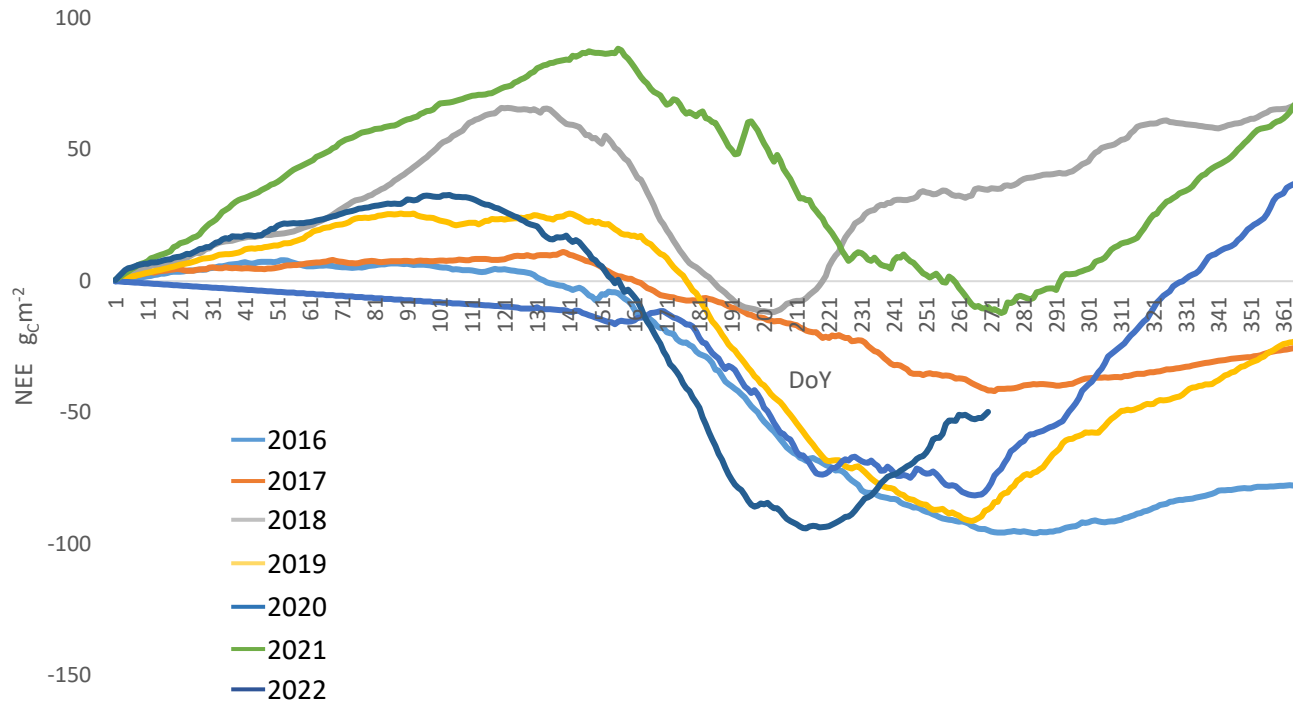


# A flux perspective over the Mechelse Heide

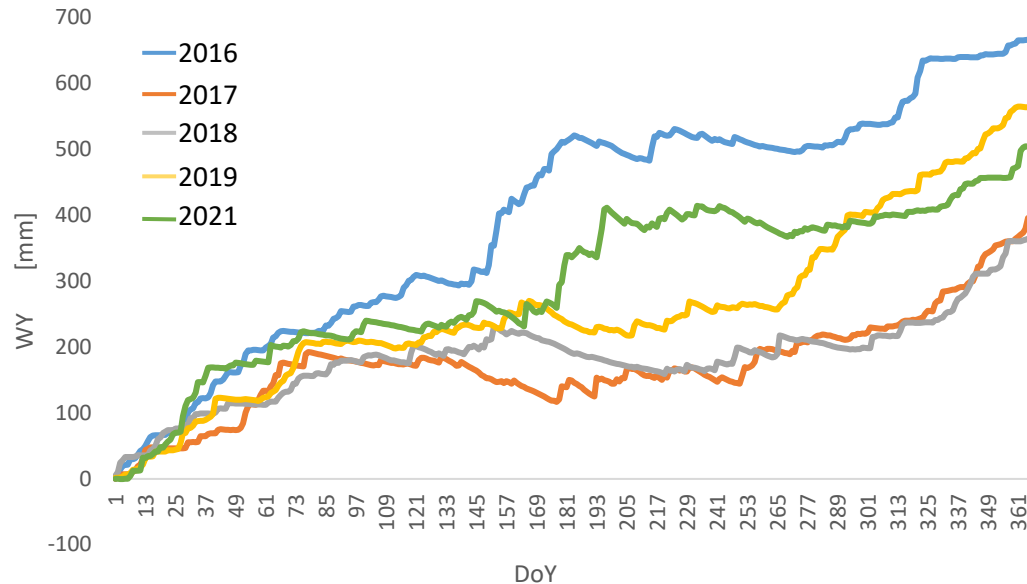
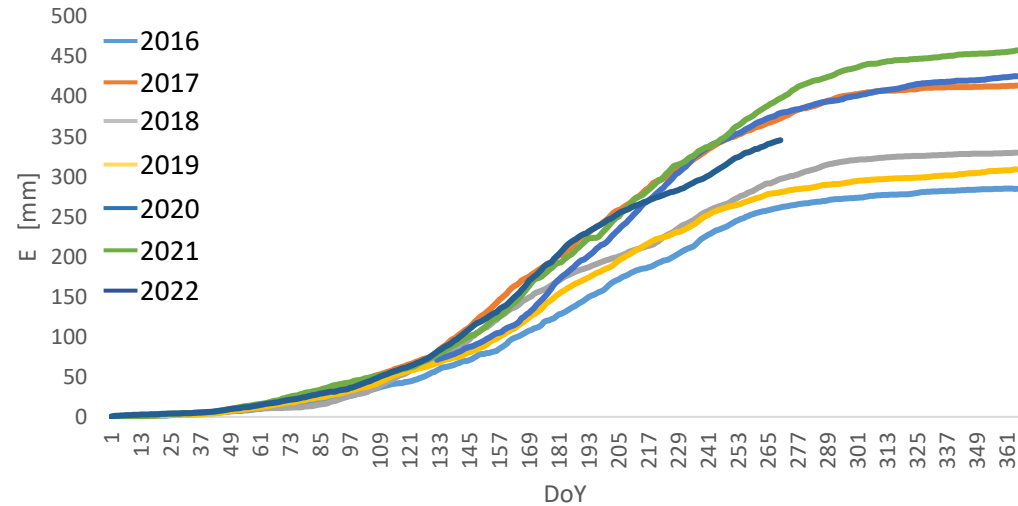
- Site description
- Carbon and water ecosystem budgets
- Carbon and water ecosystem efficiency
- Carbon monitoring and verification
- Conclusions

# Net Ecosystem Exchange



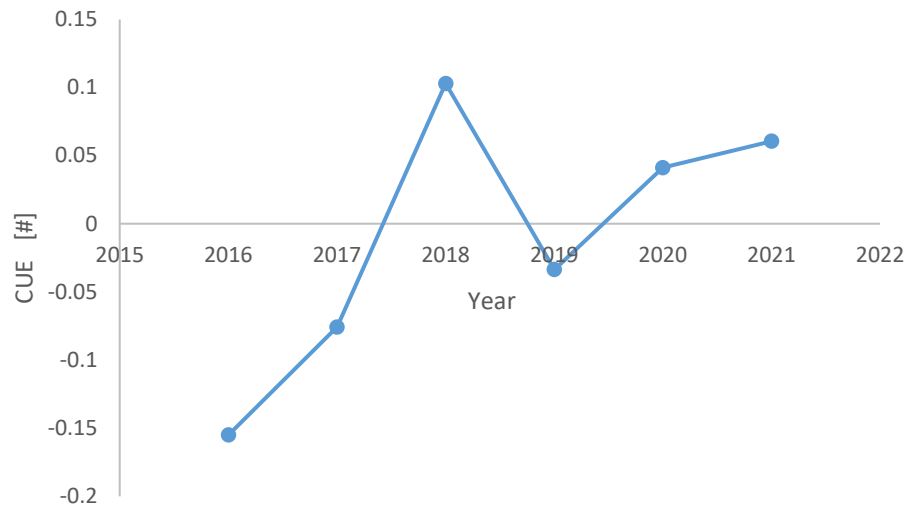
- NEE lies between positive and negative values, i.e. the heathland swings between sink and source
- Interannual average of NEE is close to zero, because annual magnitude is always low
- Significant reduction in 2018 likely attributable to summer drought (similar reduction apparently also from 2022 preliminary data)

# Evapotranspiration and Water Yield



- Water Yield, i.e. the net water retain/loss neglecting run off, is always positive
- Average WY ( $498\text{mm}^{-1}$ ) is larger than global average of temperate forests ( $315\text{mm}^{-1}$ ) obtained from +20y flux datasets

# Heathland ecosystem carbon efficiency

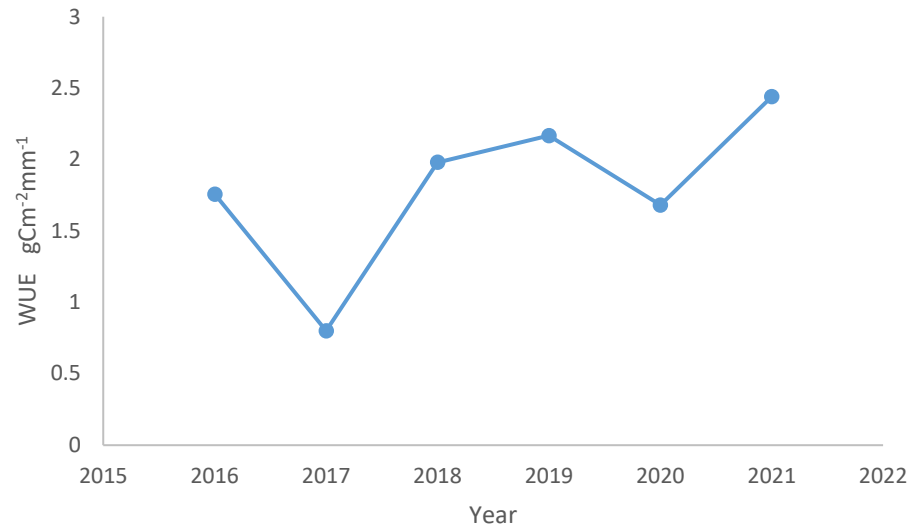


Average  $CUE_{MHeide} = -0.010 \pm 0.088$

Average  $CUE_{TempFor} = -0.22 \pm 0.20$

- Carbon use efficiency, i.e.  $NEP/GPP$ , is very low and, following the  $NEP$  oscillatory trend, changes sign.
- Compared to temperate forests the value is low, despite large uncertainty in global averages indicating a low efficiency of the heathland ecosystem in storing the uptaken carbon

# Heathland ecosystem water efficiency



Average  $WUE_{MHeide} = 1.80 \pm 0.52 \text{ gCm}^{-2}\text{mm}^{-1}$

Average  $WUE_{TempFor} = 2.96 \pm 1.14 \text{ gCm}^{-2}\text{mm}^{-1}$

- Water use efficiency, i.e.  $GPP/E$ , is relatively stable and always lower than global forest averages, including temperate and Mediterranean forests
- It suggests a moderate to low efficiency of the heathland in the carbon fixed by photosynthesis, compared to the water “used” for the process

# Carbon “removals” verification

- On November 2022 the European Commission issued a proposal for legislation, aiming at defining an European Union certification framework, with methodologies valid for specific sectors (bioenergy with carbon capture and storage or carbon storage in wood based construction but also carbon farming in agriculture and forestry)
- Expert group from outside the Commission (industry, academies, private and public organizations) is working on methodologies to be proposed to the legislators (European Parliament and the European Council)
- Eddy covariance based estimation, despite complex and lacking spatial representativeness, still provide a direct estimate of carbon removals from specific ecosystem and land uses, whose uncertainty can be estimated.
- Combined with biometric and remote/proximal sensing measurements, the methodology could be used as a verification tool for selected cases of “monitoring, reporting and verification” of carbon removals, especially when deployed in publicly managed institutions, e.g. the Hoge Kempen Park