LIVING LAB OF FRANCE

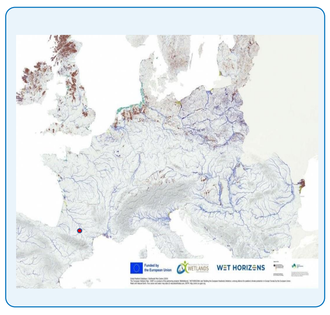
Confluent riverine wetland – a restored alluvial forest

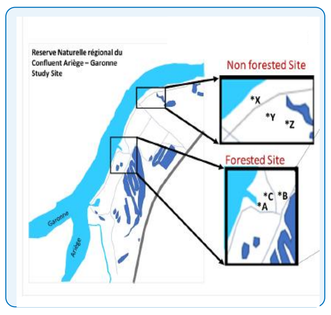


Five years of observations of GHG emissions in a riparian wetland with soil moisture gradient show that the intensity, frequency, and the proximity of the river combined with the type of soil, control the denitrification N_2O emissions regulated by enzymatic activity rather than gene abundance.

1 OUR LIVING LAB

WHERE?





THE CHALLENGE

Restoring alluvial wetlands improves water quality, reduces water pollution and GES emissions and increases the biodiversity.



WETLAND TYPES

- Alluvial and riverine wetlands, characterized by their direct link to flood dynamics.
- Nearly 300 hectares of wetland habitats and are divided into several ecological subtypes.
- Alluvial and riparian forests: These are streamside woodlands (willows, poplars) adapted to temporary flooding. They make up the bulk of the vegetation in the "ramiers".
- Wet meadows: Flood-prone grassy areas that serve as flood-spreading zones when the two rivers overflow.
- Hydraulic annexes and oxbow lakes: Marshy areas, former extraction pits, or channels cut off from the main river course. These stagnant or temporary waters are fed by groundwater and flood overflows.
- River interface zones are continuously reshaped by the current, essential for the nesting of certain birds.

CONTACT: José-Miguel SANCHEZ PEREZ
CNRS - France

jose-miguel.sanchez-perez@cnrs.fr

2 WHAT WE DID

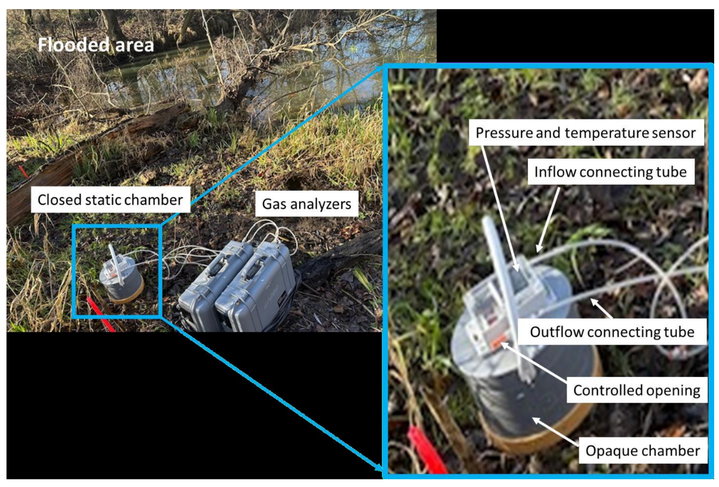
ACTIONS

5 years measurement of GHG at monthly time scale in 2 different sub sites with soil moisture gradient

Analyse biodiversity and organic matter degradation

Groudwater and soil water quality monitoring

Enzimatic activity analysis



WHAT WAS MEASURED?

- In situ GHG gas analyzers whit LI-COR LI-7820 N2O/H2O coupled to LI-7810 CH4/CO2/H2O
- N_2O production during flood-controlled conditions in the GHG-Aquacosme.
- Denitrifying enzyme activity (DEA) assessments.
- Soil pore water chemistry was collected using a microRhizon sampler.
- Assessment of bacterial diversity.
- Assessment of the diversity of N-transformation functional genes.





CO-CREATION

The study site is manage by the Regional Reserve association. The study site was involved for the last 5 years in many programs related to the evaluation of gaz emission, the soil biodiversity at Regional and European scale like Agrogreen and Below projects.

3 RESULTS & LEGACY

KEY FINDINGS

✓ forest cover showed that is better mitigating N_2O emission than unforested riparian sites with a mean emission of 0.23±0.29 µmol/m2/hr.

✓ The riparian areas with higher proximity to water bodies showed a higher mean N_2O flux with a very high variability when compared to sites with lower proximity to water bodies.

✓ Sites with lower proximity to water bodies have an average emission of 5.6± 14.4 µmol/m^2/hr and 0.60 ± 0.99 µmol/m^2/hr, respectively.

✓ Frequently flooded wet sites exhibited higher bacterial diversity, which negatively correlated with the $N_2O/(N_2O+N_2)$ ratio and denitrifier abundance.

BENEFITS & TRADE-OFFS

Climate mitigation	+
Biodiversity	++
Water quality	++
Production	+/−
Management costs	+/−
Stakeholder acceptance	++

++ strong positive
\+ positive
+/− mixed
− negative / trade-off

LESSONS

- It is complicate to catch the N_2O emissions in situ because it happens in a short period.
- By combining in situ measures and control conditions in laboratory we succeed in understanding the processes involved.
- The importance to combine the measures with modelling approaches to quantify the processes.

LEGACY AND NEXT STEPS

- Study the effect of long low water period scarcity on the N_2O emissions
- Study the effect of a high flood event of the N_2O emissions
- Study the control parameters upon the enzyme activities involved in N_2O emissions
- Modelling the N_2O emissions in riparian wetlands at fine time scale to catch the peaks
- Upscale the quantification of N_2O emissions at the scale of Europe
- Study the effect of new restorations on the emissions.
- Adding low cost measure for biodiversity

ONE KNOWLEDGE GAP

- The effect of extreme events on biodiversity functions and N_2O emissions.
- The effect of the climatic changes on the tipping point focus of the functions of the riparian wetlands.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.