandy, reed cutters express differences with protected area managers between “theoretical ecology” and the “on-the-ground» reality. Decision-making on water levels, cutting dates and areas closed to mowing is often perceived as unilateral, disconnected from the conditions on the ground, or even counterproductive.

► **Conflicts of use / lack of consultation:**

The implementation of paludiculture projects can conflict with other land uses, such as livestock farming, hunting, fishing, tourism and the free evolution of environments. Cutters must deal with divergent, sometimes antagonistic interests, which can lead to a breakdown in dialogue.

In the Seine Bay, for example, hunters created new artificial ponds for waterfowl hunting without informing other land users, including reed cutters and nature reserve managers. These uncoordinated interventions altered the hydraulic and ecological balance of the reed beds and illustrate the lack of coordination between the various stakeholders and the need for integrated territorial governance capable of arbitrating between different uses and ensuring coherent management of wetlands.

► **Reluctance to open the industry to new entrants:**

Some cutters may be reluctant to welcome new players into a niche market that they have historically dominated. While this attitude is understandable given the lack of structure and recognition in the sector, it limits the sector’s capacity for renewal. It creates a paradox: although the transfer of know-how is desirable, the conditions for welcoming new entrants are not very favourable.

► **Low visibility and lack of institutional recognition:**

The profession of cutter is little known to the public, institutions and even agricultural stakeholders. It suffers from a lack of clear professional status, recognised training or union representation. This institutional invisibility limits access to aid, training schemes and recognition in public policy. During interviews, cutters clearly expressed a lack of recognition of their role in maintaining natural environments. They feel marginalised in decision-making processes, particularly when dealing with protected area managers. Although they play an active role in maintaining wetlands, this is not recognised in public policy. There are few/no mechanisms for remunerating the services provided to the environment through the maintenance of reed beds, the preservation of open habitats or carbon storage.



► Regulatory constraints:

Wetlands are subject to strict regulations regarding intervention or the use of inputs:

- The Water Law (1992) in force in France imposes restrictions that can make the feasibility of a paludiculture project very difficult, if not impossible. Work (even if authorised or subject to regulations) that causes pollution or damage to fish fauna is also liable to prosecution and criminal penalties.
- Marshes are also often classified as Natura 2000, ZNIEFF or RAMSAR areas, which severely restricts the use of inputs (fertilisers or pesticides). In addition, farmers in the Seine Bay are prohibited from wintering their animals on sandy marshes, even though these are suitable and have been used historically.
- Since January 2025, agricultural practices eligible for CAP subsidies must comply with Good Agricultural and Environmental Conditions (GAEC), in particular GAEC2 specific to peatlands and wetlands.

Ultimately, these constraints aim to prevent diffuse pollution and preserve the quality of aquatic environments and their biodiversity. They require the use of agroecological practices adapted to sensitive ecosystems, which must include paludiculture.

🔗 Strengths and solutions

► Willingness to engage in dialogue:

Interviews conducted as part of the BUFFER+ projects show a growing willingness among stakeholders in the field to break out of isolation and build bridges with institutions. Proposals emerged during the interviews to create regional dialogue forums, involve natural area managers in technical decisions, and recognise the ecological role of reed cutters in maintaining reed beds.

► Institutional support available:

Several public measures can be mobilised to support the structuring of paludiculture sectors:

1. Investment aid.
2. Training programmes.
3. Payments for environmental services (PES) and agri-environmental and climate measures (AECM) to provide recognition.
4. European programmes (Interreg, Horizon Europe, LIFE).

Although they have not been very involved in structuring these sectors to date, Chambers of Agriculture could play a facilitating role with the agricultural community if they are integrated into appropriate local governance structures.

There is currently an AECM dedicated to reed beds that aims to encourage practices compatible with the preservation of biodiversity, particularly birdlife and insects dependent on these environments. These subsidies, amounting to €132, capped at €8,000 and contracted for five years, impose strict specifications but recognise the efforts and environmental role of the cutters.



3 | Long term & life cycle

Barriers

▶ **Rapid disappearance of stakeholders:**

The industry currently relies on a very small number of cutters, many of whom are approaching retirement. As expertise is passed on informally, often within families, without any system for capitalising on or disseminating it, it is at serious risk of disappearing, jeopardising the future of the profession. This decline can be explained by the arduous nature of the work, its lack of appeal to younger generations and the absence of training or apprenticeship schemes.

▶ **Uncertainty about the future of the profession:**

Cutters are expressing growing concern about the viability of their activity in the medium and long term. Regulatory constraints (cutting windows, water management) and the lack of financial support make it difficult to plan. This uncertainty is holding back investment, the transfer of farms and the arrival of new players. Climate change is particularly affecting reed harvesting conditions. The increasing rarity of frost periods is complicating access to reed beds, while episodes of drought or rising water levels are altering the dynamics of the environment. These changes are making reed bed management more complex and uncertain and require continuous adaptation of practices.

▶ **Emerging biological threats:**

Since the 2000s, thatched roofs have been increasingly exposed to attacks by fungi and cyanobacteria. These organisms thrive in high humidity conditions, which are exacerbated by increased water salinity (due to rising water levels) in estuaries and milder winters that no longer kill the spores naturally present on roofs through freezing. They rapidly degrade the reeds, reducing the lifespan of roofs from 40 years to 5 years in extreme cases. These threats are undermining the industry and calling into question the sustainability of the material.

Strengths and solutions

▶ **Growing interest in bio-based materials:**

Demand for eco-friendly and local materials is growing rapidly, driven by public policy (RE2020, bioeconomy plan) and societal expectations: the rise of ecological transition, material relocation and sustainable construction issues is creating a favourable context for the promotion of reed. This structural trend represents an opportunity to put the sector on a long-term trajectory, if supply is secured, and outlets are diversified. The Regional Association for the Promotion of Eco-Construction in Normandy (ARPE), reed is helping to legitimise the sector among public decision-makers and citizens. It offers an opportunity to reposition reed as a resource for the future, beyond its heritage image.

▶ **Experimentation for new outlets:**

To strengthen the sector, companies are already experimenting with processes for transforming agricultural co-products into insulation panels or building materials. Reed is a promising fibre for these outlets. These innovations pave the way for a diversification of outlets for the sector, which could justify collective investment in cutting, drying and processing tools.

▶ **Adapting practices to biological threats:**

Technical solutions exist to limit the effects of fungi and cyanobacteria: selection of better-quality reeds, fungal treatment, autoclaving, and improved drying conditions. Although costly, these approaches extend the life of the materials and secure market opportunities. They must be accompanied by research and innovation initiatives.

4 | Technical feasibility

Barriers

► **Soil bearing capacity for machinery:**

Peatlands have very low load-bearing capacity, which requires the use of agricultural vehicles with low ground pressure. The development of suitable equipment is therefore essential to ensure the technical feasibility of these crops.

In the Seine estuary, reed harvesting requires **frozen ground** or sufficient load-bearing capacity to allow machinery to pass, suitable manual or mechanised cutting, and a short harvesting period (January to mid-March). Climate change is reducing the frequency of winter frosts, making reed beds difficult to access. In the absence of frost, the soil becomes impassable, which severely limits the harvesting window.

In Brière, the situation is even more challenging: harvesting is done exclusively by hand, using a sickle and a flat-bottomed boat. The peaty soil is not stable enough to allow mechanisation, and the legal status of the marsh does not guarantee the long-term exploitation of a plot, even after preparatory work.

Strengths and solutions

► **Diversity of reed bed management methods:** In addition to cutting for thatching, other practices can contribute to the maintenance of reed beds:

1. Removing the top layer of soil to remove accumulated biomass.
2. Extensive grazing by suitable breeds (Camargue horses, water buffalo).
3. Management mowing to remove excess biomass (shredding service).
4. Mowing (mechanised) for commercial use as mulch (current outlet) or other purposes. This last option could combine agricultural production with peatland water retention.

► **Complex water level management:**

Maintaining a constant water level is crucial for the growth of paludiculture plants and to prevent peat mineralisation. This requires precise control of water inflows and outflows, which is often complex, dependent on climatic conditions and sometimes costly (investment in pumps). Furthermore, the marshes of the Seine and Loire estuaries are naturally prone to seasonal flooding, so paludiculture systems must be designed to withstand these events and limit losses.

► **Unsuitable or makeshift equipment:**

Cutters often use artisanal machines, such as modified snow groomers, due to a lack of specific equipment available on the market. This equipment is expensive, poorly standardised, difficult to maintain, and often designed locally with no guarantee of reliability. The absence of CUMA (cooperative use of agricultural equipment) or specialised maintenance services exacerbates this situation, resulting in frequent breakdowns, significant production losses, and a heavy reliance on self-construction.

These practices, combined or alternated, make it possible to maintain the ecological functions of the environments while opening opportunities for development.

► **Emergence of modelling and monitoring tools:**

When applied to peatlands, paludiculture requires regular monitoring of soil and water to adjust cultivation practices and ensure the sustainability of the system. New modelling and monitoring tools based on satellite imagery and artificial intelligence are now emerging. For example, the BUFFER+ partner HAEDS is developing a digital twin to model water levels based on landscape interventions. Such tools would facilitate water management and crop planning.

5 | Economic viability

🚧 Barriers

▶ **Weak economic structure of wetland farming sectors:**

Where they exist, wetland industries involve few players and low volumes.

Cutters sell directly to a few thatchers, without going through structured marketing channels. There are no cooperatives, purchasing centres or logistics platforms. Based on theoretical production per hectare and market prices, it is necessary to specify the minimum volume of thatch to be processed, and the area required (depending on planting density and productivity).

This fragmentation limits economies of scale, commercial visibility and the ability to respond to larger markets.

▶ **International competition:**

Despite its theoretical potential for profitability, production from paludiculture remains generally uncompetitive at current prices. Investment costs, uncertain yields and the lack of structured supply chains make importing products more economically attractive. Better economic value for products from wetlands is therefore needed to support the transition to sustainable models.

French and, more generally, European reeds are in direct competition with products imported from Turkey and China.

Thatched roofers, faced with quality requirements and tight deadlines, often turn to these alternatives due to a lack of reliable local supply, with origin not being a priority criterion. This pressure on prices undermines the profitability of French cutters.

📌 *Table: Selection criteria (in descending order of importance) for purchasing reeds for thatched roofs according to a survey conducted in northern Germany (n=46) (Wichmann et al, 2021)*

Criteria	Frequency	Percent
Quality	46	100.0
Cleanliness	42	91.3
Culm length	40	87.0
Breaking strenght	32	69.6
Culm wall thickness	26	56.5
Origin	25	54.3
Price	15	32.6
Storage and transportation	27	29.6
Color	9	19.6

📌 *Origin of reeds used for thatched roofs in northern Germany in 2018, n=44 (Wichmann et al, 2021)*

Origin	Percentage of Reed	
	Mean	SD
The respective federal state	12.8	25.1
Other parts of Germany	4.1	13.9
Polish part of Pomerania	4.3	13.2
Other parts of the European market (including Ukraine and Turkey)	62.7	40.0
China	16.1	28.9

► **Between high costs and lack of financial support:**

Upstream in the sector, reed harvesting requires specific equipment, often homemade, which can cost more than €150,000. These investments are difficult to recoup for isolated operators, especially since there is no support schemes dedicated to reed cutting, unlike in other regions such as the Camargue. This situation is hindering the entry of new players and limiting the sector's capacity for modernisation. The creation of CUMA (cooperative use of agricultural equipment), shared logistics platforms or specialised agricultural contractors would help to reduce costs.

Downstream, owners of cottages such as those in Brière complain about the high maintenance costs of thatched roofs, prone to premature deterioration due to fungi, weather conditions and the quality of the reeds used. The material becomes more expensive than slate for half the lifespan, putting the sector in difficulty and making it dependent on subsidies to ensure its survival.

🔗 Strengths and solutions

► **Reeds to reduce costs for livestock farmers:**

Reeds may have economic potential as an alternative to cereal straw for animal bedding. According to a study conducted by INRAE's Saint-Laurent-de-la-Prée experimental unit between 2018 and 2020, the cost price of locally sourced reed used as bedding can be competitive: around €53/tonne for a nearby reed bed, compared to €100/tonne for delivered straw.

Compost made from reed litter has a fertilising value like that of straw-based compost, with a good carbon/nitrate ratio, although it is slightly lower in phosphorus and potassium. This practice promotes the autonomy of marsh farms and can contribute to the ecological management of reed beds, provided that the mowing frequency is adapted (e.g. every three years). This competitiveness, combined with a short supply chain, can strengthen the autonomy of farms and justify an economic revival of the sector.



► **Diversification of outlets underway:**

Projects such as **BâtiRoseau** are exploring new uses for reeds: insulation panels, plaster bases, insulation, mulch and peat-free compost. These outlets, which are less demanding in terms of cutting quality, make it possible to recover fractions of biomass that are currently not used by thatchers. They pave the way for economic diversification and a circular economy.

► **Funding opportunities:**

Downstream in the sector, urban communities such as CAP'Atlantique (Brière pilot site) announced in 2021 that they would subsidise the maintenance of thatched cottages for owners, at an estimated cost of €1.3 million for the local authority, but which would ensure the replacement of 290 roofs in poor condition out of the 2,225 listed in the area.

Payments for environmental services (PES), currently being tested in several French BUFFER+ pilot sites for the preservation of peatlands, could be used in the future to remunerate cutters for their contribution to the sound ecological management of reed beds. This would recognise their role in preserving wetlands, secure their livelihood and strengthen the social and environmental sustainability of the sector.

6 | Sustainability

Barriers

► **Risks associated with non-intervention:**

The lack of maintenance of reed beds leads to an accumulation of dead biomass, known as siltation. This process alters the site's hydrology, encourages the establishment of shrubs and woody species, and leads to the closure of the environment. This results in a loss of biodiversity, the gradual disappearance of reeds, and a deterioration of the ecological functions of wetlands (water filtration, carbon storage, hydrological regulation). Under these conditions, establishing new reed beds in peatlands for paludiculture purposes could prove counterproductive without securing their management capacity.

► **Risks related to invasive species and impacts on biodiversity:** Paludiculture can pose a risk of introducing exotic plant species with a high capacity for proliferation into natural environments. These neophytes can supplant native and endemic species, reduce biodiversity and alter habitats. This poses a particular risk to species with a rapid rhizome colonisation system such as reeds, and can represent a danger to nesting birds, whose habitats may be altered or rendered unsuitable for reproduction. There are already precedents in peatland sites, such as in Brière and Grand Lieu, with water primrose and Louisiana crayfish, which have no predators and have spread rapidly, causing a major ecological imbalance and destroying biodiversity.

Paludiculture must prioritise species naturally present on the site and must be subject to a rigorous management and prevention plan for the introduction of new species.

Strengths and solutions

► **Compatibility of paludiculture with ecological transition and territorial resilience objectives:** Paludicultural plants, such as reeds, make it possible to reconcile environmental issues and agriculture. Reeds, for example, help maintain open environments that are favourable to biodiversity while preventing siltation. They are also an effective carbon sink, especially when grown in rewetted peatlands. By integrating the reed industry into regional resilience strategies (climate plans, Natura 2000 management plans, green and blue infrastructure), it is possible to consolidate its long-term roots and legitimacy, provided that the right conditions for dialogue between users and managers are created.

► **Integrated systems, a sustainable and multifunctional approach:** Integrated systems, combining reed cultivation (or other wetland crops) with other agricultural, aquaculture or environmental uses, represent a promising solution for strengthening the sustainability of wetland farming practices. This approach makes it possible to pool resources (water, soil, nutrients), diversify farmers' incomes and maximise the ecosystem services provided by wetlands.

For example, combining reed cultivation with extensive livestock farming and good water management of marshes for biodiversity helps address economic, ecological and specific social issues simultaneously. These systems also promote greater resilience to climate and economic hazards, while enhancing the specific characteristics of the area.

7 | Time

Barriers

The marshland industry, and particularly the reed industry, is at a turning point where the dynamics of degradation are exceeding the current capacity for innovation and recovery. Several factors are converging to create significant temporal tension:

- ▶ **The number of cutters** is declining, the domestic market is contracting, the quality of reeds is deteriorating, the effects of climate change and climate change are intensifying, and dialogue between stakeholders is weakening. These negative developments are progressing faster than the technical, organisational or economic responses we can develop.
- ▶ **Know-how at risk:** At some sites, reed harvesting trades are threatened with extinction. This loss concerns not only technical skills, but also detailed local knowledge of wetlands, which is difficult to transfer or recreate.
- ▶ **Innovation takes time:** Innovation initiatives in paludiculture, whether involving the valorisation of co-products or the structuring of new value chains, are still in their infancy. They require time, experimentation and sustained financial support to produce tangible results, but the national and European context is no longer as favourable to innovation. In France, budget cuts, particularly in the Pays de la Loire region in the bioeconomy sector, are jeopardising the momentum that has been built up. At European level, the LIFE programme, which is crucial for environmental projects, is also under threat of being scrapped.



In a nutshell

Interviews conducted in western France reveal an industry still **poorly structured and heavily dependent on artisanal skills**, which are often passed down informally within families. The two remaining reed cutters in the Seine Bay report **difficult working conditions**, a lack of institutional recognition and heavy regulatory constraints, particularly in relation to wetland management.

Despite this, demand for local reeds remains strong, particularly for thatching, and there is growing interest in alternative uses (insulation, mulch, composite materials).

However, tensions between cutters and natural area managers, difficulties in passing on know-how, lack of financial support and the absence of dedicated training are hampering the development of the sector. A concerted regional approach, involving all stakeholders appears to be essential to overcome these obstacles.

A few processing companies are **exploring innovative uses for reeds**, particularly from their by-products. Structuring projects such as BâtiRoseau, aim to quantify resources, qualify materials and create standardisation tools to integrate reed into sustainable construction. The Association Nationale des Couvreurs Chaumiers, for its part, is working to structure the thatching industry and gain recognition for reed-related trades, while seeking to bring together stakeholders around joint projects.

Germany



Introduction

Extracting and using peat results in significant CO₂ emissions. Therefore, reducing the amount of peat in growing media would be an effective climate protection measure.

Peat has been mined in north-west Germany, close to the Dutch border, for centuries. This has been done on a large scale since the 16th century, when peat was primarily used as a fuel source in households and brickworks. By the middle of the 20th century, a significant peat industry had developed, covering the entire value chain from peat extraction to horticultural substrate production and the use of peat-containing substrates in plant cultivation.

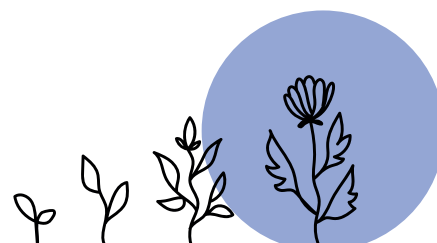
The Weser-Ems region is currently still a centre for peat extraction and use in Europe. However, this is set to change, as the German government has adopted a peat reduction strategy to protect peatlands.

Peat extraction in Germany is set to end by 2040, and the use of peat in plant soils and substrates is expected to decrease significantly or cease entirely by 2030.

This prospect is already causing major disruption to regionally important industries: more and more peat factories, substrate manufacturers, and plant producers must decide which peat substitutes they will use in future.

The main peat substitutes are green compost, fibres generated by thermo-mechanical processing of wood, composted bark and coco coir, which is a by-product of coconut processing made from coconut husk fibres. While no single material can fully replace peat, peat-free consumer soils containing mixtures of peat substitutes are already on the market. A major challenge lies in reducing peat use in professional horticulture.

The Ökowerk Emden will assess the feasibility of peat substitution in growing media.



1 | Capability

Barriers

While it is technically possible to use **peat-free resources** such as coco coir, wood fibres, composted bark and green compost, there are challenges involved. The ease of adoption is influenced by quality, consistency, processing infrastructure, and legal restrictions (e.g. the EU Fertilising Products Regulation).

To date, no single material matches peat's combination of features. **Coco coir** is a good, albeit imperfect, substitute for peat. One disadvantage of coco coir is that it must be imported from South and Southeast Asia, which increases its carbon footprint and costs.

The local availability of some materials, such as wood residues, bark and green

Strengths and solution

The current European growing media value chain includes substrate manufacturers, potting soil formulators and raw material suppliers.

Key producers in north-western Germany include major companies such as Klasmann-Deilmann, Floragard, Gramoflor, HAWITA (part of the Belgian Group DC) and Brill Substrate (part of the Finnish/Dutch Kekkilä-BVB group).

In 2024, Germany produced 7.9 million cubic metres of substrates, using 4.7 million cubic metres of peat and 4.7 million cubic metres of other materials. Of the 6.6 million cubic metres of growing media for the home market, 44% was peat and 56% was other constituents. The main peat substitutes were green waste compost and wood fibres (*source: Industrieverband Garten e.V.*).

A recent study found that **bio-based materials** such as wood fibres, composted bark, green compost and coir pith are generally available in sufficient quantities to replace peat, although availability varies by country and legal, economic and logistical

waste, varies between countries due to differences in forest cover, agricultural practices, green waste management and infrastructure for biomass processing. Germany and France, for example, benefit from abundant forestry and composting sectors, offering diverse and steady material streams. In contrast, countries such as the Netherlands and the Baltic States rely more heavily on imported peat and may lack sufficient local alternatives, particularly in scenarios involving high demand.

Peat promotes plant growth, is cheap, and is available in large **quantities**. However, it remains challenging to find good-quality, inexpensive peat substitutes that are available regionally in large quantities.

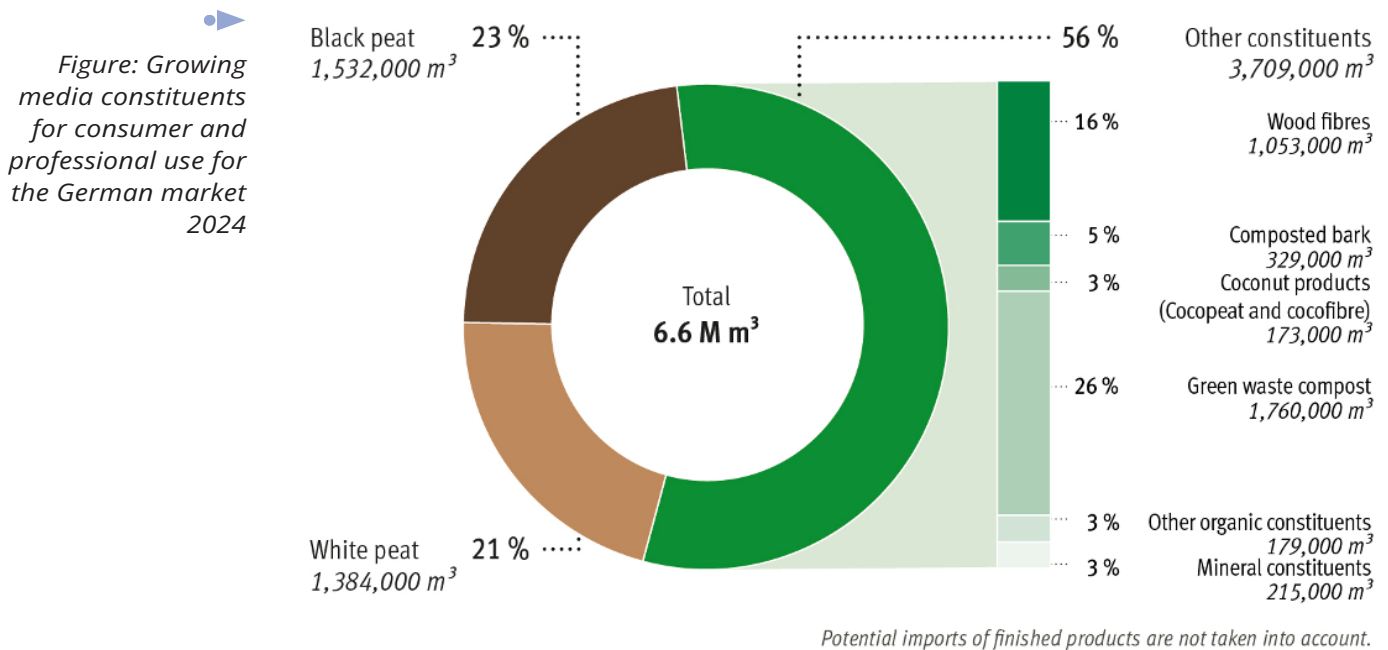
barriers remain. Additionally, transport costs and competition with other industries may limit access to some materials.¹

Against the backdrop of **Germany's peat reduction strategy**, substrate producers, research institutions, and other organisations are highly motivated to identify and test new materials, including paludiculture crops such as Sphagnum moss, *Typha*, and reed.

Additionally, new processing methods could make materials more peat-like. Hydrothermal carbonisation and pyrolysis, for instance, imitate the peat formation process within a few hours. However, both techniques are still experimental and have not yet produced peat-like substrate components.

¹ Hirschler, O., Osterburg, B., Weimar, H., Glasenapp, S., Ohmes, M.-F. (2022) : Peat replacement in horticultural growing media: Availability of bio-based alternative materials, Thünen Working Paper, No. 190.

A large-scale transition, such as peat reduction in horticulture, requires innovation, further investment, infrastructure development and the adaptation of horticultural practices.



Source: Industrieverband Garten (IVG) e.V., 2025
© Fachagentur Nachwachsende Rohstoffe, 2025



2 | Acceptability

🚧 Barriers

Peat is a well-established component of growing media. Peat-containing substrates have been used successfully for plant production for decades, whereas peat-free substrates generally perform less well in this area. Peat mining and the production of peat-based products remain important industries in some European countries, including Germany. This makes the **transition** to peat-free horticulture **difficult**. For professional gardeners, the most important criteria are optimal plant growth and high profitability.

In this respect, peat-free substrates **perform less** well than conventional substrates. Consequently, only a few plant producers currently use peat-free substrates.

The peat-free or peat-reduced label has not yet played a significant role in plant producers marketing strategies because its acceptance among major customers and consumers is still unclear. Another issue is that **nurseries purchase young plants** that have been cultivated in peat-containing substrates. Consequently, peat may be present in small quantities even if nurseries have not added it to the substrate mix. Peat-free potting soils are commercially available for hobby gardeners. However, **consumers still lack knowledge in this area**. For example, light-coloured wood fibres must be dyed with charcoal because consumers expect potting soils to be dark brown. This clearly indicates a lack of information about the nature and properties of available peat substitutes.

Strengths and solutions

Protecting peatlands is essential for mitigating climate change. Therefore, peat mining and use should be reduced as soon as possible and ultimately stopped. **Several EU countries have developed peat reduction strategies**, and a few have even established legal frameworks for peat bans.²

The German government has adopted a peat reduction strategy to protect peatlands. By 2026, plant soils for hobby gardeners must be peat-free, and the aim is for professional growing media to be significantly reduced in peat content or even peat-free by 2030. Most peat extraction licences will expire in the coming years, meaning that peat extraction and use could come to a standstill in Germany in the foreseeable future.

Amateur gardeners prioritise sustainability and clear product labelling (Dahlin et al., 2018). To improve the marketing of peat-free substrates, the BUFFER+ partners proposed introducing a peat score, like the well-known nutrient score for food. Class A would indicate that plants were cultivated without peat, while class E would indicate high peat content (>70% of the total substrate) during the cultivation process.

A study exploring the **preferences of private gardeners** regarding growing revealed that most prioritise plant health and environmental friendliness when choosing substrates³. Although peat-based products are still widely used, many gardeners would be **willing to switch to peat-free alternatives** if the quality and price were comparable.

2 Gruda, N.S., Hirschler, O. and Stuart, J. (2024). Peat reduction in horticulture an overview of Europe. *Acta Horticulturae*, 1391, 545-560.

3 Dahlin, J., Beuthner, C., Halbherr, V., Kurz, P., Nelles, M., Herbes, C. (2019) Sustainable Compost and Potting Soil Marketing: Private Gardener Preferences, *Journal of Cleaner Production*, 208, 1603-1612

Key factors influencing choice include performance, sustainability and clear product labelling. The study highlights the potential for market shifts towards eco-friendly options if there is greater awareness of, and access to, reliable peat-free products (Dahlin et al. 2019).

Many initiatives inform consumers and professional gardeners alike about the need to reduce peat use and develop new peat-free substrates. In this context, **consumers should be made aware** of the importance of peat substitutes in potting soils for climate and peatland protection.

Market analyses show that these information campaigns are successful, as evidenced by the **increasing purchase of peat-reduced and peat-free substrates** by private and professional gardeners.



3| Long term & life cycle

🚧 Barriers

Efficient horticulture is essential for supplying the world's population with vegetables and ornamental plants. For the foreseeable future, at least, peat will remain a key component of growing media. According to current projections, **the global demand for peat is steadily increasing** (Blok et al., 2021). Horticulture in some **Asian and Middle Eastern** countries is shifting towards pot-based systems, which require large quantities of peat.

Companies from these regions are already purchasing peat, peatlands, and peat extraction licences in Europe, primarily in the Baltic States.

Supply of materials is an issue: Although coco coir and, to a limited extent, wood fibres, green compost and composted bark are promising peat substitutes, it is questionable whether these materials will be available in sufficient quantities or of a reliable quality in the future.

Around 5 million m³ of peat are still used in Germany every year. Against this background, the availability of peat substitutes in sufficient quantities could potentially be a limiting factor.




@Clara DIEBOLT

Strengths and solutions

Global demand for growing media is expected to rise sharply due to urbanisation, population growth, increased prosperity and growing interest in home gardening and food security (Blok et al. 2021).⁴

By 2050, demand for professional growing media could increase fourfold. In the EU alone, around 30 millions m³ of peat was used for growing media per year in 2017, and there will also be a growing demand for alternatives to match this volume in the future.

 *Table: Total estimated market in 2050 based of the expected market increase and a more realistic estimate of the potentially available materials (Blok et al. 2021)*

	2017 (Mm ³ y ⁻¹)	2050 (Mm ³ y ⁻¹)	Increase %
Peat	40	80	200
Coir	11	46	418
Wood fiber	3	30	1000
Bark	2	10	500
Compost	1	5	500
Perlite	1.5	10	667
Stone wool	0.9	4	433
Soils/tuffs	8	33	413
New		65	
Total	67	283	

Meeting future needs will require scaling up the use of sustainable materials and improving the reuse, **recycling and circularity of growing media** (Blok et al., 2021). To ensure that future supplies of growing media remain environmentally sustainable and economically viable, coordinated international efforts, innovation and policy support are necessary.

Europe currently plays a central role in peat extraction, substrate production, and pot-based horticulture. **Reducing peat extraction** in Europe would therefore significantly impact climate change mitigation and encourage the development of peat substitutes.

However, given the **increasing demand for peat in Asia** and other parts of the world, reducing its use in Europe alone may not be enough to protect peatlands. So far,

the German peatland protection strategy and the peat reduction strategy have been based on voluntary action.

Internationally, only a few countries have launched similar initiatives to reduce peat use. For instance, in 2022, the Netherlands introduced the Covenant on the Environmental Impact of Potting Soil and Substrates with the aim of reducing peat use in horticulture and amateur gardening. In the long term, common European policies and **legislation are needed to protect peatlands** by controlling or even banning peat extraction. At the same time, **support is needed for the substrate industry to transition** from peat-based to peat-reduced and peat-free substrates.

⁴ Blok, C., Eveleens, B., van Winkel, A. (2021). Growing media for food and quality of life in the period 2020-2050, *Acta Horticulturae*, 1305, 341-355.

4| Technical feasibility

🚧 Barriers

Peat is a popular component in plant substrates thanks to its **unique blend of physical and chemical properties**. It retains water well while maintaining good air porosity, which supports healthy root growth. Peat is naturally low in nutrients and pathogens, enabling controlled fertilisation and ensuring high biosafety. It also has a stable acidic pH that is ideal for many plants, and its light weight makes it easier to handle and transport. Its structure is consistent, it decomposes slowly, and it provides reliable performance over time. These qualities make peat a highly effective and uniform growing medium that is difficult to match with any single alternative.

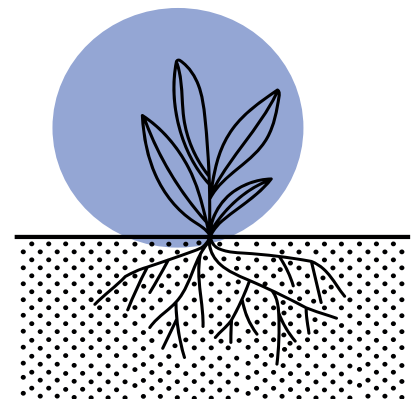
Replacing peat in horticultural substrates presents several challenges. Alternatives such as compost, bark, wood fibres and coir often **lack the ideal balance of water retention, aeration and stability that peat offers**, necessitating blends and careful formulation.

Wood fibres, for example, are produced from wood chips using a thermal-mechanical process. Peat substitutes, including wood fibres, are **often low in nitrogen (N) but high in carbon (C)**. When materials with a high C/N ratio are added to a substrate mix, microbes rapidly metabolise the nitrogen, rendering it unavailable to plants. This process is called nitrogen immobilisation.

Green compost has an alkaline pH and high nutrient and salt levels. Therefore, it can only constitute up to 30% of a substrate mixture. Most peat substitutes have a **lower water capacity** than peat. Consequently, gardeners must adjust their irrigation and fertilisation procedures. This increases the workload and can result in additional costs, for example if the irrigation system needs to be updated. In seedling cultivation, particularly in small pots or potless systems, peat-free substrates can make achieving an optimal water supply more difficult.

Typha (cattail) is a promising peat substitute thanks to its excellent water retention and structural stability, as well as its low nutrient content, which makes it ideal for use in plant substrates. It can be sustainably harvested from rewetted peatlands through a process known as paludiculture, which supports climate goals.

However, **competition with other sectors**, such as construction (e.g. for insulation materials), energy production and animal bedding, limits its use. This competition, alongside limited processing infrastructure and seasonal harvesting constraints, currently restricts its widespread use in horticulture. The same applies to the use of reed and Miscanthus as peat substitutes. There are also nitrogen immobilisation issues.



 Strengths and solutions

The development of peat substitutes should focus on cheap, readily available materials. Ideally, peat **substitute production should be diversified and established regionally** to avoid environmental damage and long transport routes. Combining different regionally available materials would ensure enough peat substitutes are available. In any case, the overall CO₂ balance of peat substitutes must be significantly better than that of peat.

If nurseries have modern irrigation systems, a lower water capacity of peat substitutes compared to peat is not a severe problem as these systems facilitate adaptation to new substrate mixtures.

Sphagnum moss is a promising peat substitute thanks to its similar properties, such as high-water retention, good air porosity, low nutrient content and a stable, slightly acidic pH. It supports healthy root development and offers consistent substrate performance. Unlike peat, it is renewable when cultivated sustainably.

Peat moss paludiculture is scalable, as has been demonstrated at sites in the Weser-Ems region. However, its availability is currently limited as large-scale Sphagnum farming is still in its early stages of development.

Cultivation requires time, space and specific wetland conditions, which means that the current supply is insufficient to meet the demand for widespread use.

The processing of peat substitute materials can be optimised. For instance, adding fertilizer to wood fibres prevents nitrogen immobilisation. However, even stabilised wood fibres cannot fully replace peat and can only make up a maximum of 30% of a growing medium. The same applies to other fibre-rich materials. As an alternative, silaging or composting bark, for example, reduces the C/N ratio and the risk of nitrogen immobilisation.

Materials can also be processed using **hydrothermal carbonisation (HTC)** or pyrolysis, resulting in peat- or char-like substances. Hydrothermal carbonisation is a method by which plant-based raw materials can be ‘turbo-charged’ in a pressure reactor at high temperatures in a matter of hours. The advantage of this technology is that any fibre-rich material can be processed. However, the production of peat substitutes using HTC is still in its infancy.



@Clara.DIEBOLT

5 | Economic viability

Barriers

Extracting peat within the region or in nearby European countries, such as the Baltic States, ensures a reliable supply and short transport routes for substrate producers in the Weser-Ems region. Another major advantage of peat is that it can be dried at the extraction site and transported directly to the substrate manufacturer on demand throughout the year, without the need for storage. These factors together make peat an inexpensive and easy-to-handle growing medium.

Most peat substitute materials need to be stored or produced and transported at the right time, which requires **complicated and expensive logistics**. For example, wood and bark must be processed; wood fibre extraction, for instance, is energy-intensive and therefore costly. Composting bark and green waste require space, time and labour.

There is also potential competition for usage, since wood and bark are often used as biomass fuel in power plants

or for construction materials and paper production, which drives up demand and prices. This became apparent during the war in Ukraine, when biomass fuel replaced fossil fuels from Russia. In the future, this competition for usage could become more significant in the transition from fossil energy to renewable energy.

Coir pith is around twice the price of peat. **Price volatility** could occur due to reliance on exports from politically and economically unstable regions such as India and Sri Lanka. Disruptions to supply can result from political unrest, trade restrictions or extreme weather. Rising global demand and competing uses (e.g. in the production of textiles or for erosion control) could put further pressure on prices. Additionally, high transport costs and shipping delays mean prices are sensitive to global logistics.

These factors create uncertainty regarding availability and cost, which poses a risk for growers who are dependent on.

Strengths and solutions

Peat substitutes are not necessarily more expensive than peat. The average prices of wood fibres and composted bark are only 7% and 12% higher than those of peat, respectively⁵. The median price of green compost is 48% lower than that of peat. Taking the upper and lower values into account, peat is not distinctly cheaper than domestic peat substitutes. **Only coir products are much more expensive than peat** (+83%) (Achieving peat-free hobby gardening for climate mitigation in Germany: Insights into prices of growing media constituents, potting soils and policy options⁴. These findings suggest that there is some room for reducing the price of peat substitute materials.

Further factors could push the prices of peat substitutes down, making peat-free substrates price-competitive in the future. If more providers sell peat-free substrates, the **market grows, and prices fall**. Using different regionally available materials would reduce logistics costs. Identifying new candidate materials would increase the amount of peat substitutes available, which would lower material prices. Promising new plant materials tested so far in BUFFER+ include reed, grass from wet meadows and marshes, and composted marine flotsam. These materials are inexpensive and widely available, and there is little competition for their use as they are not yet employed as insulation materials, biofibres or biofuels.

⁵ Hirschler, O. and Osterburg, B. (2025) *Achieving peat-free hobby gardening for climate mitigation in Germany: Insights into prices of growing media constituents, potting soils and policy options*, *Resources Conservation and Recycling*, 220, 108330.

6 | Sustainability

Barriers

Another point emphasised by the BUFFER+ partners is that peat substitutes must be sustainable. Coco coir, for example, is a by-product of coconut fibre processing. **Coconut plantations** should not be established in place of primeval forests just to produce this highly sought-after material. Similarly, the production of peat substitutes in Germany must be sustainable.

The processing of materials using thermo-mechanical techniques to yield fibres, drying and treatment by HTC and pyrolysis leads to **high energy consumption**, which increases the carbon dioxide footprint.

Strengths and solutions

Peat-based growing media pose the greatest environmental risk, particularly in terms of greenhouse gas emissions resulting from peat extraction and changes in land use.

By contrast, peat-free alternatives generally have a **lower environmental impact**, particularly green compost and bark, which are often by-products or waste materials (Peano *et al.* 2012).

However, environmental performance can vary depending on production processes, transportation distances and energy use. For example, coir has a lower carbon footprint than peat, but it can incur significant emissions through long-distance shipping⁵. Despite the long transportation routes involved, coco coir has a better CO₂ balance than peat.

Ideally, however, the production of substrate components should be diversified and established regionally to avoid environmental damage and long transport routes.

In any case, the **overall CO₂ balance** of peat substitutes must be significantly better than that of peat, ideally achieving neutrality or even negativity.

The study of Peano *et al.* (2012) emphasises the importance of context-specific evaluations, as the most sustainable choice depends on regional availability, logistics and material sourcing. It concludes that using more **locally sourced, recycled or renewable materials** can significantly reduce the environmental impact of growing media.

Plant materials processed using HTC or pyrolysis have a significantly lower CO₂ footprint than peat, especially when derived from sustainable biomass and used for soil applications⁶.



⁵ Peano, L., Loerincik, Y., Margni, M., Rossi, V. (2012) *Comparative life cycle assessment of horticultural growing media based on peat and other growing media constituents, Final Report, Quantis Switzerland*, 156 pp.

⁶ Libra, J.A., Ro, K.S., Kammann, C., Funke, A., Berge, N.D., Neubauer, Y., Titirici, M.-M., Fühner, C., Bens, O., Kern, J., Emmerich, K.-H. (2011) *Hydrothermal carbonization of biomass residuals: a comparative review of the chemistry, processes and applications of wet and dry pyrolysis. Biofuels*, 2, 89–124.

7| Time

🚧 Barriers

The Federal ministry of Nutrition and Agriculture's peat reduction strategy aims to combat climate change and protect peatlands by reducing peat extraction and its use in horticulture and agriculture. It includes measures to reduce peat use in hobby gardening and a gradual reduction in commercial horticulture. The aim is to completely replace peat in hobby gardening by 2026 and, wherever possible, in commercial horticulture by 2030. **The peat reduction strategy may be too ambitious.**

Since 2020, the average annual decrease in peat content has been 5.5% for consumer soils and 4.25% for professional substrates. Therefore, it is unlikely that peat content in potting soils will decrease from 33% to 0% by 2026, or in substrates from 65% to nearly zero by 2030.

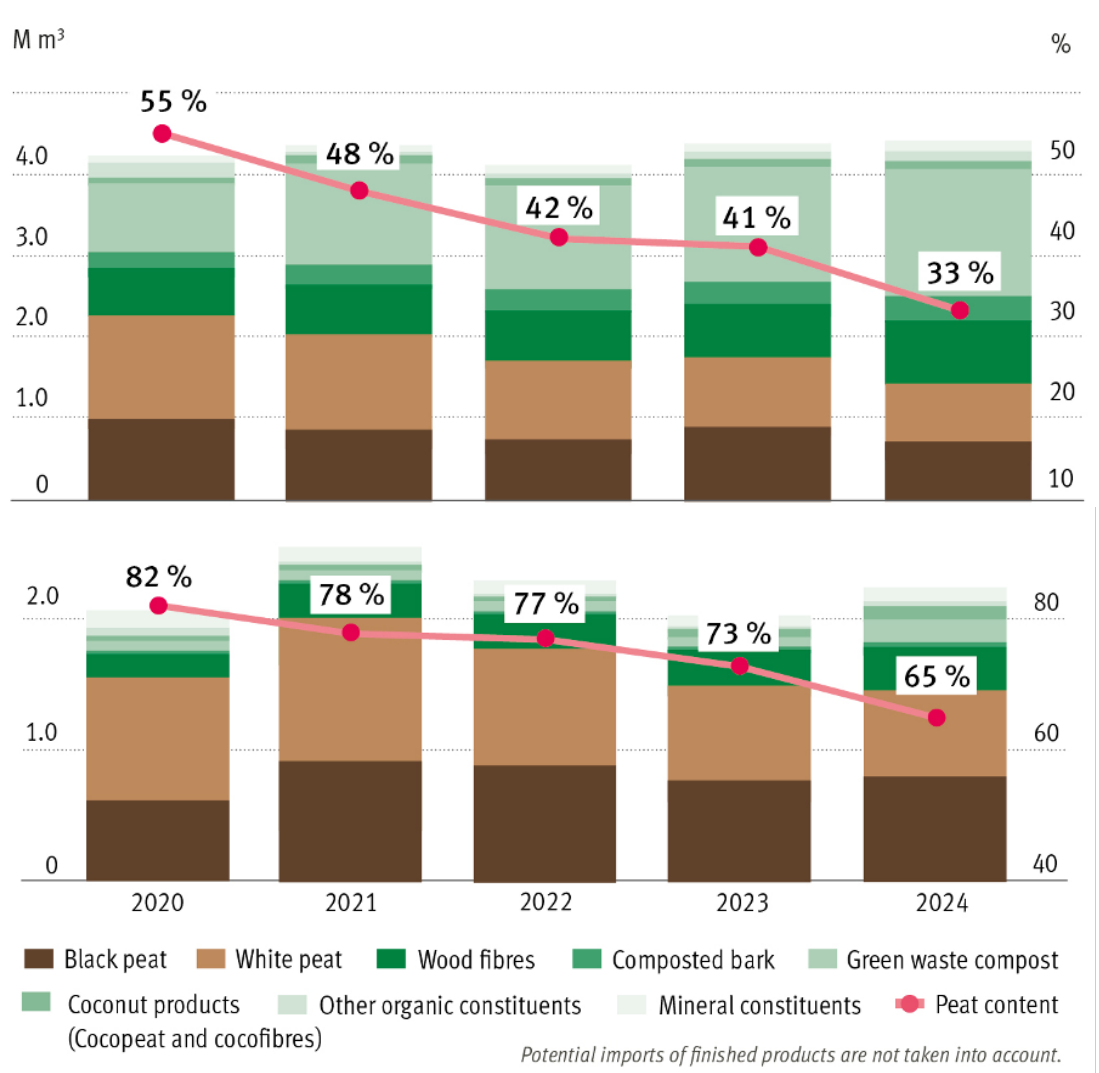
The substrate and plant production industry's (Industrieverband Garten (IVG) e.V.) **voluntary commitment** to reducing peat aims to decrease the proportion of peat in hobby soils and growing media. By 2025, the industry has committed to increasing the proportion of raw materials other than peat in hobby soils to 50%, and to 20% in growing media. These proportions are set to rise to 70% (hobby soils) and 30% (growing media) by 2030. This voluntary commitment may be insufficiently ambitious, given that the future lower limits for peat content are already significantly exceeded today as detailed below.

A general peat ban is not a good idea because it would incur high economic costs for horticulture and substrate producers.



Strengths and solutions

Currently, potting soils for hobby gardeners in Germany contain an average of 33% peat, while growing media for professional gardeners contain an average of 65% peat (Source: *Industrieverband Garten (IVG) e.V.*)



▲ Figure: Development growing media constituents for consumer (above) and professional (below) use for the German market 2020-2024 (Source: *Industrieverband Garten (IVG) e.V., 2025*)

Professional substrate users depend on maximum economic yield and are therefore reluctant to switch to peat substitutes.

However, a large proportion of growing media is used by consumers. They should primarily be encouraged to use peat-free growing media.

Municipalities, particularly parks and recreation departments, environmental agencies and cemetery administrations, are major consumers of potted plants and substrates. Therefore, it would be a **significant development if municipalities were to ban peat.**

Coordinated European solutions are urgently needed. As a first step, **peat could be banned from potting soils for consumers.** This would provide plant and growing media producers with planning security and stimulate the market for peat-free substrates.



In a nutshell

The overall international demand for substrates will increase substantially in the years to come driven by the Asian growth. In this context, the offer will also need to develop as much creating **business opportunities for both the peat and peat free substrates**.

However, the various alternatives to peat-based potting soils are each limited by different factors. Most of them suffer from **worse agronomic performances than peat**. Other have **higher prices** (like coco coir almost double as peat) or suffer from **price volatility** (like wooden chips affected by energy price variations). For some like composts, the transportation costs are too significant, so **local deposits are necessary**. However, reserves appear to be generally sufficient in Europe.

Political will varies greatly from country to country, but it is strong in Germany, which is **driving the industry forward**. On the **customer side**, it will be necessary to convince both professionals, who generally demand an effective product, and private gardeners, who are not always aware of the environmental challenges surrounding peat.



Ireland

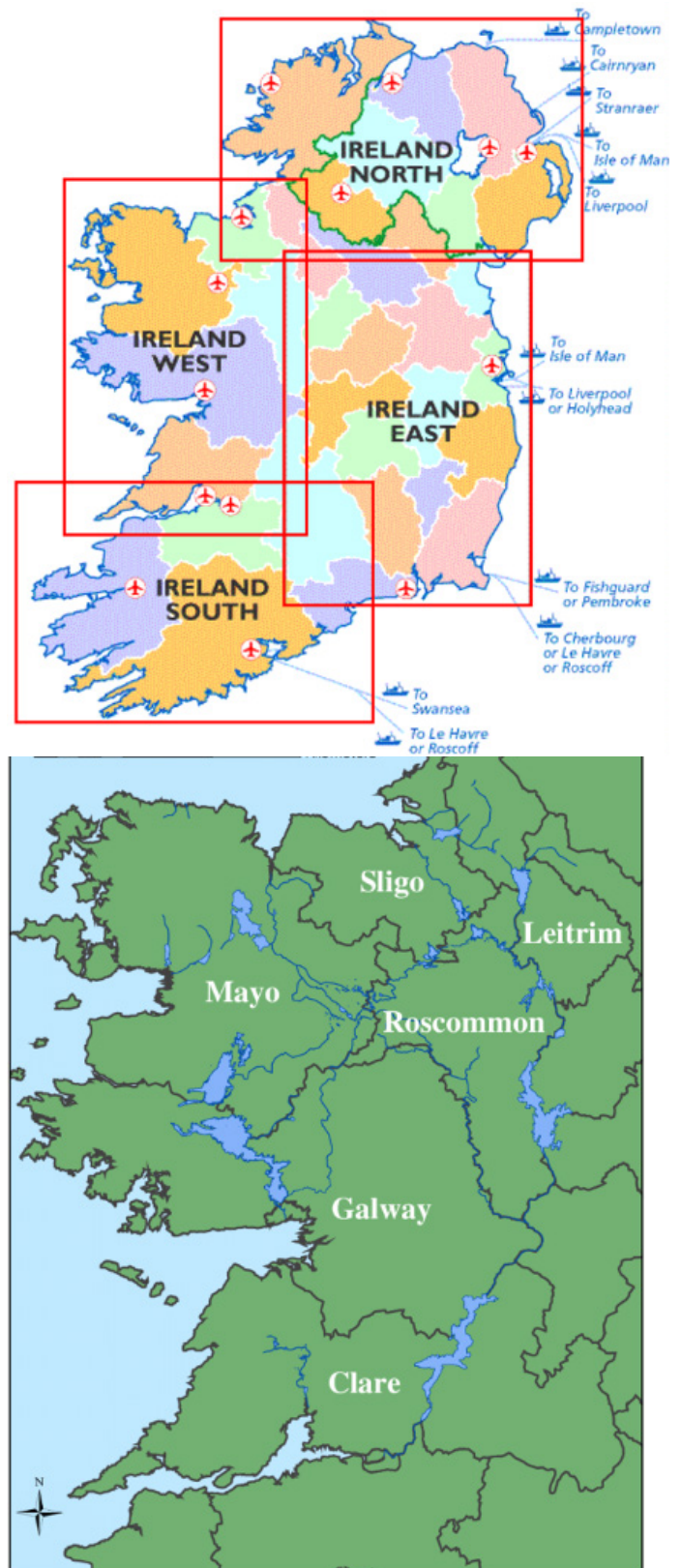


A | Paludiculture with a focus on Berries (blueberries and cranberries)

Introduction

Paludiculture is the practice of cultivating crops on wet or rewetted peatlands, offering a sustainable alternative to traditional drainage-based agriculture. Derived from the Latin word *Palus* (meaning swamp), paludiculture supports the conservation of peatlands by maintaining high water tables, which significantly reduces greenhouse gas emissions and halts peat degradation. This method allows for the productive use of peat soils while preserving their ecological functions. Crops suitable for paludiculture include reeds, sphagnum moss, and certain berries like cranberries and blueberries, which thrive in waterlogged conditions (Milner & Stuart, 2022).

Ireland has approximately 1.5 million hectares of peatland, much of which has been historically drained for agriculture, leading to substantial carbon emissions. In a reassessment of satellite images taken from 2005-2006, John Connolly's research in 2018 found that 66% of peatlands in the Republic of Ireland have undergone land use change, with the majority of those being conversion to grasslands for grazing. Rewetting these lands and adopting paludiculture could help mitigate emissions while maintaining agricultural productivity. Although large-scale implementation is still emerging, see Horizon Europe project Palus Demos, the practice is gaining attention as a sustainable alternative to conventional farming.



▲ Figure: Maps of Ireland (above) and Western Ireland region (below)

Region Focus: The West of Ireland

The West of Ireland, comprising counties Galway, Clare, Mayo, Sligo, Leitrim, and Roscommon, is a region defined by its rugged Atlantic coastline, mountainous terrain, and extensive peatlands. It spans approximately 13,800 km² and is largely rural, with only 30% of its population living in urban areas. Agriculturally, the region is the smallest contributor to Ireland's total agricultural output, accounting for just 9% of the national figure according to the 2023 national census. However, it plays a significant role in livestock farming, particularly cattle and sheep, which together make up over half of the region's agricultural output. The challenging physical environment, marked by high rainfall, poor soils, and fragmented landholdings, limits intensive crop production, making the region more reliant on pastoral farming.

Berry Production in Ireland and the West

Berry production in Ireland is a growing sector, with strawberries and raspberries being the most prominent soft fruits. Blueberries are also gaining popularity in the horticultural industry. Requiring acidic soils, they are particularly well-suited to parts of the West of Ireland. While most commercial berry production is concentrated in the east and southeast, there is increasing interest in expanding cultivation to the west, particularly in the context of paludiculture.

Blueberries and cranberries, for example, are native to wetland environments and are being explored as viable crops for rewetted peatlands. These hardy crops thrive in the acidic soils and damp conditions typical of the West. Unlike other wet crops such as cattail or sphagnum moss, blueberries already have an established market in Ireland, ensuring immediate demand and economic viability.

Market research has identified two blueberry producers in the western region-Banner Berries and Derrighter Farm, both of which supply berries to local grocers and hotel groups. Beyond the West, other successful producers include Derryvilla Blueberry Farm in Co. Offaly, Derryduff Organic Farm in Co. Cork, who focus on the national market, and Keelings who have a presence in the international berry market.



@Clara Diebolt

1 | Capability

Barriers

There is a **lack of wide spread knowledge** and understanding of paludiculture practices among local farmers and land managers. This can hinder the adoption of these practices.

- ▶ Paludiculture has been demonstrated as technically feasible on raised bogs, such as that found in the region, but is **not widely practiced**. The peatland that could be viable for paludiculture is oftentimes abandoned and therefore more difficult to utilise.
- ▶ There are small-scale growers experimenting with blueberries in counties like Mayo and Galway, often as part of diversified farm enterprises. However, there is **no indication of a large, coordinated industry or expert network** in the region.
- ▶ This region has a **large proportion of part-time farmers**, meaning they have less time to tend to the variety of crops. These farmers generally inherited the land from their parents and carried on the traditional farming practices already established. Changing land use requires time, effort and training, which most part-time farmers can find very difficult to fit into their busy schedule.
- ▶ Farmers face **unclear or restrictive regulations** around land use, water management, and subsidies. The perception of excessive “red tape” can deter engagement, especially when transitioning from conventional agriculture.
- ▶ There is a **lack of specialised facilities** for sorting, packaging, and processing berries locally. This forces producers to rely on distant markets or export routes, increasing costs and reducing competitiveness.
- ▶ While demand is growing, consumer awareness of locally grown berries is still limited. **Imported berries dominate** retail shelves, making it harder for Irish producers to compete unless they can differentiate through quality, sustainability, or origin branding (*Evidence: Teagasc Annual Farmer Survey*).

Strengths and solutions

- ▶ There are already established projects focusing on peatland restoration ongoing in area. This means the overall **potential for paludiculture** adoption is increasing.
- ▶ **Plentiful suitable peat land** in region due to western Ireland’s topography (John Connolly research).
- ▶ A significant proportion of area’s farming community are taking up **organic farming and/or regenerative farming practices**. This means there is a willingness to learn more novel styles of agriculture, which could include paludiculture.
- ▶ There are **already blueberry** producers in the region, most likely utilising peaty soil types. This showcases that berry farming is possible in the west of Ireland.
- ▶ There is already an **established market for locally grown sustainable food crops**. Examples include Banner Berries in Co. Clare- see Economical Feasibility section.



Focus on berry paludiculture value chain and cost barriers:

1. Site Preparation & Cultivation

- ▶ Land preparation equipment: foliage clearance, raised beds, soil testing kits.
- ▶ Protective structures: Polytunnels or bird netting to protect crops.
- ▶ Planting materials: Certified disease-free blueberry plants (multiple varieties for staggered harvests) and improved overall yield.

2. Crop Management

- ▶ Fertilisation & pest control: Storage and application equipment for organic or conventional inputs.
- ▶ Monitoring tools: Soil moisture sensors, weather stations, and crop health monitoring systems.
- ▶ Labour infrastructure: Seasonal worker housing, sanitation facilities, and transport.

3. Harvesting

- ▶ Harvesting tools: Hand tools (as blueberries are typically hand-picked for fresh markets and cranberries can be hand-picked to minimise additional machinery and flooding risk), picking containers.
- ▶ Transport: Field-to-packhouse transport (e.g., small, refrigerated trailers or insulated crates).

4. Post-Harvest Handling

- ▶ Packhouse facilities (depending on the scale):
 - ▷ Sorting and grading lines.
 - ▷ Cold storage rooms (to maintain freshness and shelf life).
 - ▷ Packing stations with food-safe materials.
- ▶ Quality control systems: Scales, visual inspection stations, traceability systems.
- ▶ Processing equipment: For juice, jams, or dried blueberries—presses, pasteurizers, bottling lines.
- ▶ Collaborative infrastructure: Shared facilities with other producers (e.g., apple farms for juice blending).

5. Distribution & Marketing

- ▶ Cold chain logistics (if large scale): Refrigerated vans or access to third-party cold transport.
- ▶ Retail-ready packaging: Branded punnets, eco-friendly packaging options.
- ▶ Sales infrastructure: Relationships with wholesalers, retailers; direct-to-consumer platforms (e.g., farmers markets online shops).
- ▶ Marketing tools; Website social media presence promotional materials.

2| Acceptability

🚧 Barriers

Traditional farming practices are deeply ingrained in the local culture. There may be **resistance to adopting new methods** like paludiculture, which can be seen as a departure from conventional agriculture.

- ▶ Farmers may be **concerned about the economic viability** and profitability of paludiculture compared to traditional farming. The uncertainty around market demand for paludiculture products can contribute to this hesitation.
- ▶ **Long tradition of both turf cutting and sheep farming** on peat soils in west of Ireland. Negative attitudes within farming community towards **“top-down” European scale initiatives**.
- ▶ Current Minister of State for Forestry has backed proposals to **bring back forestry on peatlands**. If key influencers and community leaders much as ministers are not supportive, it can hinder broader acceptance.
- ▶ Existing agricultural policies and **subsidies may not support the transition to paludiculture**, and there may be regulatory hurdles related to land use and water management.

🌱 Strengths and solutions

During **outreach-farmers** seemed open minded to new forms of agriculture. Change in practice can be slower but there is an **interest to learn more**.

- ▶ **Advocating for supportive policies and regulations** that promote paludiculture can create a more favourable environment for its acceptance. This includes integrating paludiculture into existing agricultural policies and providing clear guidelines for its implementation.
- ▶ **Collaboration with similar projects:** The Rivers Trust (TRT) is actively involved in the Interreg Europe project RiWET, which aims to develop a policy instrument to support Ireland’s wetlands, including peatlands. Additionally, TRT is contributing to the Horizon Europe project Palus Demos, which is making significant strides in promoting alternative uses for peatlands, such as paludiculture. The Irish members of Palus Demos have visited government buildings in Dublin twice so far in 2025, with all suggestions on integrating paludiculture into the Irish agricultural landscape being well received.





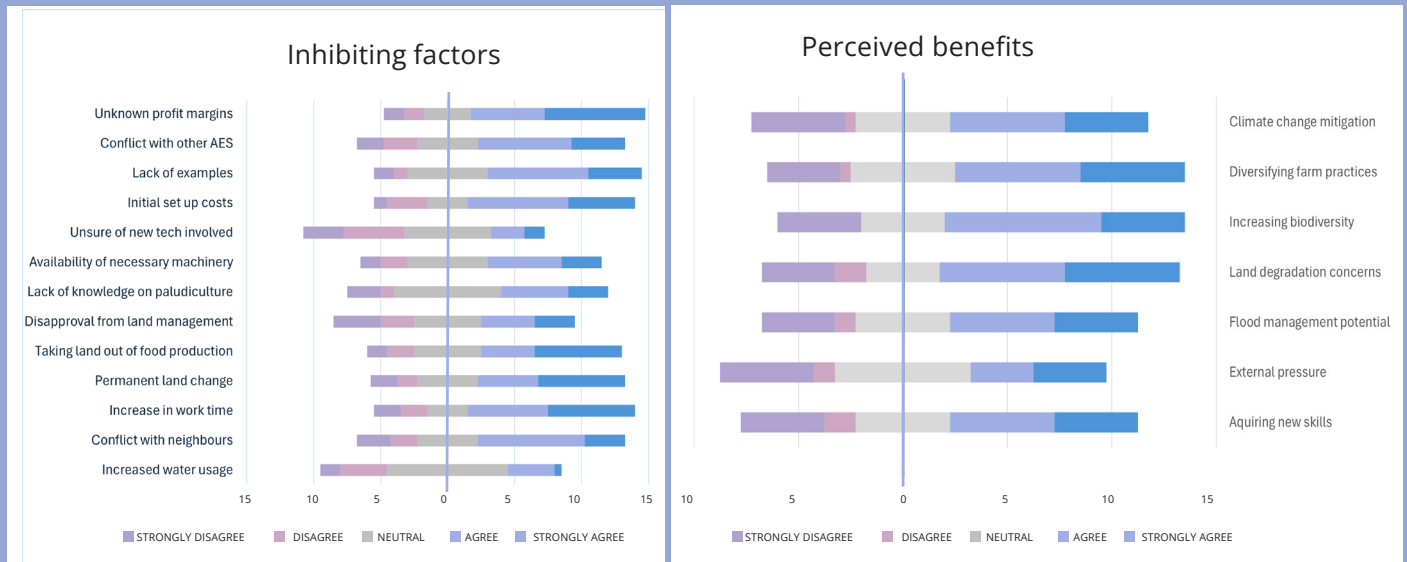
Opinions on paludiculture in Ireland Interreg North West Europe Care-Peat farmer survey

In 2023, Manchester Metropolitan University and the University of Galway conducted parallel surveys to assess farmer attitudes toward rewetting and wetland farming (paludiculture) in England and Ireland.

The Irish survey identified several prominent barriers to the adoption of paludiculture. Chief among these were concerns about uncertain profit margins, limited awareness and understanding of the practice, high initial setup costs, and a lack of practical examples or case studies. Farmers also expressed reservations about the availability of appropriate machinery and unfamiliarity with the technologies involved. While some social and environmental concerns, such as increased water usage and potential conflicts with neighbouring landowners, were noted, these were less consistently viewed as significant obstacles.

These findings underscore the importance of developing clearer economic incentives, providing technical support, and delivering targeted education and outreach to facilitate broader adoption.

In terms of perceived benefits, farmers most strongly recognised the potential for acquiring new skills, improving flood management, and addressing land degradation. Climate change mitigation and diversification of farm practices were also viewed positively, though responses were more varied. Notably, external pressure was not widely regarded as a motivating factor, and biodiversity benefits received a largely neutral response. Overall, the results suggest that farmers are most receptive to paludiculture when it offers tangible, practical advantages, particularly those related to environmental resilience and personal skill development.



▲ Horizontal bar charts showing the responses to Likert scale statements on inhibiting factors et reasons for taking up paludiculture (source: Interreg NWE Care Peat project)

3| Long term & life cycle

Barriers

- ▶ Peatlands are significant carbon sinks. **Ireland's national and EU climate policies** are increasingly focused on rewetting and restoring peatlands to reduce greenhouse gas emissions. This could lead to more emphasis in grants and **payments on restoration** of peat soils **rather than alternative methods such as paludiculture**.
- ▶ Much of the land in the west of Ireland is under **commonage**, where multiple landowners use a site for pasturing their stock. It is difficult to engage in long term land use change with large groups where there is often little to no communication when part ownership changes hands.
- ▶ Future variable: **Change in political** landscape leading to a move away from sustainable practices **in favour of high revenue agriculture** like beef and dairy for export. Future variable: **new research** on paludiculture changes current best practice and the **alterations required** **are costly**, leading participating farmers to pull out and lower uptake from potential farmers.
- ▶ Future variable: Research on paludiculture on-site work continues, but **no time is put towards creating space in the market** for the products, meaning they (in this case blueberries and cranberries) are overpriced in an area of low cost imported alternatives.
- ▶ Ireland's current climate of cool and wet winters (4-7°C) and warm summers (13-18°C), which makes it well suited to berry production. **Changing climate** could make for higher rainfall and storms in the winter months, which could damage the crops. More intense weather throughout the year would make **berry production more challenging**, along with the water table management of the site.
- ▶ Long term barriers can also be seen with the Time section.

Strengths and solutions

- ▶ New CAP (Common Agricultural Policy) reforms and Irish agri-environmental schemes (e.g., ACRES) may incentivize low-impact or nature-based farming, potentially supporting berry production if it aligns with biodiversity goals.
- ▶ If the system is taken up across the region, it will bring more demand to create processing plants and hopefully bring down the cost in mechanisation.
- ▶ Long term strengths can also be seen with the Time section.



4| Technical feasibility

Barriers

The concept of growing blueberries on peatland is technically feasible, but it comes with important considerations and constraints.

The **yield of blueberries on cutover bog** tends to range between 200-535g (*Vahejõe et al., 2010*), whereas, with optimum conditions, mature bushes grown on standard tilled soils can yield up to 6,000 pints per acres (*Demchak et al., 2017*).

- ▶ Peat soils are naturally acidic and water-retentive, which can suit certain berries like blueberries and cranberries. However, **water level and pH management are critical**.
- ▶ To enable peatlands to retain water and carbon through paludiculture, the water level needs to remain relatively high. This could impact berry production as **root rot can occur in prolonged waterlogged conditions**.
- ▶ Peat soils are low in nutrients. **Berries require specific fertilisation regimes**, especially for nitrogen, phosphorus, and potassium. Limited **local expertise in berry cultivation**, including preparation, production, and harvesting techniques, combined with the complexities of managing water tables on peat soils, presents a significant barrier to adoption.
- ▶ As this area of agriculture has not been explored extensively in the west of Ireland, **there is limited statistical data** available on the rate of imports and exports of berry product. The table within Economic Feasibility provides an insight into the range of imports available.

Strengths and solutions

- ▶ Many berry types, such as blueberry and cranberry, **thrive in wetter soils with high acidity** (pH 4.0–5.5). As most of the west of Ireland's peatlands are rain-fed, they have a naturally high acidity level. This also removes the risk of more stubborn weed plants that may encroach on planting area.
- ▶ There are now **cold-hardy and soil-tolerant blueberry varieties** that can be matched to local conditions. Generally, Ireland's conditions lend itself well to berry production, with the only potential barrier being the erratic rainfall fluctuations in the summer season.
- ▶ While general peat is low in nutrients, if it has been drained and used for agricultural purposes it will have a **high degree** of nutrients within the top layers of the soils, aiding in the initial growth of the plant.



5 | Economic viability

Barriers

- ▶ Establishing a berry-based paludiculture enterprise in the west of Ireland involves **significant upfront investment** for both producers and buyers.
- ▶ Entrepreneurs must invest in:
 1. **Specialised infrastructure for water table management** on peat soils (e.g. bunding, sluices, and drainage control systems),
 2. **Planting materials** suited to wetland conditions (e.g. cranberry or blueberry cultivars adapted to high water tables),
 3. **Harvesting and processing equipment**, which is often not readily available locally,
 4. **And potentially, cold storage** and packaging facilities to maintain product quality and meet market standards.
- ▶ For buyers or processors, the lack of an established supply chain means they may need to co-invest in aggregation, logistics, or processing hubs to ensure consistent quality and volume. This **lack of infrastructure and market maturity** increases the financial risk, especially in the absence of targeted grants or guaranteed offtake agreements.
- ▶ **Initial costs** for rewetting peatlands and establishing paludiculture systems can be high. Additionally, the market for products derived from paludiculture (e.g., biomass for energy, construction materials) is still developing.
- ▶ **Berry production has a strong history of cultivation and agronomic investment in North America.** This makes it difficult for an Irish based paludiculture system to compete with existing markets and any premiums are more likely to come from it having a local provenance.

- ▶ Many homes in the west of Ireland still **rely on cut peat (turf)** to heat their homes in the winter. To convince people from the region to utilise this land for paludiculture, reasonable alternatives must be reached.
- ▶ Berry crops may take several years to become productive, which can deter landowners seeking quicker returns.



Case study: banner berries, a blueberry producer in County Clare

Banner Berries, based in County Clare, cultivates three varieties of blueberries, with a primary focus on supplying fresh fruit. In 2025, they have diversified their product line by introducing **blueberry juice**, developed in collaboration with a neighbouring apple farm.

Their customer base spans from high-end establishments like Adare Manor in County Limerick to independent greengrocers across the region, including Ernie's in Galway City. According to the proprietor of Ernie's, Banner Berries are a consistent best-seller and are favoured over imported alternatives for their freshness and quality.



▲ Picture: Photographs of blueberry products from Banner Berries social media

- ▶ This comparison includes a selection of blueberry products available across various retailers in Galway City. Irish-grown blueberries are highlighted in green to distinguish them from imported options. This comparison aims to highlight the **availability and competitiveness of Irish-grown blueberries in the local market:**

▼ Table: Blueberry price comparison in Galway city (29/07/2025)

Company	Store	Origin	Price	Pack size	Price per 125gm
Banner Berries	Green Earth Organics (online)	Ireland (Co.Clare)	€8.49	250g	€4.25
Banner Berries	Ernies Grocers	Ireland (Co.Clare)	€6.00	250g	€3.00
Store brand	Dunnes Stores	Poland	€5.99	500g	€1.50
		Portugal	€2.49	150g	€2.08
Store brand organic	Dunnes Stores	Portugal	€2.99	125g	€2.99
Store brand luxury	Dunnes Stores	Ireland	€5.50	320g	€2.15
Keelings	Dunnes	Ireland	€2.99	125g	€2.99
Store brand	Lidl	Poland	€3.29	250g	€1.65
Store brand organic	Lidl	Portugal	€2.49	125g	€2.49
Store brand luxury	Lidl	Turkey	€1.99	125g	€1.99
Store brand	Tesco	Romania	€5.99	500g	€1.50
			€1.99	150g	€1.66
Keelings	Tesco	Zimbabwe	€3.29	165g	€2.49
Store brand	Aldi	Poland	€5.99	500g	€1.50
			€3.95	300g	€1.65
			€1.99	150g	€1.66
Natures Pride	Terryland Greengrocer	Poland	€2.49	125g	€2.49



Mario Mendez - unsplash

Strengths and solutions

- There is **growing demand for locally grown**, organic, and sustainable produce, including berries. If production methods on peatlands can be certified as sustainable, this could enhance market viability.
- In optimal conditions, **net returns from blueberry** farming can range from €5,000 to €15,000 per hectare annually, depending on yield, market price, and input costs (IBO, 2022). On peatlands, returns may be lower initially due to higher setup costs, but could improve with experience, innovation, and support schemes.
- As the official **sale of turf products has been banned** in Ireland since October 2022, there is little revenue to be gained from its extraction. Most turf being extracted currently is for personal use or small scale selling to the local community. Grants to allow people to retrofit their older country homes to **improve insulation** would in turn reduce the need for turf in the area. Wild Atlantic Nature LIFE IP is working with a small number of farmers in this region to gauge its feasibility, with results due next year.
- The **higher value niche markets**, such as berry farming, can be exceptionally profitable but only a few hectares are required to meet the expected market demand.
- A white paper published in 2022 by a large European consortium presents compelling evidence that **sheep farming on peat soils is generally not economically viable**. Specifically for Ireland, the paper estimates that such farms operate at a loss of €128 per hectare before subsidies.

Table: Sheep & Goats - Average Farm Size and Average Annual Income from the Farm Accountancy Data Network Survey (2019)

Sheep & Goats (Annual figures for 2019 Selected Countries)	Belgium	France	Germany	Ireland	Netherlands	UK	Average All Soils	Weighted Average
Share of peat area for Weighting	0.4%	4.8%	21.3%	24.4%	4.5%	44.5%	n/a	n/a
Average Farm Size hectares (SE025)	0.0 ha	86.6 ha	77.1 ha	45.2 ha	31.3 ha	242.0 ha	96.4 ha	141.0 ha
Income per farm (SE131)	€0	€103,427	€108,184	€26,112	€261,092	€107,111	€121,185	€93,974
Expenditure per farm (SE270)	€0	€120,483	€118,524	€31,890	€232,700	€129,841	€126,688	€107,248
Income less Expenditure per farm	€0	€-17,056	€-10,340	€-5,778	28,392€	€-22,730	€-5,502	€-13,274
Subsidies per farm (SE405+SE600)	€0	€46,716	€39,226	€17,541	€9,953	€49,518	€32,591	€37,398
Family Farm Income per farm (SE420)	€0	€29,660	€28,886	€11,763	€38,345	€26,788	€27,088	€24,124
Income per ha	€0	€1,194	€1,403	€578	€8,342	€443	€2,392	€1,073
Expenditure per ha	€0	€1,391	€1,537	€706	€7,435	€537	€2,321	€1,143
Income less Expenditure per ha	€0	€-197	€-134	€-128	€907	€-94	€71	€-70
Subsidies per ha	€0	€539	€509	€388	€318	€205	€392	€335
Family Farm Income per ha	€0	€342	€375	€260	€1,225	€111	€463	€265

6 | Sustainability

Barriers

- ▶ Cultivation on peatlands can lead to carbon **loss and biodiversity degradation** if not managed carefully. Sustainable practices such as no-till, organic mulching, and minimal drainage are essential to reduce impact.
- ▶ Encouraging the large scale changing of practices from sheep and cattle farming to wet farming is not sustainable for the local economy and could **divide the community**.
- ▶ **Intensive berry farming** on peatlands may reduce habitat biodiversity if not fully considered. To maintain higher production levels, fertilisers may be required, which could breach water quality boundaries if not managed carefully.
- ▶ **Increasing footfall** on peat soils will affect its overall water and carbon holding capacity and could potentially lead to compaction over time.
- ▶ **Introducing a non-native species** such as cranberries could bring new pests and diseases into the ecosystem.

Strengths and solutions

Berry production lends itself well to organic and permaculture systems, which are both more sustainable farming methods.

- ▶ **Prioritising species** that are close to native species (example- commercial blueberries and wild bilberries).
- ▶ Berry farming opens the agricultural industry in the region to more **tourism focused activities**, such as educational trips and “pick your own” events.

7 | Time

Barriers

- ▶ Transitioning from drained peatland to wetland-compatible systems requires **significant planning**, hydrological adjustments, and infrastructure changes, which can take several years.
- ▶ Farmers and landowners often face uncertainty due to evolving or unclear policies around rewetting, carbon credits, and eligibility for agri-environment schemes, **slowing decision-making**.
- ▶ Wetland restoration and crop establishment are often **limited to specific** times of year due to weather and ground conditions, extending timelines.
- ▶ Many landowners are hesitant to commit to paludiculture due to unresolved questions about **land succession and leasing arrangements**. In interviews, some expressed disillusionment with past agricultural guidance. One noted, “This is how we were told to do this and that this would make us money. It hasn’t and it’s cost us thousands.” This sentiment reflects a broader scepticism, with another interviewee describing a metaphorical “brick wall” that farmers encounter when presented with new practices marketed as revolutionary or financially promising. This historical context contributes to a cautious approach toward adopting long-term changes like paludiculture.
- ▶ The farming population is **aging** across Europe, and as per the 2023 Census, just 30% of farmers in Ireland are under the age of 45. Research from 2018 by by Esther Wahaga in Nigergia showcased by older farmers can be hesitant to invest time and money into agricultural practices that are not established in their own locality, or that could negatively affect their production levels and the timeline of uptake.

Strengths and solutions

- ▶ Ireland's current political landscape is increasingly supportive of sustainable farming practices, with **peatland restoration emerging as a national priority** under the proposed EU Nature Restoration Law. This creates a favourable policy environment for the integration of paludiculture into agricultural strategies.
- ▶ The west of Ireland has become a focal point for **paludiculture innovation**, notably through the Horizon Europe Palus Demos project, led by the University of Galway. This initiative is actively engaging with policymakers to raise awareness of paludiculture and advocate for its inclusion in agricultural grant schemes, thereby strengthening its viability for farmers.
- ▶ Although the aging farming population is often cited as a barrier to innovation, it also presents an opportunity to engage the **next generation of farmers**. Younger farmers, who are increasingly participating in university-level agricultural courses and government-led training programmes, may be more receptive to adopting new practices.
- ▶ With this demographic shift, there is a timely opportunity to embed paludiculture into **agricultural education and training frameworks**. Early exposure to the concept can help normalise it as a viable land-use option, particularly in peatland-rich regions. **Strong local networks and community engagement** in the west of Ireland could speed up uptake.
- ▶ **Establish pilot sites and farmer-led demonstration projects** to build trust, showcase viability, and reduce perceived risk over time.



In a nutshell

Berry-based paludiculture is compatible **with the west of Ireland's** naturally acidic, rain-fed peat soils.

At present, the sector remains underdeveloped, with a pressing **need to build farmers' expertise and invest** heavily throughout the value chain, particularly in farm infrastructure and equipment.

There is **cultural resistance** to the development of these products in comparison to traditional productions such as sheep farming and peat cutting. Yet, sheep farming is not very profitable, and turf cutting is facing increasing regulatory pressure.

The **yield in peatlands may prove to be inferior** to optimal berry conditions with a strong dependence on nutrient, water level and pH conditions. Today, the off-season market mainly consists of **berries imported from North America and Peru** which, however, are not **sufficiently competitive** in terms of price to overshadow domestic alternatives. These locally produced berries could benefit from a niche market demand for local, organic products.

With the different **on going pilot projects**, this business model could evolve into a viable and sustainable agricultural alternative in the years to come.



Netherlands

A| Paludiculture with a focus on cattail (*Typha*)

Actors and territory of action

As part of the peat strategy of the province of Groningen, it is interesting to investigate possibilities of paludiculture. There is a housing project on peatland next to the city of Groningen called Meerstad. The developer of the housing project is interested in biobased building materials. A cooperation between farmers in the surrounding of the housing project and the developer of the housing could set up a value chain on biobased materials from peat ground. Discussions on this subject have been initiated.

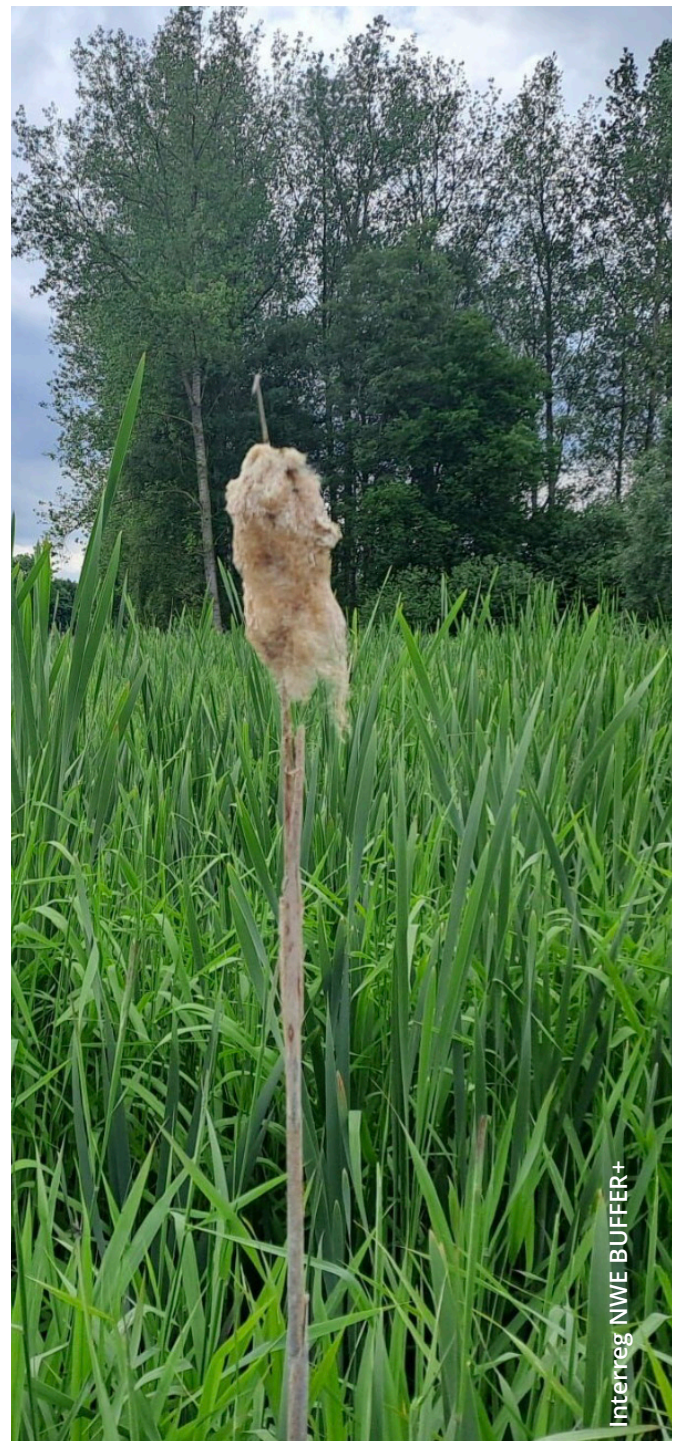
Business model

The business model for cattail (*Typha*) extends beyond its primary application in biobased insulation. While insulation remains the major market explored in this study, there is potential to explore broader uses of the material, particularly in the creative and cultural sectors. For example, artists and designers could work with *Typha* to create furniture, installations, or sustainable design objects. Investigating whether such applications have been successfully implemented elsewhere could provide valuable inspiration and open new market opportunities.

This multifunctional approach could be physically anchored at the pilot site, which may serve not only as a cultivation and research location but also as a cultural and educational hub. Such a space could host workshops, exhibitions, and collaborative projects, bringing together farmers, artists, students, and the public. Education would be a central component of this model—raising awareness about circular materials, sustainable land use, and the value of wetland crops like *Typha*. By integrating production, creativity, and learning, the business model becomes more resilient, inclusive, and community driven.

Objectives of the feasibility study

We want to assess the feasibility of cultivating and scaling cattail as a sustainable wetland crop in the Groningen region by evaluating its agronomic potential, processing possibilities, market applications, and socio-political acceptability.



1 | Capability

Barriers

One of the primary uncertainties is whether cattail can be successfully scaled up to a level that makes it economically viable. While small-scale trials may be promising, the feasibility of growing it at a commercial scale remains unproven (in our region). This includes questions around land availability, yield consistency, and long-term sustainability. The idea is to start small and build upon this.

There is also a knowledge gap regarding the optimal growing conditions for cattail in our region. While we have some preliminary data, we do not yet fully understand the soil, water, and climate parameters that best support its growth. This makes it difficult to predict outcomes or provide clear guidance to farmers.

Finally, while a potential pilot site has been identified, there are uncertainties about **soil suitability**. Although a report exists on the site's characteristics, it may not fully support *Typha* cultivation, which could require us to explore alternative locations.

Strengths and solutions

The Groningen region presents several promising strengths and opportunities that support the feasibility of introducing cattail as a wetland crop. These factors suggest that, despite certain uncertainties, the region is well-positioned to explore and potentially scale up cattail cultivation.

One of the most significant strengths lies in the **existing connections to the biobased economy**, particularly in the construction sector. Cattail is a valuable raw material for sustainable insulation and other building products. These applications align well with ambitions for circular and climate-resilient development that are present within the area where the pilot will start up. The pilot will take place in a development area for new housing and the housing development initiated the pilot to investigate as a building

product. There are already networks in place that can help bridge the gap between agricultural production and industrial processing. We are talking to the company Dijkstra Draisma (who have a biobased factory in Friesland, the province next to Groningen, and are looking to setup business in Groningen) and there are other companies who process biobased materials that are situated in Groningen. We still need to take some steps to take this further and see how we can organise the processing of the raw materials.

The location for the processing of the biobased materials is unknown for now. This could be close to the pilot site in a barn of the farmer. On the long term, it is better to locate it at an industrial area. There is also a strong **willingness among a share of local stakeholders** to experiment with and implement new agricultural models. Several businesses in the region have expressed interest in testing or piloting wet crops like cattail. They also expressed their willingness to work together to spread risks. This openness to innovation provides a fertile ground for collaboration and experimentation, which is essential in the early stages of introducing a new crop.

The region benefits from a **collaborative agricultural culture**, with groups of farmers already organized and willing to work together. These collectives can play a key role in sharing **financial risks**, pooling resources, and supporting each other through the transition. This social infrastructure is a major asset when introducing a crop that may require new methods, equipment, and market development.

Finally, cattail has the potential to serve as a **regional showcase**—a visible, tangible example of how wetland-compatible agriculture can contribute to climate goals, biodiversity, and economic development. If successful, it could inspire other regions and stakeholders to follow suit, positioning the pilot territory as a frontrunner in sustainable peatland farming.

2| Acceptability

Barriers

One of the primary concerns is the **visual and spatial impact** of cattail on the landscape. As a tall-growing plant, it may alter the open character of the region's rural areas. This could lead to resistance from stakeholders who value the traditional open landscape, particularly when compared to other tall crops like reed or maize. The visual transformation of the land may be perceived as a threat to cultural or aesthetic values.

Another significant issue is **the lack of regulatory clarity**. Currently, there are no specific regulations or guidelines for cultivating *Typha*, especially in relation to **plot rotation and fertilisation** of paludiculture. Fertilization increases production; however, it hinders water quality improvement and is **prohibited** on water-saturated soils. It is, however, allowed to implement precision fertilisation, but how you can do this if the parcel is inundated is not clear.

There are also **uncertainties around harvesting in nature areas**. If *Typha* is grown in or near protected wetlands or conservation zones, it is unclear whether and how it can be harvested without conflicting with nature protection laws.

The same accounts for fertilising the crop. This legal ambiguity could delay or complicate implementation. The pilot site is not a nature area, but we do aim for extensive agricultural use and contributing to biodiversity, water quality and climate goals.

A practical ecological challenge is the **presence of geese**, which are known to feed on young cattail plants. These birds often rest and forage in wetland areas, and their activity could significantly damage early-stage crops. Preventive measures would be necessary, but these may add complexity and cost.

Socially, there is a degree of **public scepticism and misinformation**. Some individuals express concerns about (the product of) cattail being flammable or attracting pests such as mice. These narratives, whether accurate or not, can influence public opinion and create resistance, particularly among those who feel their existing agricultural practices or business models are threatened.

Finally, the **current political climate in the Netherlands** tends to favour more conservative, status-quo approaches to land use. This may make it more difficult to gain broad political support for experimental or non-traditional crops like *Typha*, especially in rural areas where change is often met with caution.



 Strengths and solutions

One of the most promising aspects is the **growing willingness among local farmers** to embrace change. Several farmers in the region have expressed a desire to contribute to more sustainable agricultural practices and are open to experimenting with new crops like *Typha*.

This proactive attitude is a strong foundation for regional innovation and can help normalize the presence of wetland crops in the agricultural landscape. *Typha* has been added to the CAP regulations as an agricultural crop. Which means a farmer can produce cattail and get a CAP pillar 1 subsidy.

In addition, there is a **broader societal shift toward biobased and circular solutions**. A growing group of residents and stakeholders are eager to support and implement sustainable materials, including those derived from local crops. *Typha*, as a source of natural insulation and building materials, fits well within this narrative. Its visibility in the landscape can even enhance public engagement—residents can literally see the crops that may one day insulate their homes, creating a tangible sense of circularity and local impact.

Interestingly, the **current lack of specific regulations** around cattail cultivation may also present an opportunity. In the absence of rigid frameworks, there is more room for experimentation and innovation, allowing early adopters to shape best practices and influence future policy development.

Regarding ecological challenges such as geese predation, **practical mitigation strategies** might be possible. These could include providing alternative food sources or using deterrents like sound or light systems—though it's important to ensure these methods are permitted, especially near protected nature areas. With proper planning and site selection, these risks can be managed effectively.

Finally, the **proximity to urban centres** such as Groningen adds a valuable dimension. Urban populations often show greater openness to sustainability initiatives, and their influence can help shift public and political discourse in favour of innovative land use. This urban-rural connection may reduce resistance and increase the perceived legitimacy of *Typha* as a future-oriented crop.



Interreg NWE BUFFER+

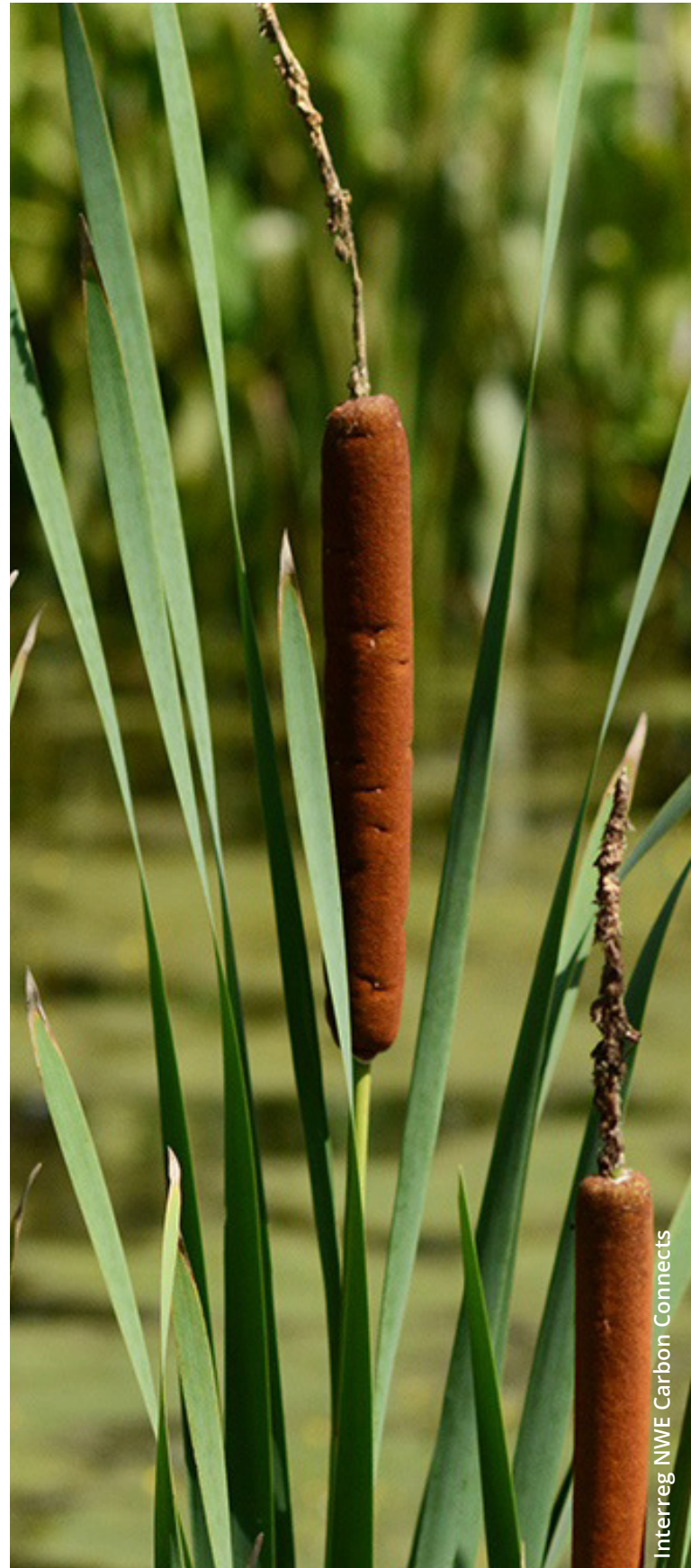
3| Long term & life cycle

Barriers

One barrier for the long term is the question whether *Typha* farming can be scaled up to the number of hectares that will be required to build a sustainable business model. Current pilots often are quite small scale so **knowledge about the scalability is not yet sufficiently gathered**. If we would like to use cattail fibres to develop building materials, we would need a steady and sizeable stream of production to go into processing plans, which currently are also not present yet. In the pilot we aim for a growing model in which we start with 1 hectare of cattail and then build towards 5 hectares after 3 years and 10 hectares after 5 years.

When looking at alternative business models, we must question **market saturation**: will there be enough demand if most farmers on peatlands shift towards cattail or similar fibre crops? Currently, the sales market is not up to that scale yet. At the moment in Groningen in new constructed houses 0.8% biobased materials are used. This implicates a huge potential for growth. Furthermore, there is a national goal in the Netherlands to increase this to 30% in 2030.

Will the **current political context** in Groningen (or even the Netherlands) support investigating new business models like growing cattail on a bigger scale? A probable good outcome would be that the national government restores the funds that were reserved for rural transition in 2023 (24.3 billion). This money was intended for area-based interventions based on water, soil, nature and nitrogen. This money was cut back by the national government in 2024, since this government has fallen, and new elections will take place in 2025. The probably bad scenario is moving away from a systems approach, which would reduce the awareness of peat-oxidation and thus business-models as they must take place on a big scale to get to economies of scale.



Strengths and solutions

The pilot facilitates a larger scale *Typha* pilot allowing us to investigate the **possibility for scalability. Furthermore, the knowledge and skills gained** from this pilot with the involvement of local farmers could help political transition towards more openness for alternative business cases and more involvement of farmers in the long-term.

The pilot can act as a showcase of **possible future land use on peatlands**. This can open a threefold of developments:

- ▶ Initiating new pilots or businesses that would like to rewet their lands.
- ▶ Initiating a growing demand side.
- ▶ Initiating an increase in political willingness as this pilot is executed with local farmers.

By focusing on growing *Typha* on peatlands, these agricultural lands can still be used for production that has societal and **economic value**. Peatland rewetting is often associated with nature development. Farmers often argue that this nature does not have economic input in the sense of creating food or material. By opting for cattail production there is still an agricultural business case in place, that also contributes to European goals of CO₂ reduction and biobased building.

By investigating this pilot and the water system changes that are required to successfully re-wet these peatlands **increases local technical knowledge on rewetting**. This knowledge can then be applied to future rewetting sites making future alternative use of peatlands easier to implement.

The pilot facilitates local policy-officers to walk through the whole system of requiring permits and possibilities within current policies. It can also **showcase the current bottlenecks** in policy, which can be adapted towards a future where peatland

rewetting is easily possible. Furthermore, the pilot offers insights into the possibility of investigating the business case further and to see whether exploring the possibility for subsidies is required.

Isolatieaanpak (Isolation approach) Groningen (maatregel 29 Nij Begun) will give an impulse to the isolation market in Groningen. Although biobased isolation is not mandatory, it is possible to get subsidy for biobased insulation (as well as for current materials).



Jaakko Kempainen - Unsplash

4| Technical feasibility

🚧 Barriers

A significant barrier is the **lack of specialized machinery**. Traditional agricultural equipment is not suited for wetland crops like *Typha*. Farmers may need to invest in new tools or technologies and **specialised training** for sowing, harvesting and processing and the specialised machinery. For example, sowing might require innovative methods such as drone seeding or the use of floating hoses, techniques that have been piloted in other countries like Ireland. However, these methods are not yet common practice, and their applicability in our specific conditions is still uncertain.

Technical interventions needed to raise and maintain the water level within the areas where the crops will be growing.

Another barrier is the limited understanding of the exact abiotic conditions required. Which kind of peat or water quality is best. It will need time to figure this out in detail for every location. We have identified potential sites, but are those the best sites? Maybe this will need to be a trade-off.

The current **water condition** in the search area for the pilot is not yet perfect for *Typha*. An adjustment will be needed (for example small dikes and extra supply of water). The ground level varies considerably across the area. The elevation of the plots generally ranges from -2.8 m above sea level to -1.0 m below sea level. The current water level is -3.00m. This also results in considerable variation in the drainage of the various plots in the area: generally, between -2.6m and -0.4m below ground level in the summer.



▲ Picture: Summer drainage of the various plots in the research area (red frames).
 ● Data source: Water Board Hunze and Aa's

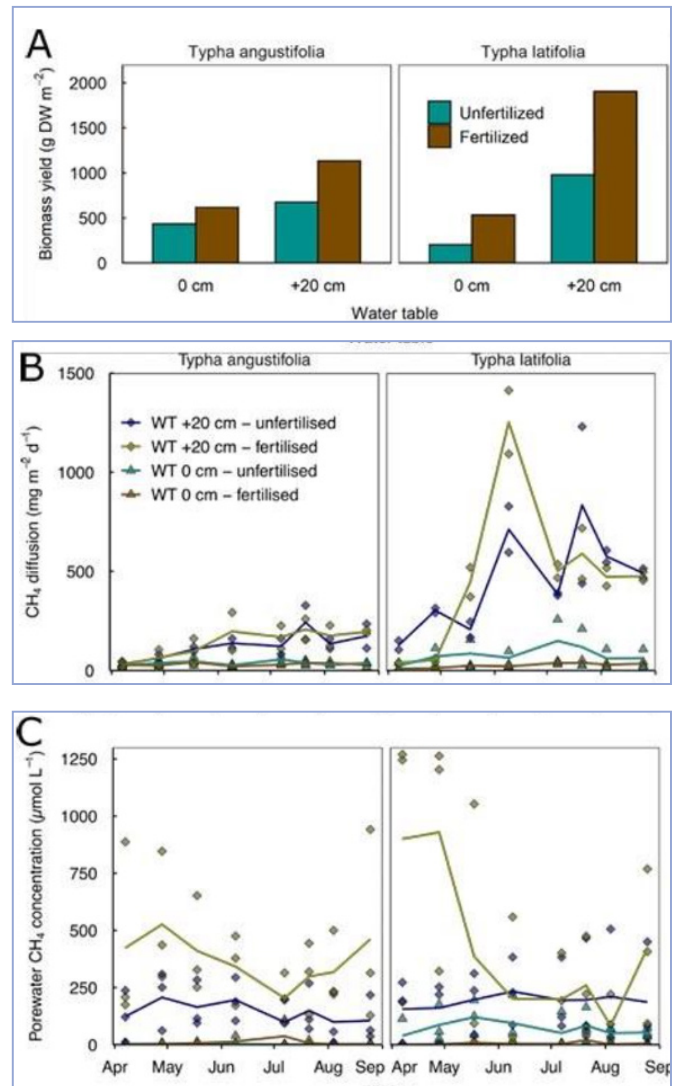
Wildlife pressure, particularly from geese, presents another barrier. Geese are known to feed on young cattail plants – example is the Heggewarren in the Province of Friesland, especially in wet nature areas where they rest and forage. This can significantly reduce crop yields and necessitate additional interventions, which may have their own environmental or regulatory implications.

Strengths and solutions

A potential pilot site has already been identified, and while there are some concerns about soil suitability, this site offers a valuable starting point. Importantly, a soil report is already available, meaning we are not starting from zero. This existing knowledge can guide further site selection or adaptation strategies.

In terms of technical feasibility, there are national and international examples we can learn from. For instance, in Ireland, cattail has been successfully sown using drones—an approach that could be adapted to our local context. Exploring such innovations could help overcome machinery-related barriers and reduce the need for heavy investment in new equipment. Furthermore, there are studies in the Netherlands that show *Typha* growing and management options.

Innovative farmers are already in the region, and entrepreneurs in the region already. There are opportunities for technical education and training. Adaptation of best practices of neighbouring region with a course on *Typha* with several lessons is already being organised in Friesland by Biosintrum.



▲ Figure: Comparison of the agronomic performances of *Typha* with different level of fertilisation



5 | Economic viability

Barriers

Agricultural land in the Netherlands has one of the highest costs (85% higher than the European average). Questions can thus be raised whether the **market values of Dutch agricultural peatlands** are a limiting factor in setting up a viable business case. Current pilots often rely on subsidies, or on the lands not being owned by farmers themselves. However, the market values of peatlands decrease because of soil subsidence caused by peat oxidation and in the future **societal and social costs of the water management** of these peatlands in their current use are expected to rise.

The market for biobased building materials is **not yet competitive with existing markets**. This limits farmers in their opportunities to move towards an alternative business case. There is no specific market in the Netherlands yet, so it is not a viable business model yet compared to for example milking cows.

In the South of the Netherlands a pilot growing cattail was recently visited by Groningen partners. Here the **high cost of renting specialised equipment** was mentioned.

As there are not many machines in place locally these machines must be rented from elsewhere in the country to harvest the cattail. The costs of this were so high it could not be compensated by the economic gains of growing cattail.

Cost indications for cattail in The Netherlands:

- ▶ Planting: €6,000 - €8,000/ha.
- ▶ Yearly maintenance: €250-€1,500/ha
- ▶ Yearly margin: €900 - €4,000/ha

The variability depends on the growing circumstances, growing from seeds vs. from seedlings, costs during the production process, the rent of machinery etc.

Processing of cattail to insulation material is around €90-€130 per m² (including drying, chopping, pressing).

Comparison with conventional materials: Stone wool: €20-€40 per m²; PUR insulation: €30-€60 per m²; Wood fibre insulation (biobased): €50-€80 per m².



When compared to other biobased building materials the following graph can be shown.

 Table: Comparison of the economic performances of different biobased building materials

Category	Cattail	Reed	Miscanthus	Hemp
Revenues (€/ha)	4,263	3,263	1,263	1,271
Crop sales	4,000	3,000	1,000	1,008
Entire Plant	2,400	3,000	1,000	1,008
Seed Heads (Aren)	1,600	0	0	0
Other Income	263	263	263	263
CAP Subsidy (GLB)	263	263	263	263
Other	0	0	0	0
Revenues (€/ha)	2,904	2,134	1,458	1,408
Land Use	714	714	714	714
Crop Care	460	460	240	155
Energy & Water	100	0	0	0
Taxes & Insurance	175	175	175	175
Maintenance	205	25	25	0
Harvesting & Storage Costs	1,250	760	304	364
Operating Balance (€/ha)	1,359	1,129	-195	-137
Unallocated Costs (€/ha)	1,100	825	421	679
Depreciation & Repayment of Cultivation Invest.	1,100	825	421	679
Labour / Machinery / Equipment / Financial Costs	0	0	0	0
Net Result (€/ha)	259	304	-616	-815

Strengths and solutions

There are groups of farmers present within the region that are willing to **work together** to minimize the financial consequences.

Often with new business models, **upscaling leads to decreased** costs and a better business case. Therefore, we can expect that when cattail farming is scaled up less investments are required per square meter, in terms of labour, machinery, seed costs, and water works. This would then lead to a higher share of profit.

The purchasing side/demand side of the pilot is already in place, as the local housing developments are willing to use the cattail. The processing part is not yet in place, which can be considered a risk.

Soil subsidence due to peat oxidation leads to infrastructure subsidence as well. There are a lot of costs accompanied with this. By starting up a pilot these costs can also partly be reduced.

PES – Carbon Credits (in Dutch Valuta voor Veen) is interesting on the long term. You need a large area in hectares to apply for the carbon credits. Since we want to start small and then build towards 15 hectares, it is interesting to see if carbon credits can contribute to the business model on the long term.

6| Sustainability

Barriers

From an environmental perspective, one of the main challenges in cultivating cattail is the need for consistent **high-water levels**. Maintaining these conditions can be technically demanding and may conflict with the drainage requirements of neighbouring (agricultural) plots. Additionally, while cattail supports wetland restoration, large-scale monoculture cultivation could pose biodiversity risks if not managed with ecological variation. It may displace native species and reduce habitat diversity. This is something to take into consideration for the future when upscaling of cattail becomes a reality.

Strengths and solutions

Environmentally, cattail has a **strong potential for climate mitigation**. According to recent life cycle assessment (LCA) research, cattail cultivation on rewetted peatlands can reduce greenhouse gas emissions by up to 32% per hectare compared to conventional dairy farming on drained peat soils. When used in insulation materials, cattail biomass also contributes to long-term carbon storage, potentially resulting in negative emissions if accounted for under standards like PAS2050.

Cattail requires minimal inputs such as fertilizers and pesticides, which helps reduce nutrient runoff and chemical pollution. Its cultivation also supports peatland restoration by halting subsidence and improving hydrological balance, contributing to long-term soil health and ecosystem resilience.

Furthermore, if rewetting is not properly maintained, there is a **risk of continued peat oxidation**, which would undermine the climate benefits of cattail cultivation by allowing carbon leakage.

On the social side, cattail fits well within the **growing circular economy**. It can be used not only in insulation but also in furniture and artistic applications, supporting local value chains and innovation. Pilot sites can serve as educational hubs, engaging the public and showcasing sustainable land use practices. There is also **strong interest among farmers** in the region to experiment with cattail, and existing networks can facilitate collaboration and risk-sharing.

The proximity to Groningen city and Meerstad enhances **urban-rural synergy**, supporting market development and public engagement. Interestingly, the current lack of strict regulations around cattail cultivation may also offer room for innovation, allowing early adopters to shape best practices and influence future policy.



7 | Time

Barriers

It will take some time to organise the cattail pilot. Since it is not a grown market, we will have to **find permission from our board** (Gedeputeerde staten) to subsidise or give some external impulse to the project. It will also take time to organise this. We should make sure this is not regarded as state support by the EU. Also, there are different ways to organise the pilot. We could work in a cooperation of farmers or just with one farmer.

And finding a parcel and adjusting the water system for growing cattail will also be time consuming. At this moment we expect **at least one year of preparation**.

Strengths and solutions

There are farmers that have shown interest. Also, we are in contact with a building developer willing to buy the product. These are **external inputs that will have a positive influence on the progress** of the pilot.



In a nutshell

The cultivation of cattail as a paludiculture crop in the Groningen region could answer **emerging demands for biobased construction** and circular economy initiatives. However, for now, new constructed houses contain only 0.8% of biobased materials in Groningen and those material are not yet competitive. The national goal in the Netherlands is to increase this to 30% in 2030 which could fuel a huge growth in demand if the political objective is followed by real implications.

On rewetted peatlands, cattail can also reduce greenhouse gas emissions by up to 32% per hectare compared to conventional dairy farming on drained peat soils which **align this business model with climate goals**.

However, cattail paludiculture is **not yet economically competitive** compared to other well implanted business models like dairy farming. This is primarily due to high establishment and harvesting costs and relatively low revenues sources. For now, the revenue to investment ratio is too low but as the system matures (efficiency gains and demand growth with higher prices), these economic parameters can become more favourable.

A| Extensive grazing

INTRODUCTION

Actors and territory of action

As we have both crops and cattle farming in our region, we expect that extensive grazing can be a suitable business model. However, our region is not ready yet to do the CALLTEST for a specific pilot on this business case, as we believe this is something that should be done with the stakeholders in the area. Even though several conversations on extensive grazing have started about possible pilots, we need more time to get together with the involved stakeholders to come to a real pilot. Therefore, this CALLTEST is for now on a fictional pilot for extensive grazing and cannot give specific details on a given site.

Looking at the peat soils in Groningen, there are a lot of dairy companies that produce

milk on drained peatlands. The question we are trying to answer here is: What would the business model of a dairy company look like if we rewet these peatlands towards 40cm in 2030 and 20 cm in 2050?

Business model

Finding a new way of income to compensate for the smaller amount of cattle and maybe becoming more extensive by acquiring more land.

Objectives of the feasibility study

Assess what a dairy farm would look like on rewetted peatland and what is the difference with the current situation.



1 | Capability

Barriers

Farmers now have a larger number of cows on their lands than what is required for extensive grazing. This is what their business case and their **mortgage** is based upon. They are often trapped in a situation where reducing the number of cattle would jeopardize their business model, as it would prevent them from covering their high operational costs. A company is considered extensive if its stocking density is a maximum of 1.5 to 2 livestock units (LVE) per hectare. The average number of livestock units (LVE) per hectare in Groningen is 2.55.

Rewetting can change the yield and quality of the crops, which impacts the **feed value** and thus the supply of the cows.

The cattle breeds currently present in the area are often not adapted to wetter conditions. There are **animal health** risks like hoof problems, an increased parasite load, thermal stress and injuries. Furthermore, there are risks for soil compaction and damage, vegetation loss from overgrazing and water quality issues because of manure.

Strengths and solutions:

The cattle farmers in the area have a long history of **expertise about cattle grazing** and their lands. This can be channelled into learning about a new method and breeds to apply to their lands. Furthermore, the region is familiar with the **collaboration between cattle and arable farming**. A local value chain is already present.

A solution to the animal health can be using **lighter and more mobile breeds** (e.g. Galloway, highland cattle) that are better suited to wet, rough terrain. Furthermore, **rotational grazing** can limit access during the wettest periods. Since the grounds are never fully level, **dryer resting areas**, can also be designed, reducing the constant exposure to wet grounds.

There is a presence of slaughtering and processing facilities in the region. The region is now already known with cattle grazing. The use of different breeds will not make a difference in this.

2| Acceptability

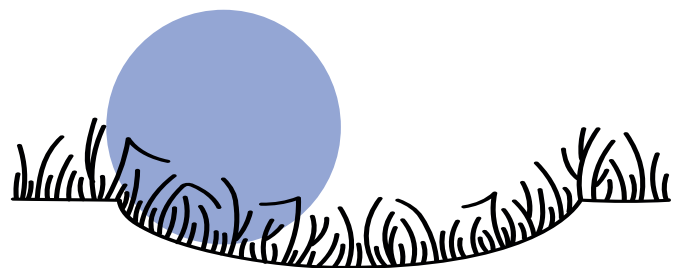
🚧 Barriers

Legal ambiguity: While rewetting aligns with EU climate and biodiversity goals, Dutch agricultural and water laws are still catching up. Farmers face uncertainty about long-term land use rights, subsidies, and compliance with environmental regulations. The **Dutch Water Law** does not yet clearly define how raising water tables aligns with compensation mechanisms. The **CAP and Dutch National Strategic Plan** offer subsidies for sustainable practices, but is not always clear whether rewetting qualifies, especially when it reduces productivity.

Many farmers feel targeted by top-down policies and **fear a loss of autonomy, income and identity**. The government is often seen as untrustworthy and high tensions are present within some areas in the region. There are opposing interests present meaning.

Each farmer has a different approach for livestock farming. Some farmers already work more extensively. Some farmers also express opposition to extensive grazing, as they fear it could lead to nature development that would, in turn, result in stricter regulations and increased pressure on their businesses. Since no two farmers are alike, legislation and policy must reflect these differences. Farmers operating on peatlands face distinct conditions and should be able to develop viable business models, just as those farming on clay or sandy soils.

The bank has a big responsibility in giving out loans for different ways of operating an agricultural business. They should also offer the space to make extensification an existing business possible. However, there are risks attached to this which makes them hesitant to do so. Looking at a waterbed effect, less cattle lead to less meat production, which will also impact the butchery business chain and less local meat for supermarkets. If the demand does not decline, this would mean more importation of meat. There are **opposing interests and space is limited** and completely planned in the Netherlands. While current livestock farming is often quite intensive, there is also growing interest in recreational land use and space for nature. Additionally, water managers advocate for a robust, system-wide approach, whereas farmers tend to prefer more tailored solutions and greater autonomy. This often leads to situations where tensions are high and distrust arises between parties, which complicates discussing the future. Furthermore, it leads to situations where new policy can be made without consulting the stakeholders in the area.



Strengths and solutions

Extensive livestock farming is legally possible in the Netherlands and good examples already exist. Legally, **extensive livestock farming is allowed and encouraged**, especially near Natura 2000 areas and in peat meadow zones. The province of Groningen has policies that restrict expansion of intensive livestock farms and encourages sustainable and nature-inclusive agriculture. There is significant potential to integrate extensive grazing into local nature management, but a viable business model has yet to be established. Such an approach could also create more space for meadow birds and strengthen the overall ecological connectivity and system.

Extensive livestock grazing on peatlands, combined with rising water levels, can benefit the overall water system by helping retain more water in the area. This could also help surrounding farmers in times of drought. Currently, the waterboard and province are researching the potential impact of **storing more water in the peatland area**.

The Dutch government aims for a 50:50 ratio of animal to plant-based protein consumption by 2030, shifting from the current 61% animal / 39% plant ratio. This creates opportunities to implement more extensive forms of livestock farming. Working with animals in extensive livestock farming is quite like more intensive livestock farming. A farmer thus does not need to learn working with a completely different species or crops. The barrier to switch might thus be lower because of this. Furthermore, contact with the local agricultural school is already in place. They want to teach their students future proof methods in terms of business models. Extensive grazing is one of these approaches.

In Groningen the **trust in the government**, regarding agriculture, is relatively good compared to some other European and Dutch regions. The conversation is already in place and collaboration between local governments is also good.



3 | Long term & life cycle

Barriers

One of the main long-term challenges for extensive grazing systems lies in the **evolving regulatory landscape**. The Common Agricultural Policy (GLB) is shifting toward sustainability, with new eco-activities and conditionalities introduced in 2025. While this opens opportunities, it also creates uncertainty for farmers who must adapt to changing subsidy structures and compliance requirements. Navigating these changes requires administrative capacity and long-term planning, which can be a barrier for smaller or traditional farms.

Another barrier is the **lack of localized knowledge about disease and pest management** in wetter farming systems.

As water levels rise in peatlands, the risk of fungal diseases and pest outbreaks may increase, yet integrated pest management strategies for these conditions are still under development. Research into paludiculture and wetland-compatible crops is ongoing, but practical knowledge and extension services are not yet widely available for specifically the Groningen region. **Water security** is also a growing concern. Climate change is expected to bring more variability in precipitation and water availability, which could affect the feasibility of maintaining higher water tables in peatlands. While rewetting helps reduce CO₂ emissions and prevent peat degradation, it also increases dependency on consistent water supply and effective water management infrastructure. This makes long-term planning complex, especially in areas with competing land uses and infrastructure constraints.

Strengths and solutions

Despite these challenges, extensive grazing systems offer **significant long-term resilience**. By reducing input dependency and aligning with natural water and soil systems, these farms are better equipped to adapt to climate change. Lower livestock densities and flexible land use make it easier to respond to extreme weather, shifting regulations, and market changes. This adaptability enhances the overall robustness of the agricultural landscape in Groningen.

Moreover, extensive grazing is particularly well-suited to peatland areas. It aligns with the “water and soil-led” planning principle now guiding Dutch land use policy. By integrating water management with agricultural practices, farmers can contribute to climate mitigation while maintaining productive land use. This system-based approach supports long-term sustainability and policy alignment, making extensive grazing a strategic fit for the future of farming in the region.

4| Technical feasibility

Barriers

One of the key technical barriers to implementing extensive grazing in wetter peatland areas is **the lack of suitable machinery**. While there are agricultural equipment suppliers in Groningen, most machinery is still optimized for conventional, drier conditions. Specialized lightweight or amphibious equipment needed for wet soils is not yet widely available or affordable for most farmers in the region. This limits the ability to manage land effectively under higher water tables, which are often necessary for peat conservation and CO₂ reduction.

Another challenge lies in the apparent **contradiction between extensive grazing and the regional push for green gas production**. Green gas initiatives in Groningen rely heavily on manure fermentation, which requires a steady and substantial supply of manure. However, extensive systems typically involve fewer animals and less manure output. This creates a tension between two sustainability goals: reducing livestock for environmental reasons versus maintaining enough manure for energy production. Although innovations like biological acidification of manure have shown promise in reducing emissions and increasing gas yield, they are more compatible with intensive systems.

Infrastructure is another area of concern. Transitioning to extensive systems may require **different types of barns or housing systems** that support seasonal or outdoor grazing. These alternative stables often need to meet stricter environmental and animal welfare standards, and their design must be adapted to wetter conditions. While there are promising innovations in stall systems—such as those supported by the Taskforce Toekomstbestendige Stallen—these are still in development and often tailored to intensive systems. Adapting them for extensive, low-input models

remains a technical and financial challenge. Finally, the **hydrological complexity** of the Groningen landscape poses a significant technical barrier. The region is not flat, and water levels cannot be managed on a per-parcel basis without affecting neighbouring plots, infrastructure, or buildings. This makes it difficult to implement targeted water level increases for peat conservation or biodiversity without risking safety or damaging infrastructure. The Province of Groningen acknowledges this in its area plans, which emphasize the need for integrated **water management strategies** that consider both agricultural use and spatial planning.

Strengths and solutions

The Groningen region is already a **hub of agricultural innovation**, which positions it well for a timely and effective transition to extensive grazing. Many farms are experimenting with or adopting more extensive practices, creating a fertile ground for scaling up technical interventions. As more farms shift toward extensification, the demand for and development of supportive technologies—such as precision grazing tools, low-emission manure systems, and biodiversity monitoring—can accelerate, making these solutions more accessible and market-ready.

Compared to arable farming, the **technical challenges in extensive livestock systems are relatively limited**, as they often build on existing infrastructure and knowledge.

Furthermore, the Netherlands' **highly engineered water system offers a unique advantage**: in nearly all peatland areas, water levels can be actively managed and raised to support wetter, more climate-resilient grazing systems. This level of control over hydrology makes the implementation of extensive grazing not only feasible but also adaptable to future climate and policy demands.

5 | Economic viability

🚧 Barriers

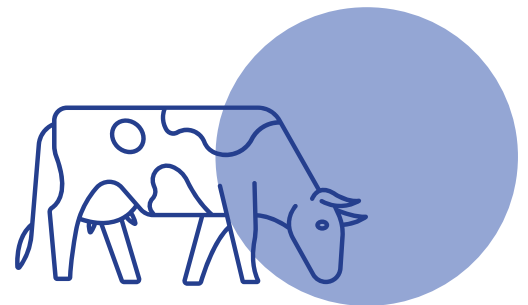
Extensive grazing systems present a fundamental challenge to the prevailing **global agricultural model**, which is largely built on the principle that **increased production leads to increased income**. This model incentivizes high-input, high-output farming, whereas extensive grazing requires a shift toward a business model that prioritizes lower inputs, reduced costs, and long-term sustainability. Making this switch is not just a technical or ecological decision—it demands a rethinking of profitability and value creation on the farm. For many farmers, this transition is daunting, especially in the absence of clear financial incentives or institutional support.

One of the most immediate financial implications of extensive grazing is the **reduction in livestock density**, which directly translates into lower milk production per hectare. This poses a significant challenge for farmers with existing mortgage obligations based on higher production levels. The reduced income potential under an extensive model can create tension with financial institutions, which often assess farm viability based on conventional productivity metrics. Without adjustments to these financial frameworks, farmers may find themselves unable to meet their repayment obligations, making the transition economically risky.

In addition to reduced production, the shift to extensive grazing may require **changes in infrastructure**, such as alternative barn designs that better suit outdoor or seasonal housing. These changes can introduce new financial burdens and complicate existing mortgage agreements. Banks and lenders may be unfamiliar with or skeptical of these alternative systems, leading to difficulties in securing financing or renegotiating terms. This adds another layer of complexity to the already challenging economic landscape of extensification.

Moreover, extensive systems are more **vulnerable to fluctuations in forage quality and availability**. If pasture quality declines—due to weather, soil conditions, or overuse—farmers may need to purchase additional feed to maintain animal health and productivity. This introduces a level of cost uncertainty that can undermine the economic benefits of extensification. The extent of this risk is closely tied to land ownership and access; farmers with limited land may be disproportionately affected, further exacerbating economic vulnerability.

Finally, to remain competitive and economically viable, farmers must/might **have to explore and develop alternative revenue streams**. This could include payments for ecosystem services, regional branding, or diversification into agritourism. However, creating these new income sources is not straightforward. There is often a gap between the compensation currently available for sustainable practices and the actual income needed to sustain a farm. Farmers need to be fairly paid for the broader societal and ecological benefits they provide—not merely compensated with symbolic or insufficient subsidies. Bridging this gap is essential for the long-term success of extensive grazing systems in the region.



Strengths and solutions

Despite the economic challenges associated with extensive grazing, the Groningen region offers several promising strengths that can support its viability.

One of the most notable developments is **Friesland Campina's biodiversity platform**, which includes a dedicated fund for meadow bird conservation. This initiative provides financial rewards of up to €300 per hectare for farmers who implement biodiversity-enhancing practices such as herb-rich grasslands, delayed mowing, and wetland creation. These payments help offset the income loss from reduced milk production and demonstrate a growing willingness among market players, banks, and governments to invest in ecological farming.

In addition to private initiatives, public compensation schemes under **the Agrarisch Natuur- en Landschapsbeheer (ANLb)** program offer substantial support. Farmers in designated areas of Groningen can receive payments for various nature management practices, including up to €2,631 per hectare for wetland creation and over €1,800 for herb-rich grassland management. These subsidies are coordinated through local agricultural collectives and provide a stable financial foundation for farmers engaging in extensive grazing and biodiversity conservation.

Another **innovative model is the "Valuta voor Veen" project**, which introduces a carbon credit system for peatland farmers

who raise water levels to reduce CO₂ emissions.

By preventing peat oxidation, farmers can earn tradable carbon credits through a national carbon bank, creating a new income stream while contributing to climate goals. This model is particularly relevant for Groningen's peat areas and aligns well with the ecological goals of extensive grazing.

The **concept of Payment for Ecosystem Services (PES)** is also gaining traction in the Netherlands. PES schemes reward landowners for maintaining or enhancing ecosystem services such as water regulation, biodiversity, and carbon sequestration. Although still in development, PES offers a framework for integrating ecological value into farm income, making extensive grazing more economically attractive.

Finally, **local diversity in farm business models** adds resilience to the regional agricultural economy. In areas like Gorecht, many farmers have already diversified their operations with campsites, farm shops, or educational activities. While these ventures often operate separately from the dairy business, they demonstrate the entrepreneurial capacity of farmers and the potential for integrating alternative income sources. Moreover, the coexistence of conventional farming on sandy and clay soils with extensive systems on peatlands creates a robust and adaptable agricultural landscape that can better withstand economic and environmental pressures.

6 | Sustainability

Barriers

From an environmental perspective, one of the main concerns with extensive grazing is its **contribution to greenhouse gas emissions**, particularly methane. Cattle farming remains one of the leading sources of agricultural emissions in the Netherlands, and even in extensive systems, ruminant digestion continues to produce significant methane output. While extensive grazing reduces input intensity, it does not eliminate this core environmental impact.

Another challenge is the **potential for overgrazing or mismanagement in sensitive peatland areas**. If grazing intensity is not carefully controlled, it can lead to soil compaction, damage to wetland vegetation, and disruption of water retention functions. Additionally, the rewetting of peatlands, essential for reducing CO₂ emissions, can be difficult to reconcile with traditional grazing practices, which often require drier conditions for animal welfare and accessibility.

Socially, there may be **economic barriers for farmers transitioning to extensive grazing models**. These systems typically yield lower productivity per hectare, which can affect income unless supported by subsidies or premium markets. Furthermore, the shift to extensive grazing may require changes in infrastructure, herd management, and land use planning, which can be resource-intensive and complex to implement.

Achieving full **CO₂ neutrality in agricultural systems is difficult** when land must remain productive and economically viable. In Groningen's area, extensive grazing offers environmental benefits, but reducing emissions often means lowering livestock density or changing land use, with an impact on income. Raising groundwater levels is effective for cutting peat CO₂ emissions, but it also limits traditional agricultural practices, creating a tension between ecological goals and maintaining a viable business model.

Strengths and solutions

Despite these challenges, extensive grazing offers several important sustainability benefits, particularly when integrated into peatland landscapes. One of its key environmental strengths is its role in **maintaining open landscapes**. Without grazing, many peatlands would undergo natural succession toward shrubland or forest, which can lead to increased drainage and CO₂ emissions. Grazing helps preserve the open, wet character of these ecosystems, supporting both climate goals and biodiversity.

Extensive grazing also contributes to **biodiversity conservation**. Grazing animals help control invasive species and promote a mosaic of vegetation types, which supports a wider range of flora and fauna. In addition, farmers involved in extensive grazing often play a crucial role in **maintaining hydraulic infrastructure**, such as ditches and sluices, which are essential for water management in peatland areas.

From a social perspective, extensive grazing aligns well with **low-input, nature-inclusive farming**, a model that is gaining traction in the Netherlands. It avoids competition between animal and human food sources, as animals graze on grasslands rather than consuming feed crops. This makes it a more resource-efficient system in terms of land and energy use.

Moreover, extensive grazing can be integrated into **agro-tourism and educational initiatives**, offering opportunities for public engagement and awareness-raising around sustainable land use. In regions like Groningen, where landscape identity and cultural heritage are closely tied to agriculture, extensive grazing can help preserve both ecological and social values.

Switching to more extensive grazing systems strengthens long-term sustainability by **aligning better with ecological limits and future policy directions**. Extensive systems typically involve fewer animals per hectare, which directly contributes to lower nitrogen emissions. This reduction is crucial for meeting national and EU environmental targets, especially in sensitive regions like peatlands. Research from Wageningen University shows that while technical innovations can help reduce emissions, extensification (reducing livestock density) is essential to achieving lasting environmental improvements.

Extensive grazing also fits better within future-proof agricultural systems. Studies from WUR and Deltares emphasize that sustainable land use must balance productivity with ecosystem services such as biodiversity, water regulation, and carbon storage. **Extensive systems are more adaptable to climate change** and less dependent on high-input farming, making them more resilient in the face of extreme weather and shifting regulations. This adaptability positions extensive grazing as a viable long-term strategy for farmers in Groningen.

Finally, moderate water level increases in peatlands, without reaching full surface-level saturation, can **reduce CO₂ emissions from peat oxidation while avoiding the introduction of methane emissions**. Methane, a much more potent greenhouse gas than CO₂, tends to be released when peatlands are fully saturated. Research from the Innovation Program Veen and NMI Agro shows that maintaining groundwater levels around 20–30 cm below surface can strike a balance: reducing CO₂ emissions without triggering significant methane release. This makes partial rewetting a practical and climate-smart option for extensive grazing systems in peat areas.



7| Time

Barriers

One of the most pressing barriers to implementing extensive grazing in Groningen is the **uncertainty and slow pace of political and administrative processes**. Although the Dutch government has set ambitious goals for 2030 under the National Program for Rural Areas (NPLG), the actual implementation at the provincial level remains in early stages. In Groningen, the area-based transition process only began in earnest in 2023, with the first full area plan adopted in early 2025. These processes are designed to be inclusive and collaborative, but their **voluntary nature and reliance on pioneering farmers** mean that progress is slow and fragmented. Area-based planning typically spans 5 to 10 years, which creates a significant **mismatch with the urgency of national climate, biodiversity, and nitrogen targets**. As a result, many farmers and stakeholders are hesitant to invest time and resources into extensive systems that are not yet structurally supported or incentivized. The risk is that political delays and indecision will outpace the ecological and economic transitions needed, leaving the region unprepared to meet its 2030 commitments.

Strengths and solutions

Farmers do not need to start entirely new types of businesses or acquire radically different skill sets to adopt extensive practices. **The core competencies of livestock management remain relevant**, and the shift primarily involves adjusting stocking rates and grazing strategies rather than overhauling entire operations. Moreover, the presence of pioneering farmers in the region has already generated valuable practical knowledge and experience. These **early adopters serve as a foundation for scaling up**, allowing future participants to learn from proven approaches and avoid common pitfalls. As a result, once broader support mechanisms are in place, the region can move quickly toward larger-scale adoption, leveraging the groundwork laid by these pioneers to accelerate the transition.



In a nutshell

The strength of extensive grazing lies in the fact that it **doesn't require a radical transformation** – rather, it presents primarily **technical and political challenges**. Still, it offers a solution that is likely to gain broad support, as it fits well within the existing system.

Joint conclusion

A | Extensive grazing in peatlands

An endangered model worth preserving and developing

Ruminant farming is generally already present in peaty marshes or moorlands due to their ability to make use of the forage resources of these environments. These livestock allow the landscape to be maintained and kept open. A low stocking rate is particularly suited to the carrying capacity of peatlands and their productivity. The meat and dairy sectors are also well structured in our pilot regions enabling opportunities in both short and long supply chains.

This report identified heterogeneous realities in our Western European territories:

- ▶ Most of the **Western French** peatland cattle breeding systems are already particularly extensive in nature adapting to the physical and regulatory constraints associated with these environments.
- ▶ This is not necessarily the case in **West Flanders and the Netherlands**, where intensive systems generally dominate.

A very concrete consequence of these diverse realities can be seen in **the price of the agricultural land**, which is much more expensive in the Benelux countries compared to western France. Land portage is therefore an ever more powerful lever to encourage farmers to transition to extensive systems in Flanders and the Netherlands.

In addition, all the livestock sectors of the areas studied face a common challenge: an **aging population** and a **renewal crisis** leading to spatial expansion of the farms and/or the gradual disappearance of these systems. This general crisis can be even more acute in peatlands because of their **specific technical constraints** and the skills needed to thrive in them.

Attracting younger generations to this sustainable farming model is then the main challenge. It can be combined with support for the transition from existing farms to more extensive ones. Extensive cattle breeding has several assets which could boost its appeal like its higher level of subsidies, low needs for investment and low expenses level.

The key is to promote the **attractiveness and accessibility** of the model. The solutions lie in communication, training, regional dialogue in environments with complex interplay of actors, and the public allocation of legible technical and economic supports.

Overall, the feasibility level of this business model seems good in all pilot regions. The challenge is to create regional dynamics. A difference is the level of maturity of these dynamics in the different regions, which involves different timings and actions.



B | Paludiculture

A strong potential that has yet to structure and prove itself

Paludiculture is a remarkable solution to the problem of agricultural production in peatland areas: it is based on crops that can produce in a high-water level environment compatible with the preservation of peat.

However, as of right now, paludiculture is mainly part of niche value chains that are not always sufficiently profitable. The structuring of this value chain is crucial to unlocking the development potential of paludiculture. It would overcome several significant barriers, such as the **lack of lucrative outlets** and difficult access to **specialized equipment** and know-how for farmers in wetlands.

This feasibility study looked at a wide range of wetland farming models, outlets and crops:

- ▶ **Cattails** planted and harvested in the wetland mainly for building materials in Groningen.
- ▶ Native **reeds** collected in the wetland for thatching and litter in western France.
- ▶ **Berries** bogs for local markets in western Ireland.

The various **regulatory conditions** require significant adaptation of practices depending on the country and local rules. For example, it is prohibited to plow or fertilize wetlands in France, which limits paludiculture to a form of “gathering.”

Overall, paludiculture **lacks clear legal recognition** and therefore misses out on agricultural subsidies such as those provided by the CAP. As a new economic model, it also lacks recognition by local

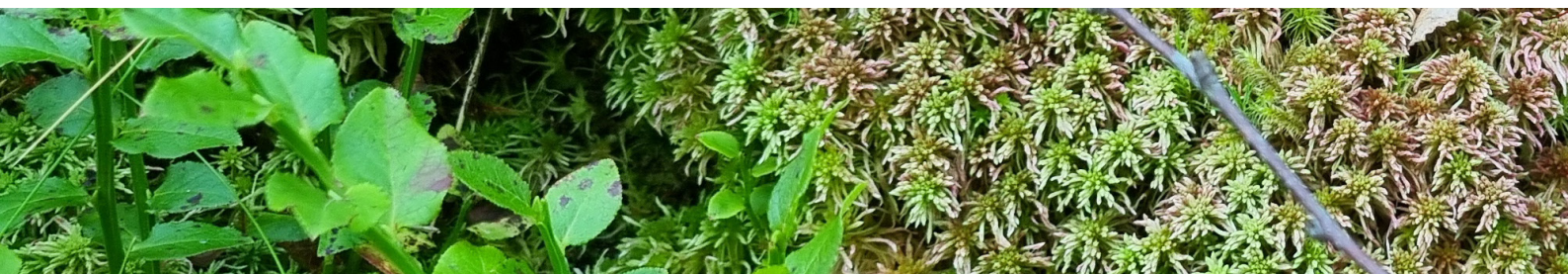
stakeholders including farmers and may even face **cultural resistance** compared to more traditional productions.

These local products also face stiff competition:

- ▶ Local Irish berries could theoretically defend themselves well against North American imports.
- ▶ The same can be said for French thatching where the demand for local reeds remains strong even though the market share of imports is growing due to a decline in domestic supply.
- ▶ For construction materials in the Netherlands, the cattail offers good performance compared to other bio-based solutions but not in the face of traditional solutions, which remain very much in the majority. Its market will therefore depend on the level of political will to move away from the fossil-based materials.

Overall, paludiculture is a promising solution but it needs to convince industries and farmers that it is an economically viable model. The **return on investment** can currently be rather negative if we include the costs of restoring peatlands. This business model must therefore be supplemented with public support or PES support. It can also rely on innovation that could improve its technical performance.

There is therefore still a degree of uncertainty regarding the **feasibility of large-scale deployment** of paludiculture. For the time being, however, it appears to be more feasible in **niche markets**.



C | Payment for ecosystem services

A lever for transition and support to sustainable practices

Payment for ecosystem services offer financial incentives to move towards environmentally virtuous practices. This business model is highly complementary to the previous two as it can only be a **supplement, a diversification of income** for the project leader.

It may be the result of private or public funding:

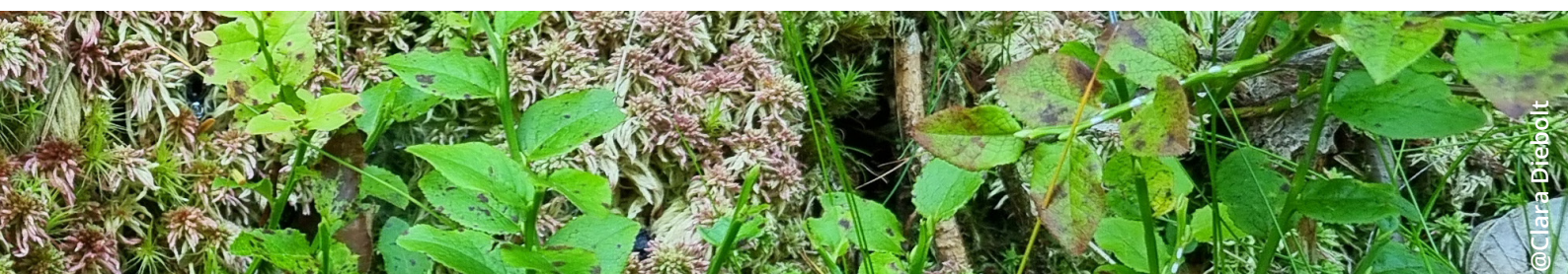
- ▶ For public funding, there are various regulatory limits in place to prevent distortions of competition. Some European funding like the AECM from the CAP is an example but the funding can also come from national, regional or local public structures (like the province of West Flanders).
- ▶ For private funding, it's mostly an over-the-counter market which means that it is based on contracts where the price and/or the project commitment are freely negotiated. It's therefore completely dependent on the willingness of the farmers and investors.

Their acceptability is **based on trust** and can therefore be undermined by various risks such as greenwashing, funding instability, failure to comply with commitments, regulatory changes (risk of losing additionality) or a lack of technical flexibility.

The **joint development of PES** allows both investors and farmers to be involved, to reassure and develop a solution tailored to everyone's needs and concerns.

These markets are not naturally occurring and need for a player to **connect supply and demand** and carry the **transition costs** (administrative and technical build-up and follow-up of the scheme). In our pilot region of West Flanders, the province is directly responsible for the process. In France, regional associations governed by farmers have taken on this responsibility.

Both have existing experiences and a positive context in their pilot territory that seems compatible with a **high level of feasibility for this business model**.



D | Peat free substrates

A growing market to meet an economic and environmental need

Peat free substrates are not strictly speaking a “on peatland” business model, even though it can use different types of biomasses from paludiculture. However, the development of this business model is important to limit a business model that has harmful direct environmental effects on peatlands: the **turf cutting**.

The overall international demand for substrates will increase substantially in the years to come driven by the Asian growth. In this context, the offer will also need to develop as much **creating business opportunities** for both the peat and peat free substrates.


However, the various alternatives to peat-based potting soils are each limited by different factors. Most of them suffer from **worse agronomic performances than peat**. Other have **higher prices** (like coco coir almost double as peat) or suffer from price volatility (like wooden chips affected by energy price variations). For some like composts, the transportation costs are too

significant, so **local deposits are necessary**. However, reserves appear to be generally sufficient in Europe.

Political will varies greatly from country to country, but it is strong in Germany, which is **driving the industry forward**. On the contrary, countries like France don't have any political commitment.

On the **customer side**, it will be necessary to convince both professionals, who generally demand an effective product, and private gardeners, who are not always aware of the environmental challenges surrounding peat.

Overall, there is a **clear highly feasible business case** with peat-free substrate. However, it seems difficult to imagine that the development of this business model will put an end to the harvesting of peat for horticultural use worldwide. It may still have an effect in Europe when combined with the increasing stricter regulations on peat uses and cutting.

 *Table: National Initiative to reduce peat in horticulture in European countries (Gruda, Hirschler and Stuart, 2024)*

Country	Last statement/goals set on horticultural peat	Form / Authority
Germany	Hobby sector: 100% reduction by 2026; professional sector: substantial reduction by 2030. The new government aims to develop an exit plan on peat use and extraction	German Ministry of Agriculture (BMEL)
	Hobby sector: 30% peat rate by 2025 and 10% by 2030; professional sector: 50% peat rate by 2025 and 30% by 2030	Self-commitment of the industry groups ZVG and VDG
	Hobby sector: 50% peat rate by 2025 and 30% by 2030; professional sector: 80% peat rate by 2025 and 70% by 2030	Self-commitment of the industry groups IVG, BdB and BHB
Ireland	Hobby sector: 100% peat use reduction by 2025; all sectors: by 2030, maximum 2030	A proposal from the Working group report to the Department of Housing, Local Government and Heritage
Netherlands	Hobby sector: max. 40% peat in 2025, max. 15% in 2030; professional sector: max. 65% in 2025, a new target to be set for 2030. Use of RPP peat, the goal for 2050 on climate neutrality in and max. 10% peat in all substrates	Agreement between the government and stakeholders
Flanders (Belgium)	All sectors: 65% peat rate (not including peat with “sustainable” label and non-reused peat) in all substrates in 2025	Agreement between the government and stakeholders
France	The peat-free alternative substrates could be addressed on an international level”	French Ministry of the Environment

E| In a nutshell

Preserving the environmental functionality of peatland areas while making these spaces valuable to their operators is a **difficult balance to strike**. Overall, the hydrological and pedological conditions of healthy peatlands make any kind of agricultural production in these areas **technically challenging**. However, this study has highlighted the feasibility to develop several business models that leverage these constraints and turn them into opportunities.

Extensive grazing is already well-established in regions like western France and offers high feasibility due to its environmental compatibility, low investment needs, and existing market structures. However, it will need to attract young people to continue to exist and develop.

Paludiculture, though ecologically sound, is currently performing better in niche markets (organic berries, thatched roofs...). Otherwise, it sometimes has large investment needs without lucrative outlets. However, provided it innovates and structures its value chain, it could have significant potential in the coming years. Better recognition, particularly legal recognition, will be necessary.

Payment for ecosystem services provides a valuable supplementary income stream, contingent on stakeholder trust and coordination.

Meanwhile, **peat-free substrates** are a necessity in a growing market where peat extraction will not be able to keep up anyway. In Europe, it's driven by environmental concerns and regulatory support even though the economic and agronomic performance of peat alternatives generally does not match its level.

In conclusion, **no business model was totally discarded** but they all face significant barriers that will need to be tackled. Most of these business models are **complementary and together can provide systemic solutions** to farmers and other economic actors in peatlands:

- ▶ Extensive grazing can be in tandem with paludiculture to make the most of each plot depending on its water level on a peatland farm.
- ▶ Paludiculture can produce biomasses for peat-free substrates.
- ▶ Payment for ecosystem services provides funds to stimulate the transition towards these different models while diversifying income.

