Peatland Forestry

"Building the European Peatlands Initiative: A Strong Alliance for Peatland Climate Protection in Europe"

A project formed under the European Climate Initiative (EUKI)—aims to strengthen pan-European collaboration for the protection, restoration, and sustainable use of peatlands. The project supports adopting peatland strategies and policies based on up-to-date data and enhances multi-stakeholder collaboration on peatlands. Moreover, it aims to share peatland restoration practices and foster multi-national cooperation between countries to mitigate climate change successfully on a European level.

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The project "Building the European Peatlands Initiative, formed under the European Climate Initiative (EUKI), aims to strengthen Europe-wide cooperation for the protection, restoration, and sustainable use of peatlands.

The project promotes adequate climate protection across Europe by supporting the adoption of strategies for peatlands based on up-to-date data and encouraging cooperation between different stakeholders. It also aims to exchange restoration practices and promote multinational cooperation to protect peatlands as an essential part of the climate solution.

Peatlands are essential ecosystems that cover only 3 to 4%[1] of the Earth's surface but store around a third of the world's soil carbon - more than twice the carbon of all forest biomass. However, these ecosystems have been severely degraded by man, resulting in around half of European peatlands being degraded and 10% being lost forever. European peatlands have been drained for agriculture and forestry, and peat extraction for energy production, horticulture and soil enrichment has further decimated these areas. As a result, although peatlands are essential for mitigating climate change, international and national legislation still needs to give them more importance.

State of peatlands in Europe

Source: Global Peatlands Assessment, p.125

Peatlands are naturally water-saturated ecosystems consisting of partially decomposed organic material called peat. Their ability to store carbon, prevent flooding and ensure water quality makes them invaluable to the global ecology. However, they become significant sources of greenhouse gas (GHG) emissions when drained. Globally, drained peatlands emit about 2 gigatonnes of CO_2e per year, about 4%[2] of total man-made emissions. In the EU, agricultural drainage of peatlands, which only accounts for 3%[3] of agricultural land, contributes 25% of the sector's emissions.

2Gt

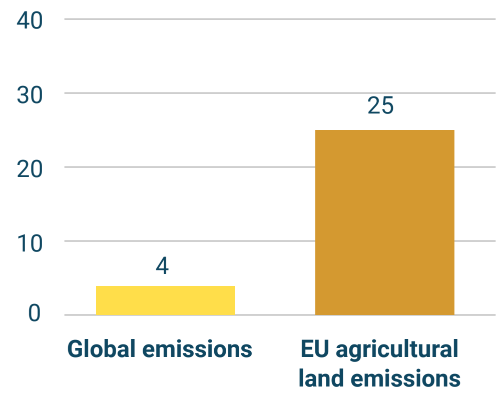
of CO_2e are emitted annually by drained peatlands

=

4%

of total man-made emissions

Contribution of Drained Peatlands to Global and EU Agricultural CO_2 Emissions (%)



1. Numbers according to UNEP (2022) Global Peatland Assessment https://www.unep.org/resources/global-peatlands-assessment-2022, p.7

2. Numbers according to: UNEP (2022) Global Peatlands Assessment https://www.unep.org/resources/global-peatlands-assessment-2022 p.13

3. Numbers according to: UNEP (2022) Global Peatlands Assessment https://www.unep.org/resources/global-peatlands-assessment-2022 p.140

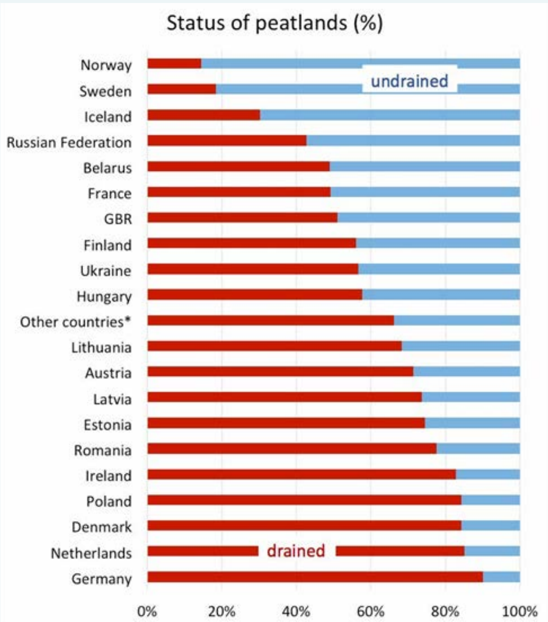
Peatland restoration offers an incredible opportunity to reverse these damaging trends. Rewetting drained forested peatlands, a proven restoration technique, can reduce net total soil GHG emissions by around 70%[4] and restore their ability to act as carbon sinks within decades. Greenhouse gas emissions from degraded peatlands in Europe are estimated at 582 Mt CO_2e per year[5], despite occupying only a small fraction of the land surface. This immense storage capacity highlights their critical role in climate stabilization. Beyond climate benefits, rewetted peatlands improve water retention, reducing the risk of floods and droughts in surrounding areas, and enhance water quality by filtering nutrients and pollutants. Furthermore, peatlands support a diverse range of species, including wetland birds, amphibians, and sphagnum mosses, many of which are highly specialized and dependent on the unique waterlogged conditions of these ecosystems.

Ultimately, protecting and restoring peatlands is not just a regional issue but a global imperative. By prioritizing these vital ecosystems in climate and conservation strategies, we can secure their benefits for generations to come.

EU Carbon Storage: The Crucial Role of Peatlands

582Mt **CO_2e** per year are the estimated greenhouse gas emissions from degraded peatlands in Europe.

Proportion of drained (red) and undrained (blue) peatlands in Europe per country (partly including organic soils)



Calculations are based on the drained area for forestry, agriculture and peat extraction.

*Sum of European countries with less than 100,000 hectares of peatland area.

Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre. p. 139

4. Escobar, D., Belyazid, S., Stefano Manzoni, S. (2022). *Back to the Future: Restoring Northern Drained Forested Peatlands for Climate Change Mitigation.* Retrieved from https://www.researchgate.net/publication/359060706_Back_to_the_Future_Restoring_Northern_Drained_Forested_Peatlands_for_Climate_Change_Mitigation p.5

5. Numbers according to: UNEP (2022) Global Peatlands Assessment https://www.unep.org/resources/global-peatlands-assessment-2022 p.140

Peatland Forestry

Peatlands are vital ecosystems that serve as carbon sinks, store water, and support biodiversity. However, unsustainable forestry practices, particularly draining peatlands for timber production, have caused significant environmental damage.

Draining peatlands for forestry accelerates peat oxidation, leading to substantial greenhouse gas emissions and the release of stored carbon. This degradation undermines the natural role of peatlands as carbon reservoirs and disrupts their ability to regulate water and support unique habitats.

Certain adaptive forestry practices can reduce these effects, particularly those that support hydrological stability to reduce peat degradation through rewetting. Such measures can reduce emissions, increase carbon storage and maintain or even restore peatland biodiversity.

Rewetting, where feasible, further enhances these benefits, restoring peatland hydrology and reducing emissions from degraded areas. While this is moving away from traditional forestry, note that sustainable management of peatland can be economically viable. Research highlights that continuous cover forestry in peatland forests can outperform traditional rotation forestry in long-term profitability, especially in spruce-dominated forests. Furthermore, the economic trade-offs of rewetting versus timber production demonstrate that rewetting provides higher ecosystem service value by improving water retention, sequestering carbon, and reducing greenhouse gas emissions, provided that the value in the provision of ecosystem services is properly recognised.

Peatland restoration efforts must consider the balance between timber production and the preservation of peatlands' ecological functions. Techniques such as rewetting and paludiculture — sustainable biomass production on wet peatlands — can harmonize economic activities with ecological conservation goals. These measures not only secure the multifunctional benefits of peatlands but also align forestry practices with global climate objectives. These incentives help landowners and stakeholders transition to practices that align with climate and biodiversity goals while preserving economic viability.

Avoiding unsustainable forestry practices is crucial for maintaining ecological services, such as carbon storage, biodiversity conservation, and water regulation, while also supporting economic resilience. By adopting sustainable methods and prioritizing restoration, peatland forestry can contribute to combating climate change and securing long-term environmental and economic benefits.

Rewetting vs Forestry

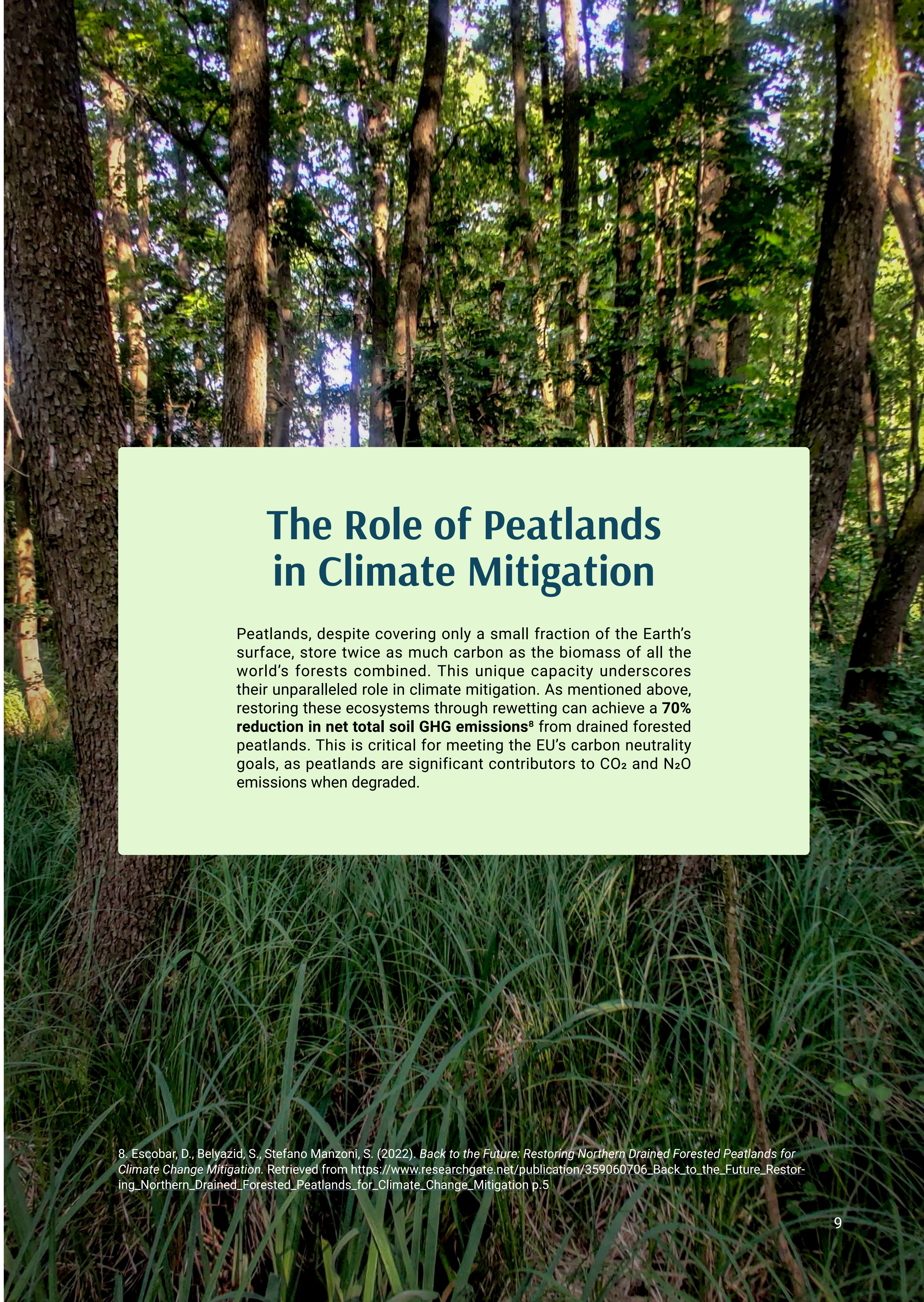
The relationship between rewetting and forestry on peatlands presents both challenges and opportunities. Rewetting restores the natural hydrology of peatlands, effectively halting greenhouse gas emissions like CO_2 and N_2O by ceasing peat decomposition. This process reinstates the crucial carbon sink function of peatlands and prevents ongoing soil degradation, including oxidation and nutrient loss.

In contrast, afforestation of drained peatlands often fails to fully restore ecosystem functions, with carbon losses from peat degradation outweighing the carbon sequestration achieved by tree biomass over a forest's life cycle. Studies have shown that drained forested peatlands emit significant greenhouse gases, while their water regulation and biodiversity functions remain compromised.

However, rewetting poses challenges for traditional forestry, as higher water levels can stress the root systems of non-adapted tree species, reduce tree growth, and complicate logging operations in waterlogged areas. Additionally, rewetted peatlands can produce methane emissions, especially in the early stages of rewetting[6]. Still, these emissions are outweighed by the long-term reductions in CO_2 and N_2O emissions, making rewetting the more climate-beneficial option[7].

6. Jurasinski, G. et al,. (2024). *Active afforestation of drained peatlands is not a viable option under the EU Nature Restoration Law.* Ambio, 53(970–983). https://doi.org/10.1007/s13280-024-02016-5

7. Greifswald Mire Centre & Wetlands International Europe. (2023). Questions & Answers: Bringing clarity on peatland rewetting and restoration. Briefing GMC WI-EA, 8 p. Available at: https://www.greifswaldmoor.de/files/dokumente/Infopapiere_Briefings/QA%20peatland%20rewetting_fin_2023-05-22.pdf



The Role of Peatlands in Climate Mitigation

Peatlands, despite covering only a small fraction of the Earth's surface, store twice as much carbon as the biomass of all the world's forests combined. This unique capacity underscores their unparalleled role in climate mitigation. As mentioned above, restoring these ecosystems through rewetting can achieve a **70% reduction in net total soil GHG emissions**[8] from drained forested peatlands. This is critical for meeting the EU's carbon neutrality goals, as peatlands are significant contributors to CO_2 and N_2O emissions when degraded.

8. Escobar, D., Belyazid, S., Stefano Manzoni, S. (2022). *Back to the Future: Restoring Northern Drained Forested Peatlands for Climate Change Mitigation.* Retrieved from https://www.researchgate.net/publication/359060706_Back_to_the_Future_Restoring_Northern_Drained_Forested_Peatlands_for_Climate_Change_Mitigation p.5

Forestry within Peatland Restoration

Forestry and peatland restoration are often viewed as conflicting objectives, yet innovative approaches offer pathways to align them. Alternative forestry practices, such as continuous cover forestry and Paludiculture, can integrate forestry into rewetted peatlands.

In particular, Paludiculture, the wet utilisation of rewetted and wet peatlands comprises the cultivation of wetland-adapted tree species in wet management schemes[9] for fuelwood or the cultivation of high-quality timber using peatland-adapted tree species such as black alder (*Alnus glutinosa*) and wetness-tolerant willow species (*Salix* spp.), enabling carbon storage while maintaining some economic returns for landowners. This approach leverages the multifunctional nature of peatlands, balancing climate goals with socioeconomic benefits.

Moreover, rewetting degraded peatlands enhances biodiversity by creating habitats for species dependent on wetland conditions. By adopting a **zoned approach**, poorly performing forestry areas can be prioritized for rewetting, while productive zones are managed conventionally, optimizing land-use efficiency. This strategy supports the creation of biodiversity corridors, strengthens ecosystem resilience, and balances rewetting and forestry objectives. For example, peatlands with low timber yields can be restored completely, while more productive areas can continue adaptive forestry practices. Such zoning enables ecological and economic goals to coexist, ensuring both biodiversity conservation and timber production are effectively achieved.

9. OrgBalt Project, 2024. *4th Technical Article: Peatland Restoration and Management.* Available at: https://www.orgbalt.eu/wp-content/uploads/2024/07/4th_technical_arrticle_Orgbalt-1.pdf

Policy Opportunities for Peatland Forestry and Peatland Restoration

Peatland restoration plays a pivotal role in advancing climate goals under the EU's climate policies, such as the Climate Law and the "Fit for 55" package, which aim to increase carbon sinks by 310 Mt CO_2 equivalent by 2050[10].

These efforts can be bolstered by EU standards on good agricultural and environmental condition of land (GAEC) like the GAEC2 under the Common Agricultural Policy, which emphasizes the protection of peatlands. However, limited budget and delayed implementation in several Member States highlight the need for enhanced policy enforcement and incentives to encourage timely restoration and sustainable forestry practices.

EU legislation like the **Nature Restoration Regulation**[11] provide a strong policy foundation for peatland restoration. This regulation emphasizes rewetting as a key component of restoring degraded ecosystems, including forestry-drained peatlands. Financial incentives, such as grants for transitioning to paludiculture or adopting sustainable forestry methods, are expected to offer vital support to landowners and stakeholders. These incentives must also mitigate economic losses associated with reduced timber yields during the transition phase, until a new economic model is settled.

Additionally, integrating peatland restoration into national strategies under the **LULUCF (Land Use, Land Use Change, and Forestry)** regulation enhances accountability and ensures alignment with EU-wide climate targets. Policies promoting research and innovation in wetland forestry, such as optimizing tree species and improving harvesting techniques on rewetted soils, further facilitate the coexistence of forestry and restoration efforts.

10. Numbers according to the European Green Deal: EU agrees to increase carbon removals through land use, forestry and agriculture. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6784

11. Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202401991

The Path Forward

Peatlands, described as "irreplaceable ecosystems" for their role in carbon storage and climate regulation, must be prioritized within forestry and land management strategies.

Policymakers have the opportunity to scale up rewetting efforts, incentivize sustainable forestry practices, and support multifunctional land use systems that harmonize economic, ecological, and climate objectives. Achieving these goals will require stronger enforcement of existing regulations, enhanced financial mechanisms, and collaborative approaches that engage stakeholders across sectors.

By aligning forestry with peatland restoration, the EU can not only meet its climate commitments but also secure the long-term ecological and economic resilience of its landscapes.

Sustainable Management of Peatland Forests

Sustainable forestry on peatlands requires a shift from traditional practices like drainage and clear cuts to methods that prioritize conservation and restoration of ecosystem services.

Key practices include Continuous Cover Forestry (CCF) to maintain a continuous canopy and longer rotations that minimize soil disturbance and paludiculture to cultivate wetland-adapted species. This involves careful planning, hydrological management, biodiversity enhancement, and ongoing monitoring. By implementing these practices and leveraging available policy and financial incentives, landowners can still maintain timber production while respecting the ecological needs of peatlands, contributing to carbon sequestration and biodiversity conservation.

Water Management

Effective water management is the cornerstone of sustainable forestry on peatlands, balancing the needs of tree growth, carbon storage, and ecosystem integrity.

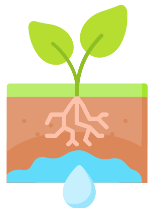
Water levels play a pivotal role in conservation of existing peat deposits and potential to form new peat, with significant implications for both forest productivity and climate mitigation.

The Role of Water Levels

Trees in peatland forests perform best when their roots remain above the water table. If the water table rises too high, anaerobic conditions can stress the roots, slow tree growth, and, in some cases, lead to methane emissions. Conversely, lowering the water table through excessive drainage accelerates peat decomposition, leading to substantial CO_2 emissions and long-term degradation of the peatland ecosystem.

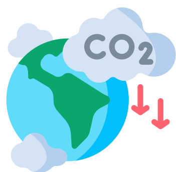
Sustainable Water Management Practices

To achieve ecological balance while meeting forestry needs, water levels must be well monitored and managed. A carefully designed water management plan can:



Maintain optimal root-zone moisture

This ensures tree health and growth while preventing water stress caused by excessively high or low water levels.



Reduce greenhouse gas emissions

By keeping peatlands wet enough to prevent decomposition but not excessively flooded, CO_2 emissions can be minimized without increasing methane release significantly.

Support biodiversity and hydrological functions

Proper water levels promote the natural hydrology of peatlands, preserving habitats for wetland-dependent species while maintaining water quality and flood prevention capabilities.

The Role of Peatland Restoration in Future Forestry

To address the increasing frequency and severity of summer droughts, along with rising water demands, water management must be restructured at the catchment and landscape level.

A key component of this strategy is the restoration of peatlands as natural water retention areas. In the future, particularly in central and southern Europe, foresters should retain surplus winter water to compensate for summer deficits, helping to prevent severe damage to forests on drier mineral soils. Rewetting peatlands and catchment areas will inevitably lead to the loss of conventional forests in these areas.

However, this approach will ensure a more stable water supply for surrounding forests, while also creating opportunities for wet afforestation with adapted species. Additionally, such measures will help mitigate or halt soil carbon loss. Achieving this transformation will require adjustments in policy frameworks and funding mechanisms to support long-term ecological and economic benefits.

Practical Recommendations

1. Assessment of Ditch Conditions

Landowners who own ditches should regularly inspect old drainage networks, especially in late summer, to prevent excessive drainage of peatlands.

While blocked or outdated ditches can be adjusted to restore natural hydrology, any modifications should also support forestry operations. However, it is important to recognize that periodic flooding is a natural characteristic of peatlands, and in many cases, maintaining this hydrology is preferable. Given the condition of certain stands, ditch adjustments may sometimes be justified, but they should not be framed as a matter of peatland conservation. Instead, the focus should remain on balancing hydrological restoration with the needs of wet cultivation.

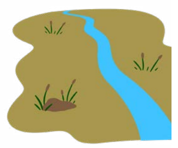
Furthermore, not all forestry operations require ditches. Some can be carried out effectively in ditch-free forests.

2. Rewetting and Controlled Drainage

Partial rewetting of specific zones can help preserve existing peat, reduce CO_2 emissions, and support ecosystem services while still allowing for some tree growth.

Controlled drainage, though potentially challenging, can be used to manage water levels dynamically, helping to mitigate methane emissions during the growing season.

Effective paludiculture has different mean water levels according to the species.To compensate for summer water deficits, retaining surplus winter water for as long as possible is essential, ensuring conditions are adapted to the needs of the targeted paludiculture species. This approach balances carbon release reduction while minimizing methane emissions during the vegetation period.



3. Buffer Zones and Hydrological Integrity

Designating buffer zones around drainage networks can help manage water flows, preventing excessive water loss and protecting areas of high ecological value.

This also supports adjacent biodiversity corridors and stabilizes hydrological cycles.

4. Innovative Water Retention Systems

Technologies like adjustable weirs or dams[12] can provide precise control over water levels, helping to prevent both excessive drainage and flooding.

These systems support the alignment of forestry objectives with peatland conservation while enhancing water retention at the catchment level.

Looking ahead, large-scale water management must also focus on reactivating natural retention areas within former river floodplains. This will be crucial for mitigating water deficits caused by increasingly severe and frequent summer droughts, which impact conventional agriculture and forestry on mineral soils. Restoring these retention capacities may also lead to new scenarios for wet alder carrs, shaping future landscape hydrology and land use strategies.

12. Ramsar Convention. (2018). *Briefing note 11: Practical peatland restoration.* Retrieved from https://www.ramsar.org/sites/default/files/documents/library/bn11_practical_peatland_restoration_e.pdf. P.7

Balancing Forestry and Water Management

The interplay between forestry and water management must consider both ecological and economic factors. Over-drainage for timber production can lead to increased CO_2 emissions and long-term damage to peatland functionality, undermining sustainability goals. By maintaining a focus on water regulation that supports natural hydrology, forestry operations can protect peatlands' critical ecosystem services while ensuring productive and sustainable use.

Ultimately, strategic water management is essential for fostering the coexistence of forestry and peatland preservation, mitigating climate impacts, and ensuring the resilience of these unique ecosystems.

Ditch network

Ditch networks, historically established to manage water levels in peatlands, have had severe environmental consequences. Draining peatlands for forestry, agriculture, or other purposes causes peat decomposition, leading to substantial greenhouse gas emissions, primarily CO_2, as well as a loss of biodiversity and long-term ecosystem degradation.

These networks disrupt the natural hydrology of peatlands, depleting their ability to store water and carbon effectively.

Poorly designed or overly maintained ditch systems exacerbate these issues. Drainage lowers the water table, exposing the peat to oxygen, which triggers decomposition and releases stored carbon. Furthermore, the drying of peatlands can lead to soil subsidence, increased fire risk, and the loss of habitats for species reliant on wetland conditions.

While some forestry operations depend on managed water levels, it is essential to recognize the ecological cost of drainage-focused practices. Maintaining a ditch network perpetuates the degradation of peatlands, undermining their ability to function as critical carbon sinks and natural water regulators. These impacts highlight the urgent need to reconsider the role of ditch networks in peatland landscapes, prioritizing practices that support ecological stability over prolonged drainage.

Transitioning Away from conventional Drainage Practices

Landowners with forestry operations on peatlands often rely on income derived from managed drainage. However, maintaining ditch networks is incompatible with the restoration and long-term health of peatlands. Instead of focusing on drainage, landowners can explore alternatives that protect peatlands' ecological integrity while generating sustainable income:

1. Rewetting and Restoration

Blocking drainage ditches to restore natural water levels is the most effective way to halt peat degradation. Rewetting prevents further carbon emissions and supports the re-establishment of peat-forming vegetation essential for forestry on peatlands. In regions like Central Europe, alder is a practical choice for wetland forestry, as it thrives under wet conditions and contributes to peat formation. While this approach may limit traditional forestry practices, it highlights the potential of sustainable, peat-friendly forestry methods tailored to wetland environments.

2. Rewetting and Paludiculture

This approach involves maintaining water-saturated conditions to support wetland cultivation practices, which can include growing species. These trees thrive under waterlogged conditions and offer economic value, providing an alternative income stream for landowners while preserving peatlands' carbon-storing capacity.

3. Continuous Cover Forestry

Transitioning to continuous cover forestry, where tree canopy structure is maintained, supports biodiversity and helps stabilize water levels. This method avoids clear-cutting, reduces disturbances to the soil, and can be adapted to accommodate rewetted conditions.

Best Practices for Rewetting and Water Management

If ditch networks are present, the focus should shift from maintaining drainage to promoting hydrological restoration:

Blocking Ditches

Fill or block ditches to raise the water table, thereby halting peat decomposition. This restores the natural hydrology, supporting both carbon sequestration and biodiversity.

Creating Buffer Zones

Establishing buffer zones around rewetted areas can enhance water regulation, protect sensitive habitats, and reduce the risk of nutrient runoff into water bodies.

Incorporating Hydrological Modelling

Using advanced modelling tools can help predict water flows and optimize the placement of rewetting interventions, minimizing ecological disruptions.

Fertilization

While fertilization can address certain nutrient deficiencies in peatland forests, its ecological implications must be carefully considered. Peatlands, by their nature, are carbon-rich ecosystems that play a critical role in mitigating climate change.

Fertilization practices, particularly those involving phosphorus and nitrogen, can accelerate peat degradation under drained or partially drained conditions. This results in the loss of the peat's function as a permanent carbon sink, trading long-term ecological benefits for short-term forest growth—a trade-off that is ecologically unsound.

Nutrient Imbalances and Peatland Degradation

Many peatlands, depending if fen or bog, and its state of drained or wet, are naturally abundant in nitrogen, but trees growing on these lands often struggle with phosphorus and potassium deficiencies. Addressing nutrient deficiencies through fertilization has shown mixed results. Studies indicate that while wood ash, rich in phosphorus and potassium, can stimulate tree growth, it may exacerbate peat decomposition when applied in areas that are not fully rewetted. In fully wet areas, it may even deteriorate the water quality. This is particularly concerning, as peat degradation releases stored carbon, undermining the climate benefits that peatlands inherently provide.

Nitrogen fertilization, commonly used on mineral soils, is unnecessary for peatlands and can further disrupt nutrient cycles, intensifying greenhouse gas emissions. Instead of supporting long-term ecosystem health, such practices risk transforming these landscapes from carbon sinks into significant sources of CO_2 emissions.

Limitations of Ash Fertilization

Ash fertilization has been promoted as an alternative to traditional drainage practices, with the rationale that healthier, faster-growing trees may reduce water levels through increased evapotranspiration. However, this approach has critical limitations:

Increased Peat Oxidation

Ash fertilization in drained or semi-drained peatlands can intensify peat oxidation, leading to a net loss of stored carbon over time.

Temporary Benefits

While tree growth may temporarily improve the soil fertility for most trees, the broader ecological consequences of mimicking a mineral soil cause disruption of peatland hydrology and a loss of biodiversity that relies on that hydrology, far outweighing the initial gains of ash fertilization.

Site-Specific Effectiveness

Fertilization is only effective on moderately drained sites with sufficient existing nutrient content. On nutrient-poor or overly drained peatlands, the benefits are minimal and may even worsen environmental degradation.

To protect peatland forests' long-term health, it's crucial to avoid nutrient-intensive interventions like fertilization on drained peatlands. Instead, focus on restoring and preserving the peat's natural state. Rewetted peatlands support healthier ecosystems, reduce greenhouse gas emissions, and maintain their role as long-term carbon sinks. Fertilization, even with benign materials, can disrupt ecological processes. This involves carefully considering less invasive alternatives to support tree growth and landowner livelihoods while safeguarding the ecological integrity of peatlands. By acknowledging the inherent risks of fertilization and emphasizing sustainable practices, we can ensure that peatlands continue to serve as vital ecosystems and climate regulators for generations to come.

Continuous Cover Forestry

Continuous Cover Forestry (CCF) is an innovative approach to forest management that prioritizes selective tree harvesting while maintaining a continuous canopy. It minimizes soil disturbance, supports biodiversity, and promotes long-term ecosystem health. This method is particularly suitable for peatlands, where restoration through CCF has proven more effective than conventional forestry.

Key practices, such as retaining sufficient tree cover to regulate water levels through evapotranspiration and reducing reliance on drainage systems, enhance the sustainability of peatland forests.

Studies indicate that CCF is financially viable, especially in spruce-dominated peatland forests[13]. Unlike conventional rotation forestry, it avoids costly silviculture expenses, such as soil preparation, artificial regeneration, and ditch maintenance, relying instead on natural regeneration. This cost-effective approach ensures steady timber yields and environmental benefits over time.

13. University of Eastern Finland. (2021). *Continuous cover forestry is financially profitable in spruce-dominated peatland forests.* Retrieved from https://www.uef.fi/en/article/continuous-cover-forestry-is-financially-profitable-in-spruce-dominated-peatland-forests

Key Drivers of CCF

Peatland Suitability

Spruce-dominated peatland forests are ideal for CCF due to their natural resilience and ability to sustain ecosystem services through selective thinning and the maintenance of sufficient canopy cover.

Cost Saving Opportunity

CCF eliminates expenses associated with soil preparation, sapling tending, and drainage maintenance. By reducing reliance on intensive management, it offers financial sustainability for forest owners.

Biodiversity-Friendly Practices

CCF aligns with biodiversity-friendly guidelines by promoting natural regeneration, reducing anthropogenic pressures, and retaining tree-related habitats. These practices improve forest resilience and adaptive capacity.

Benefits of Continuous Cover Forestry

Water Level Regulation

CCF helps regulate water levels in peatlands by maintaining sufficient tree cover. Evapotranspiration prevents excessive waterlogging, reducing the need for ditch maintenance.

Reduced Greenhouse Gas Emissions

Avoiding soil disturbance under CCF minimizes emissions of methane and carbon dioxide, contributing to climate change mitigation.

Enhanced Biodiversity

By promoting a diverse forest structure with varied tree species and age classes, CCF supports habitats for a wide range of flora and fauna. Deadwood retention and microhabitat conservation further enhance biodiversity.

Improved Soil Health

CCF preserves soil integrity by minimizing erosion, preventing compaction, and encouraging organic matter accumulation, resulting in healthier soils.

Long-Term Financial Sustainability

Although initial economic returns may be slower than with clear-cut systems, CCF ensures financial sustainability through steady timber production, reduced management costs, and reliance on natural regeneration.

Felling methods

Managing your forest effectively involves choosing the appropriate felling method tailored to your forest's unique characteristics and personal objectives as a landowner. All felling methods aim to foster healthy tree growth, ensuring forests remain productive and sustainable for future generations. Effective felling not only enhances forest biodiversity but also maximises the economic and ecological value of your woodland.

Regeneration Felling

Regeneration felling replaces an old tree generation with a new one, marking a harvest phase in the forest lifecycle. It is often the most financially rewarding method, yielding the largest amount of valuable timber.[14]

Clear Felling

This method removes the entire tree stock from an area, except for retention trees, naturally regenerating seedlings, and buffer zones around water bodies. The area is then replanted or sown with seeds. This method significantly alters the landscape, and post-harvest replanting or sowing is required. Although economically rewarding, clear felling has been associated with **soil carbon release and hydrological disruptions on peatlands.**

Seed-Tree and Shelterwood Felling

Promotes natural regeneration using existing trees.

- **Seed-tree felling** retains a few well-spaced trees to naturally regenerate pine-dominated forests on dry or semi-dry sites.
- **Shelterwood Felling** is commonly applied in spruce forests, leaving a protective canopy of 100–300[15] trees per hectare, particularly for spruce forests, to protect and promote the growth of seedlings. This method helps regulate soil moisture and reduce erosion.

14. For more details and practical measures of the Metsä Group Plus management model on regeneration felling, intermediate felling, young stand management and continuous cover methods see: https://www.metsagroup.com/metsaforest/sustainability/regenerative-forestry/metsa-group-plus/

15. Metsä on selection cutting for peatlands https://www.metsagroup.com/metsaforest/news-and-publications/articles/selection-cutting-is-suitable-for-peatlands/

Selection Cutting

This approach helps maintain stable water levels in peatlands, preventing peat decomposition and methane emissions. Individual or small groups of trees are selectively harvested based on age, size, and health. By minimizing canopy disturbance, it prevents peat decomposition and reduces methane emissions. This method promotes biodiversity, maintains a mixed-age forest structure, and avoids costs associated with drainage maintenance. However, skilled operators are essential, and it is most effective in forests with established seedling regeneration. Selection cutting also supports long-term forest health and can be repeated every 15-20 years.

Thinning

Thinning removes selected trees to improve the growth conditions of the remaining stand. It encourages trees to grow sturdier and more rapidly, increasing their quality and commercial value.

- **First Thinning:** Targets poor-quality or unhealthy trees, improving the growing conditions of the remaining stock. Typically performed in Nordic evironments when trees are 12–16[16] meters tall, this stage produces marketable roundwood.
- **Subsequent Thinning:** Focuses on enhancing tree sturdiness and transforming pulpwood into higher-value log wood.

Enhancing Biodiversity in Felling

Every felling method should incorporate practices to preserve forest biodiversity:

- Retention of decaying and dead trees to provide habitats for birds, insects and fungi.
- Creation of biodiversity stumps to support fungi and insect colonization.
- Buffer zones around water bodies to maintain water quality.
- Conservation of valuable habitats and protective thickets.

These measures ensure forests support various plant and animal life, safeguarding their ecological integrity.

16. Metsä: Different felling methods. https://www.metsagroup.com/metsaforest/wood-trade-and-forest-services/request-an-offer-on-wood-trade/different-felling-methods/

Professional Execution and Long-Term Planning

Skilled professionals are critical to minimizing environmental impacts during felling. Properly planned operations incorporate hydrological, carbon storage, and biodiversity considerations to align with sustainable management goals. For instance, rewetting drained peatlands post-felling reduces emissions and restores ecological balance.

Regenerative Forestry - Building Resilience in Peatland Forests

As a landowner, you have the opportunity to manage your peatland forest in a way that benefits both current and future generations. Regenerative forestry offers a sustainable approach, prioritizing not only timber production but also the health, biodiversity, and carbon storage potential of your forest ecosystem to include a closer-to-nature management.

What is Regenerative Forestry?

Regenerative forestry is a holistic approach to forest management that actively enhances the health, diversity, and resilience of forest ecosystems. Rather than focusing solely on resource extraction, it incorporates long-term ecological, social, and economic sustainability.

Peatlands, which are vital ecosystems rich in stored carbon, water, and biodiversity, benefit particularly from regenerative forestry. These areas, when managed carefully, can provide critical ecosystem services:

1. Provisioning Services

Timber, fuelwood, and non-timber products such as berries and mushrooms can be sustainably harvested while maintaining the ecological integrity of peatlands. Restored peatlands can also act as reservoirs for clean water and habitat for native species.

2. Regulating Services

Peatlands play a crucial role in carbon sequestration and climate regulation. Their waterlogged soils minimize carbon release, making them key assets in mitigating climate change. Additionally, they regulate water flow, reduce flooding, and protect soils from erosion.

3. Cultural Services

Peatland forests offer recreational, spiritual, and educational opportunities, fostering a deeper connection with nature.

4. Supporting Services

Peatlands support biodiversity by providing habitats for rare and specialized species, and they contribute to nutrient cycling and soil formation.

Regenerative Forestry Practices for Peatland Forests

To implement regenerative forestry in peatland ecosystems, practical, evidence-based techniques should focus on restoring hydrology, reducing soil disturbance, and enhancing biodiversity:

1. Restoring Hydrology and Water Balance

Rewetting Drained Peatlands

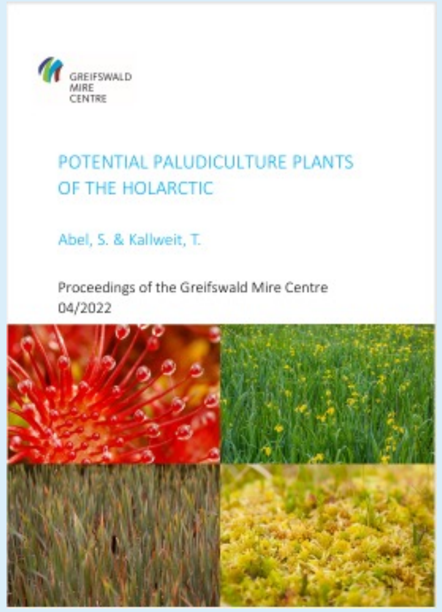
Restoring natural hydrological conditions is essential. Blocking drainage ditches, creating bunds, or allowing water to naturally re-accumulate helps restore peat-forming processes and reduces greenhouse gas emissions.

Minimizing Soil Disturbance

Avoid heavy machinery or activities that compact soil, as this can disrupt peatland hydrology.

2. Utilizing Native and Adaptive Tree Species

- Select tree species naturally adapted to peatland conditions, such as downy birch or Scots pine, which thrive in wet soils and contribute to ecological balance. Native species are better suited for nutrient cycling and local biodiversity support.
- Utilizing native and adaptive tree species is key to sustainable forestry on peatlands. For further guidance, the GMC publication on Potential Paludiculture Plants of the Holarctic provides a valuable resource, offering insights into suitable species for wetland environments.



3. Enhancing Forest Structural Diversity

Mixed-Species Planting

Introduce a mix of tree species with varying growth rates to create a resilient ecosystem.

Deadwood Retention

Leave old and decaying trees to provide critical habitats for fungi, invertebrates, and birds. Deadwood also plays a vital role in carbon and nutrient cycling.

4. Selective Cutting and Natural Regeneration

Implement continuous cover forestry techniques, such as selective cutting, to maintain canopy cover, stabilize water levels, and support natural regeneration. This approach avoids the soil disruption associated with clear-felling.

5. Protecting and Expanding Valuable Habitats

Identify unique peatland habitats, such as wet hollows or moss-rich areas, and prioritize their protection. These microhabitats are often hotspots for biodiversity. Establish buffer zones around sensitive areas to reduce edge effects and protect water quality.

6. Improving Carbon Sequestration

Peatlands naturally store vast amounts of carbon. Maintaining waterlogged conditions and minimizing disturbances are critical for keeping this carbon locked in the soil.

7. Creating Biodiversity Corridors

Enhance the connectivity of your peatland forest by linking it with other natural areas. Corridors and buffer zones allow species to move freely between habitats, strengthening the ecological network.

The Long-Term Vision for Peatland Forests

Regenerative forestry provides an opportunity to align timber production with ecological restoration and climate mitigation goals. By adopting practices tailored to peatland forests, you can:

• Safeguard your forest's ecological integrity.

• Enhance its resilience to climate change.

• Ensure sustainable economic returns through well-managed provisioning services.

• Improve natural water retntion needed for forestry on drier mineral soils in the catchment.

Peatland forests managed under regenerative principles not only leave a legacy of sustainability but also contribute significantly to global climate and biodiversity targets.

Monitoring and Support

Key indicators such as tree species composition, decaying wood volume, and forest age structure are essential for evaluating the success of regenerative forestry practices. For peatland forests, which are especially sensitive ecosystems, additional indicators like hydrological conditions and peat decomposition rates should also be incorporated. These factors are critical for maintaining the ecological integrity and carbon storage capacity of these unique landscapes. As with continued peatland decomposition (rate), carbon storage is not maintained.

Engaging a forester with specialized training in undrained peatland ecosystems is vital. Studies emphasize that traditional forestry methods may not suit these environments, and improperly trained foresters might inadvertently exacerbate peatland degradation. Continuous professional development, with a focus on practices like minimal intervention and rewetting, can significantly enhance the effectiveness of forest management strategies.

Collaborating with experts can aid in developing a tailored monitoring plan that includes both ecological and economic metrics. For example, transitioning to continuous cover forestry (CCF) in peatlands, a method proven to be financially and ecologically sustainable, minimizes soil disturbance and supports natural regeneration.

Looking at the Finances

Landowners can potentially enhance the financial viability of peatland-compatible forestry by leveraging available EU and national subsidies to support sustainable land management. Engaging with carbon credit programs designed explicitly for forestry, such as those linked to carbon sequestration, may offer long-term income opportunities. Collaborating with private investors or corporate social responsibility (CSR)-focused companies can help secure initial funding and market access for forestry projects.

Additionally, exploring income streams from non-wood products such as combining sustainable forestry with compatible activities like berry cultivation, could potentially enhance economic returns, offering a more diverse approach to land use and conservation if carefully developed and supported by evidence. Here are a few practical starting points to help begin the process and strategise your goals.

International Public Funding

EU-funded Initiatives

Projects like LIFE PeatCarbon, LIFE Mitraji (Wetlands), LIFE Multi-Peat, and Peat Pals for LIFE promote sustainable peatland management, including forestry. Joining such projects can provide valuable insights and frameworks for restoration activities and sustainable land use, emphasizing the balance between ecological and economic goals. However, it is important to note that new funding opportunities for landowners may not be available within existing projects, such as LIFE Multi-Peat and Peat Pals for LIFE. Instead, new proposals, like those submitted under the LIFE program, could be developed to secure funding for specific restoration efforts. For more information, refer to LIFE support for applicants.

Agri-environmental Payments

Government programs can incentivise paludiculture (wetland-compatible forestry) on peatlands. Examples include the CAP's eco-schemes, which reward sustainable practices.

Forest-Specific Subsidies

In Latvia, for instance, government-backed peatland restoration programs could be extended to forestry landowners focusing on native tree species or mixed-species plantations, aligning with carbon storage and sequestration goals. Please research your national government programs.

Carbon Markets and Ecosystem Credits

While carbon markets and ecosystem credits are growing in awareness and are being developed, we have not yet seen such an opportunity for peatland forestry. However, we wanted to draw your attention to income forms for peatland that is not forested.

Carbon Credits for Forestry in Peatlands

Programs such as the Peatland Code (UK) primarily focus on the restoration of degraded, *non-forested* peatlands through rewetting and habitat restoration to generate carbon credits. While these programs exclude forested land, they highlight opportunities for landowners to consider alternative uses for areas without trees. Forestry carbon credits, meanwhile, represent a growing market and can provide financial returns for sustainable forestry practices on suitable peatlands.

Bundled Ecosystem Credits

Schemes like MoorFutures (Germany) are designed to support landowners in restoring peatlands and integrate adaptive forestry practices. These projects combine carbon credits with biodiversity or water quality credits to create "eco-credits," incentivizing holistic peatland restoration and conservation. Similar to the Peatland Code, MoorFutures *excludes forested land*, emphasizing opportunities for integrated approaches on non-forested peatlands.

Private Sector and Innovative Financial Mechanisms

Private Equity and Impact Investment

Forestry projects that restore or sustainably manage peatlands appeal to impact investors seeking environmental and social returns. Partnerships with entities like the Landscape Finance Lab can help structure investments.

Blended Finance

Combining public subsidies with private investment through mechanisms like green bonds and concessional loans reduces the financial risks forestry projects on peatlands.

Corporate Partnerships

Businesses may fund peatland forestry projects as part of their Corporate Social Responsibility (CSR) initiatives, focusing on carbon offsetting and biodiversity goals. However, it is crucial to ensure that such sponsorships align with transparent, measurable, and scientifically grounded restoration outcomes to avoid accusations of greenwashing.

Entrepreneurial Opportunities in Forestry

Agroforestry

Combining peatland forestry with crops like berries or medicinal plants enhances biodiversity and diversifies income streams. Projects like those supported by LIFE Mitraji (Wetlands) show the potential of multifunctional landscapes.

Timber

Sustainable harvesting of fast-growing native species from rewetted or restored peatlands can be profitable.

Eco-tourism

Forestry projects integrated into peatlands can attract visitors interested in unique ecosystems, supporting local economies.

Examples of National Forestry Funding Support linked to Peatlands

Germany

In Germany some initiatives promote "paludiculture", combining wetland conservation with forestry. Other initiatives support the rewetting of peatlands, including those previously used for forestry, for peatland rewetting and restoration, such as under the EU Nature Restoration Law (part of the Green Deal), with targets to restore at least 30% of degraded peatlands by 2030—which may include some areas previously drained for forestry.

Belgium

Belgium has initiatives like the LIFE Wetlands4Cities combining ecological restoration with sustainable forestry practices through paludiculture rather than traditional forestry.

Estonia

Estonia uses EU LIFE funding for peatland restoration projects like LIFE Mires Estonia, which includes forestry-compatible activities such as planting native trees on rewetted lands.

Latvia

Latvia hosted LIFE REstore focusing on sustainable forestry on rewetted peatlands.

Finland

Finland provides national incentives, like the Catch the Carbon Initiative and Helmi Habitats Programme. The METSO Forest Biodiversity Programme supports biodiversity in areas impacted by commercial forestry and collaborates with initiatives like the Boreal Peatland LIFE project.

Considering these financial strategies could help you create a tailored plan that allows you to maintain viable peatland forest operations while contributing to carbon sequestration, biodiversity, and other ecosystem services.

Starting the journey

Any efforts toward peatland restoration and sustainable forestry management can feel like a significant step, but even small actions can make a big difference.

Simple initial measures, as described in this manual, are impactful first steps that can begin restoring the ecological balance of your land. Once you've taken these first steps, consider engaging in available eco-schemes or joining peatland conservation networks. Note currently they are more for full restoration of peatlands, rather than (agro) forestry. These programs offer valuable resources, funding, and support to help you maintain and expand your efforts while contributing to broader environmental goals.

Starting small and engaging with these initiatives can build a sustainable future for your peatland and its surrounding ecosystem.

Conclusion

As a landowner managing peatland areas, you play a crucial role in the balance between sustainable land use and environmental conservation.

By adopting practices such as rewetting, sustainable forestry, and more diverse land-uses, you actively contribute to safeguarding their invaluable carbon storage, water regulation, and biodiversity support functions.

The long-term success of these practices requires careful attention.The use of available funding and incentives, such as EU subsidies, carbon credits, and innovative financial mechanisms, can ensure that your efforts are financially viable as well as environmentally sustainable.

By starting with small, actionable steps and engaging in eco-schemes and peatland restoration networks, you are contributing to the preservation of a unique ecosystem that benefits both the environment and society. Your commitment to peatland forests benefits generations to come, fostering a legacy of environmental stewardship and sustainable land management.

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ELO European Landowners' Organization

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