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INTERREG CARE-PEAT

Care-Peat impact on Landemarais peatland in France

REPORT

Final overall report on the Care-Peat impact within Landemarais peatland, France

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Summary

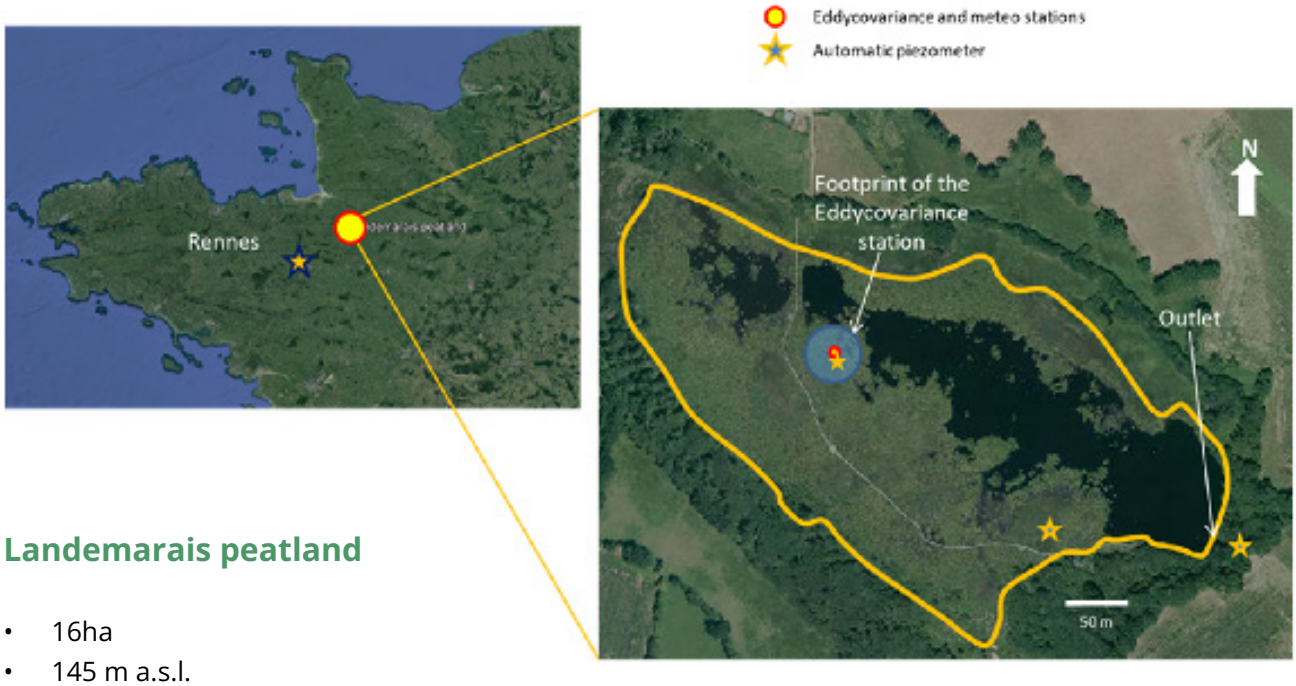
In North-West Europe, most of the peatlands are disturbed locally by human activities. Whatever the activity carried out (extraction, forestry, agriculture), the first step is to drain these wetlands, causing a decrease in the level of the water table. Peatlands naturally function as a carbon sink (C) for the atmosphere. However, the lowering of the water table caused by the drainage leads to increased mineralization of the peat due to the increased availability of oxygen over a greater peat thickness. The ecosystem can then become a source of C for the atmosphere and participate in global warming.

Restoring disturbed peatlands could therefore be an effective way of mitigating the effects of anthropogenic disturbances on the climate. Restoring peatlands contribute to the sustainable storage of C in the soil and thus mitigate climate change. Until now, peatland restoration success was estimated mainly with flora and fauna criteria. The criterion "storage of C" should become more and more important. Little is known on this subject and the transfer of knowledge towards site managers is very poor. Managers are probably less aware of restoration action leading to the recovering of the C storing capacity than actions promoting biodiversity. This is why, through the setting up of 7 pilots in the North-West European region, the Care-Peat project aims to highlight good management practices for the restoration of C storage capacity of peatlands.

In the investment work package WP I7, corresponding to the restoration works undertaken in the French site Landemarais, we capitalize on a previous restoration works realised in La Guette peatland in Région Centre Val de Loire project (WP I2). First, vegetation and the first 10 to 20 cm of peat were stripped over two areas of about 500 m2 to remove common species, *Carex paniculata*, and its seed bank in the top soil. Such a vegetation decreases biodiversity and probably promote carbon source function. Second, to promote in the long-term C storing, *Sphagnum* spp. patches were set up. It consisted in transplanting *Sphagnum* spp. taken in other parts of the site in 7 squares of 50 cm by 50 cm. In places. In aquatic area, an experiment with small *Sphagnum* rafts was undertaken. *Sphagnum* species were chosen because this moss is a very efficient plant to store C and because this moss is already present in this site. After less than one year of observation, the results on the vegetation showed that the *Sphagnum* survived and tended to expand.

Description of the sites

Located at an altitude of 145 m in the commune of Parigné in the Massif Armoricain **(Fig. 1)**, the Landemarais peatland is owned, managed and labelled as a "Sensitive Natural Area" (Espace Naturel Sensible - ENS) by the Ille et Vilaine County Council. It covers an area of 26 ha, essentially composed of sedge meadows **(Fig. 2)**, *Molinia caerulea*, ericaceous shrubs and a pond, with local *sphagnum* patches. The climate of the Landemarais site is oceanic. Annual rainfall is around 870 mm with an average annual air temperature of 11°C. The site is included in the SNO Tourbières **(Fig. 3)** labelled by the INSU, https://www.sno-tourbieres.cnrs.fr/) and in the long-term ecological research zone "Zone Atelier Armorique" (ZAAR, https://osur.univ-rennes1.fr/za-armorique) supported by the INEE. The site is mainly rainfed and



Landemarais peatland

- 16ha
- 145 m a.s.l.
- Protected area (Escape naturel Sensible)
- Managed and owned by Ille et Vilaine Country Council
- Part of French peatland observatory networks

Figure 1: Localisation of the Landemarais peatland.

Figure 2: *Carex paniculata* tussoks

Figure 3: Sites of the French peatland observatory network (Service National d'Observation Tourbières). Landemarais in located in the north-west part of France.

Restoration works

The objective for this pilot is make the first test in this site of peat stripping on the first 10 to 20 cm and adding *Sphagnum* in patches in 2 zones of approximately 20 m x 20 m. The 2 zones were chosen to have a difference in terms of water table to assess the effect of this variable on the growth of *Sphagnum*. The stripping of the peat will induce the growth of several plant species of interest.

The expected results are an increase in floristic diversity typical of peat and plant species of interest, beyond the quantities present before the management action, as well as an increase in the capacity to store C through a significant increase of the *Sphagnum* percentage cover.

2.1 Peat stripping

The restoration works in Landemarais peatland consisted in stripping 1) the vegetation, dominated by *Carex paniculata*, which decreases biodiversity (almost monospecific areas, Fig 2) and probably promotes C losses, and the first 10 to 20 cm of peat **(Fig. 4)**. The excavated peat (full of seeds of *Carex paniculata*) was placed in the wooded buffer area of the peatland, between the lateral canal and the peatland itself.

Figure 4: Overview of the two stripped area: **A)** relatively high water table depth area, **B)** relatively low water table depth.

2.2 *Sphagnum* setting-up

Sphagnum plants were collected from intact area to do dense patches when the situation was not too aquatic, and floating mats when the system was permanently aquatic.

2.2.1 Dense patches

Sphagnum mosses were taken outside the area to have enough materials to set up 6 dense patches in the less aquatic restored plots **(Fig. 5)**. They consisted in squares of 50 cm x 50 cm surrounded by cotton string to make the patch stable. Bamboo sticks were used to installed the cotton string and to serve as supports for *Sphagnum*.

Figure 5: Example of two dense *Sphagnum* patches within the wet restored plot.

2.2.2 Floating mats

In four squares of 50 cm x 50 cm of cork, a square of 40 cm x 40 cm was taken off to make frames. The four frames were linked together with cotton stings and a net made of hemp was installed at the bottom. *Sphagnum* plants were put within this "basket" to make a floating mat **(Fig. 6)**.

Figure 6: Cork frame **A)** within which *Sphagnum* plants were installed to make a floating mat **B)** fixed to a wooden stick.

2.3 Walk-board installation

Removable walk-board were constructed by the CD35 **(Fig. 4)**. They were installed on site in February 2023 the walk-board, at the same time as the collars for the GHG measurments **(Fig. 10)**. Finally, in March 2023, the monitoring started and the walk-board allowed to do the measurements without walking within the restored plots.

Figure 7: walk-board constructed by Jura the CD35 installed to have access to the collars to do fluxes measurements.

Monitoring and Restoration Outcomes

3.1 Monitoring plots and results

Monitoring in La Guette peatland started in March 2023 and continued up to September 2023. Collars were set up in the "less wet" restored area (n=6) and in a control area (n=6) dominated by *Carex paniculata*. Thanks to these walk-board, measuring can be done without trampling of the site **(Figs. 7 and 8)**. When possible, nets were used to assess the response of the system to varying radiation intensity. In the restored area, the measurements were made in bare peat plots (n=3) and in *Sphagnum* patches (n=3). In the control area, the measurements were made in bare peat plots (n=3) and in *Carex paniculata* tussocks (n=3).

Figure 8: Examples of GHG flux measurements in the restored area **(A - in a *Sphagnum* patch)** and in the control area **(B – with *Carex paniculata*)**.

The first results of CO2 fluxes show that *Carex paniculata* plots are exhibiting large ecosystem respiration (Reco) fluxes **(Fig. 9A, blue line)**. In spite of a large CO2 uptake, this system tends to functions as a source of CO2 most of the measuring times **(Fig. 9A, orange line)**. In all the other plots, Reco were lower **(Fig. 9)**. The results show that restored area functioned as a sink of CO2 during most of the measuring period. This highlights a positive effect of the restoration works on the CO2 fluxes during this first year.

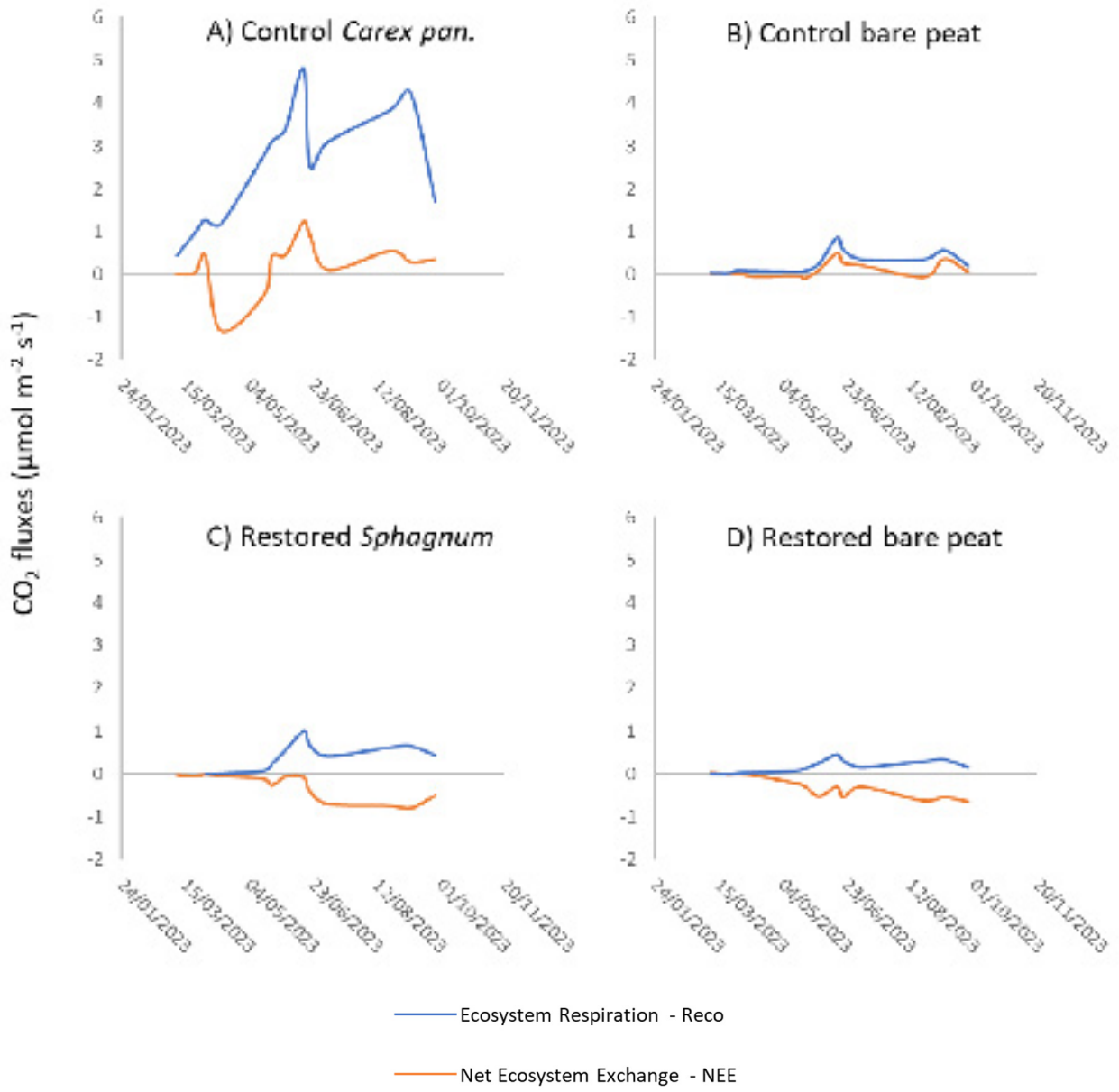


Figure 9: CO2 fluxes (n=3, in µmol m-2 s-1) in the Control with *Carex paniculata* (A), Control bare peat (B), Restored *sphagnum* (C) and Restored bare peat (D). The blue line represents ecosystem respiration, and the orange line represents the net ecosystem exchange.

3.2 Restoration results

Stripped area was quickly covered by typical colonising species (Juncus spp., *Hydrocotyle vulgaris*, *Drosera rotundifolia*). *Sphagnum* mosses were installed in February 2023. It survived the first year and tended to expand beyond their initial area. We can expect that the patches should grow in the next years. The year 2023 was not too dry, which helped the survival of the *Sphagnum*. However, the restoration success is highly dependent on the frequency and intensity of droughts that are observed years after years.

Stakeholder engagement

A workshop was organised in October 2023. A wide range of people with different interest was reached during this workshop, spanning from site managers to private companies. As most of the participants are involved in the management of large peatland in the North-West part of France (Cotentin peatlands and Brière peatlands, two of the largest peat storing area in France), a session was dedicated to the future of these sites. Issues on raising water level and C fluxes monitoring, as well as relationship with landowners (mainly farmers), all topics at the heart of Care-Peat, were discussed and future projects will emerge.

Overall conclusion

Setting up a pilot site in the Landemarais peatland was not only important to test restoration actions on C sink capacity in this specific site, but also a tool to communicate to managers and public on the necessity to restore peatlands. People involved in the pilot site could use the Care Peat work as a lever to reach the public through press articles and events. Finally, the Care Peat project was a focus point to many managers of the North-West France to start new project and collaboration in much larger peat storing sites.

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