

# ABOUT SMALLER AND BIGGER KIDNEYS: RIPARIAN ZONES AS NUTRIENT BUFFERS IN DENMARK

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# OUTLINE

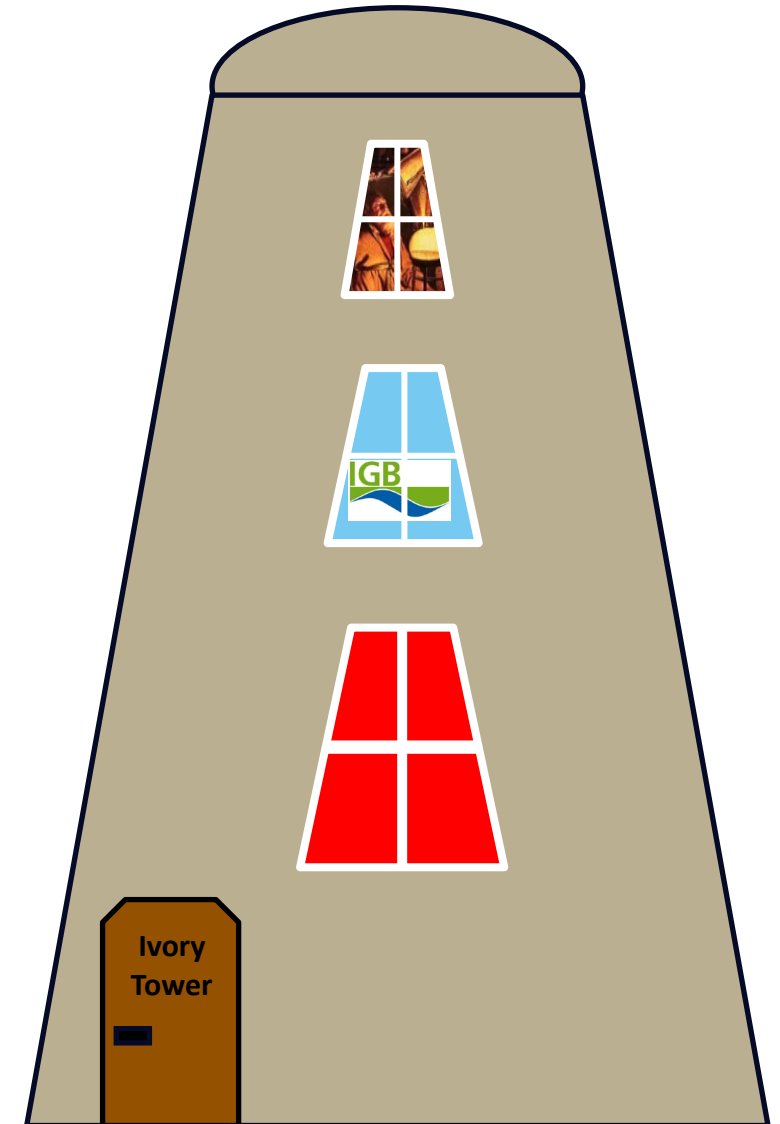
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**1. How it started?**

**2. What I learned?**

**3. Where it goes?**



# BREAKING NEWS

PROLOG

PROCESSES

PROGRESS

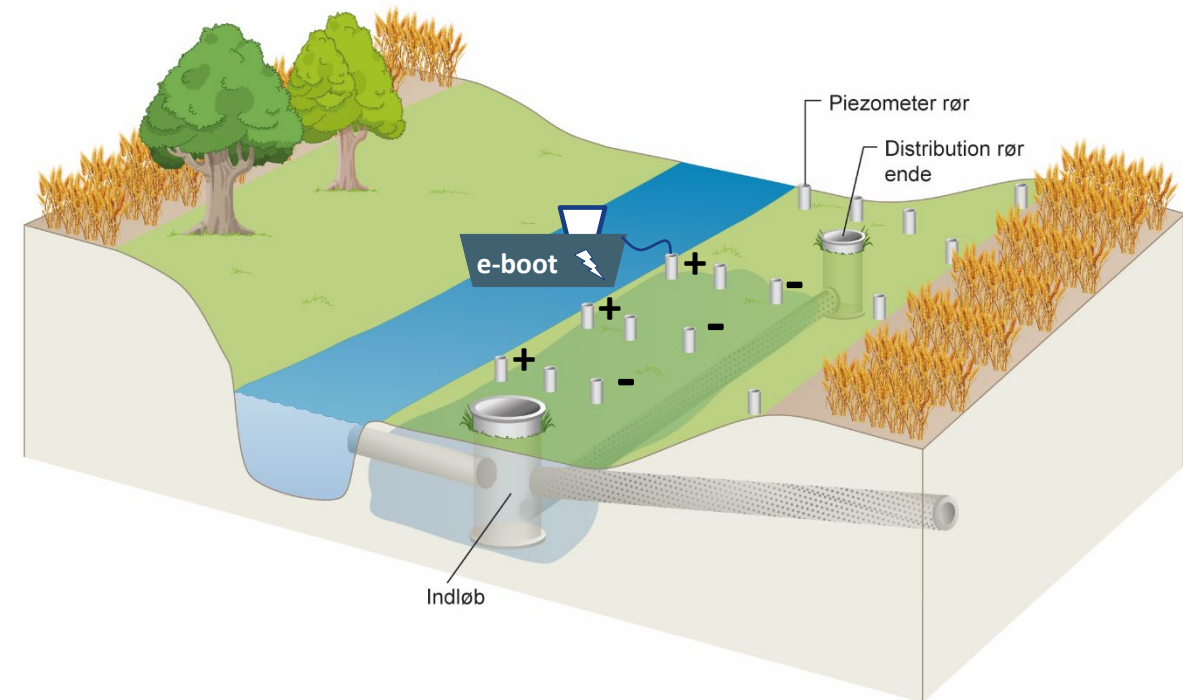
SCIENCE.NEWS

## **“Forever” diamond battery takes up to 28,000 years to run out of charge**

03/27/2021 / By Virgilio Marin



## **Constructed Wetland as batteries?**





# “MAKE USE OF WETLAND WASTE”

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PROCESSES

PROGRESS



After decades of (any) land use the peatland once denotes as useless became indeed a kind of „wasteland“, their recovery is challanging!

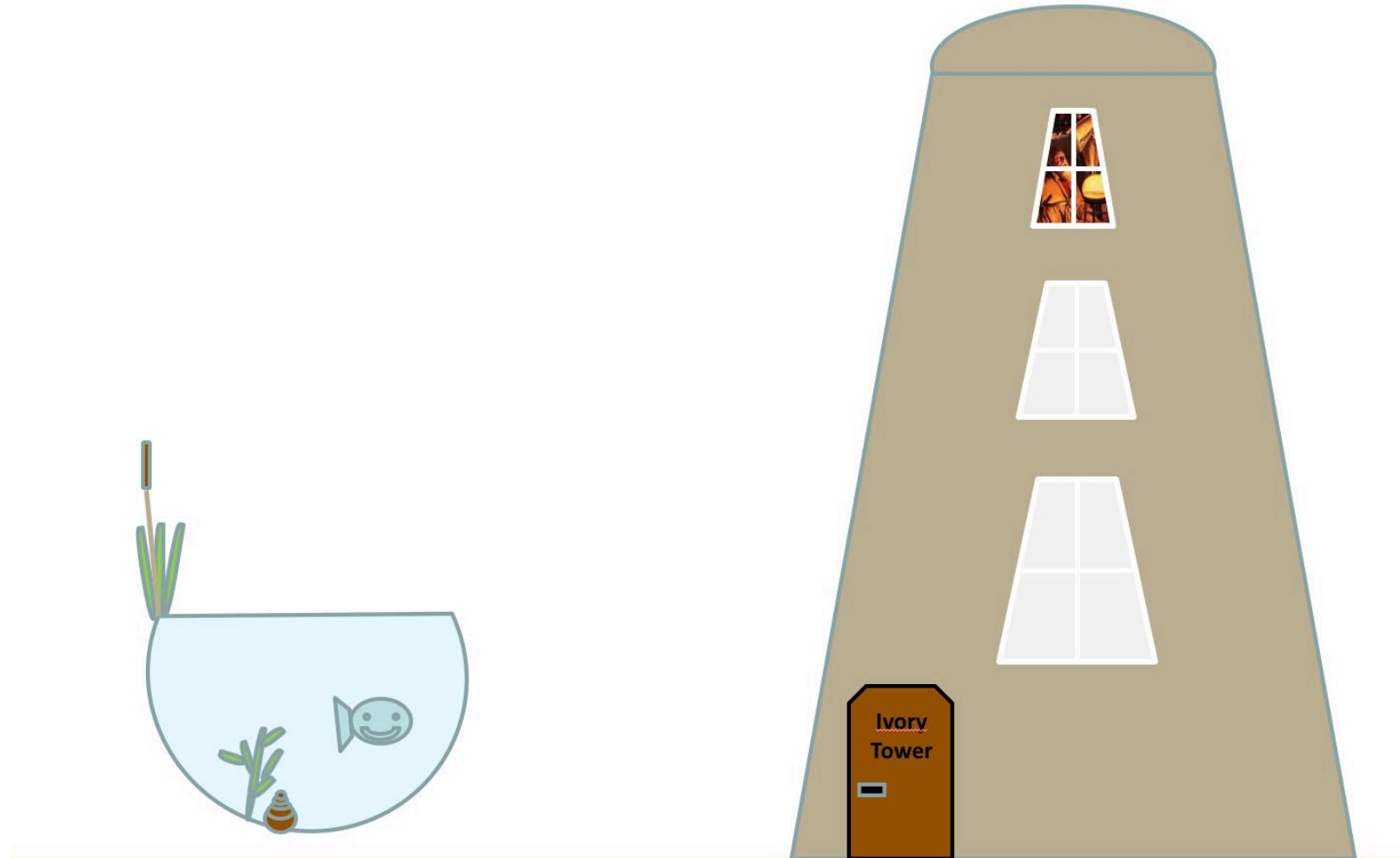


Paludiculture to overcome the legacy of long-term degradation of natural peatland and accelerate the restoration success!



# HOW IT STARTED (CA. 350 YEARS AGO)?

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# DISCOVERING OF THE 13. ELEMENT

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PROLOG

PROCESSES

PROGRESS

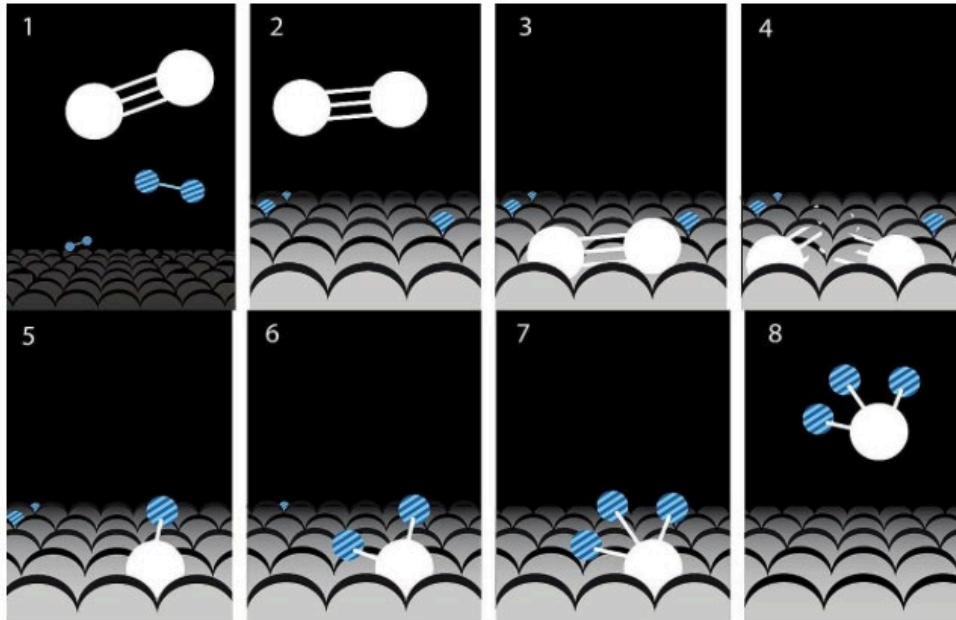


**Pharmacist & Alchemist  
Hennig Brand looking  
for the “Philosopher’s  
Stone” but discovered P  
as the 13. element in  
1669 (after Fe & S).**

Source: <https://baunetzwerk.biz/-was-der-stein-der-weisen-ist/150/4169/84096/>

# NEXT INVENTION “N HARVEST FROM THE AIR”

**1908 F. Haber  
registered the patent  
for the ammonia  
synthesis and C. Bosch  
improved the  
catalysator so that  
1913 the first Haber-  
Bosch-plant was  
constructed...**

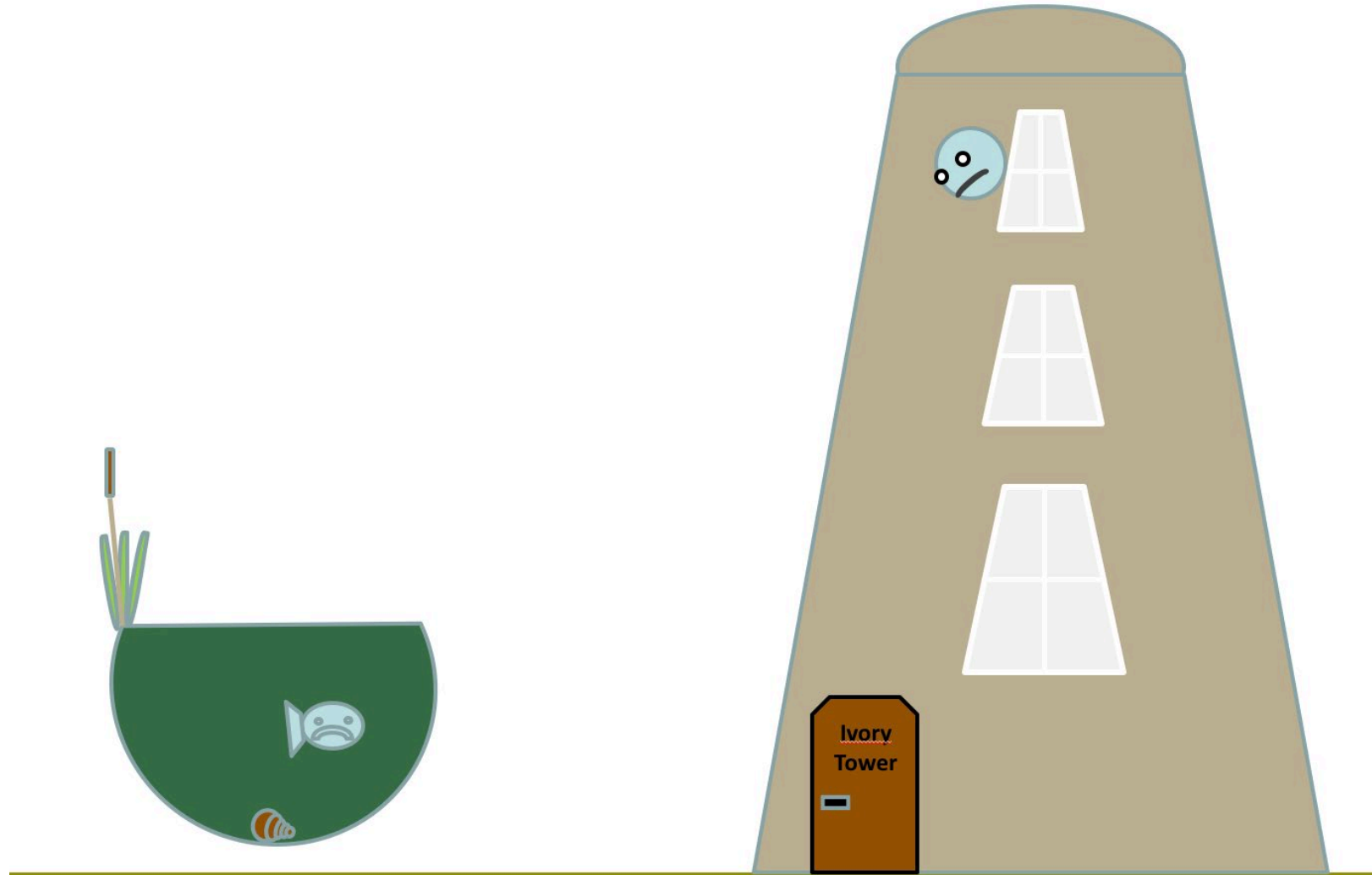


© THE ROYAL SWEDISH ACADEMY OF SCIENCES 2007 / NOBELPRIZE.ORG (AUSSCHNITT)



# THE "DARK-GREEN SIDE" OF PROGRESS

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# SOME “HOPE”- P GOES DOWN?

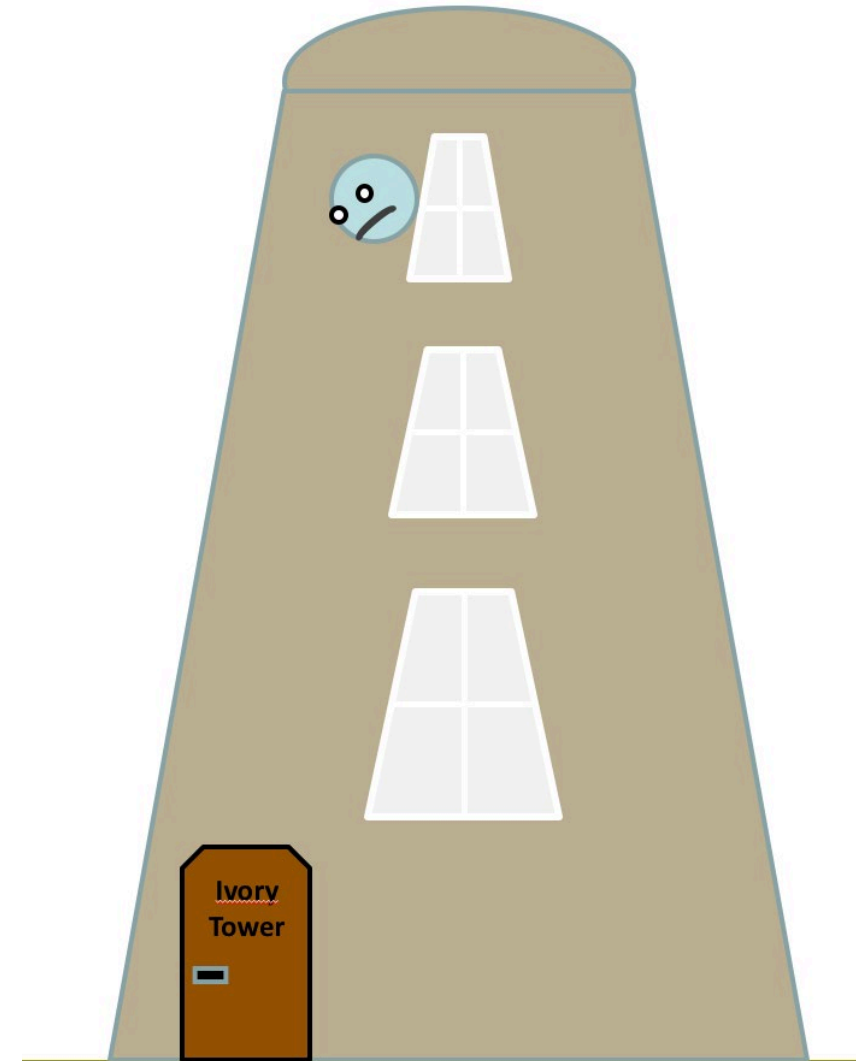
PROLOG

PROCESSES

PROGRESS



Quelle:  
<https://www.mibellegroup.com/index.php/de/nachhaltigkeit/nachhaltige-innovationen/phosphatfreie-geschirrspuelmittel>

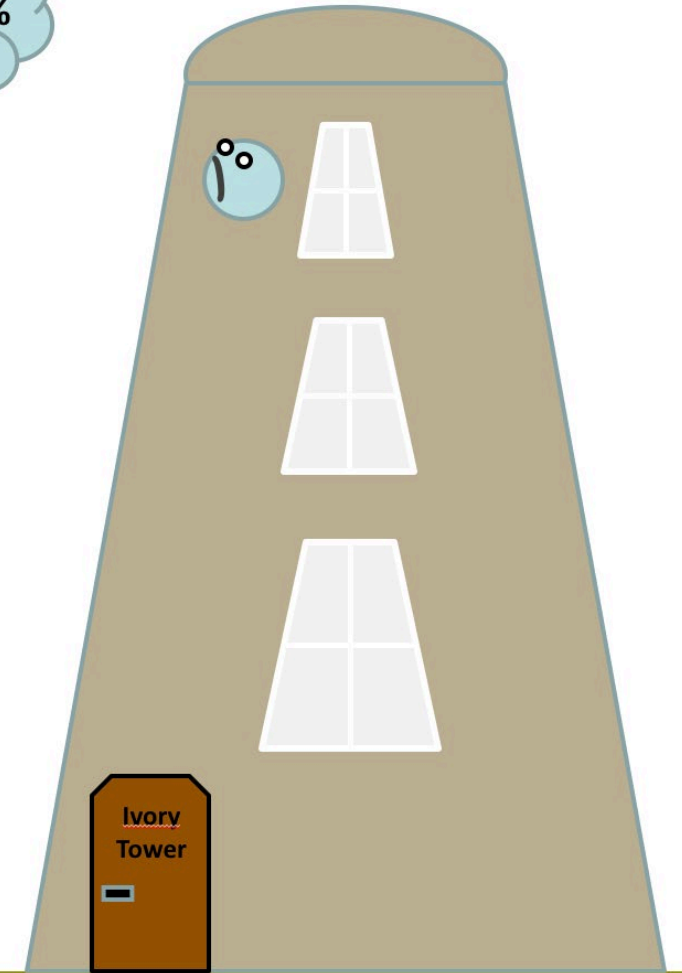
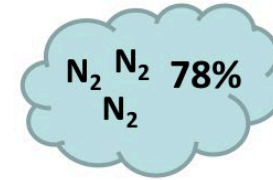
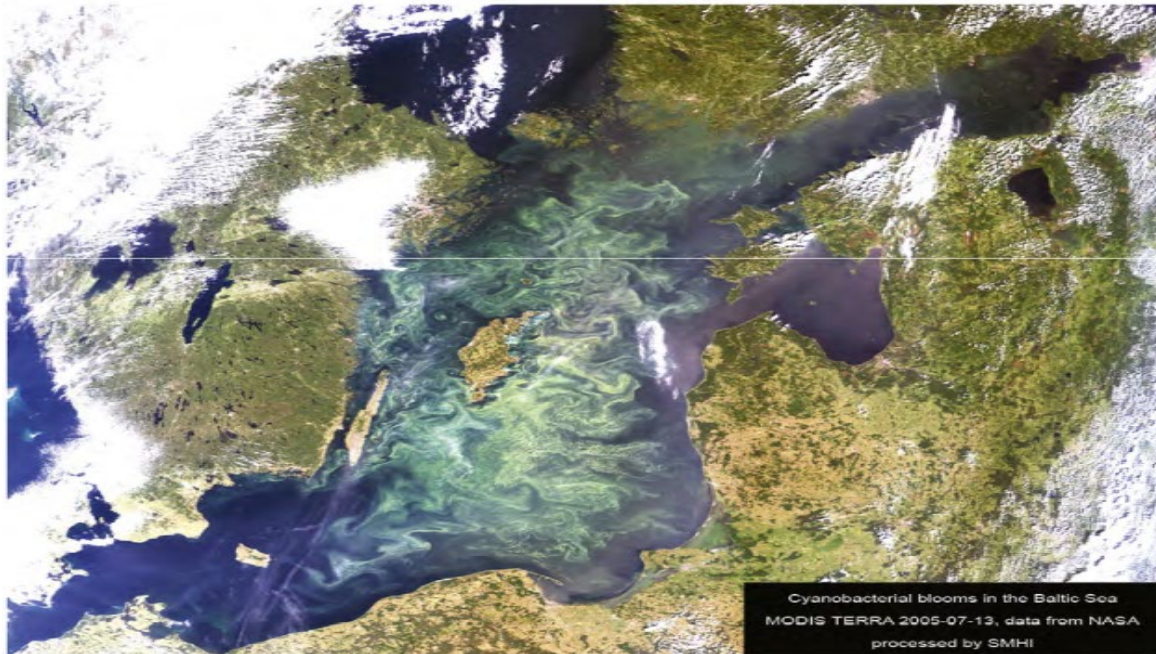


# HOWEVER WE DO HAVE N FOREVER!

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PROGRESS



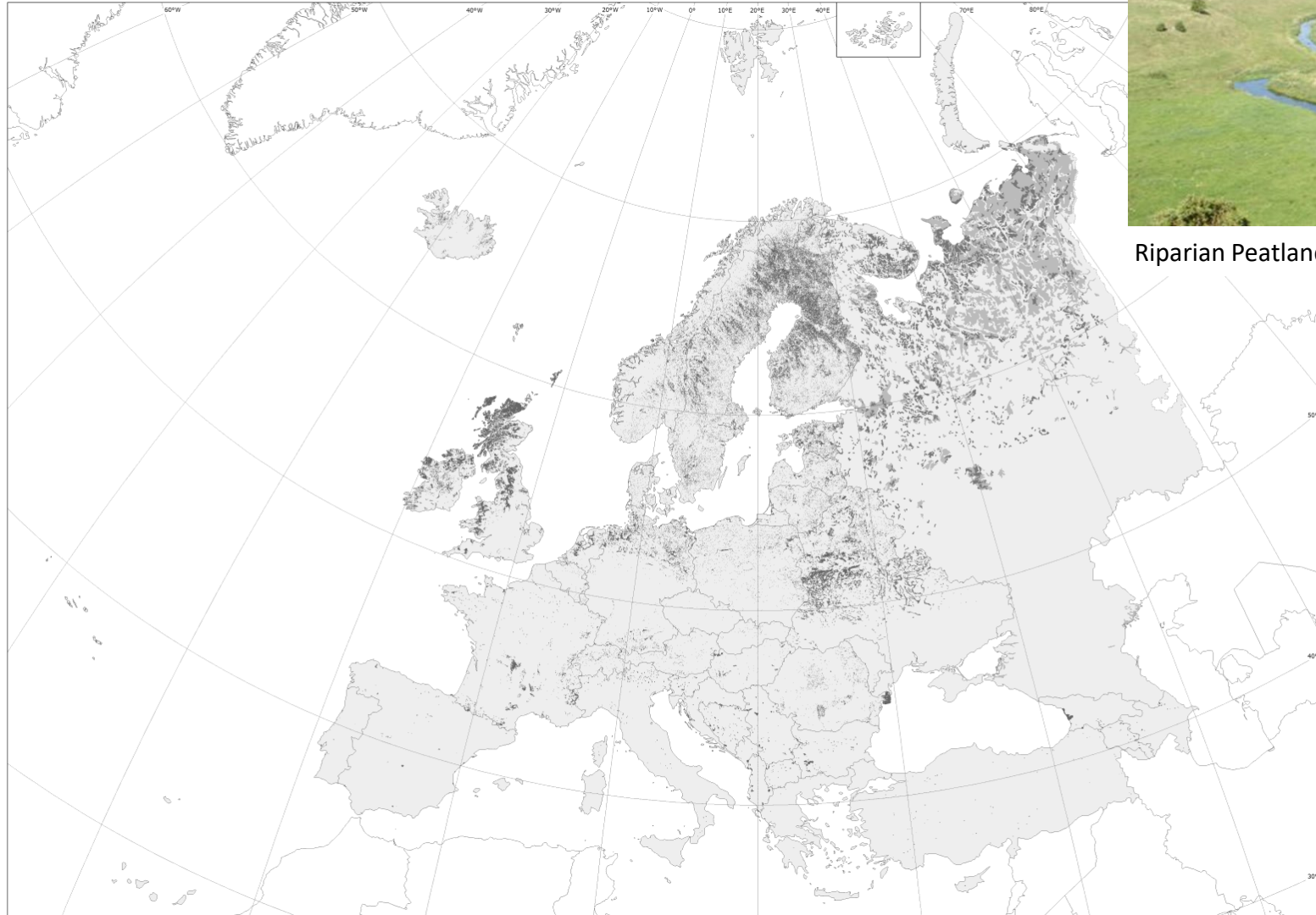


# “NATURAL FILTERS” IN EUROPE

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Riparian Peatland in DK (<http://www.naturstyrelsen.dk>)

**“Kidneys of the landscape” and few things more!**

# MORE THAN 60% ARE DRAINED

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PROGRESS





# CONSEQUENCE OF DRAINAGE

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PROLOG

PROCESSES

PROGRESS



**Reducing POLLUTION  
of water bodies!**

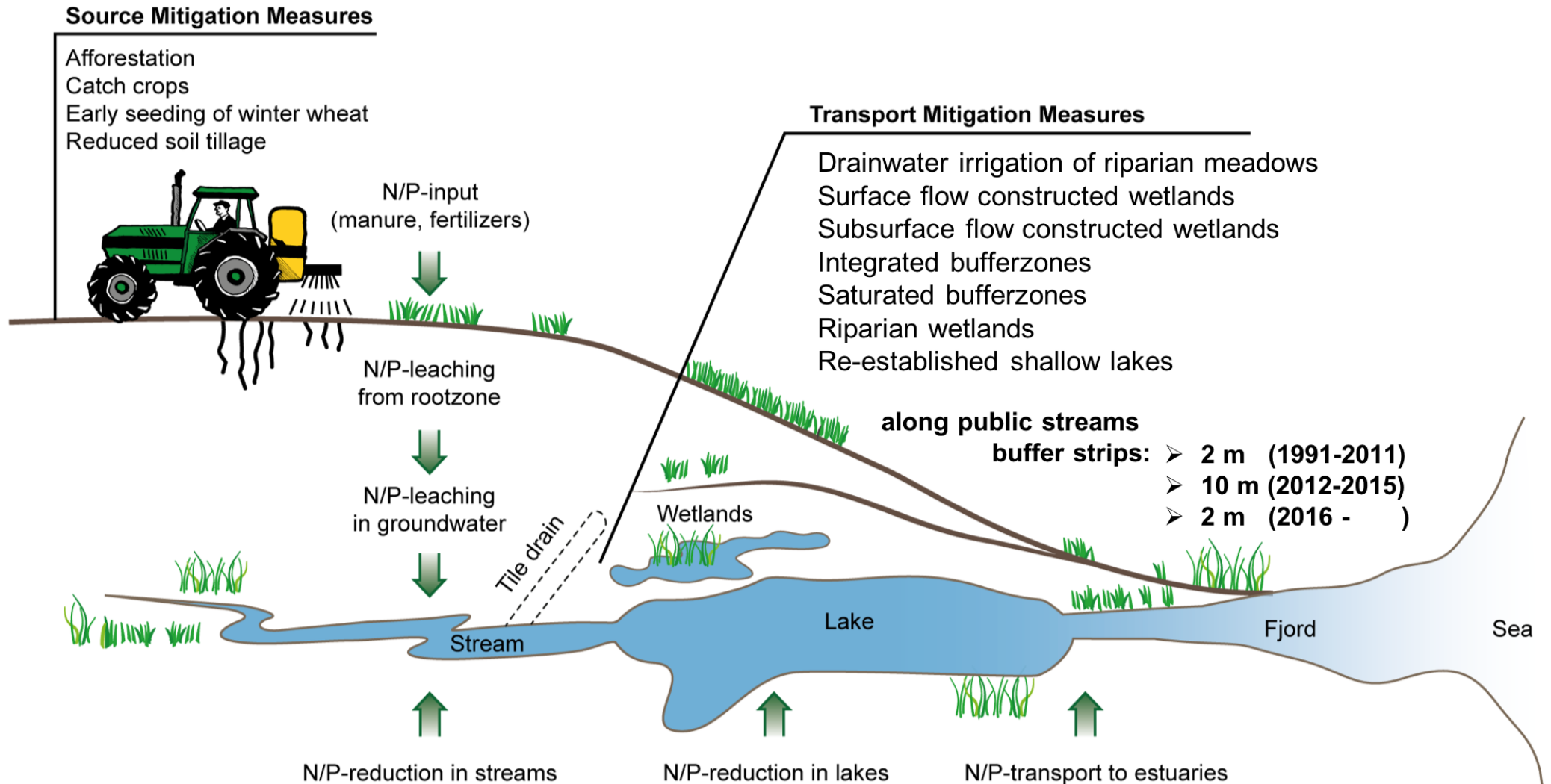


# BY GREEN TRANSITION IN DENMARK

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PROGRESS



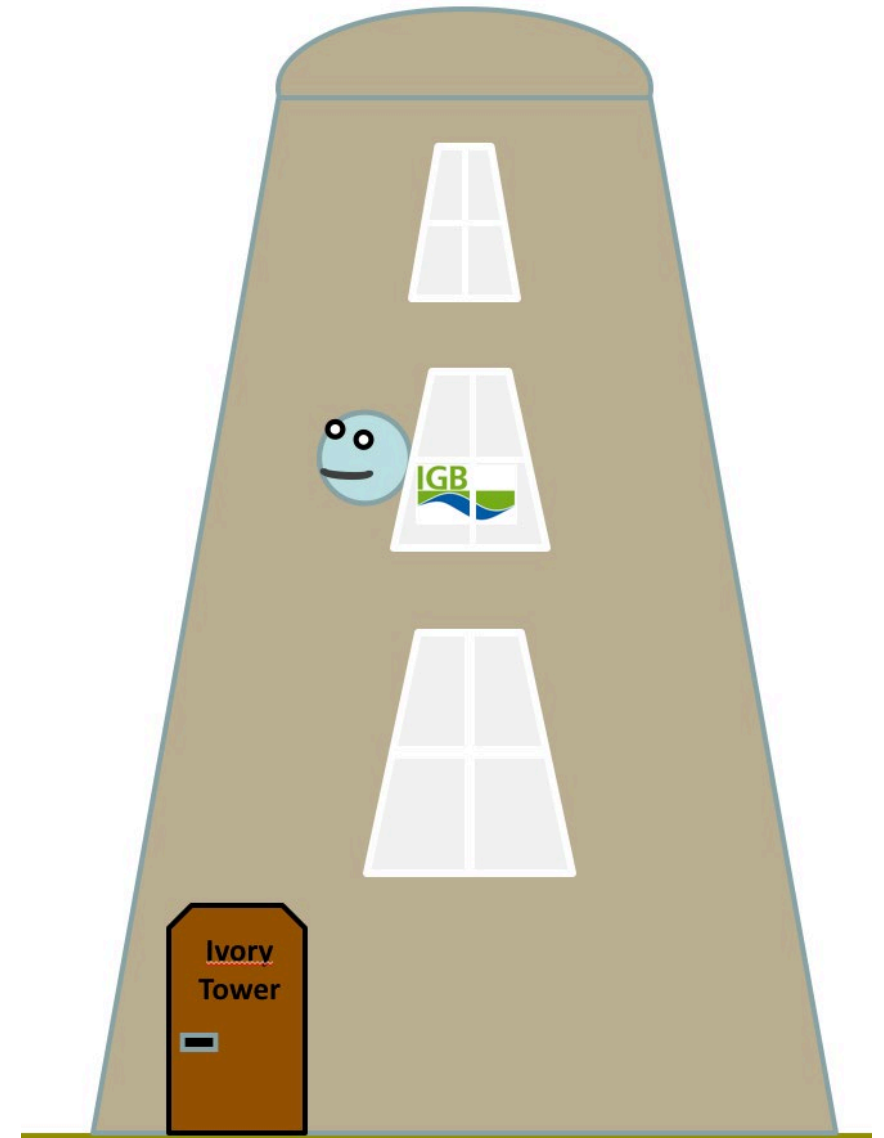
# THE NEED OF KNOWLEDGE!

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1) The bird perspective

2) The worm perspective

3) The missing perspective



# 20 YEARS AGO

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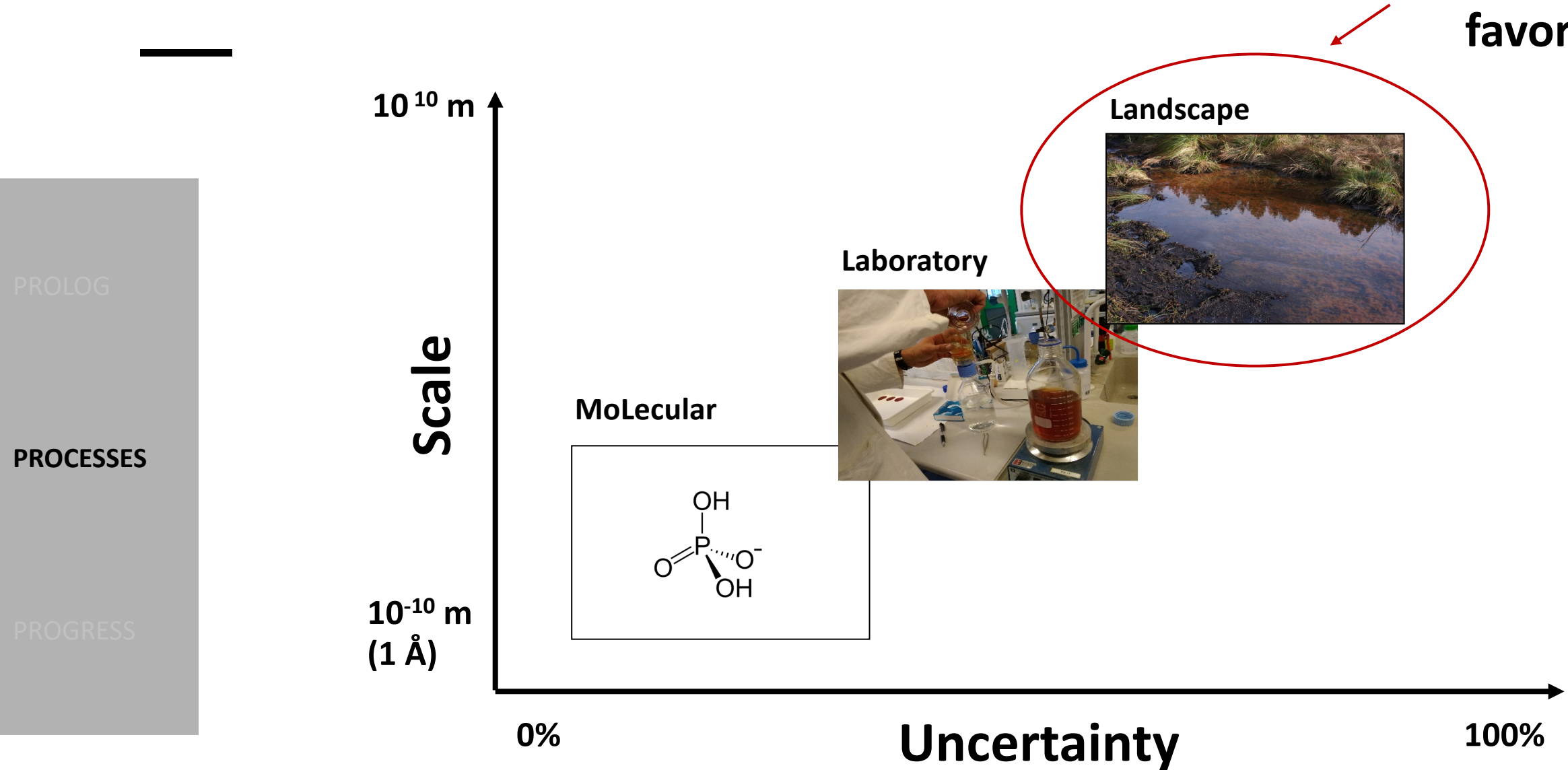


**I was falling in  
love with the  
riparian  
wetlands  
becoming also  
my research  
focus!**



# OUR RESEARCH SCALES

Authorities  
favorite



# NATURE AS BIRDS ONCE EXPERIENCED

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**Or if you fly to the east!**



# NATURE AS BIRDS TODAY EXPERIENCE

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PROLOG

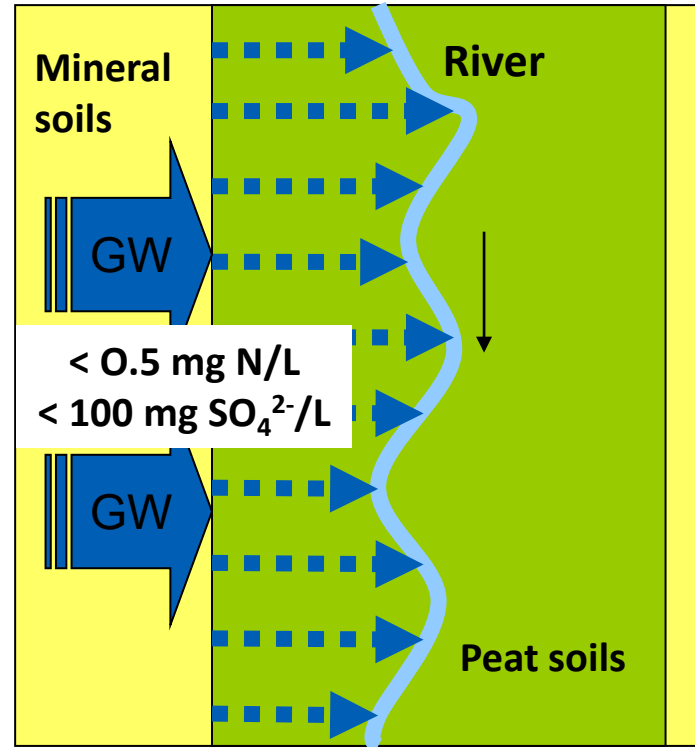
PROCESSES

PROGRESS

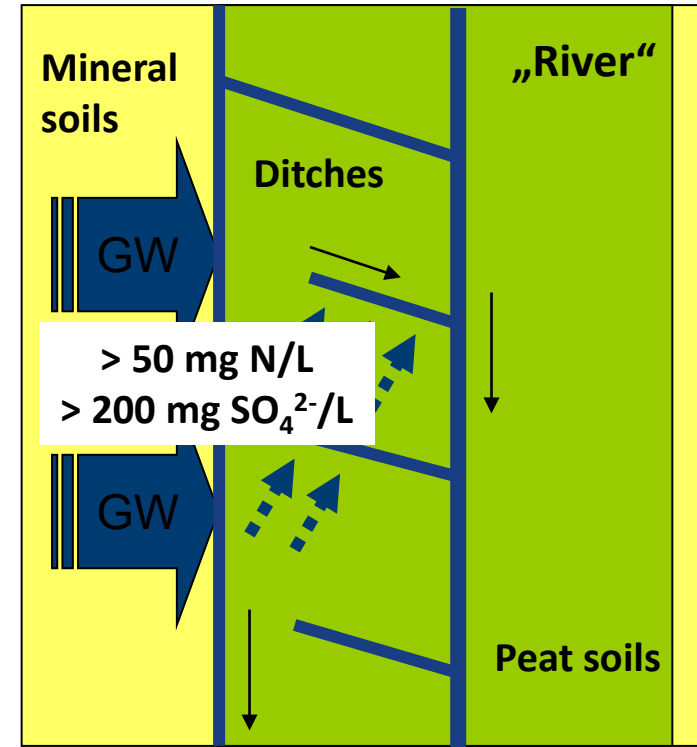


**Well we are many and some of them are even benefiting from it!**

# THE LOW-FLYING BIRD PERSPECTIVE



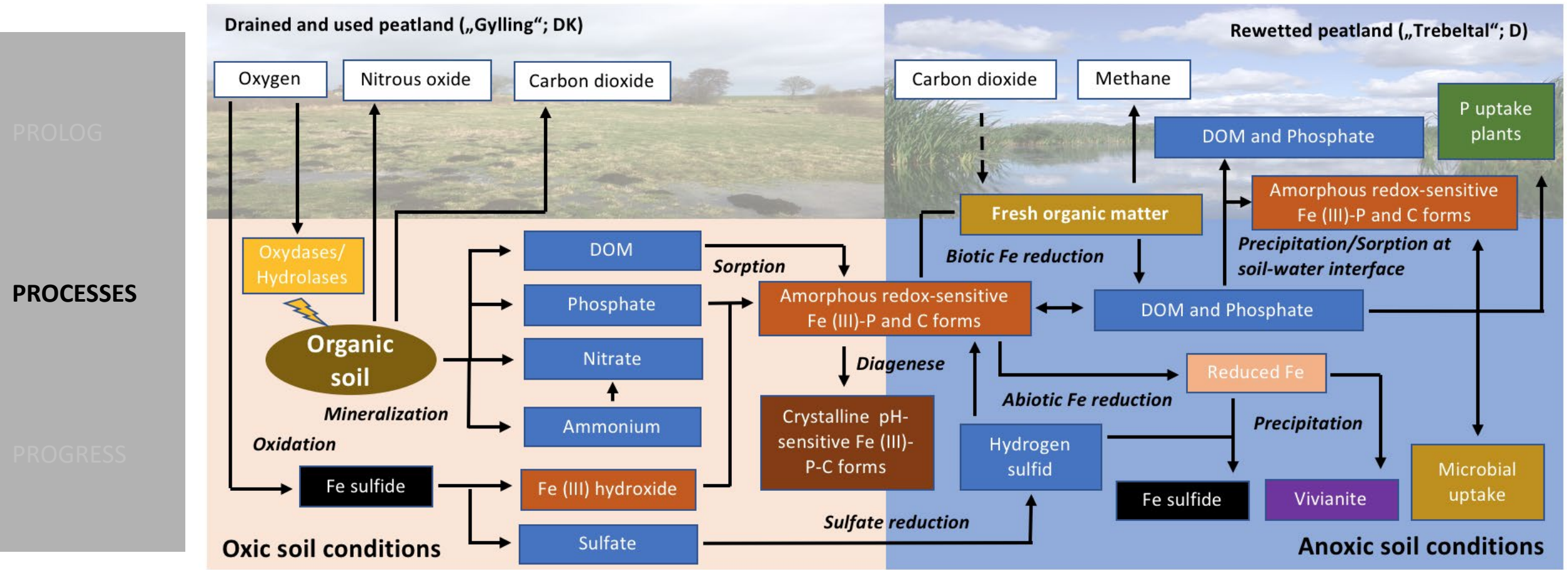
Natural Peatlands as percolated filters for ground water (GW); „kidney of landscape“



The loss of the filter function by complex drainage systems



# THE WORM PERSPECTIVE



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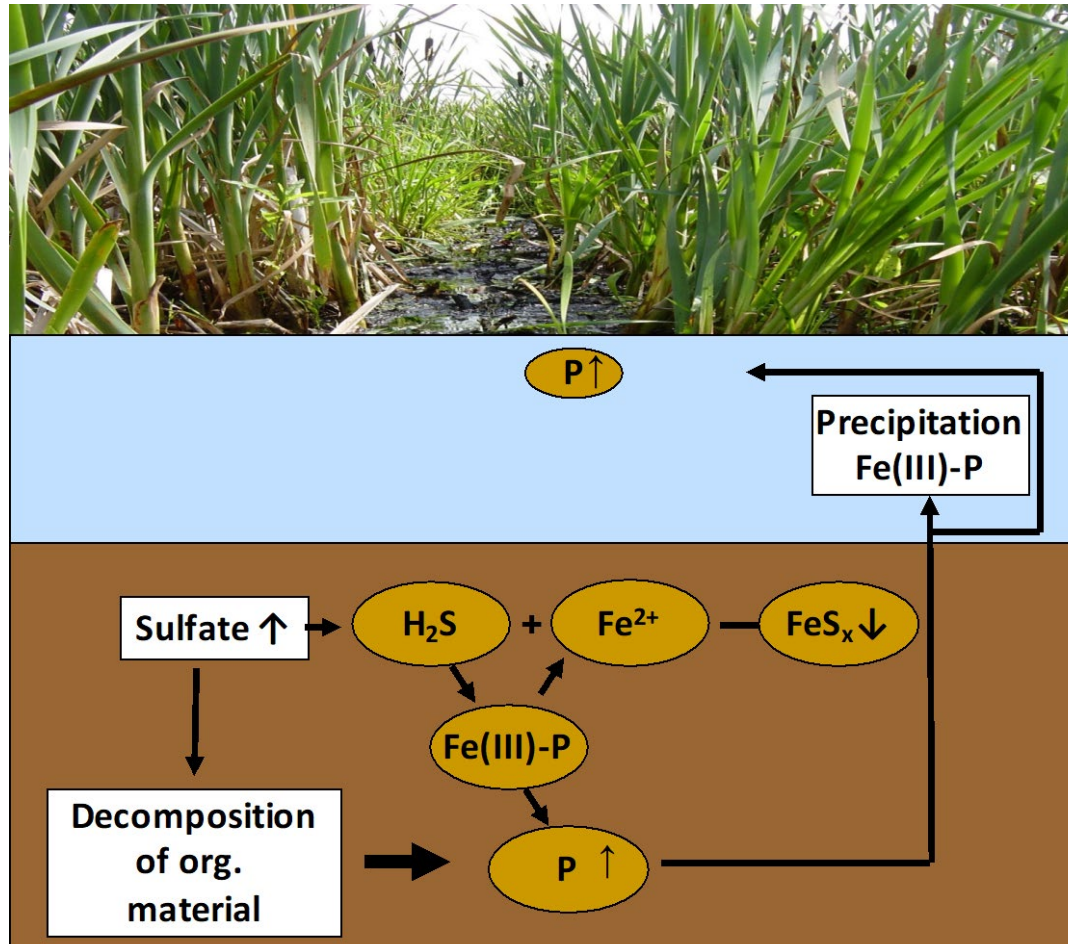


# THE MISSING PERSPECTIVE ON SULFATE

PROLOG

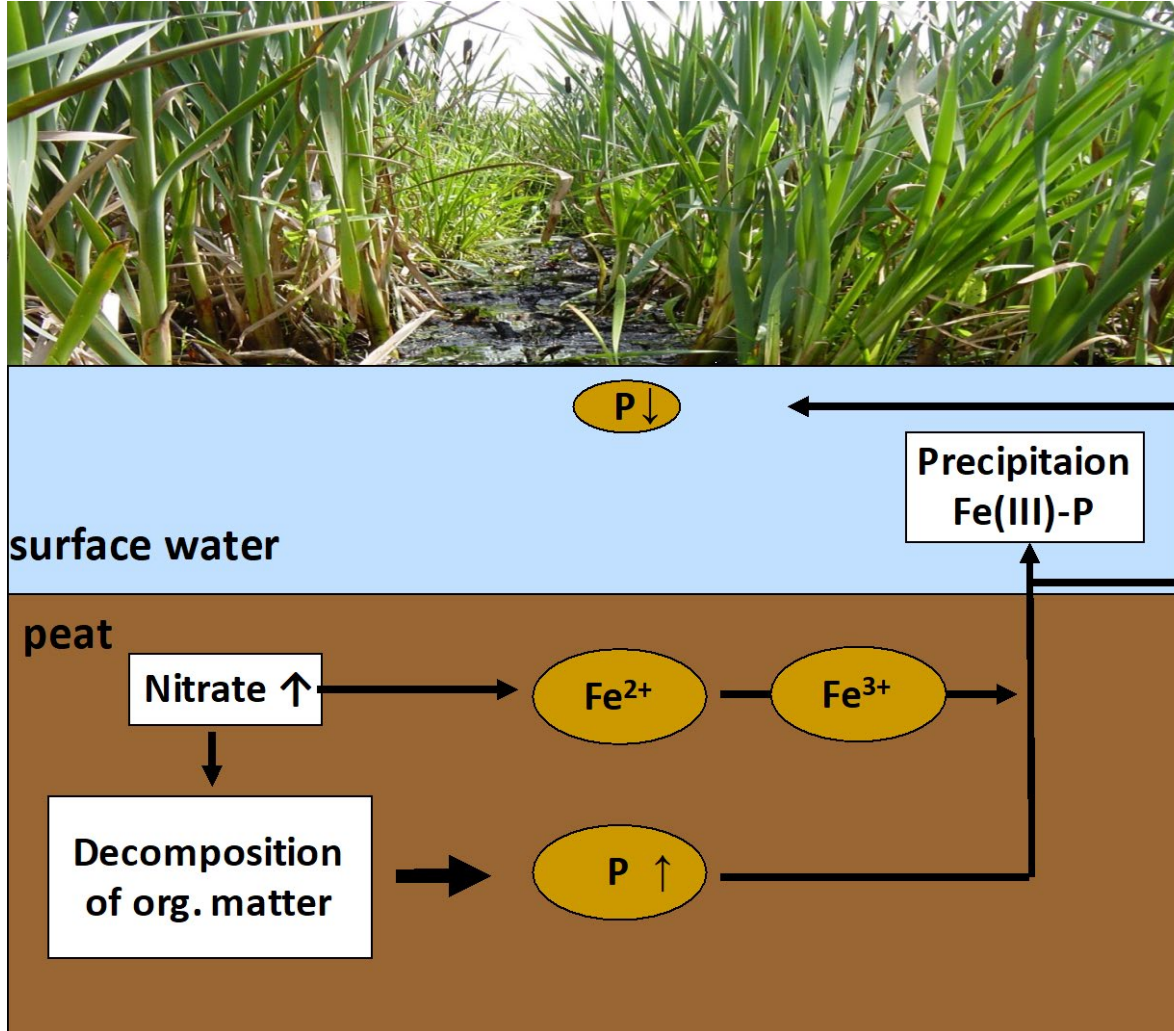
PROCESSES

PROGRESS



**Sulfate pollution is causing both internal eutrophication and higher P loss downstream!**  
**(Zak et al. 2009)**

# THE MISSING PERSPECTIVE ON NITRATE



**Nitrate pollution might suppress the internal P mobilisation and also the P loss downstream! (Cabezas et al. 2013)**



# THE DANISH WAY

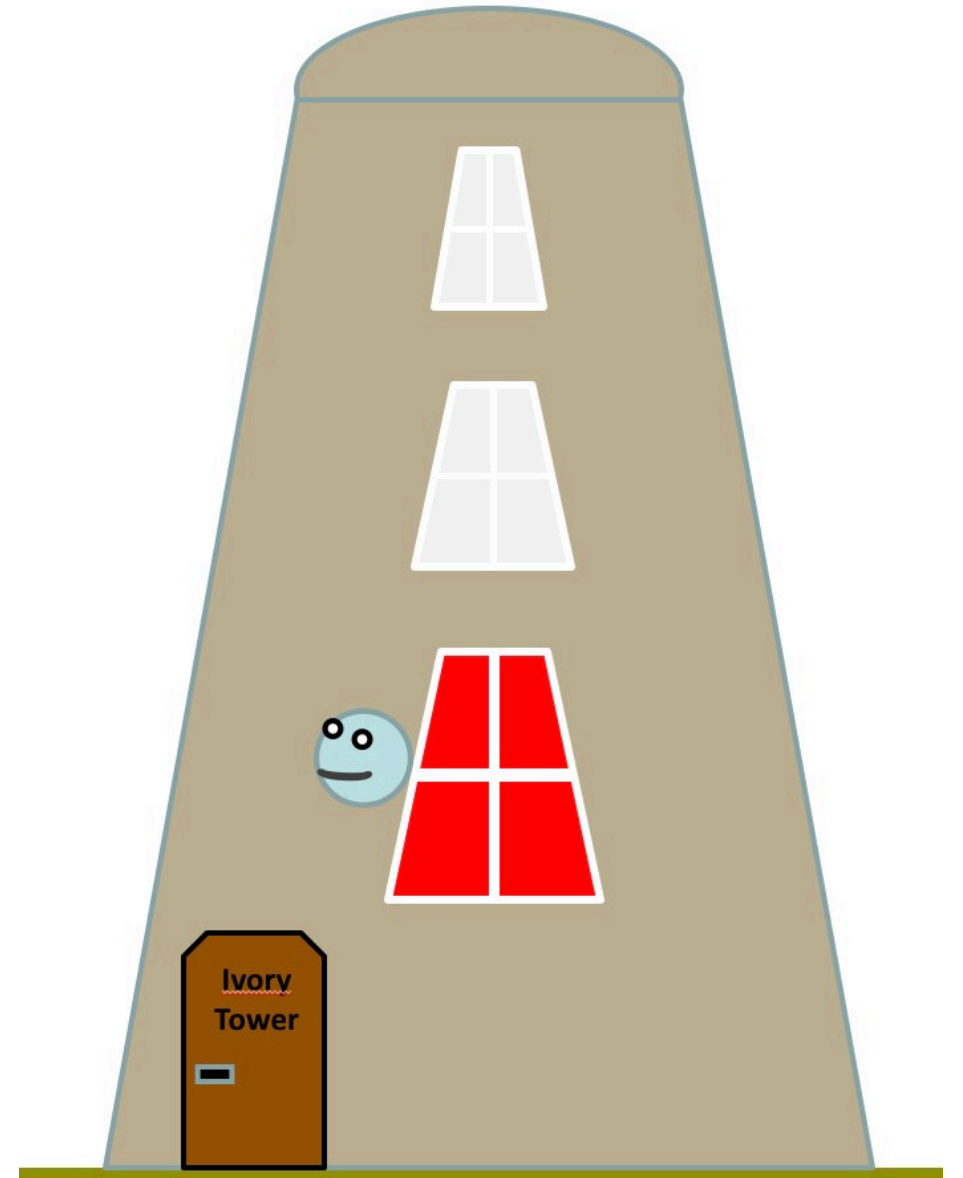
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**1) Restoration constraints**

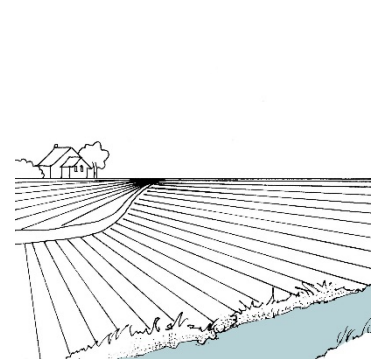
**2) Riparain buffer genesis**

**3) Restoration upgrades**



# RESTORATION CONSTRAINTS IN DK

## What happens to stream buffers?



Images by Halina Galera (Clearance 2017-2020)

Degradation

noitarotseR

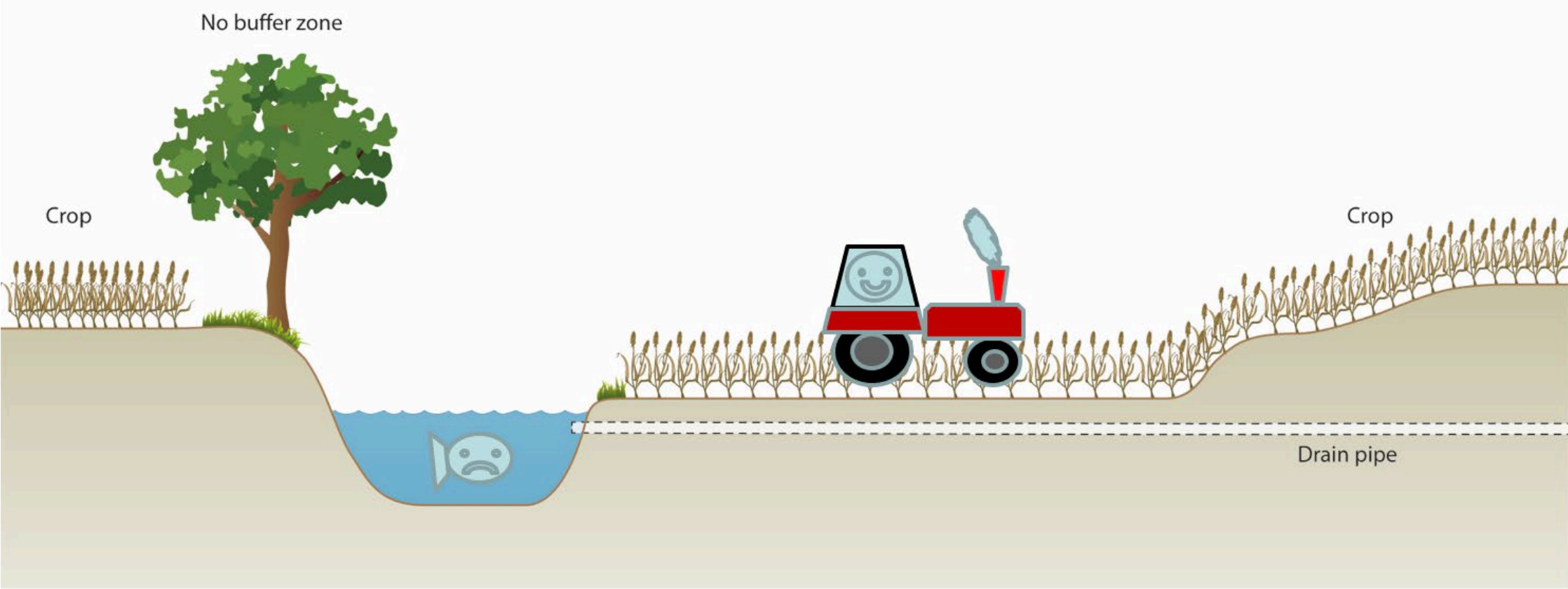
Other options?

# GENESESIS – NO BUFFERSTRIPS

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PROGRESS



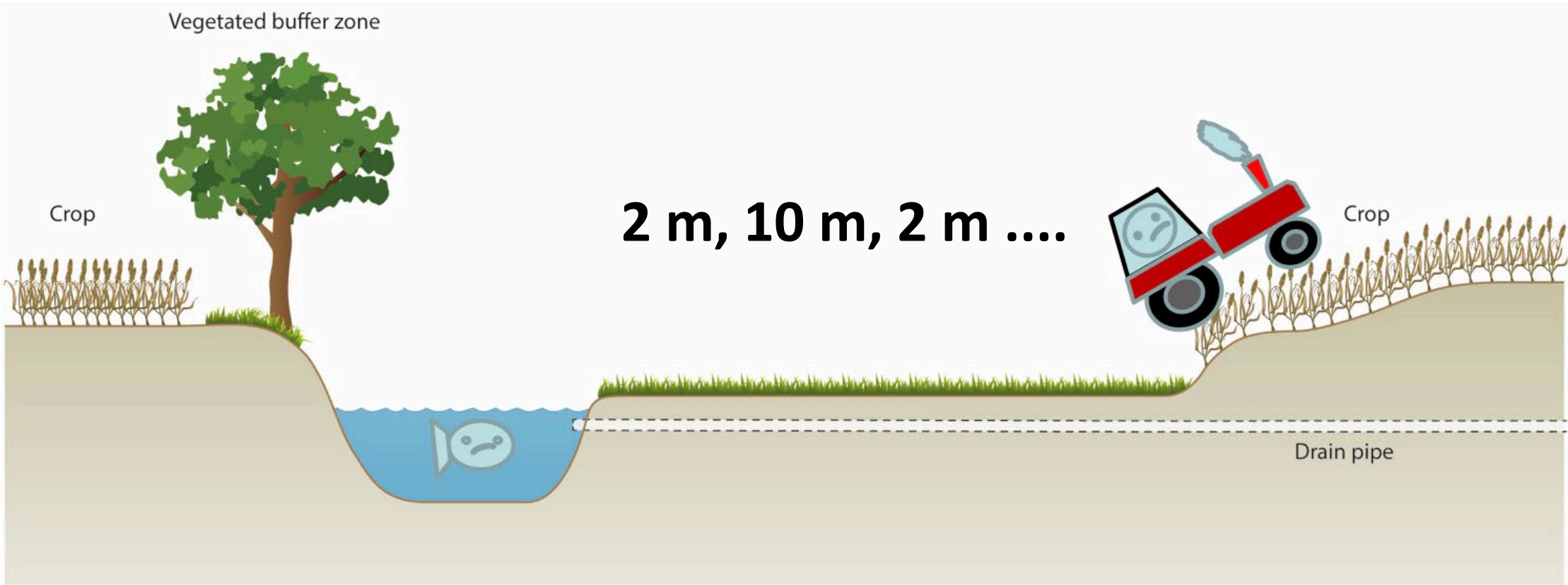


# GENESESIS – VEGETATED BUFFERZONES

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PROGRESS

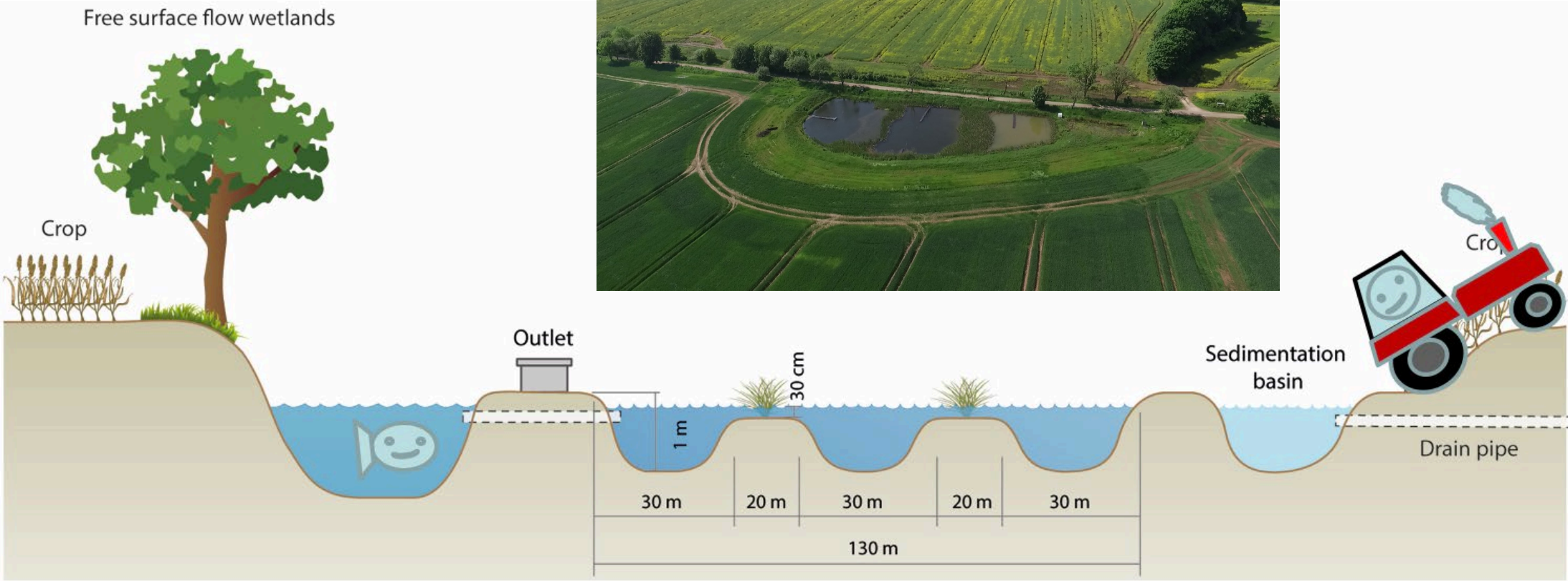


# GENESESIS – FREE SURFACE FLOW WETLANDS

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PROCESSES

PROGRESS



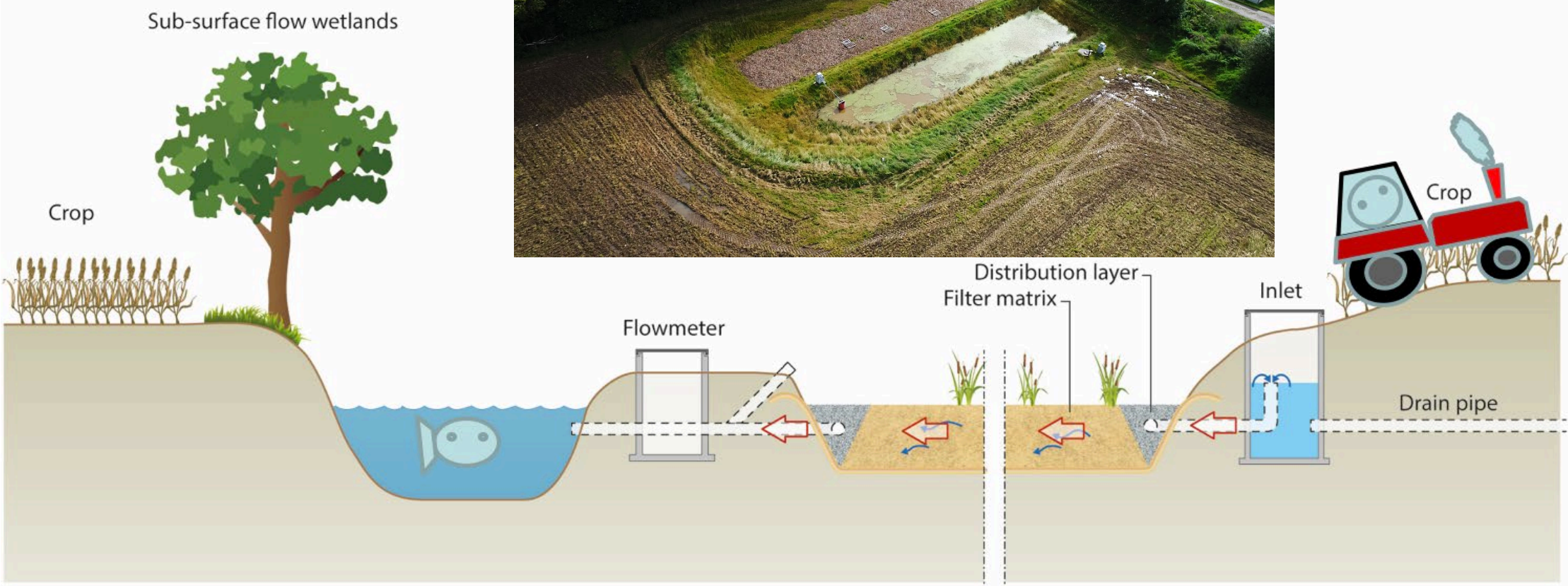


# GENESESIS – BIOREACTORS

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PROGRESS



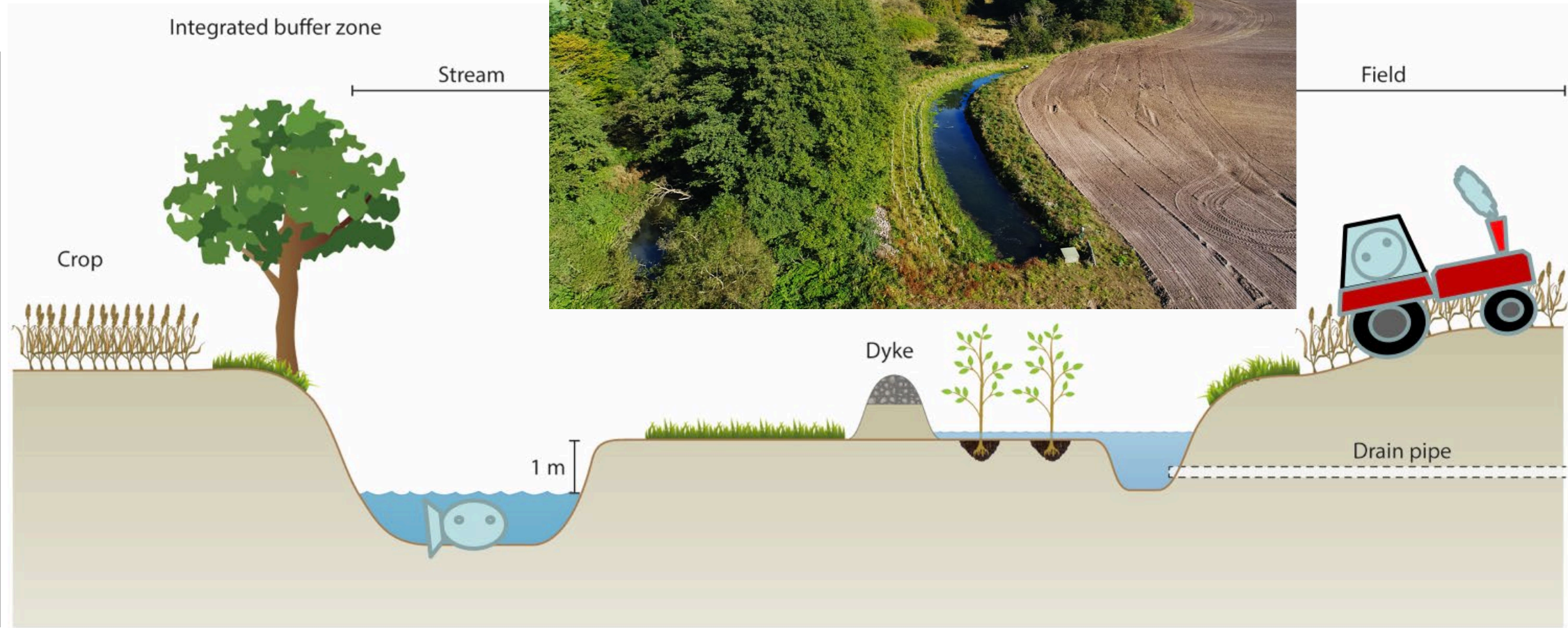


# GENESESIS – INTEGRATED BUFFERZONES

PROLOG

PROCESSES

PROGRESS

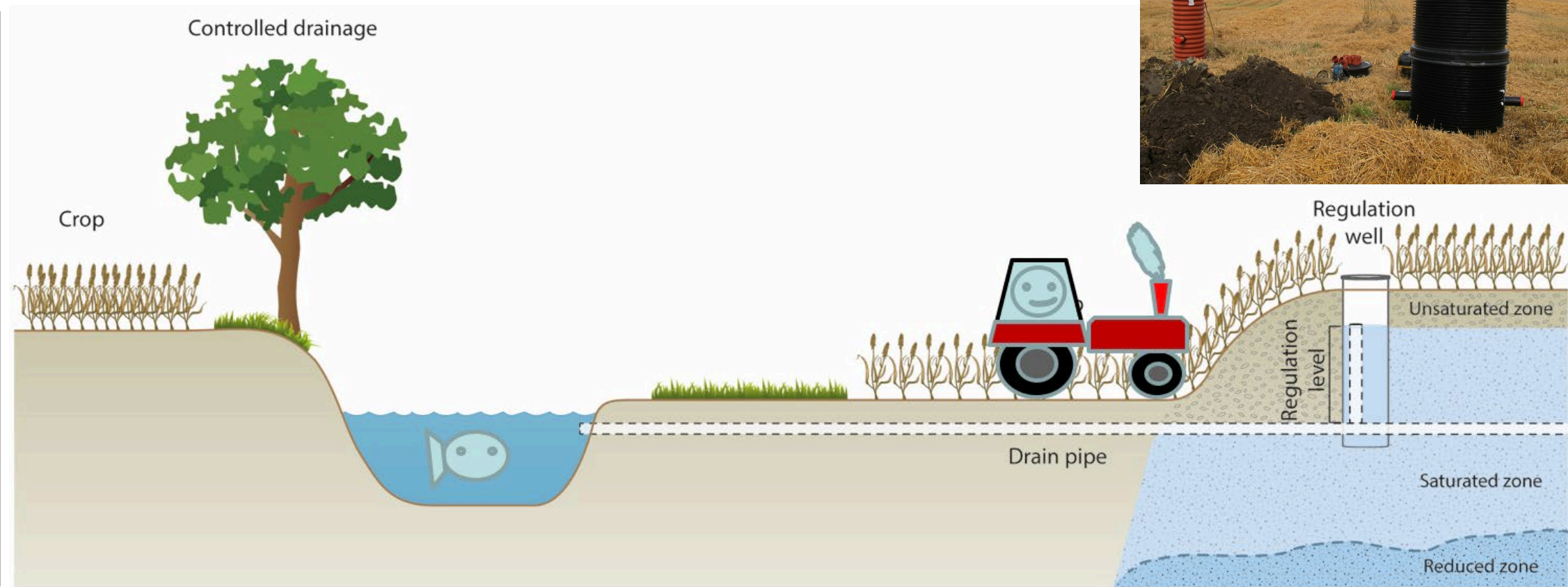


# GENESESIS – CONTROLLED DRAINAGE

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PROCESSES

PROGRESS



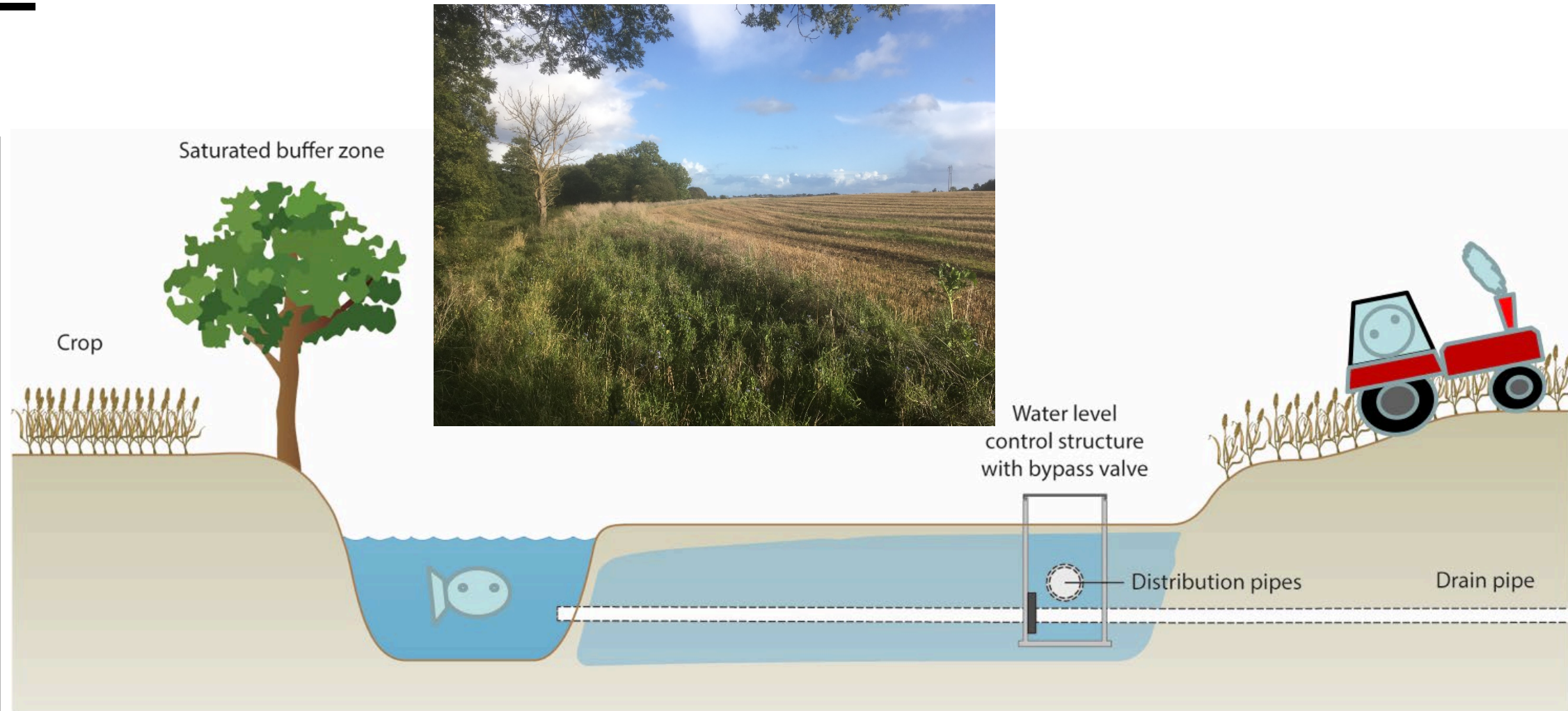


# GENESESIS – SATURATED BUFFERZONE

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PROGRESS





# WHAT ABOUT WETLAND RESTORATION

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**What we wish:**



**What we get:**



**A polytrophic lake with high release of phosphorus and methane and slow development of target peatland species. (Zak et al. 2018)**

# SOME MANAGEMENT STRATEGIES

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## TO REMOVE P SURPLUS!

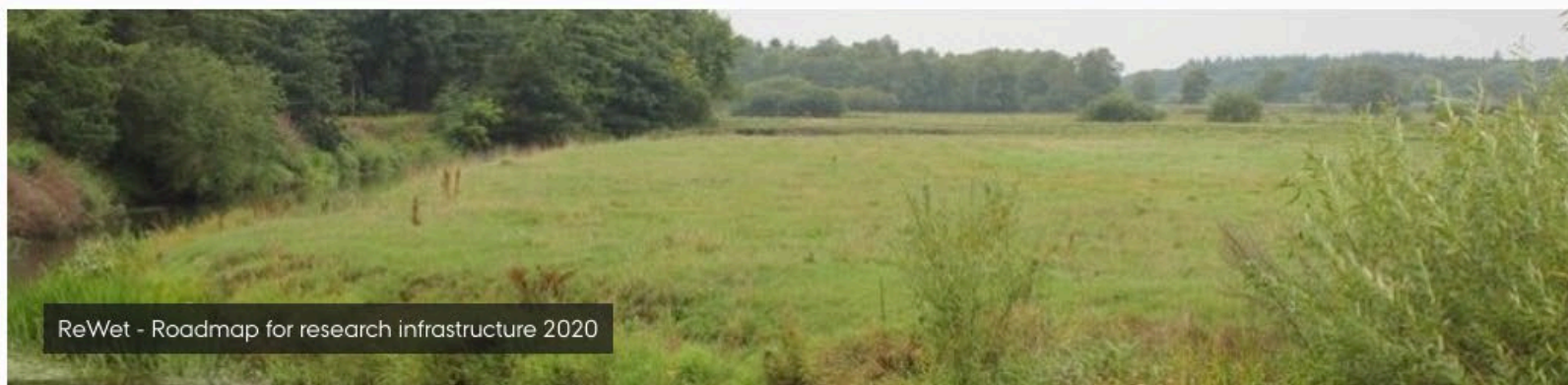


# REWET - ROADMAP FOR RESEARCH INFRASTRUCTURE 2020

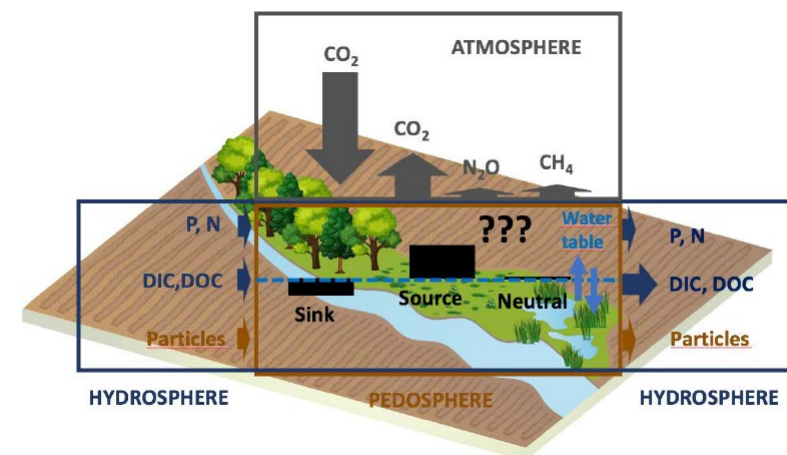
Wetland observatories for rewetting of drained peatlands

## ReWet

- › Site descriptions
- › Partners



<https://projects.au.dk/rewet/>





# SOME FUTURE PERSPECTIVES

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Pictures from Karsten Reise (plenary talk on the SWS meeting 2016 in Potsdam)

## THINKING BROADER!



AARHUS  
UNIVERSITY

**Many thanks for your  
attention!**

