

# Dynamics of dissolved organic matter after peatland restoration

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**Characteristics of dissolved organic matter following 20 years of peatland restoration. The Science of the Total Environment (2009, Sci. Tot. Environ. 408, 78-83)**

**Fiedler, S.<sup>1</sup>, Höll, B.<sup>2</sup>, Kalbitz, K.<sup>3</sup>, Freibauer, A.<sup>4</sup>, Drösler, M.<sup>5</sup>, Stahr, K.<sup>1</sup>, Jungkunst, H.F.<sup>6</sup>**

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# C budget of a peatland (Worral et al., 2009)

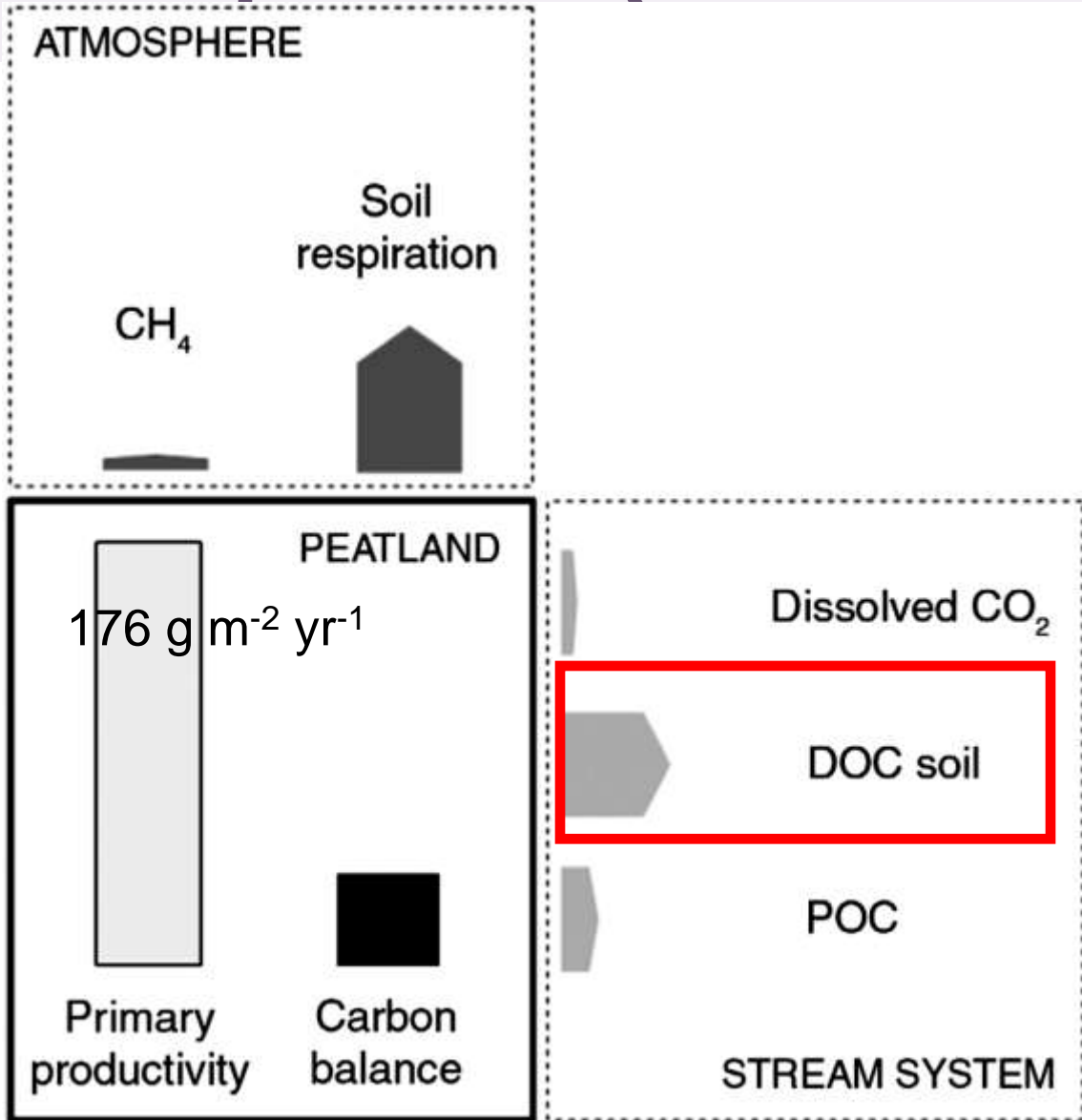
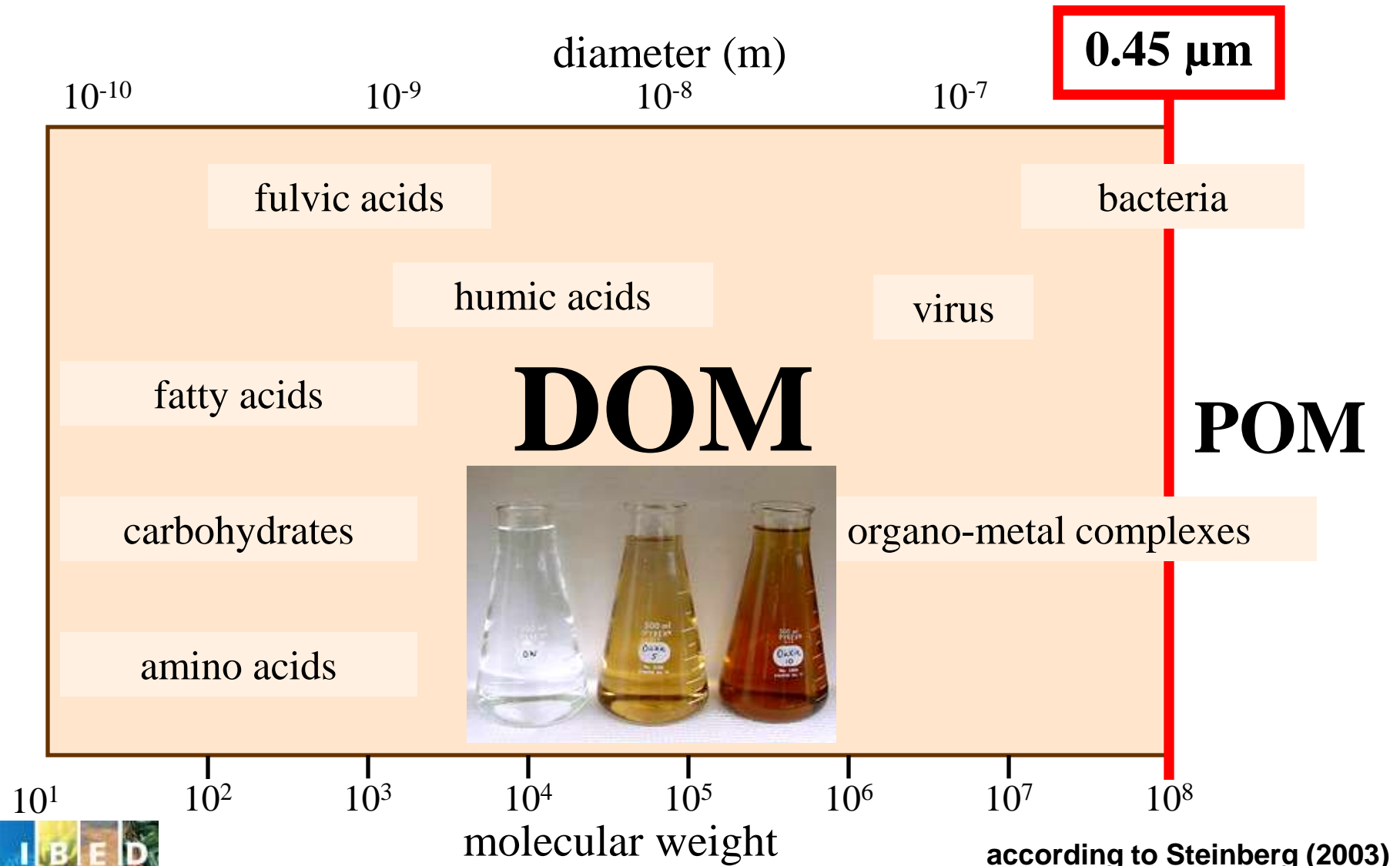


Fig. 7. A schematic representation of the amount and pathways of carbon loss and uptake from the study site.



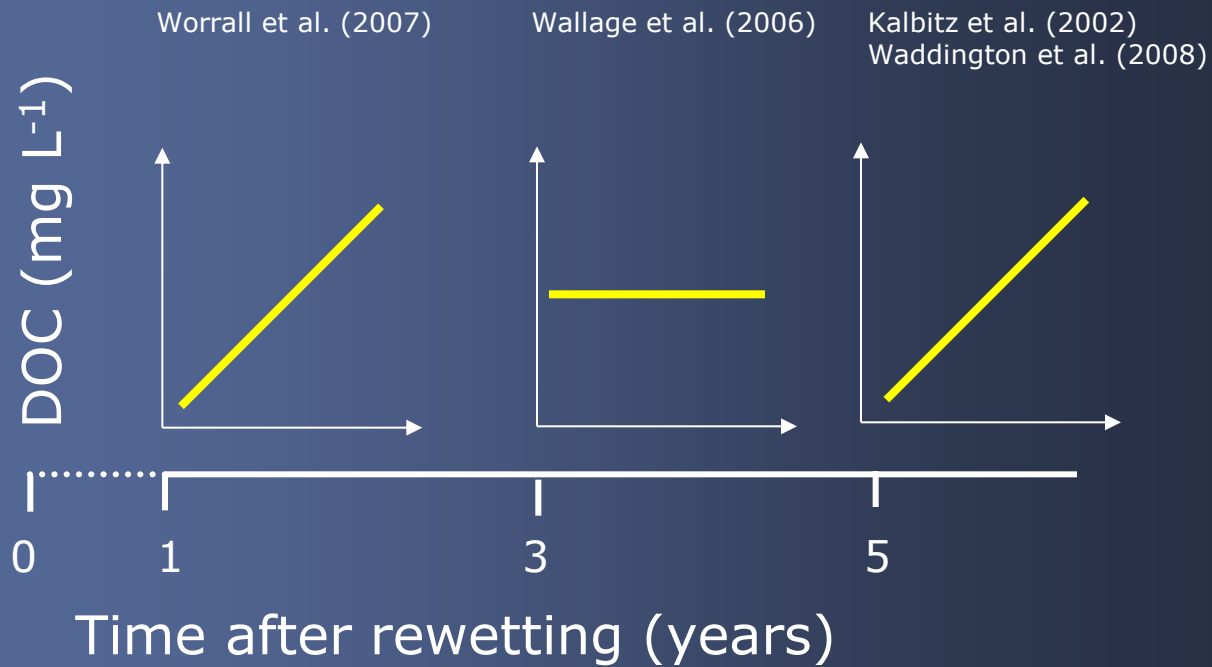
# Dissolved organic matter – DOM



according to Steinberg (2003)



# What do we know: Effects of peat restoration on DOM



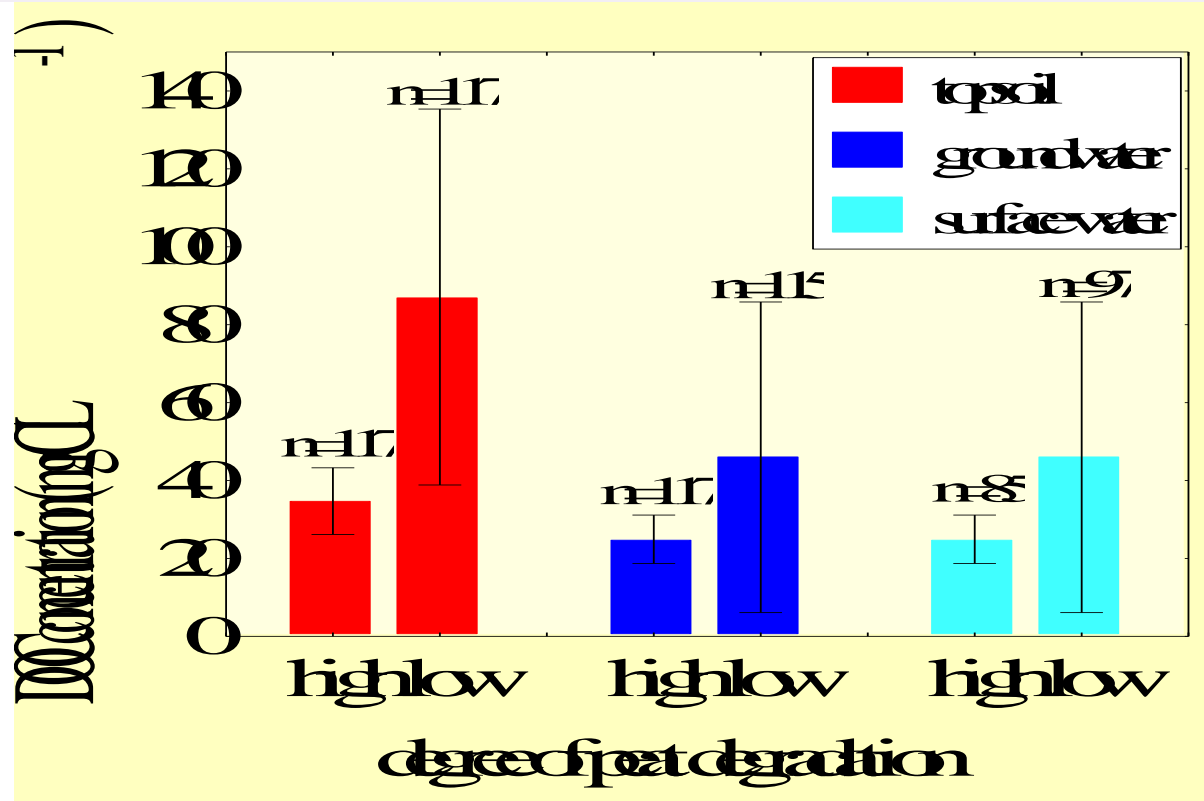
# What do we know: Effects of peat restoration on DOM (results from the 'Drömbling' fen area)



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Sites with restoration measures and lower degree of peat degradation:

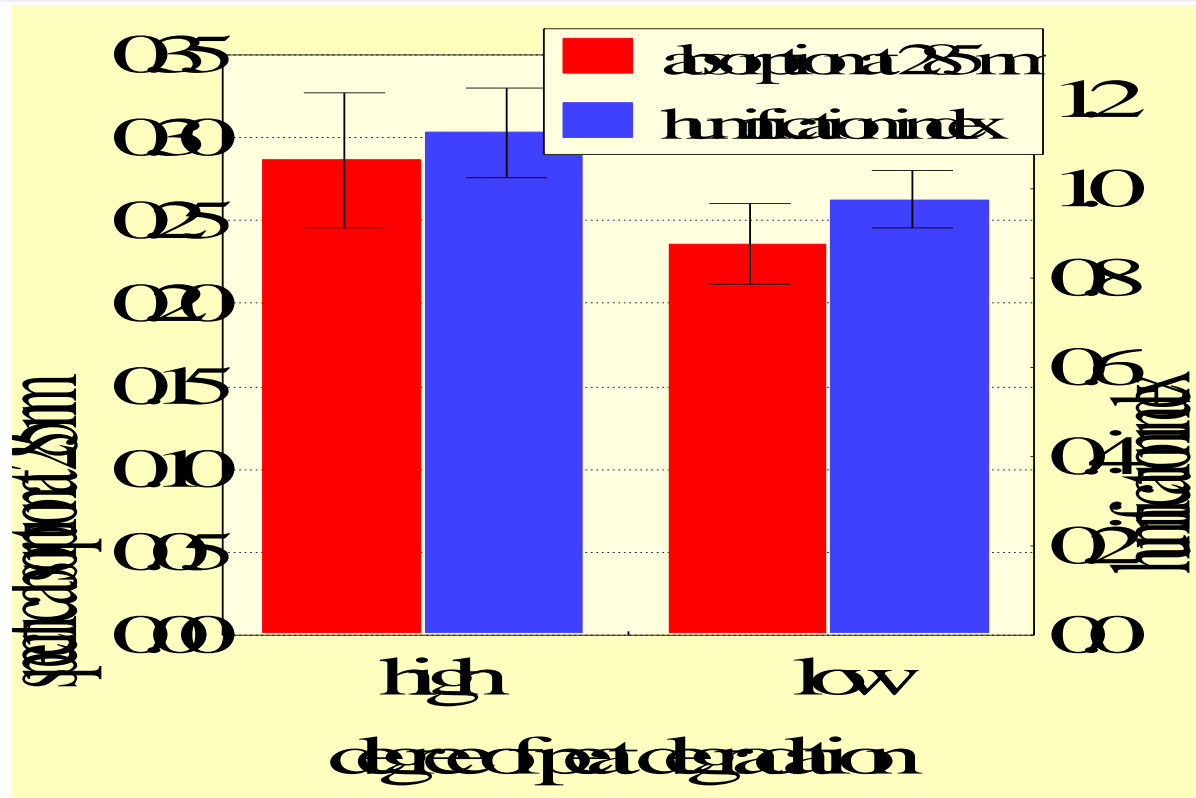
- higher DOC concentrations



Kalbitz et al, 1999, redrawn



# What do we know: Effects of peat restoration on DOM (results from the 'Drömbling' fen area)



Sites with restoration measures and smaller degree of peat degradation:

- lower proportions of aromatic compounds
- younger

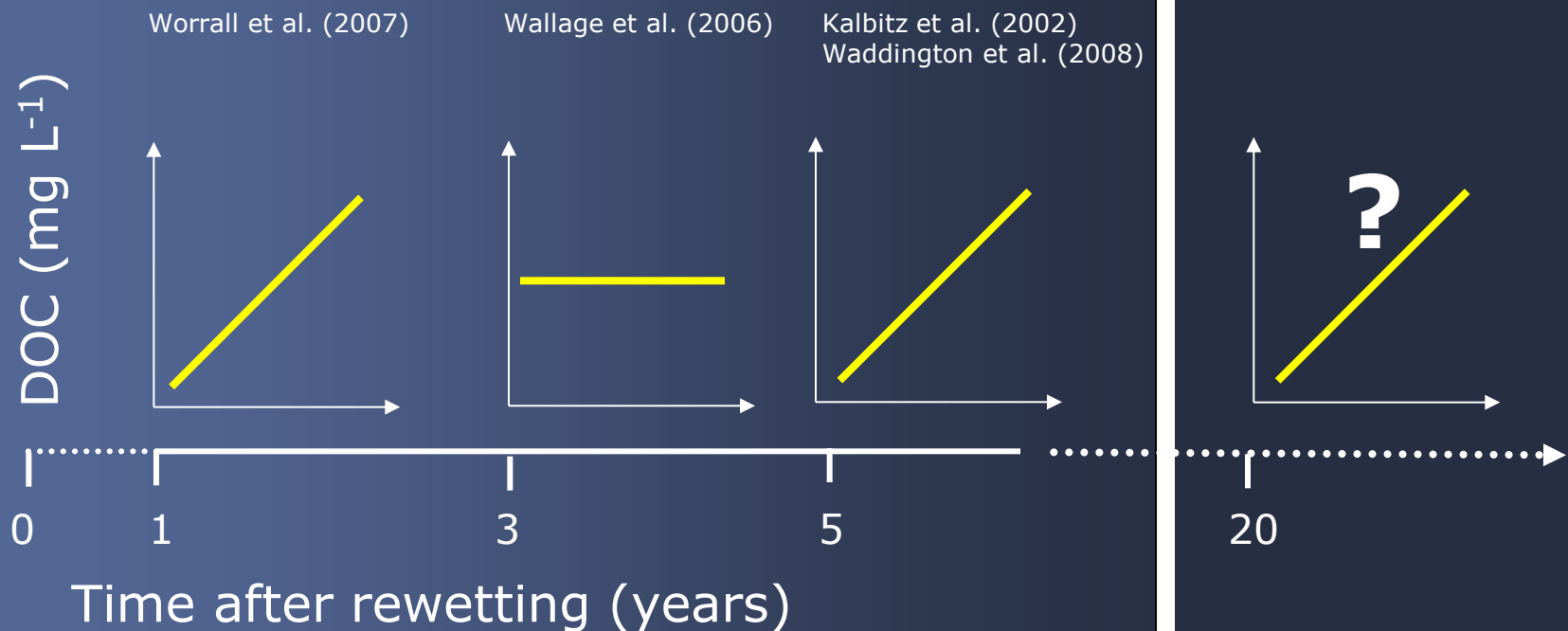


Kalbitz 2001, redrawn





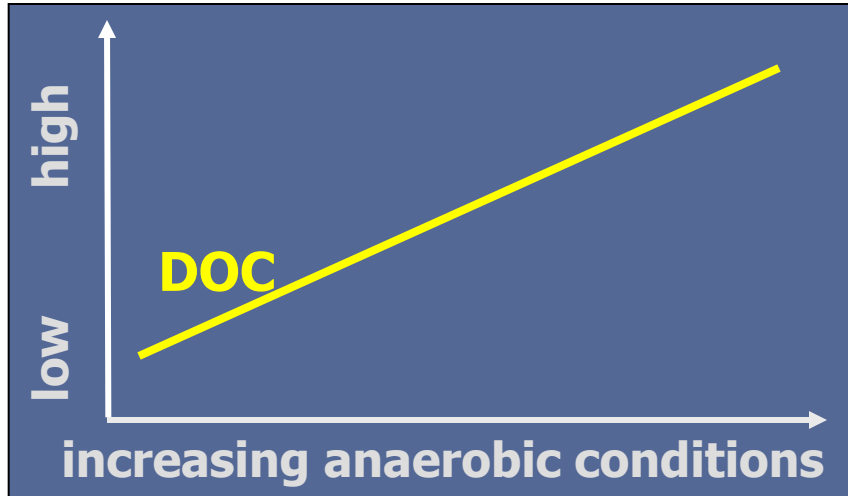
# What do we know: Effects of peat restoration on DOM



**□ Just a small number of field studies without any long-term study**

# We expect:

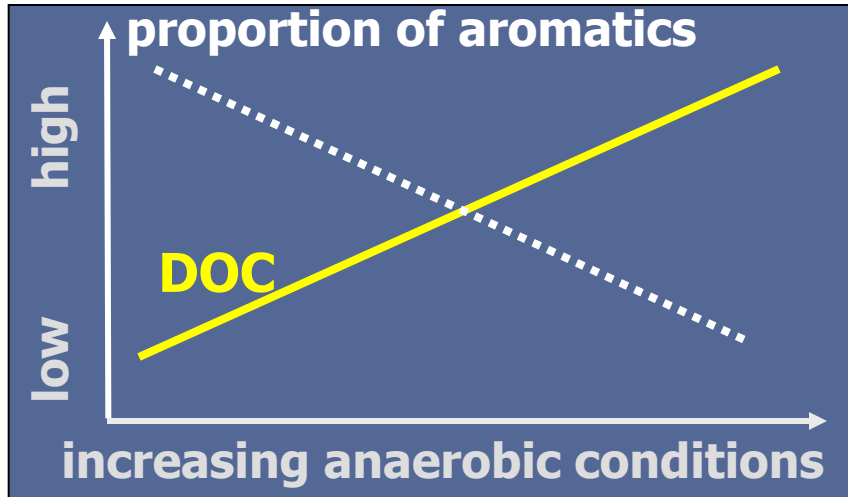
Due to **anaerobic conditions** = decreased peat decomposition:



**(1) higher DOC concentrations**

# We expect:

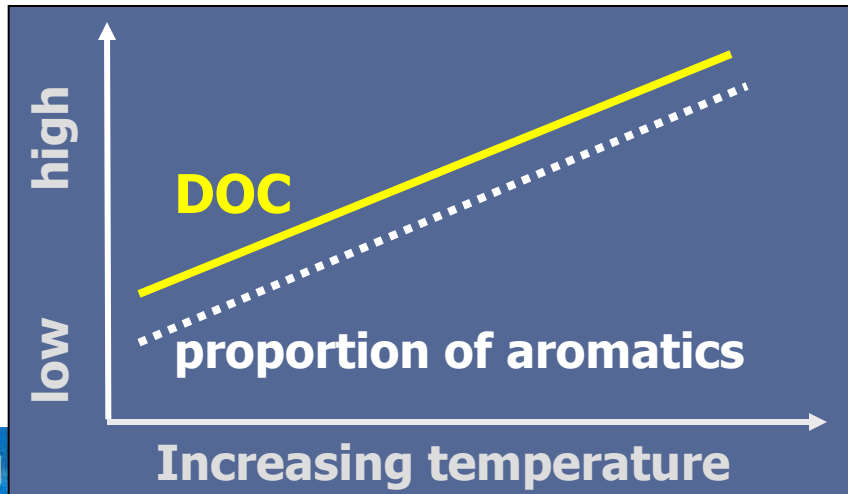
Due to **anaerobic conditions** = decreased peat decomposition:



## (1) higher DOC concentrations

smaller proportion of aromatic compounds

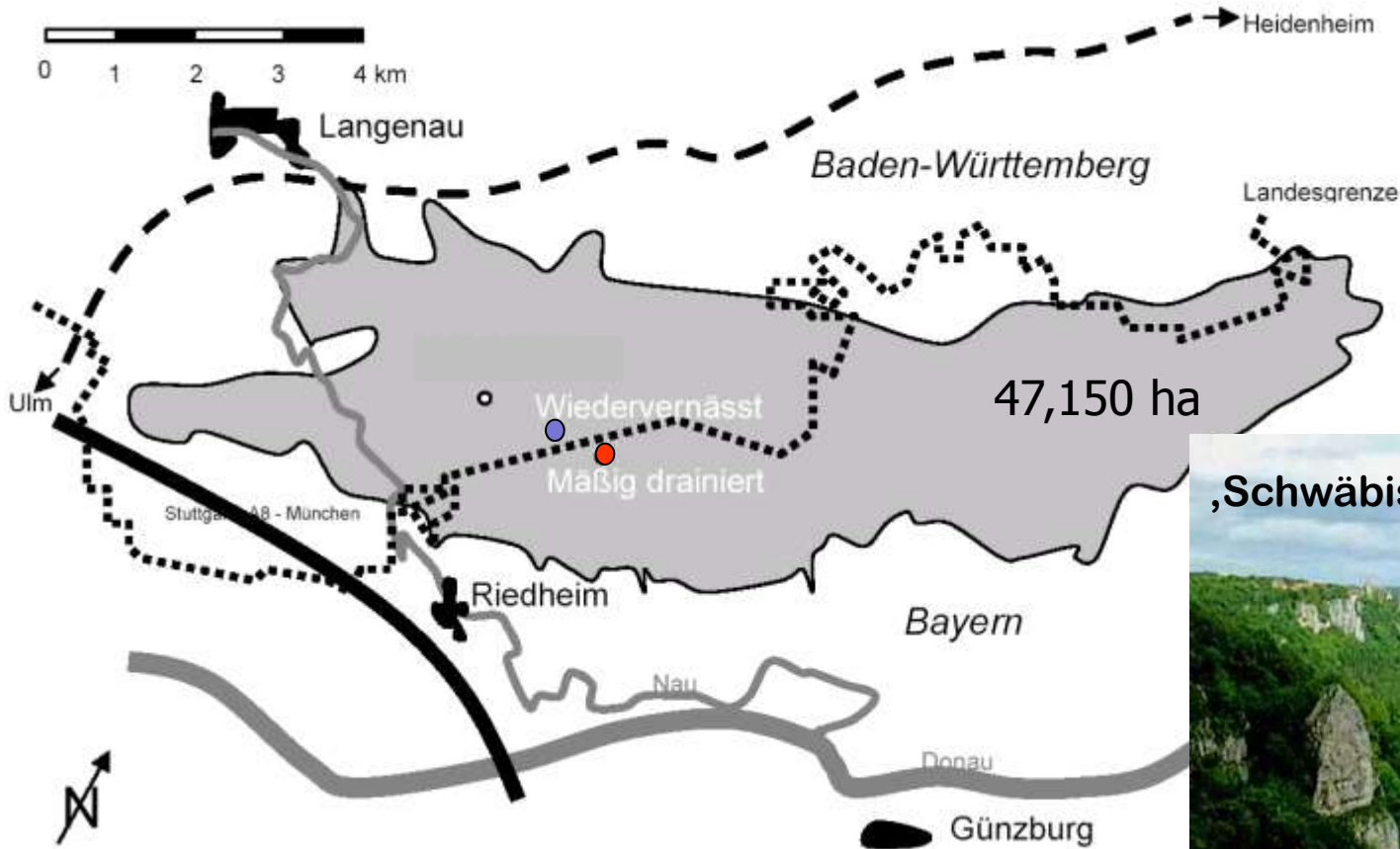
**Higher temperatures** – increased peat decomposition:



## (2) Higher DOC concentrations in Summer than in Winter

at the same time increasing proportions of aromatic compounds

# Study sites – Langenauer Ried (Germany)



,Schwäbische Alb' (Karst)



MAT: 7.7°C, MAP: 750 mm

since ca. 1900 intensive use of peat (direct, agriculture)

peat loss (1951-1990) = 7.2 mm a<sup>-1</sup> (= 5.67 t C ha<sup>-1</sup>a<sup>-1</sup>)



# Study sites: rewetted and moderately drained peatland (fen)



*Typha, Carex spp.*

rewetted (since 1984)



Calcari-Sapric Histosol  
(Erd-Kalkniedermoor)



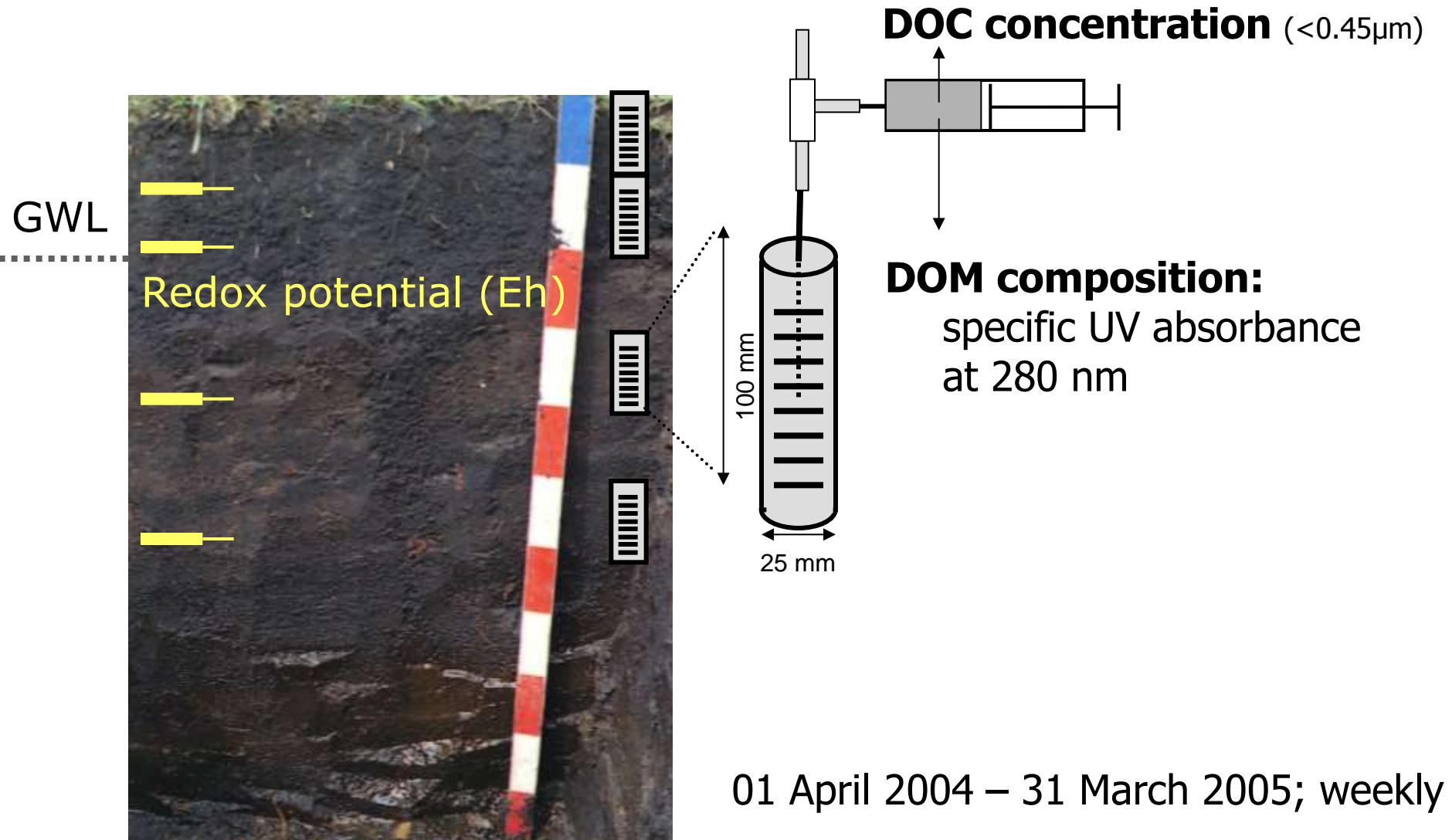
*Festuca ovina, Bromus erectus....*

Moderately drained

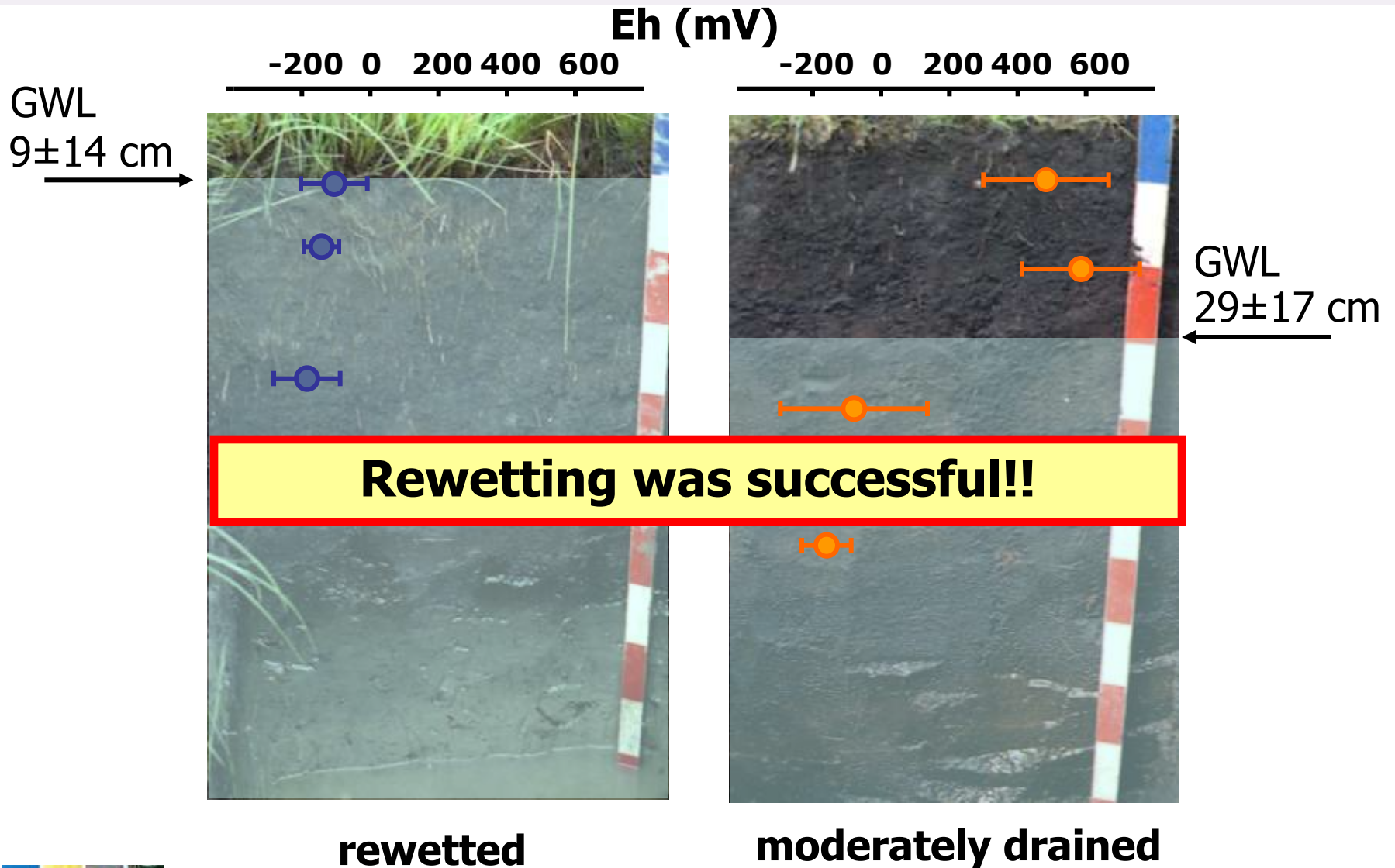


Calcari-Fibric Histosol  
Erd-Kalkniedermoor

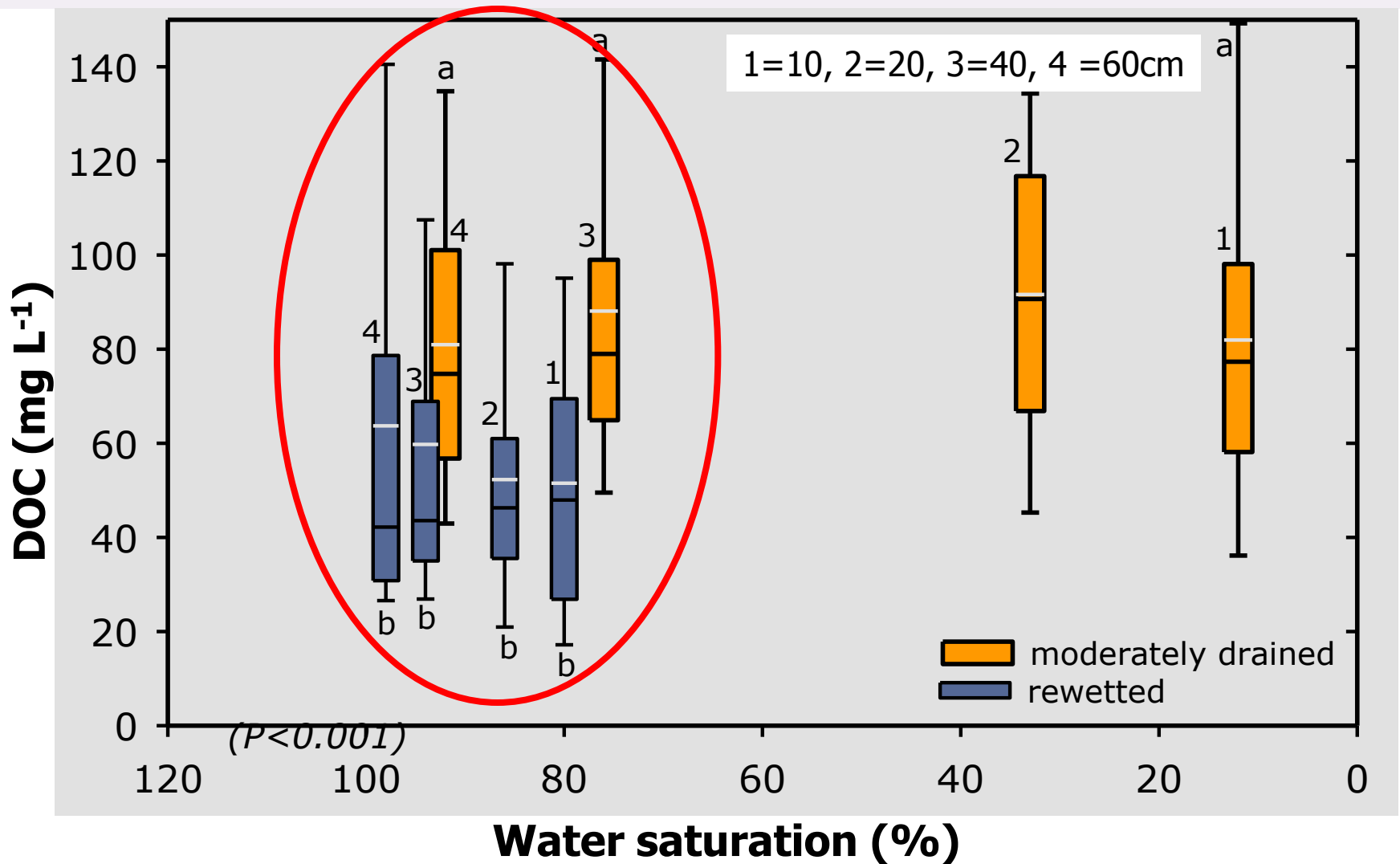
# Measured parameters



# Rewetting resulted in anaerobic conditions



# DOC concentrations

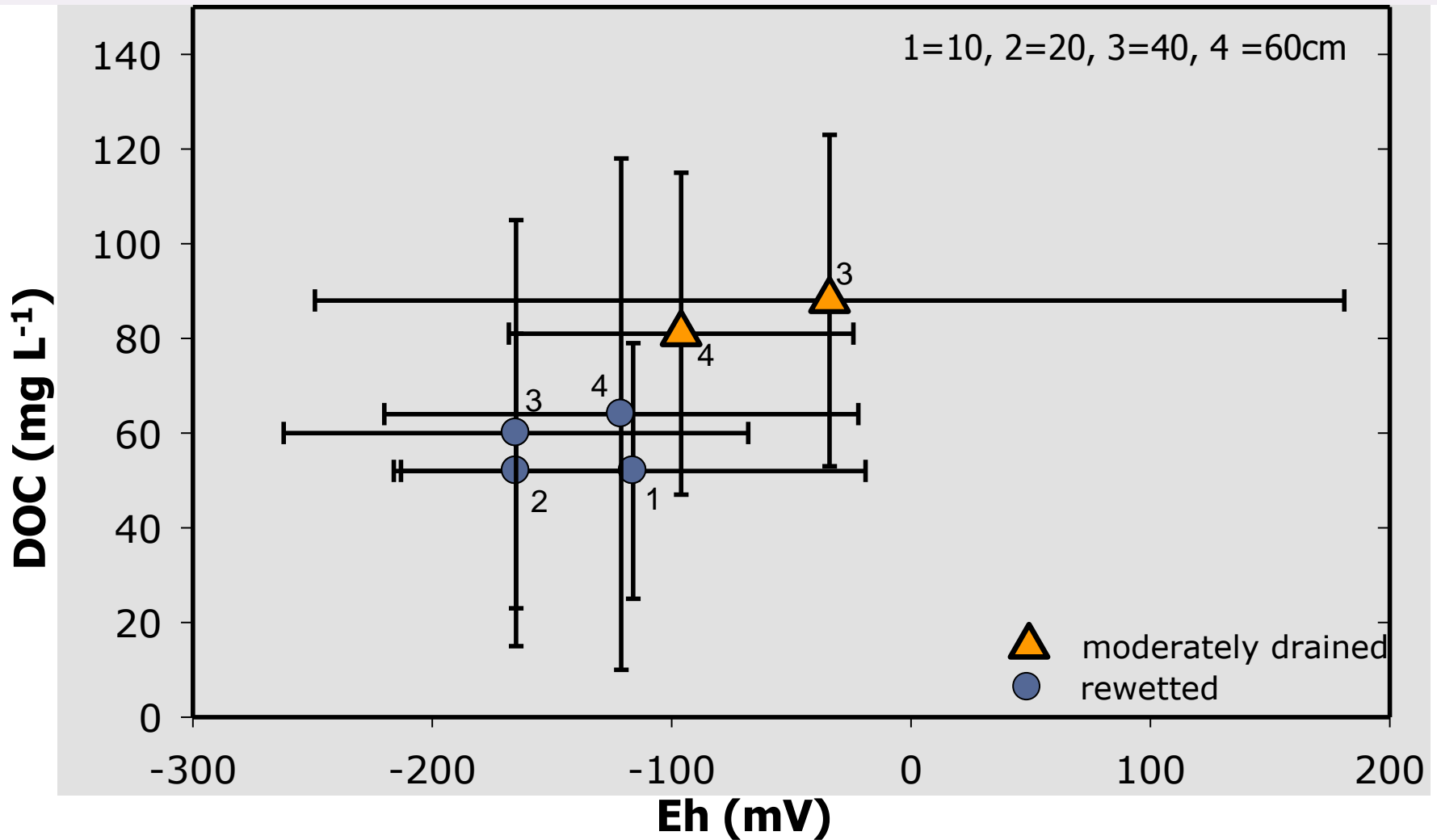


□ DOC concentrations: decrease by rewetting





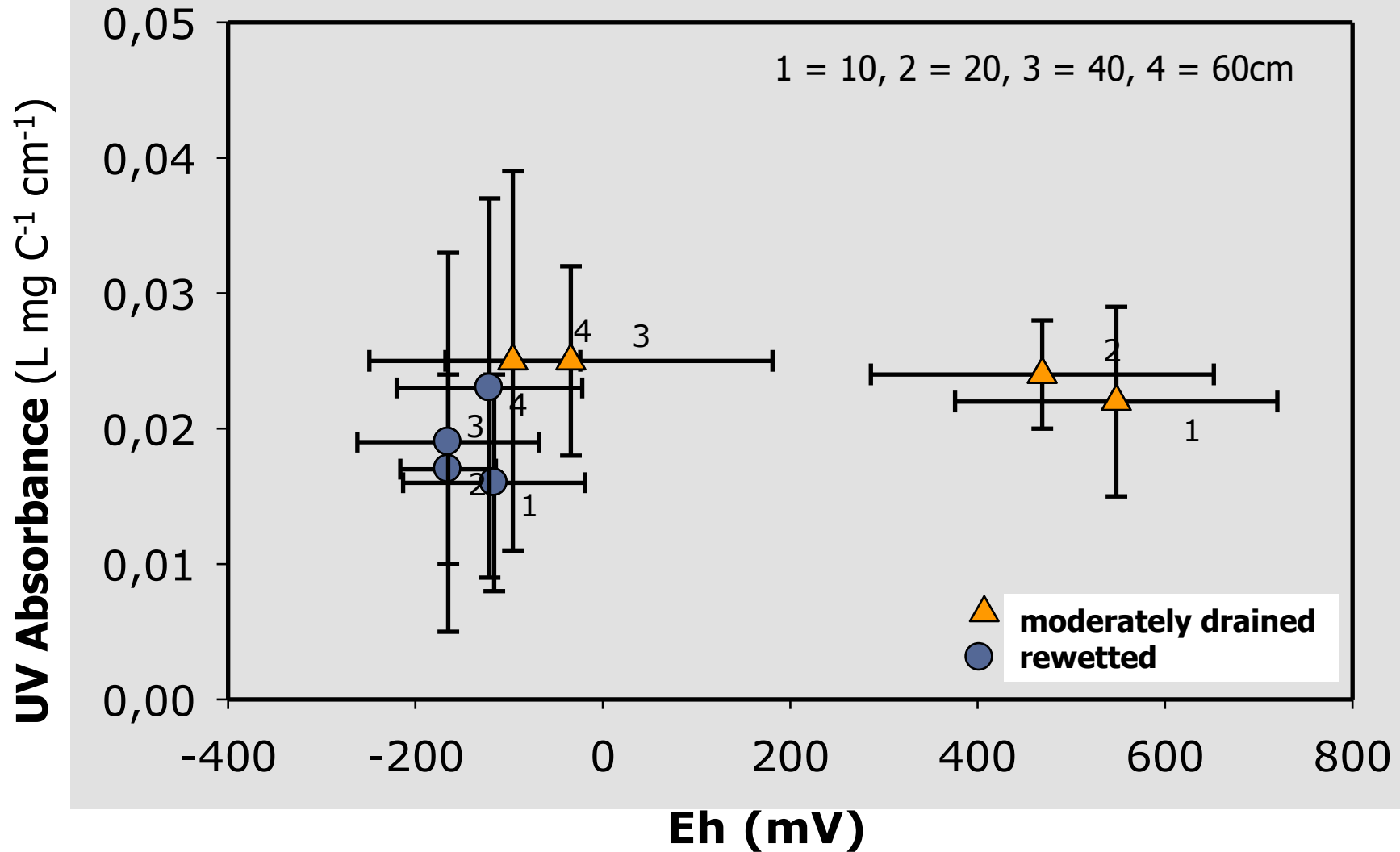
# DOC concentrations



□ DOC concentrations: decrease at anaerobic conditions



# DOM composition: aromaticity



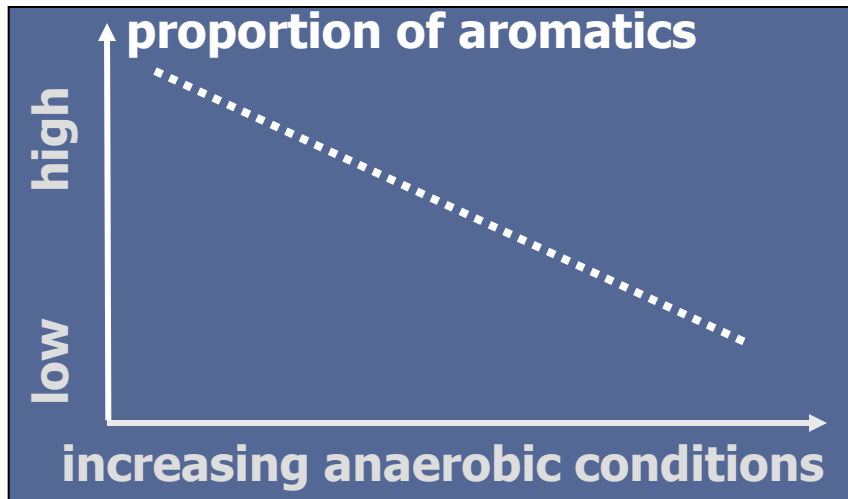
□ Aromaticity: decrease at anaerobic conditions



# First summary

## Hypothesis:

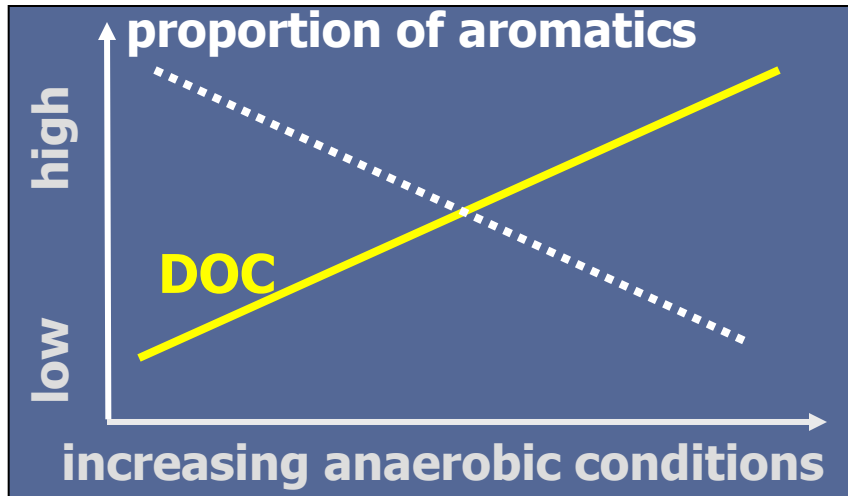
- ❑ Long-term rewetting = anaerobic conditions ✓
- ❑ Decreased peat decomposition ✓



# First summary

## Hypothesis:

- Long-term rewetting = anaerobic conditions ✓
- Decreased peat decomposition ✓

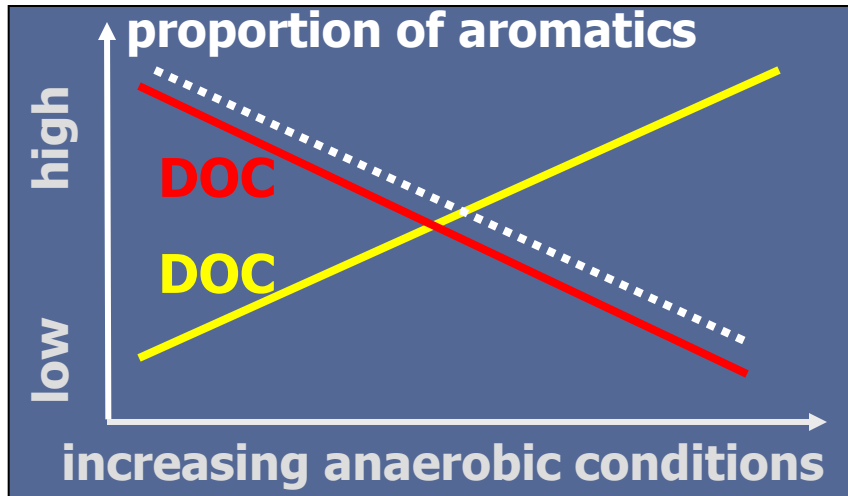


- Increasing DOC concentrations at anaerobic conditions ✗

# First summary

## Hypothesis:

- Long-term rewetting = anaerobic conditions ✓
- Decreased peat decomposition ✓



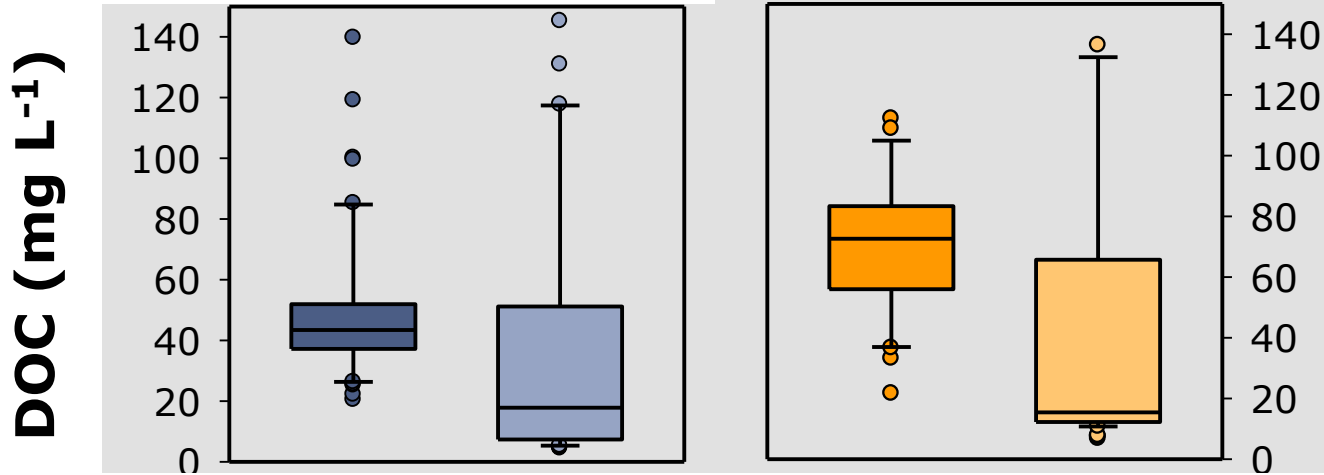
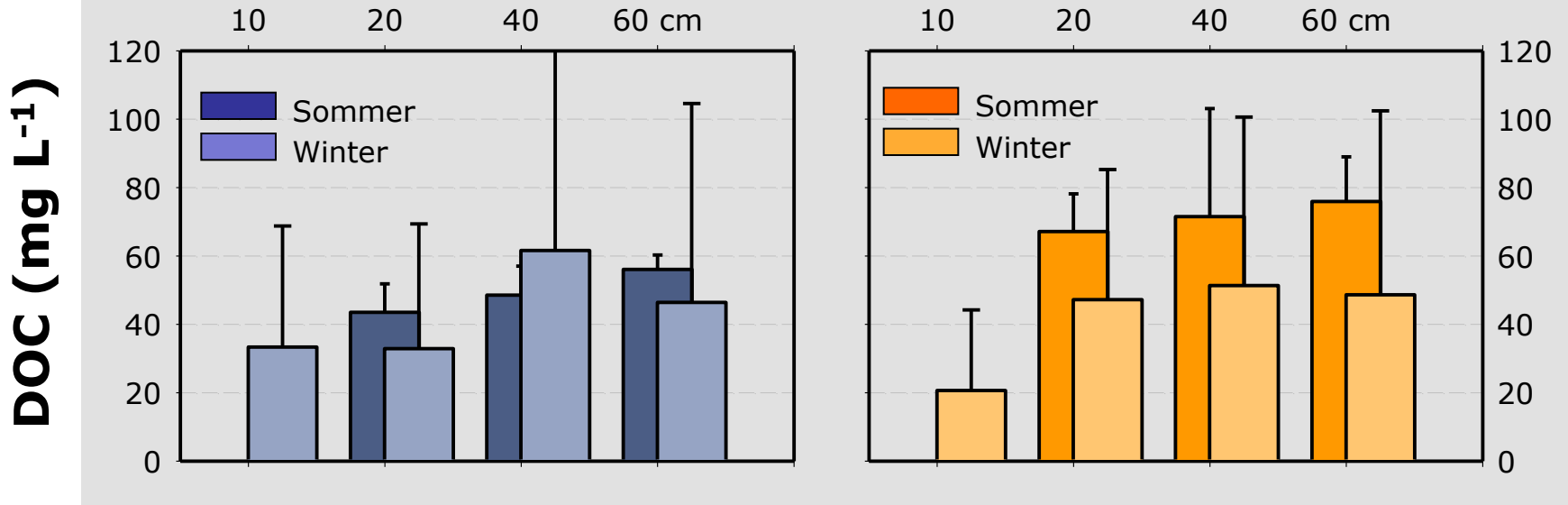
- Increasing DOC concentrations at anaerobic conditions ✗

- low peat decomposition – DOC production is more inhibited than expected

# DOC concentration: temperature effects

rewetted

moderately drained



DOC concentrations: Summer > Winter

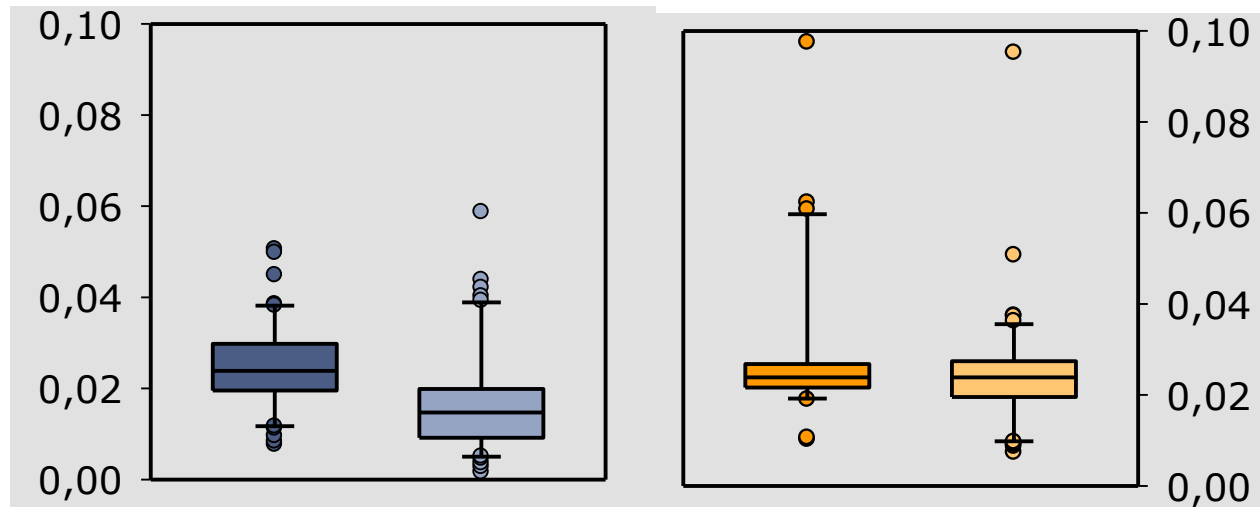
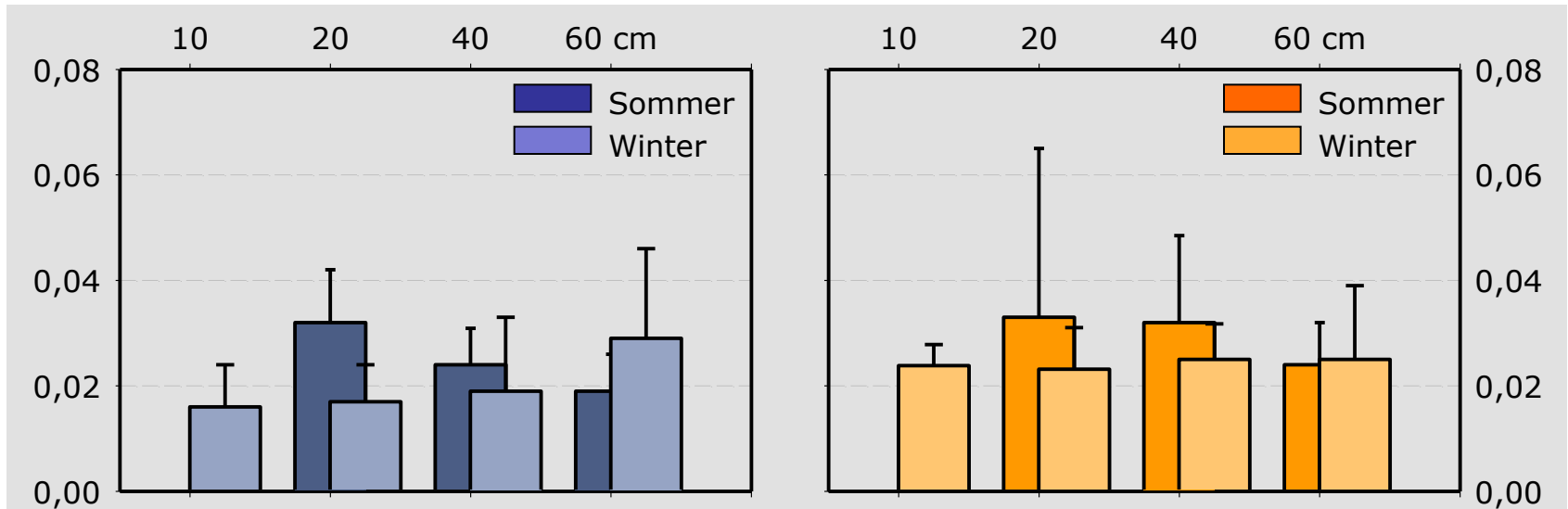


# DOC composition: temperature effects

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moderately drained

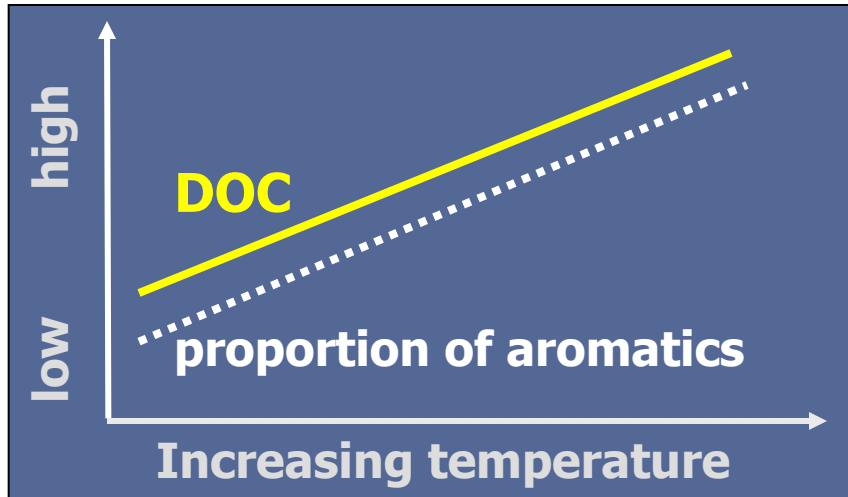
Spec. UV absorbance ( $L\ mg\ C^{-1}\ cm^{-1}$ )



**□ aromaticity: Summer > Winter**

# Second summary

Hypothesis – increasing temperature:



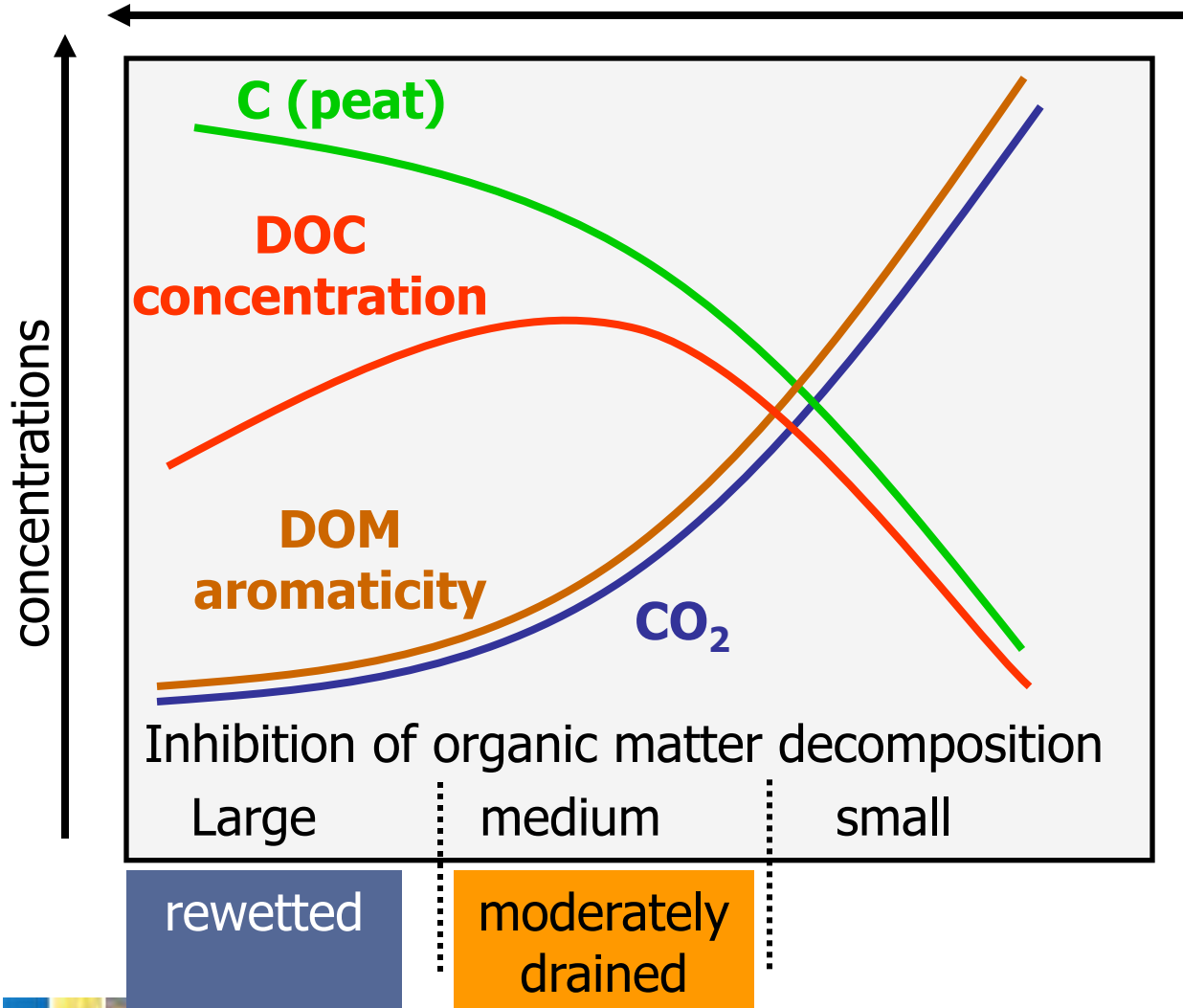
- increasing DOC concentration ✓
- enrichment in aromatic compounds ✓

**Close linkage between C mineralization and DOC production**



# Peat restoration: conceptual model of C dynamics including DOM

Water saturation, anaerobic conditions



**Strictly anaerobic conditions prevent both production and decay of DOC**



**Low DOC contents**



# Conclusion

- ❑ **On a long-term perspective restoration of peatlands by rewetting will result in decreasing DOC concentrations if continuously shallow water levels are linked with anaerobic conditions**
- ❑ **Anaerobic conditions result in less DOC concentrations than previously assumed**
- ❑ **Short-term effects are not useful for long-term predictions**



A photograph of a field of tall, green grasses. A wooden path or boardwalk runs through the field on the right side. In the background, there is a dense line of trees, including evergreens and deciduous trees. The sky is clear and blue.

**Thank you very  
much for your  
attention!**