Infiltration via submerged drains: a promising measure to reduce peat oxidation and subsidence and GHG emissions of meadow peatlands

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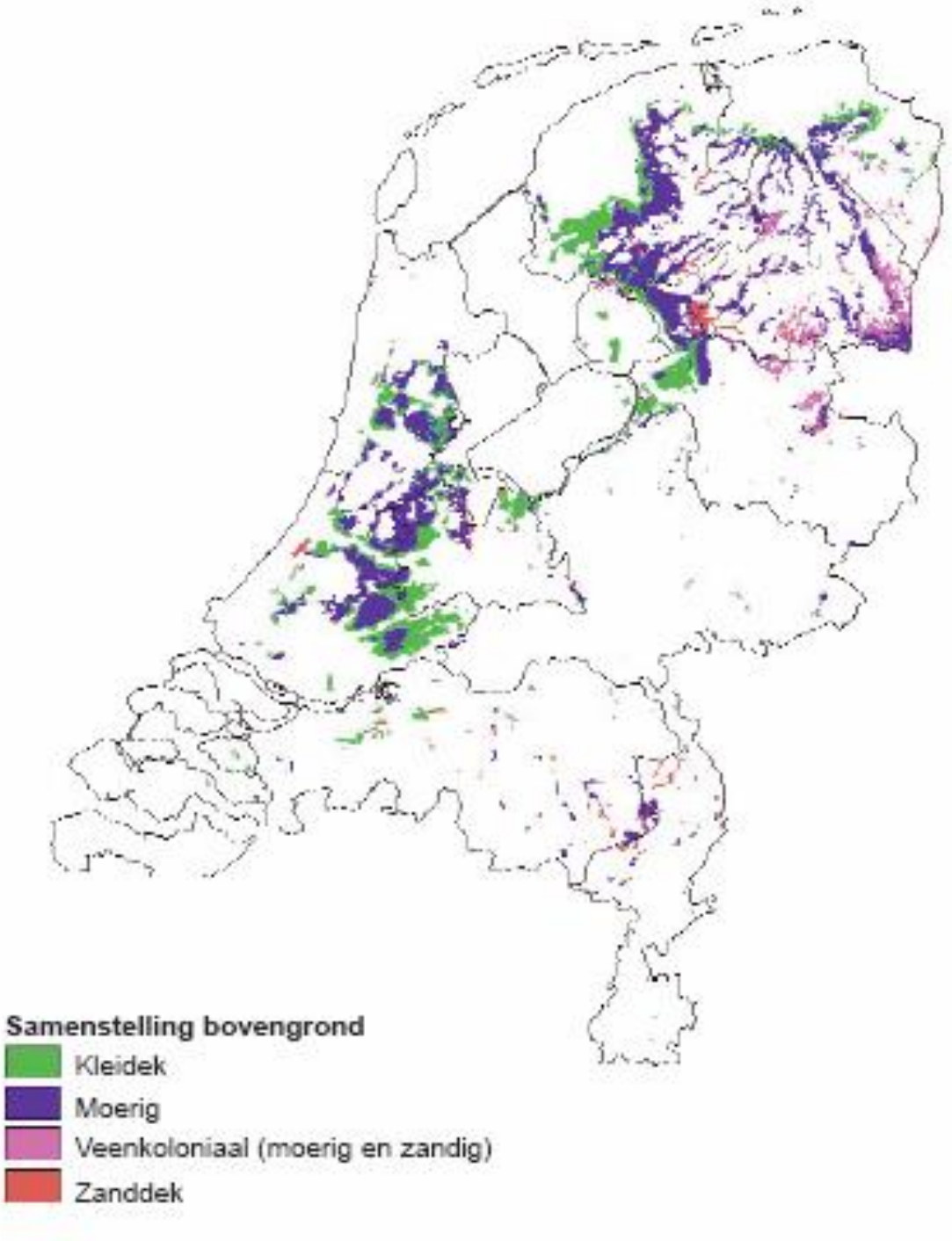
Peat soils in The Netherlands

Agriculture	220,000 ha
Nature	35,000 ha
Other	35.000 ha
Total	290,000 ha



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Problem: Degradation of peat soils by oxidation

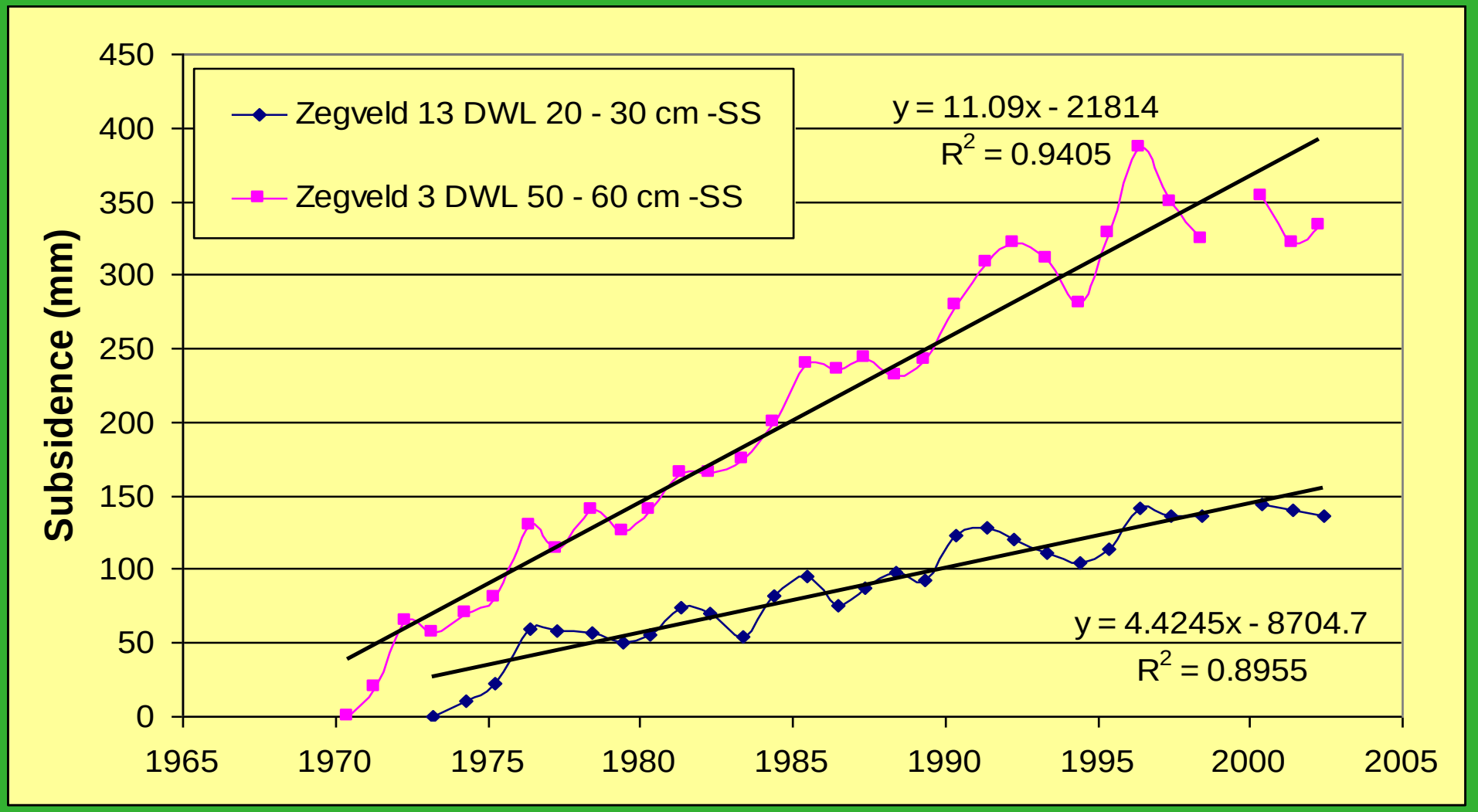
- Subsidence (NL: 0 – 2.5 cm per year)
- Damage to buildings and infra structure
- Increasing costs of water management
- Drainage of nature reserves to lowered agricultural land
- Water pollution
- Green House Gas emissions (NL: 2 – 3 % total CO_2)
- Loss of peat soils (NL: 2 % per year)

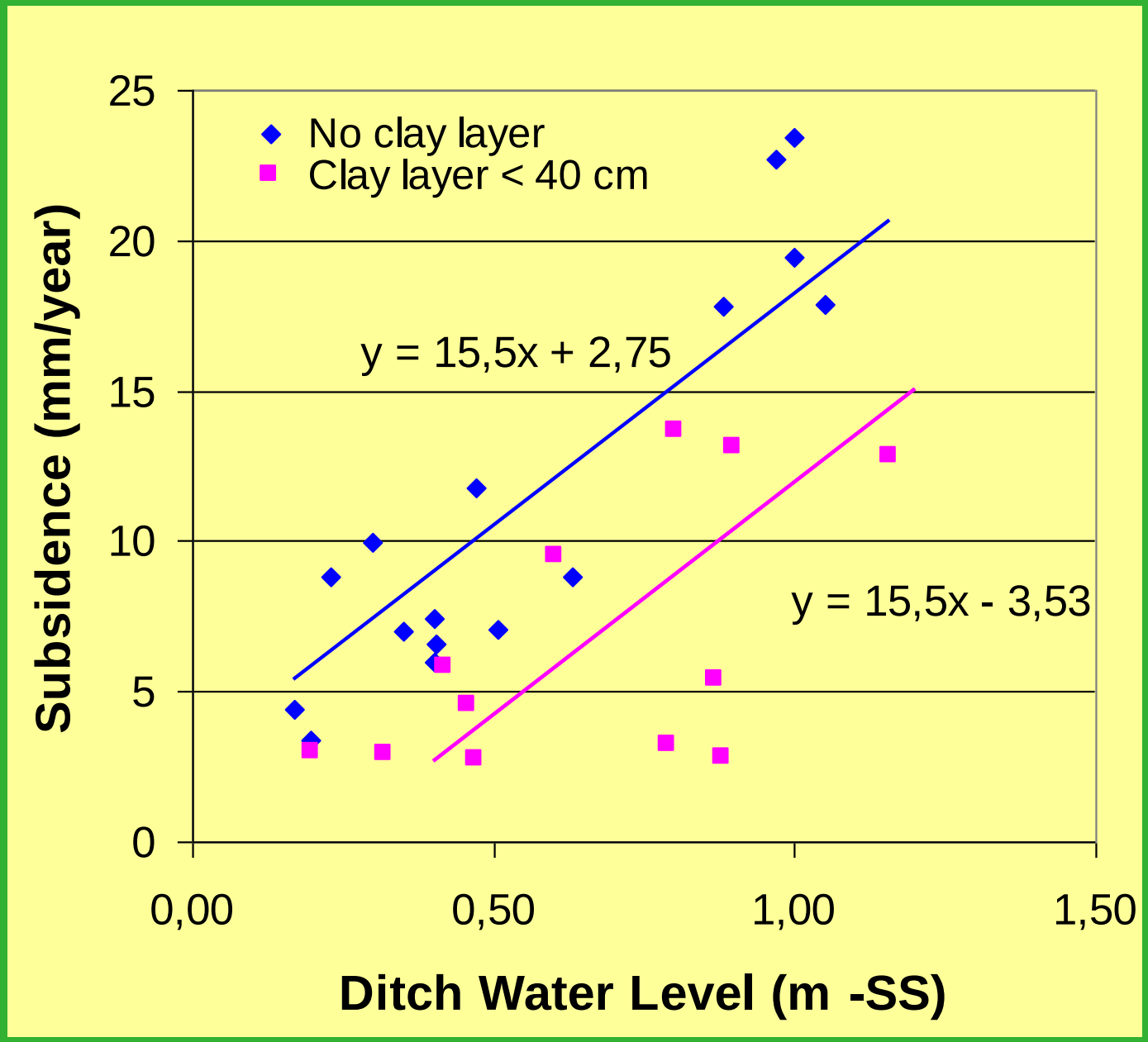
Components subsidence

- Consolidation
- Shrinkage
- Oxidation (biological decomposition) => CO_2

1 mm subsidence = 2.26 t CO_2 per ha

Subsidence in relation to Ditch Water Level





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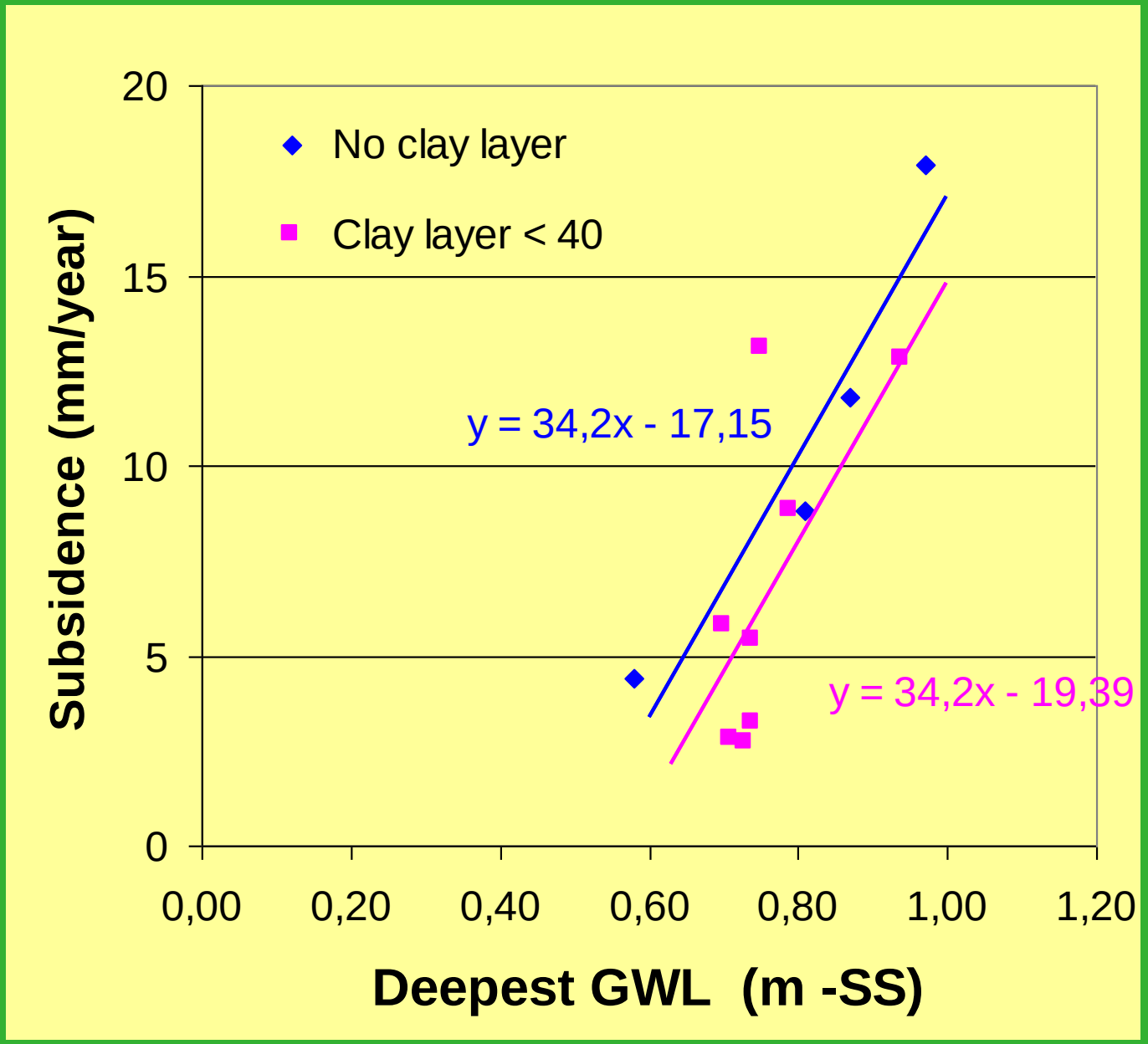
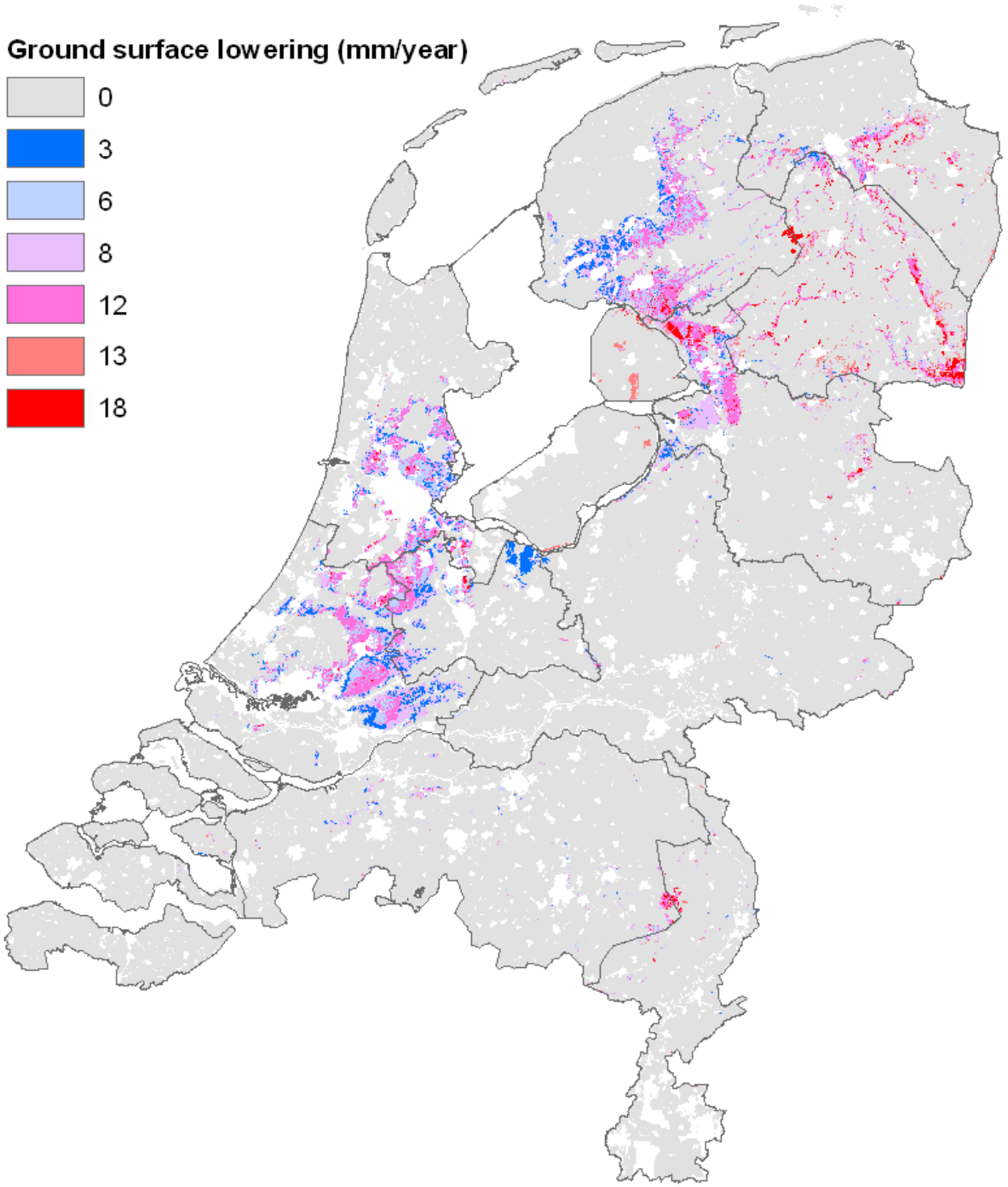

20
15
10
5
0
Subsidence (mm/year)
No clay layer
Clay layer < 40
y = 34,2x - 17,15
y = 34,2x - 19,39
0,00
0,20
0,40
0,60
0,80
1,00
1,20
Deepest GWL (m -SS)

Subsidence peat soils calculated from mean deepest groundwater levels (mm/year)



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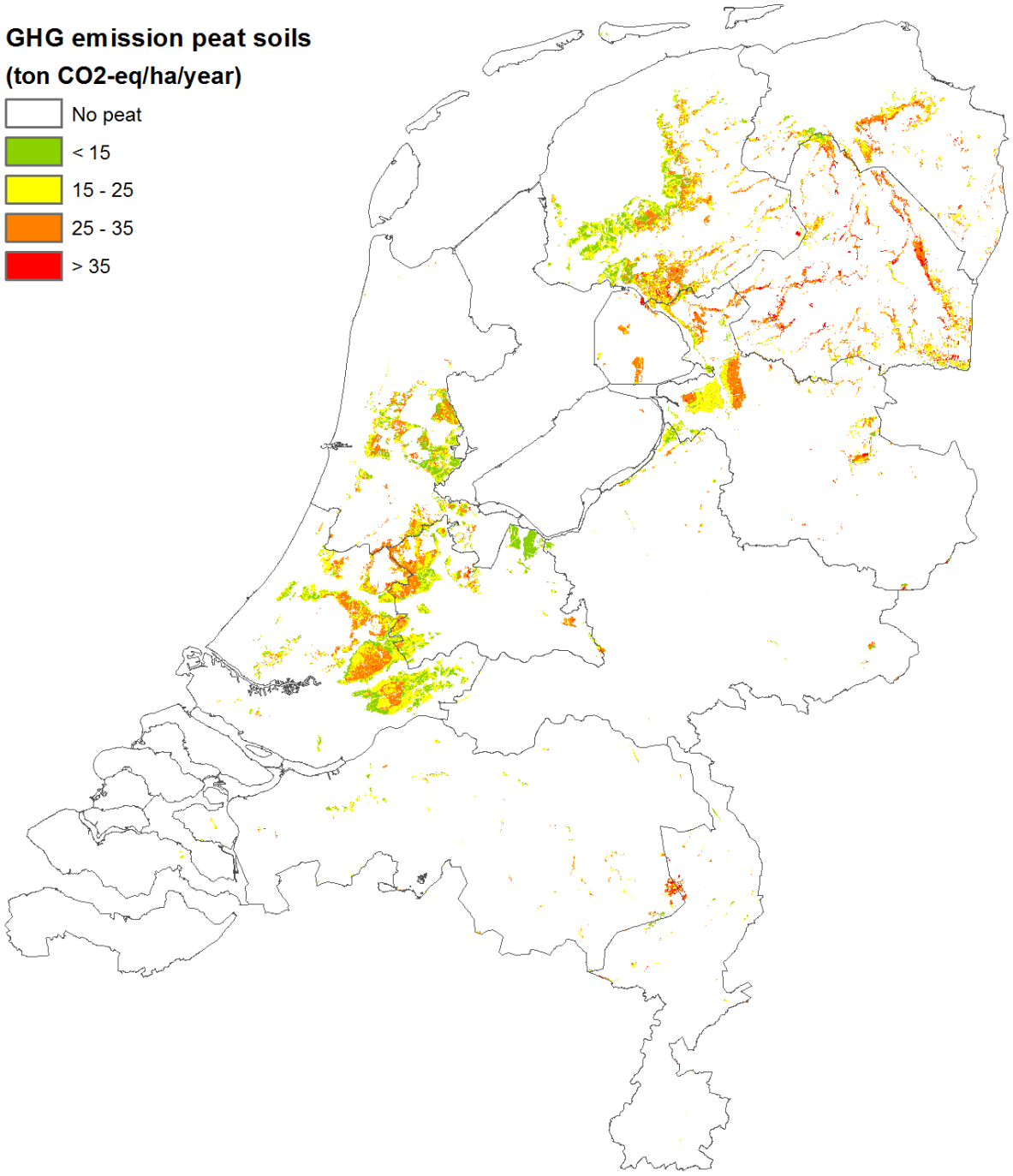
CO_2-eq emission peat soils (ton CO_2-eq per year)



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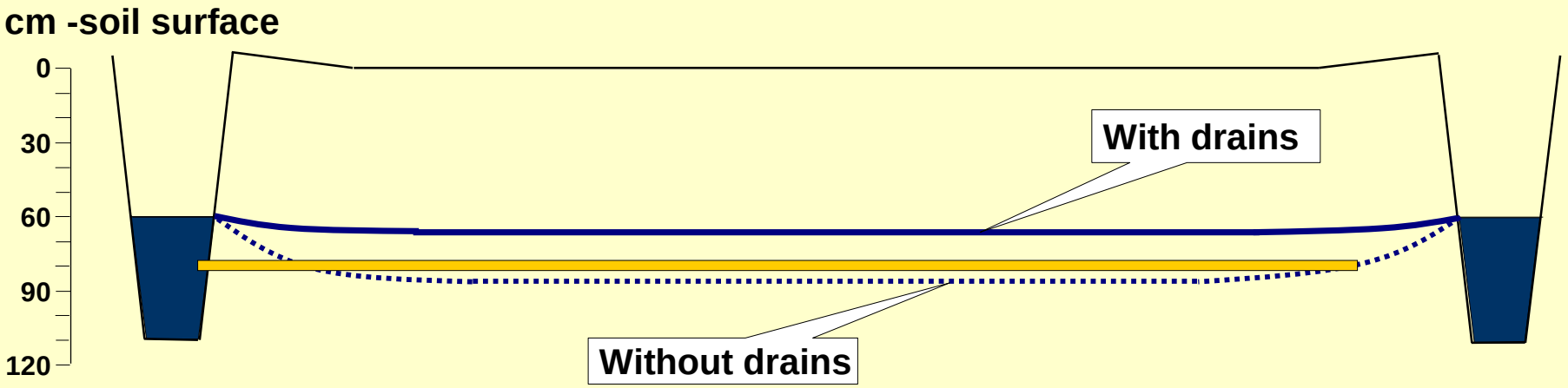
CO_2 and N_2O emissions Netherlands in CO_2 eq

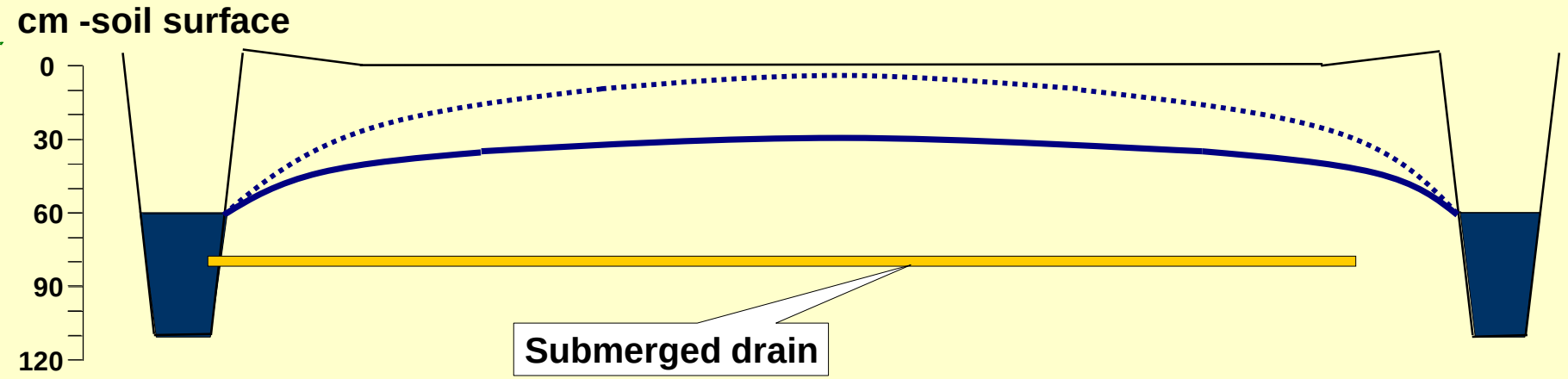
CO_2 equivalents	Emission in Mton CO_2
CO_2	4.24
N_2O	0.51
Total	4.76

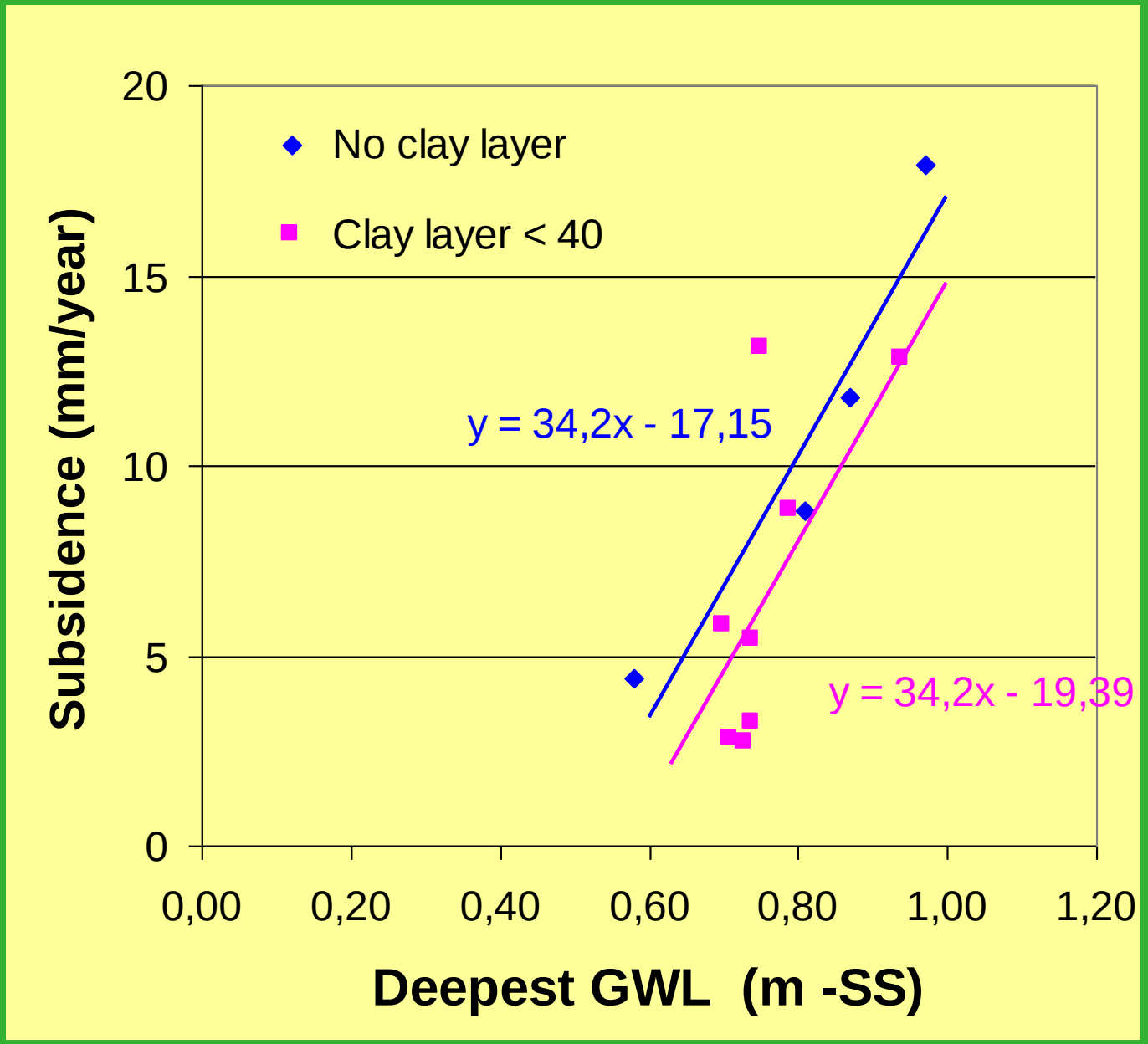
Prevention by infiltration with submerged drains

a. groundwater level in summer



b. groundwater level in winter

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Installation submerged drains

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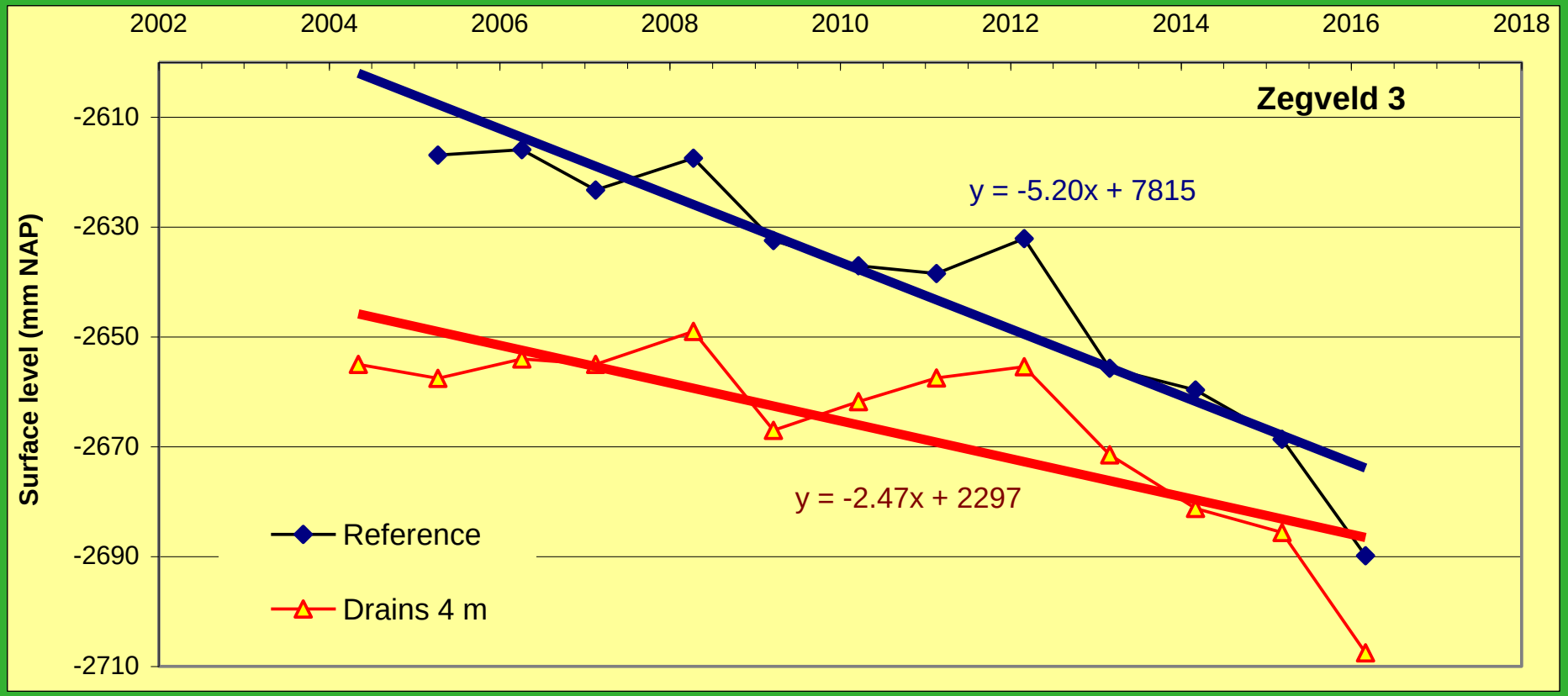
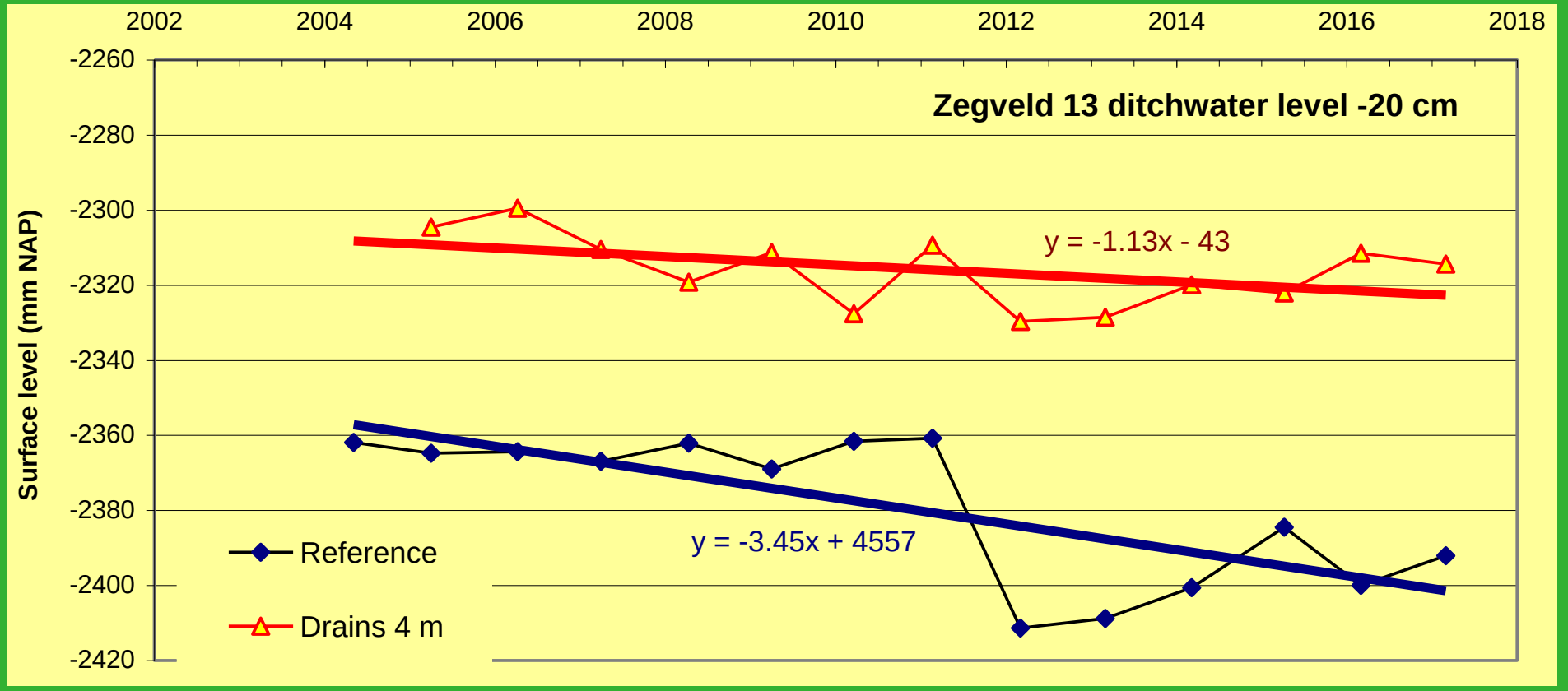
Subsidence Zegveld 3, Ditch Water Level = 55 cm

(based on three cross sections)



Subsidence Zegveld 13, Ditch Water Level = 20 cm (based on 8 points around reference pole)



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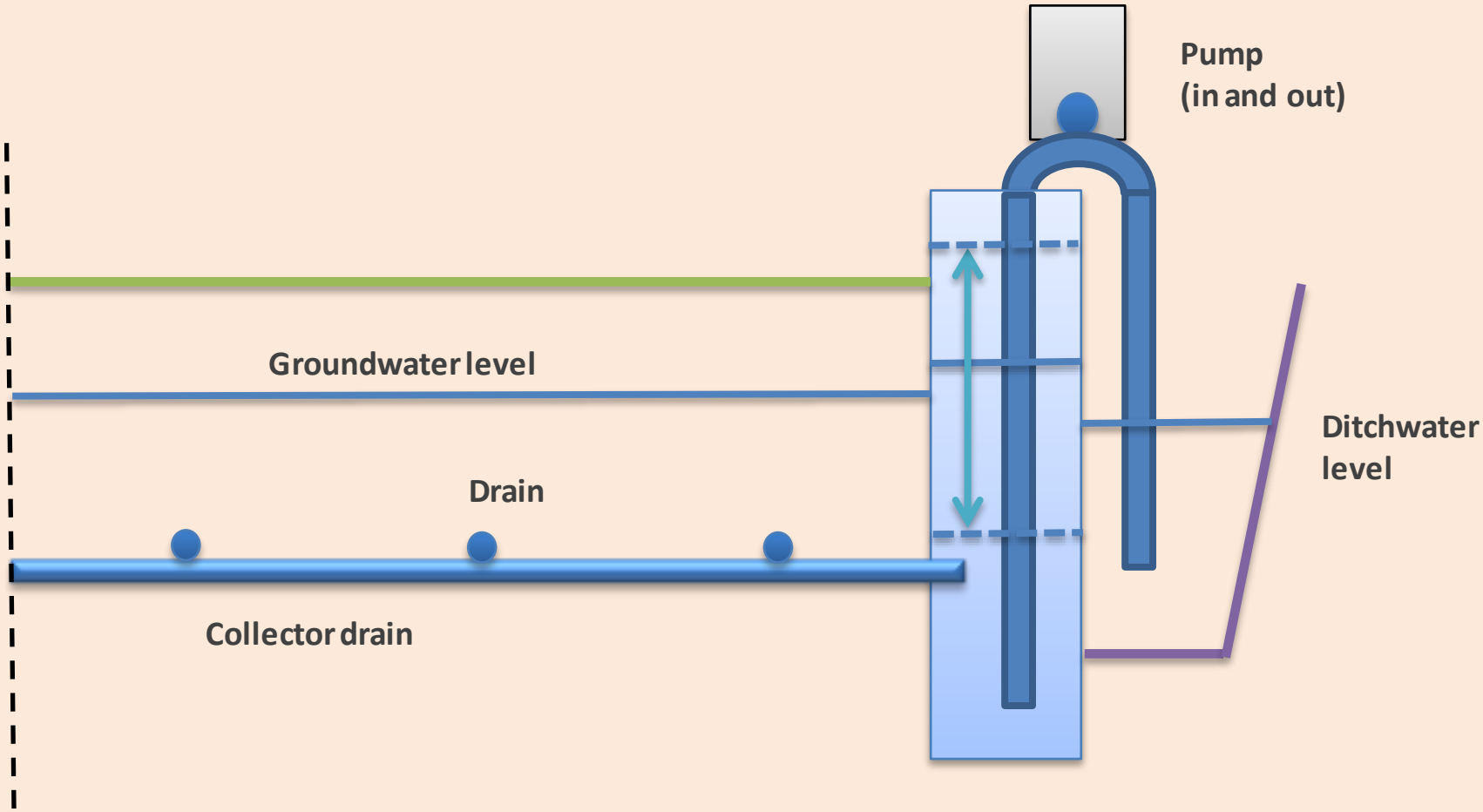
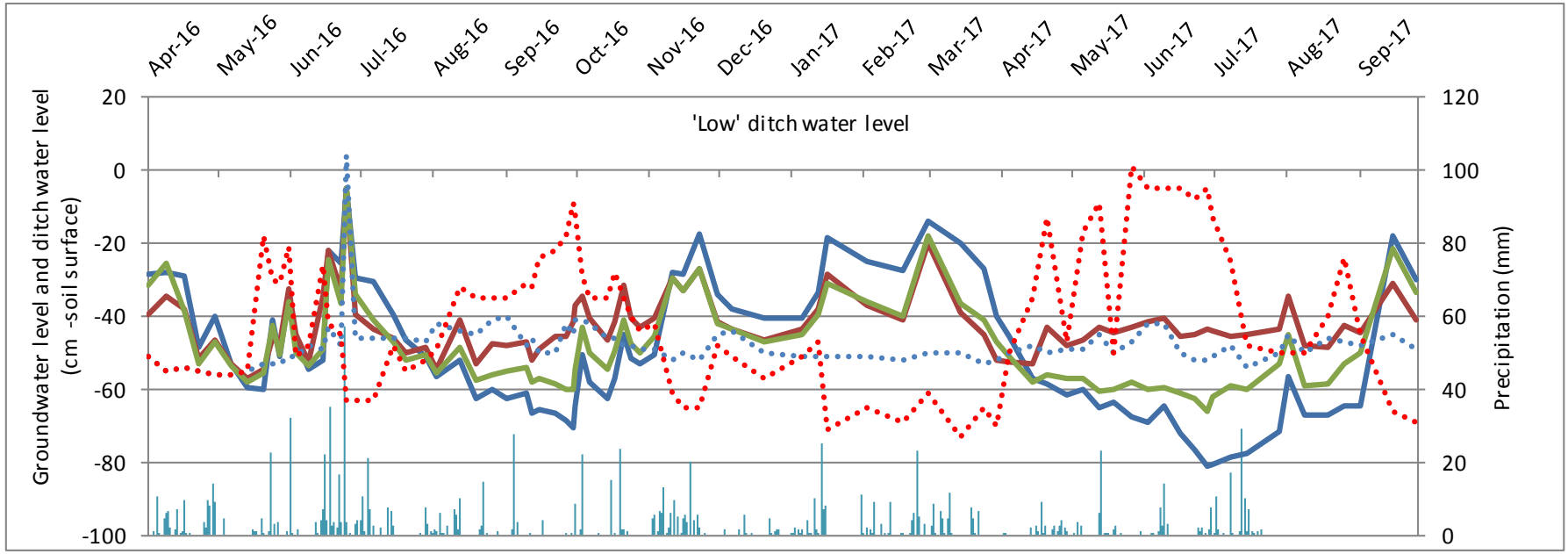
Next generation



Ditch water level 55 cm below surface



Precipitation (mm)
No drains (control)
Submerged drains connected to ditch
Compiled submerged drains connected to vessel with pump (level controled)
Dich water level 55 cm below soil surface
Vessel level

Dairy farming (costs, yields, etc)

- Costs installation all in € 1 / m drain; € 1700 – € 2500 / ha
- Live time: 20 – 30 years
- Significant extra days with ‘good’ bearing capacity
- Yield lower due to reduced mineralization of N
- Yield higher due to better usage of manure (better nutrients efficiency)
- Less trampling of grass
- Longer grazing season
- In total a higher effective yield
- Short term: slightly cost effective. Long term: good cost effective

Conclusions

- Problems with subsidence, CO2, water quality, etc will increase in time
- Climate change will double the problems
- Adaptation and minimizing peat oxidation is urgently needed
- A strong reduction of subsidence and GHG emissions is possible by using submerged drains
- Conservation of peat soils requires WATER
- Submerged drains are the most **water** efficiënt solution to conserve peat soils
- Submerged drains are also the most **cost** efficiënt solution

Where to find:

- Van den Akker et al., 2015. Decline in organic matter in peat soils. In: *Stolte et al., 2015. Soil in Europe: Threats, functions and ecosystem services.* JRC – report.
- http://eusoils.jrc.ec.europa.eu/
- http://www.recare-project.eu/
- www.caos-project.eu/

Thank you for your attention

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