LIVING LAB OF RAMPILLON (FRANCE)

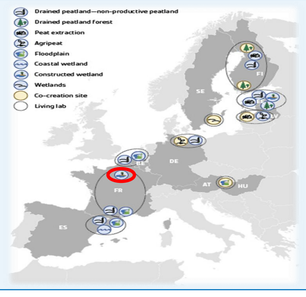
Monitoring restoration in constructed wetland



Transformation of agricultural area into wetland can support water quality, climate and biodiversity goals while balancing water, production, costs and stakeholder objectives.

1 OUR LIVING LAB

WHERE? Rampillon (70km South-East of Paris)





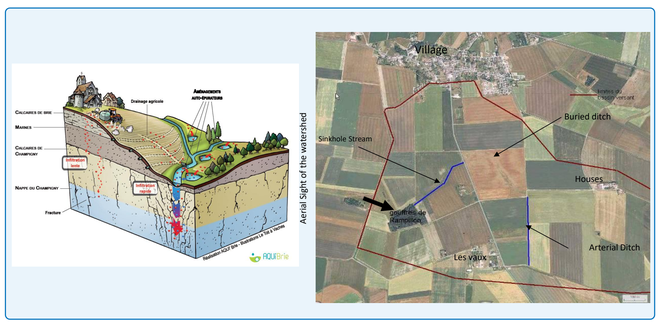
THE CHALLENGE: Carbon budget of artificial wetland

Considering all constructed wetland compartments to establish annual carbon budget and long term trajectory.
Assessment of water quality improvements and ecological trajectory.
Stimulating stakeholders' interactions.



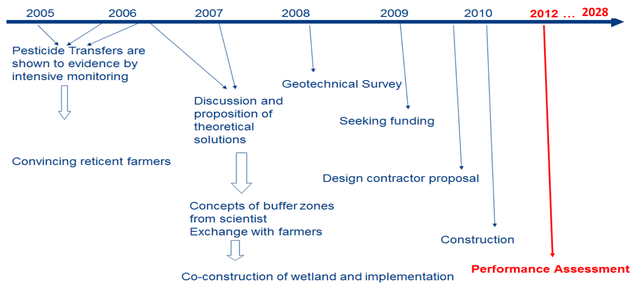
WETLAND TYPES

Conventional farming modified strongly landscape by land reclamation and water quality by use of chemicals. In order to mitigate non point pollution, a constructed Wetland (0.5ha) was built in 2010 to intercept water coming from subsurface drained area upstream (watershed 355ha).



CO-CREATION

A long step by step process involving local stakeholders since 2005 and on going





Workshops coupling different participatory approaches: individual and collective survey to share perception of wetlands (as buffer zone); field trip to share knowledge; agronomic simulator for long term economical scenario; serious game to support implementation of artificial wetlands

2 WHAT WE DID

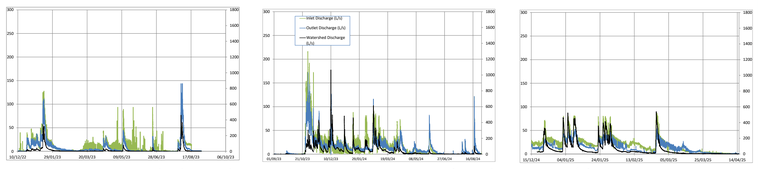
ACTIONS

- **Water management linked to hydrological catchment responses**
- **Natural processes for mitigation of nutrients and pesticides**
- **Biodiversity support – Ecological refuge or trap?**
- **Green House Gas (GHG) estimation**



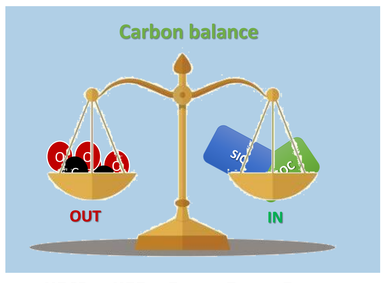
WHAT WAS MEASURED?

- Water quality : [NO3-] , DOC, DIC, pH , conductivity …
- Weather station, Waterflow
- Vegetation cover
- GHG emission : Eddy Covariance tower (CO2) ; Dark floating chamber (CO2, CH4 and N2O)
- Sediment sampling : organic and inorganic carbon
- Biodiversity inventory (8 taxons)

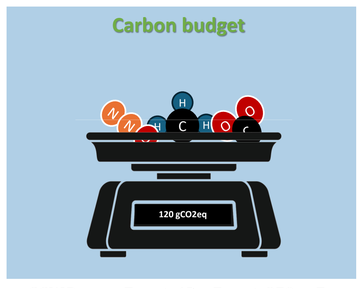


Hydrological monitoring 2022 to 2025 (Discharge in L/s)

WHAT WAS CALCULATED?



$$NECB = NEE + F_{CH4} + F_{DOC} + F_{DIC}$$



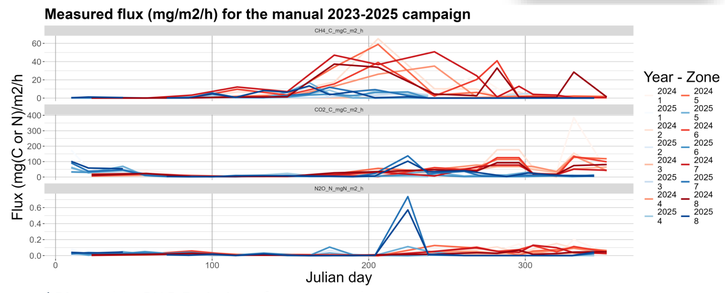
$$SGWP_{100} = F_{CO2} + 45 * F_{CH4} + 270 * F_{N2O}$$

- Water flow (inlet vs outlet)
- Nutrients and pesticides removal (flux in vs out)
- GHG fluxes and actual evapotranspiration
- Biodiversity index
- Ecotoxicity of pesticides on amphibians
- Temperature index around constructed wetland using remote sensing

3 RESULTS & LEGACY

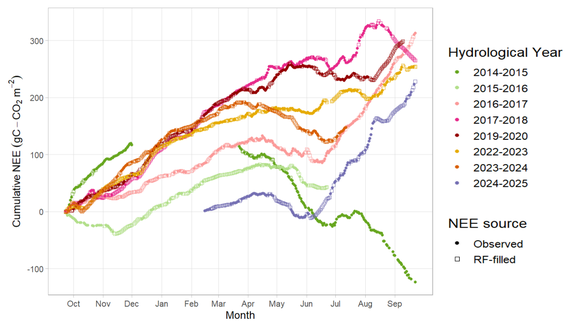


KEY FINDINGS

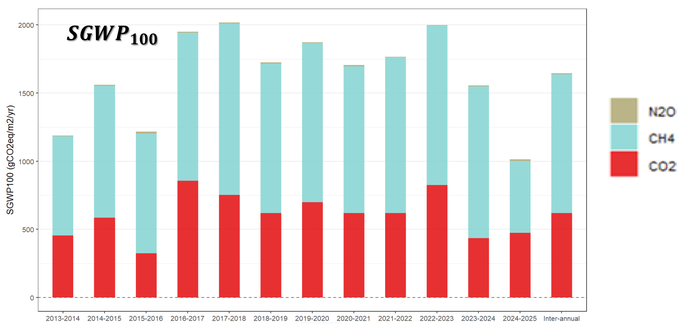


✓ Bimonthly GHG Emissions from manual chambers

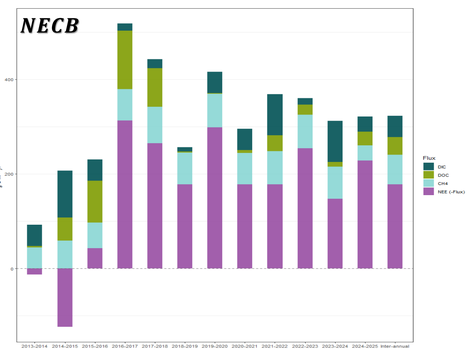
✓ Interannual CO_2 Emissions from Eddy Tower → Net emission of CO_2

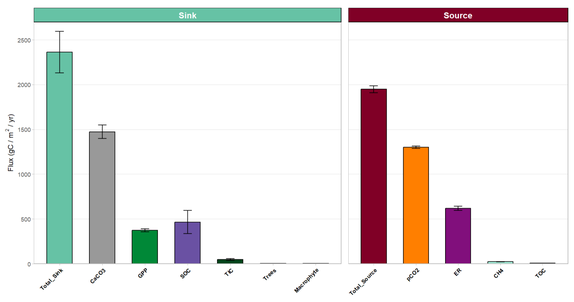


✓ As warming effect, despite a weak flux, CH_4 remains the main contributor



✓ NEE as main carbon compartment (microbial respiration)





✓ Carbon budget of constructed wetland → Respiration is counterbalanced by inorganic carbon storage in sediment

BENEFITS & TRADE-OFFS

Climate mitigation (depending to temperature and vegetation cover)	+–
Biodiversity (more than 200 species in the survey)	++
Water quality (-20mgNO_3/L and 35% pesticide removal)	+
Production (use land land for agricultural production)	–
Management costs (no intervention inside and control outside)	+
Stakeholder acceptance (positive for water agencies, negative for farmers)	+–

++ strong positive
+ positive
+/– mixed
– negative / trade-off

LESSONS

Understanding carbon cycles in the different compartments of constructed wetland was achieved.
Despite difficulties linked to seasonal and inter-annual variabilities (water level, vegetation cover).
Results could be applied for constructed wetlands built at outlet of subsurface drained watershed in loamy soil.

LEGACY AND NEXT STEPS

Constructed wetlands are now a mandatory requirement for all new agricultural subsurface drainage projects as buffer zones between agricultural plots and receiving water bodies.

ONE KNOWLEDGE GAP

Long term ecological trajectory of the constructed wetland is the next step.

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