



# WATERING DRY LANDSCAPES

A design for a climate adaptive moraine landscape of Nijmegen which facilitates a symbiotic relationship between human and nature

**NICOLLE COBBEN**

**P5 presentation | 3 November 2022**

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## The Netherlands..

Denkend aan Holland  
zie ik breede rivieren  
traag door oneindig  
laagland gaan,  
rijen ondenkbaar  
ijle populieren  
als hoge pluimen  
aan den einder staan,  
en in de geweldige  
ruimte verzonken  
de boerderijen  
verspreid door het land,  
boomgroepen, dorpen,  
geknotte torens,  
kerken en olmen  
in een grootsch verband,  
de lucht hangt er laag  
en de zon wordt er langzaam  
in grijze veelkleurige  
dampen gesmoord,  
en in alle gewesten  
wordt de stem van het water  
met zijn eeuwig rampen  
gevreesd en gehoord.

Hendrik Marsman, 1963



## Vulnerable to flood and water nuisance



Watersnoodsramp 1953



High water Limburg 2021



Source:  
Right: ANP  
Left: Rijkswaterstaat

## News items summer 2022

**NOS**

NOS Nieuws • Woensdag 3 augustus, 14:16 •  
Aangepast woensdag 3 augustus, 17:17

### Officieel watertekort: vanaf nu verdeelt een landelijk crisisteam het schaarse water

Vanaf vandaag bepaalt het landelijke Managementteam Watertekorten (MTW) hoe het schaarse water in Nederland wordt verdeeld. Door de aanhoudende droogte is er inmiddels sprake van een "feitelijk watertekort", laat minister Harbers van Infrastructuur en Waterstaat weten. Op dit moment zijn er geen extra maatregelen nodig om problemen te voorkomen, maar als de droogte aanhoudt binnenkort wel. Wat die maatregelen dan precies inhouden is nog onduidelijk.

WATER SHORTAGE



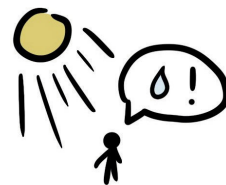
Rijksoverheid

### Water moet worden verdeeld door aanhoudende droogte

Nieuwsbericht | 03-08-2022 | 14:15

De aanhoudende droogte zorgt ervoor dat er landelijk een grotere vraag is naar water dan wat er ons land binnenkomt via regen en rivieren. De voorspelling is dat dit nog een tijd aanhoudt, waardoor komende weken mogelijk nieuwe maatregelen volgen om het water te verdelen. Minister Harbers (Infrastructuur en Waterstaat) schrijft vandaag aan de Tweede Kamer deze waterverdeling vanaf nu bij het Managementteam Watertekorten (MTW) te beleggen.

WATER MUST BE DIVIDED

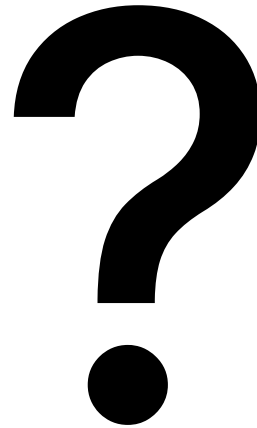


## Fascination

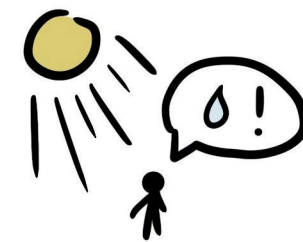
From



**WATERLAND**



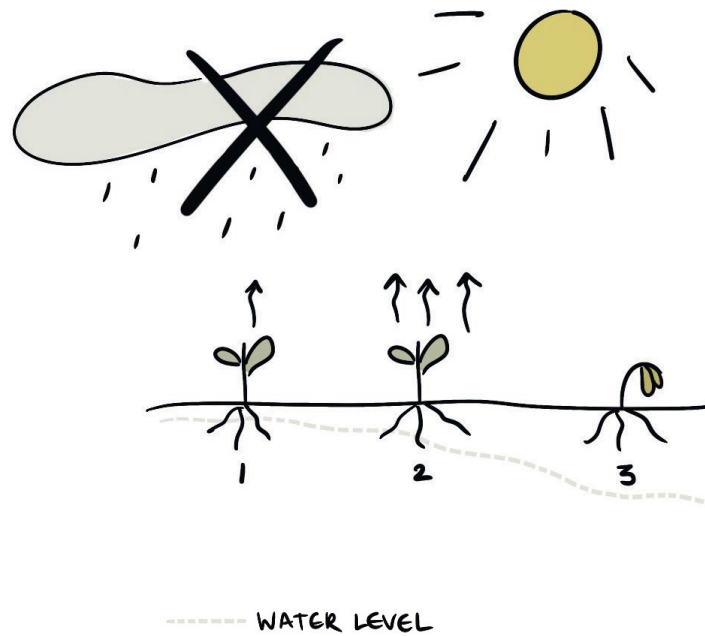
To



**DROUGHTLAND**

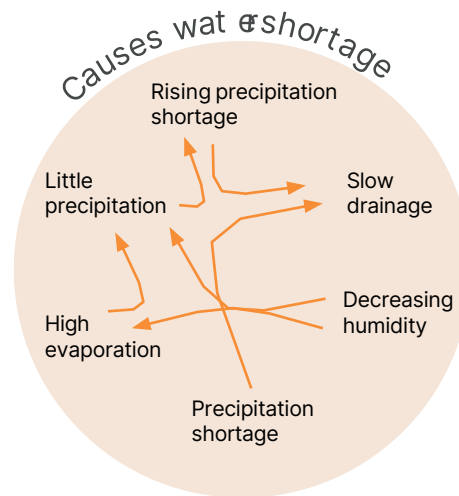
# Drought

Precipitation shortage



# Drought

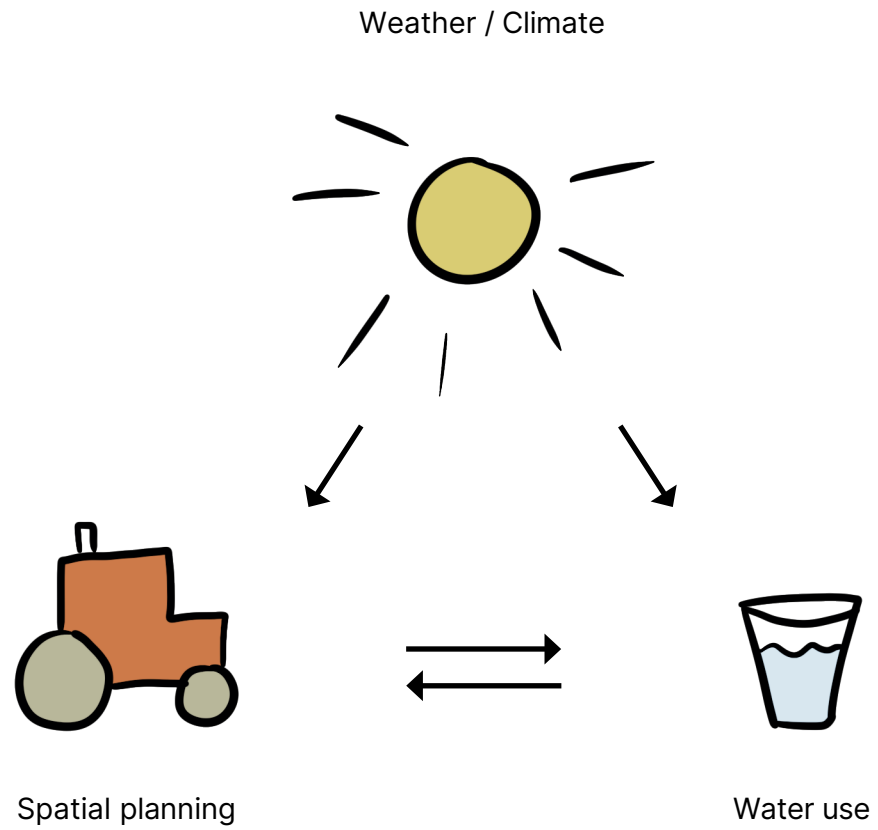
## Water shortage







# Interplay drought



## Water shortage caused by humans

spatial planning



# Water shortage caused by humans

water use



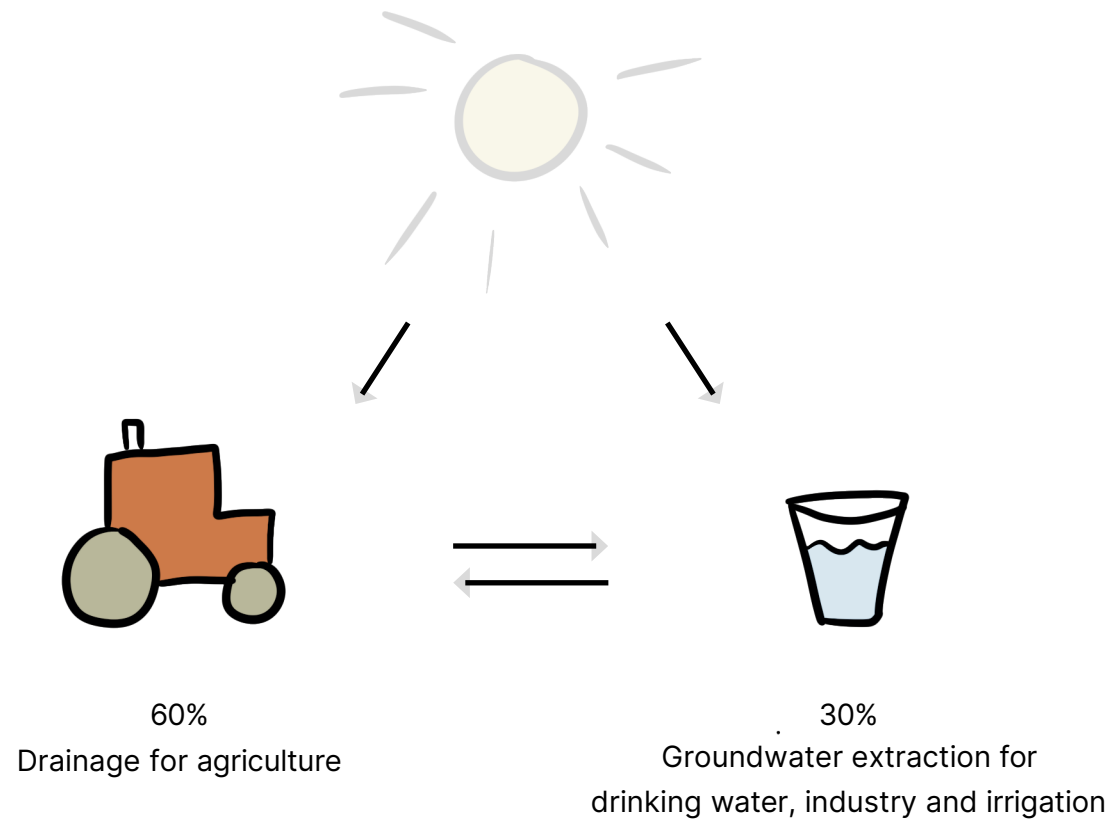
Irrigation



Drinking water & industry

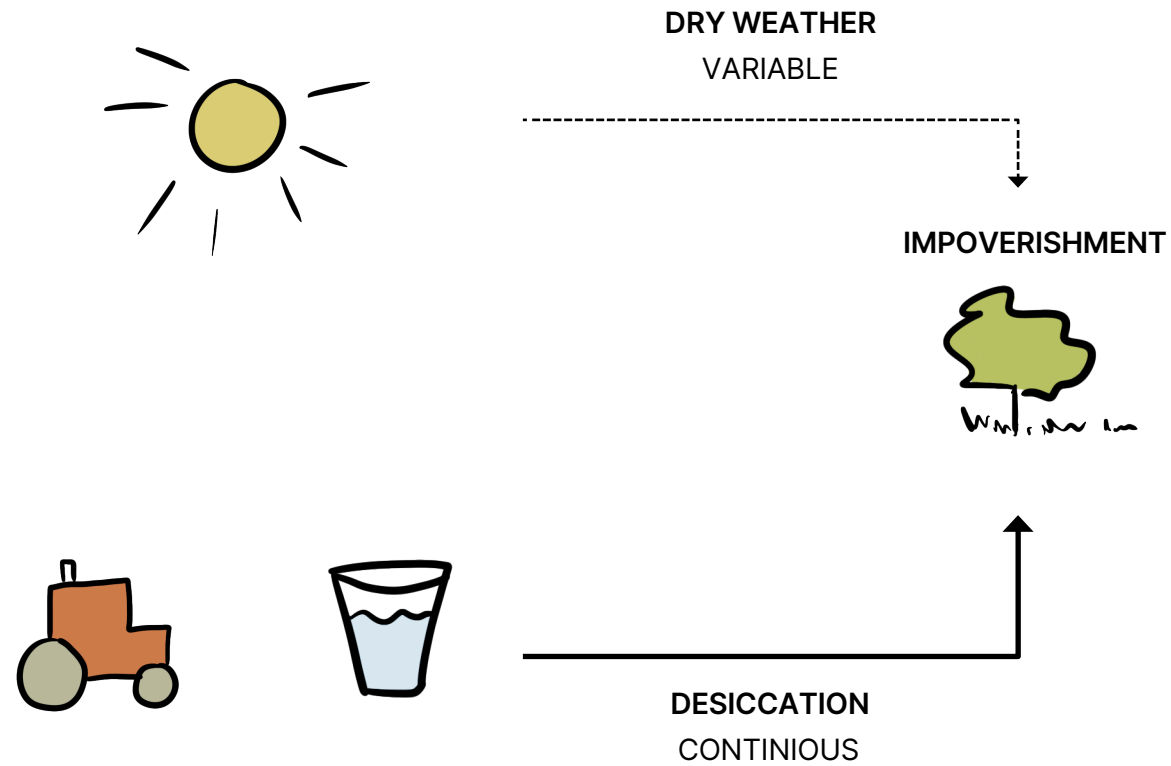
Source:  
Right: Drinkwaterplatform  
Left: De Stentor

# Desiccation



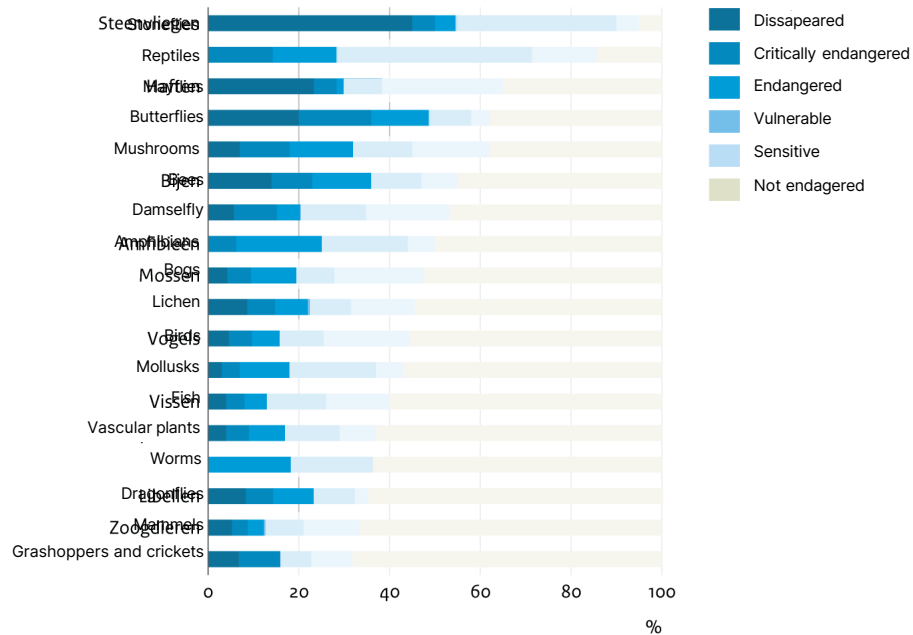
# Desiccation

structural problem



# Nature deteriorates

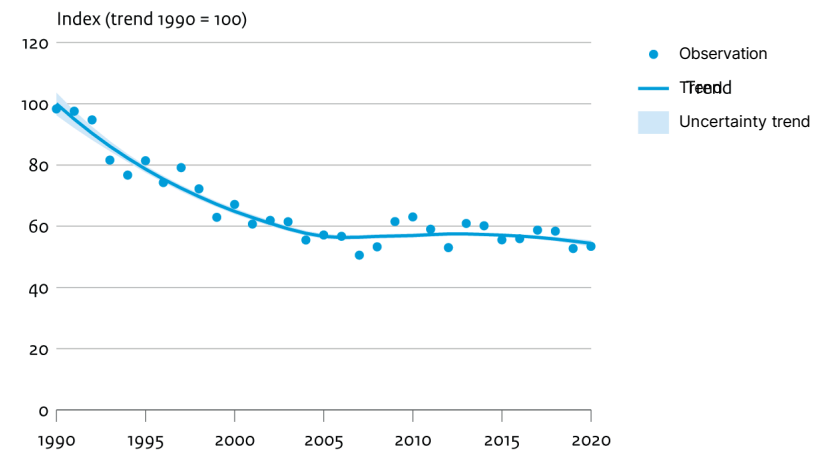
Number of endangered and dissapeared species, 2019



Bron: Soortenorganisaties, WUR

CBS/nov20  
www.clo.nl/nl105217

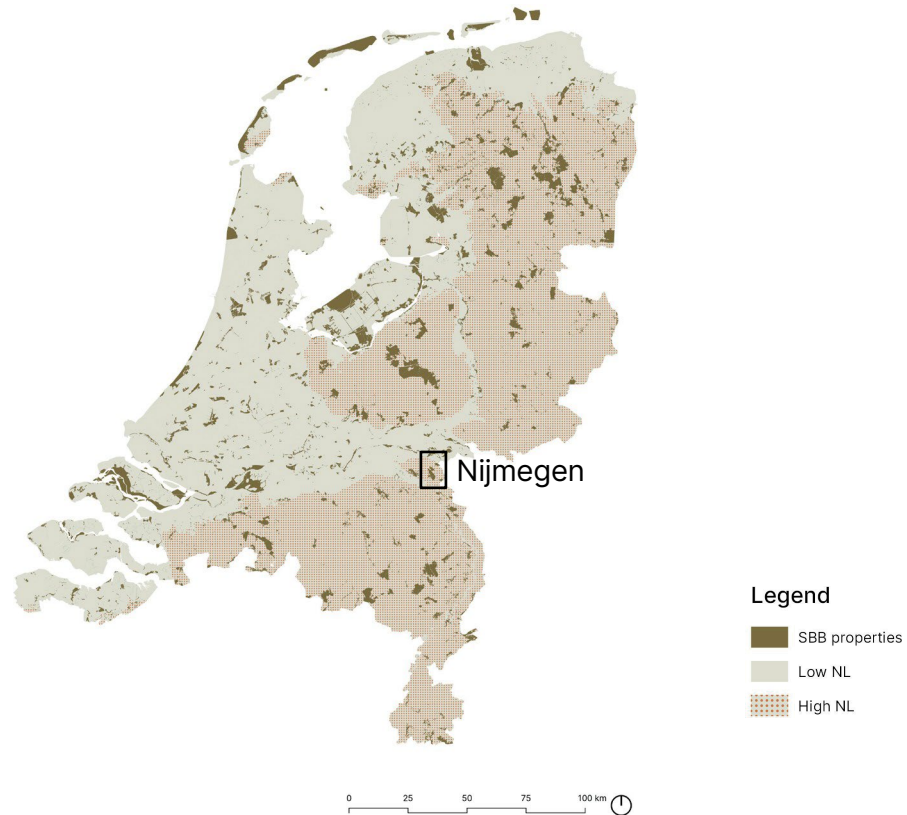
Fauna of nature reserves on land 1990 - 2020



Bron: NEM (Soortenorganisaties, CBS)

CBS/mrt22  
www.clo.nl/nl158107





## Analysis for Staatsbosbeheer



## Analysis for Staatsbosbeheer



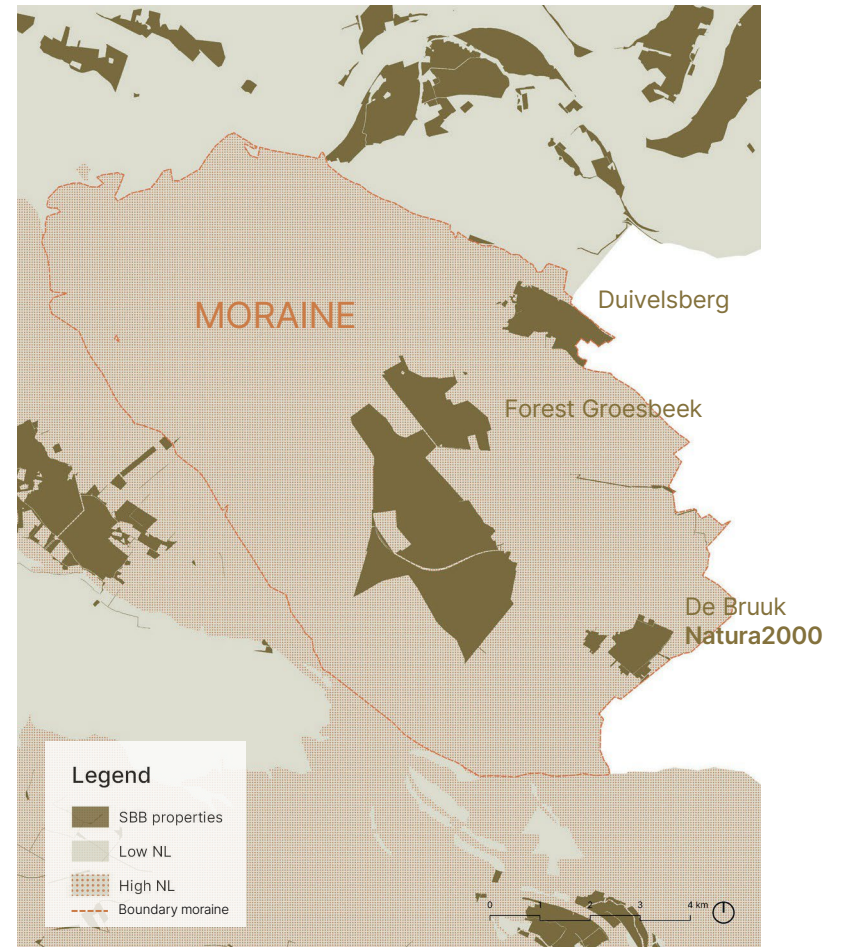
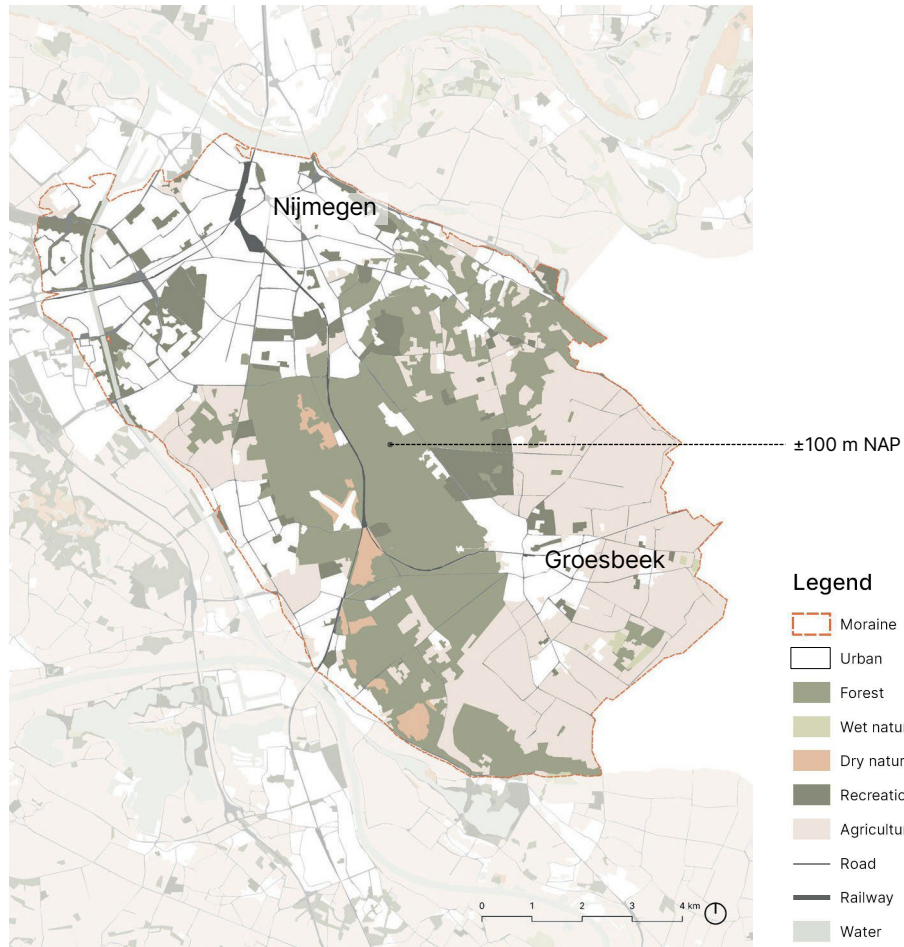
### Legend

-  SBB properties
-  Low NL
-  High NL
-  Boundary moraine

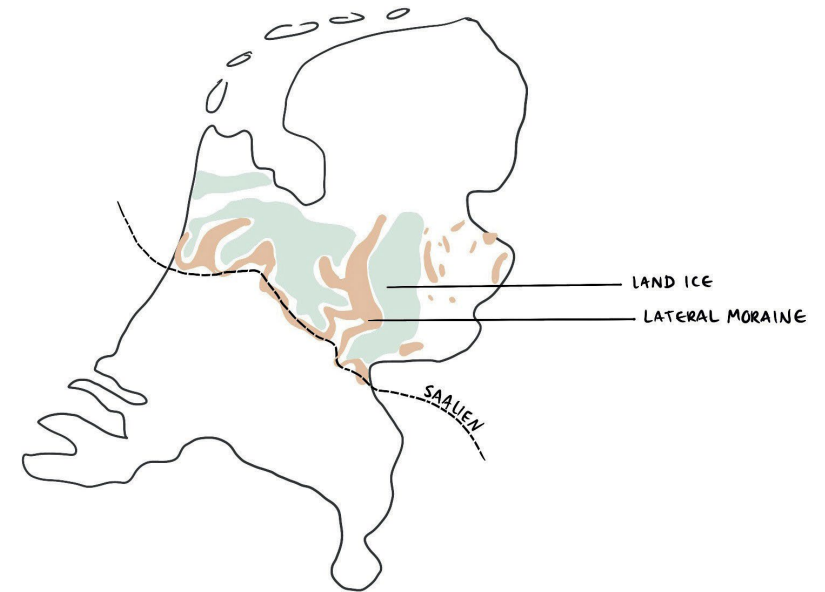
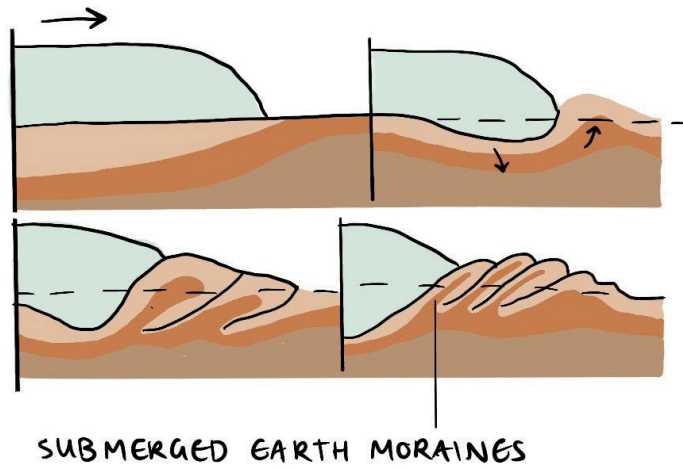




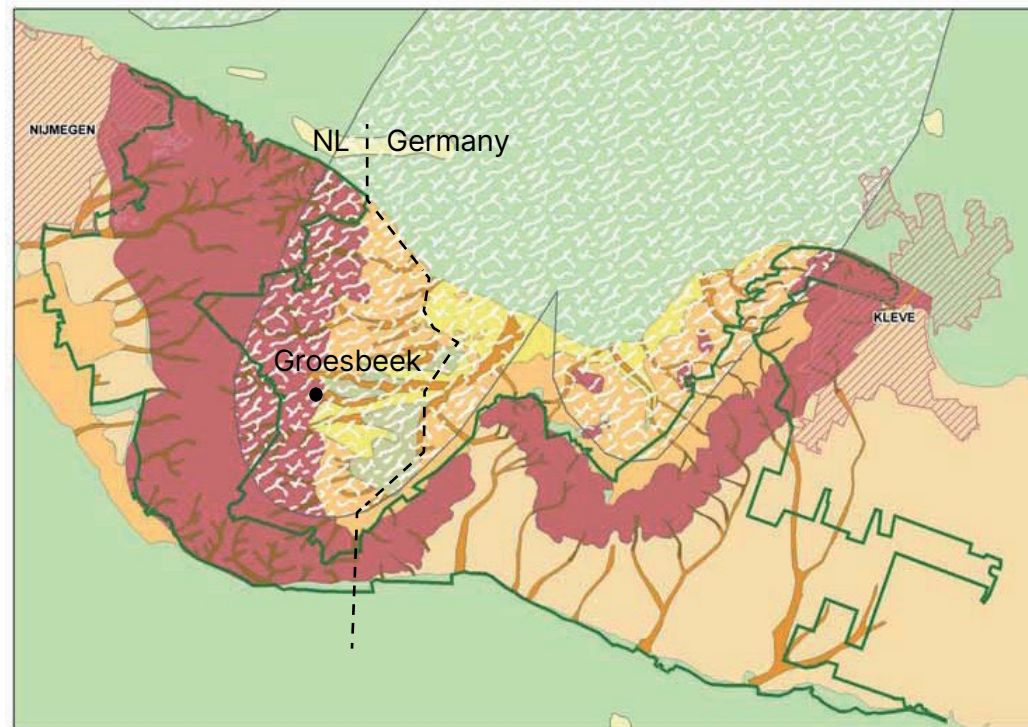
# The moraine of Nijmegen



## Formation moraine

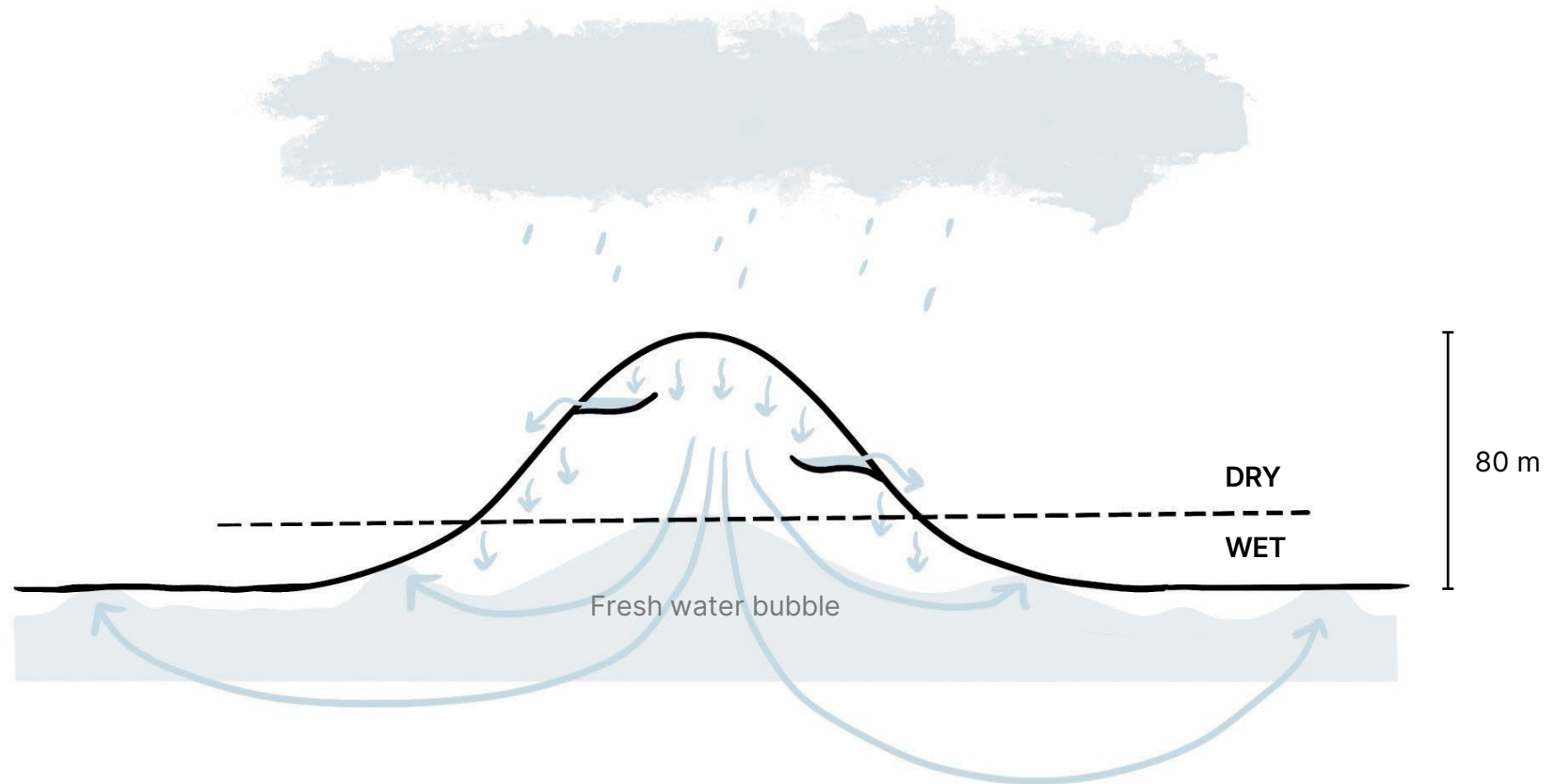


## Land ice Nijmegen - Kleve



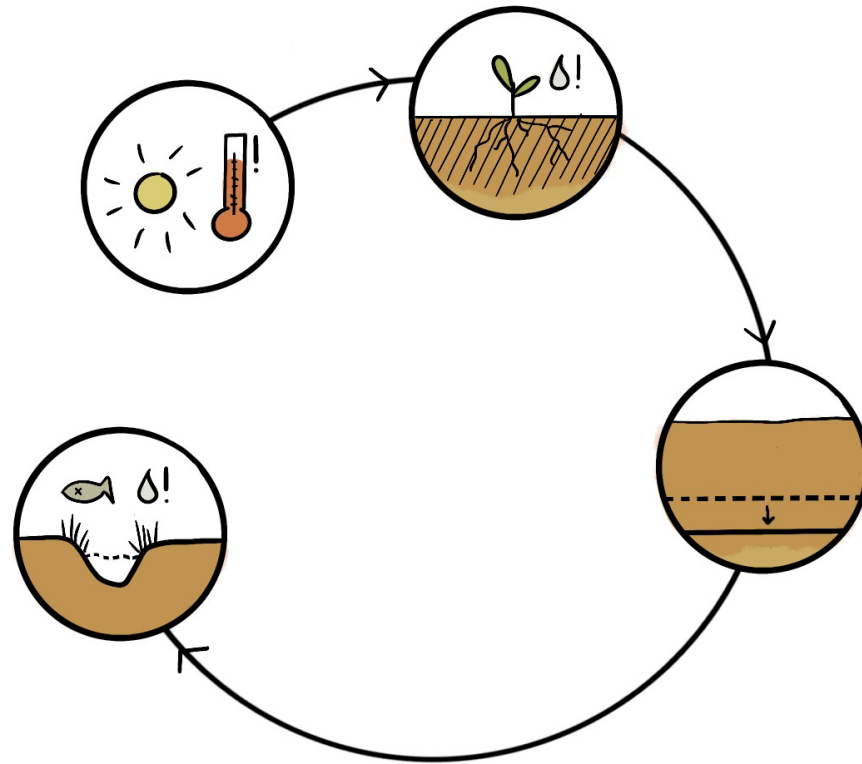
# Soil-water system

SPONGE

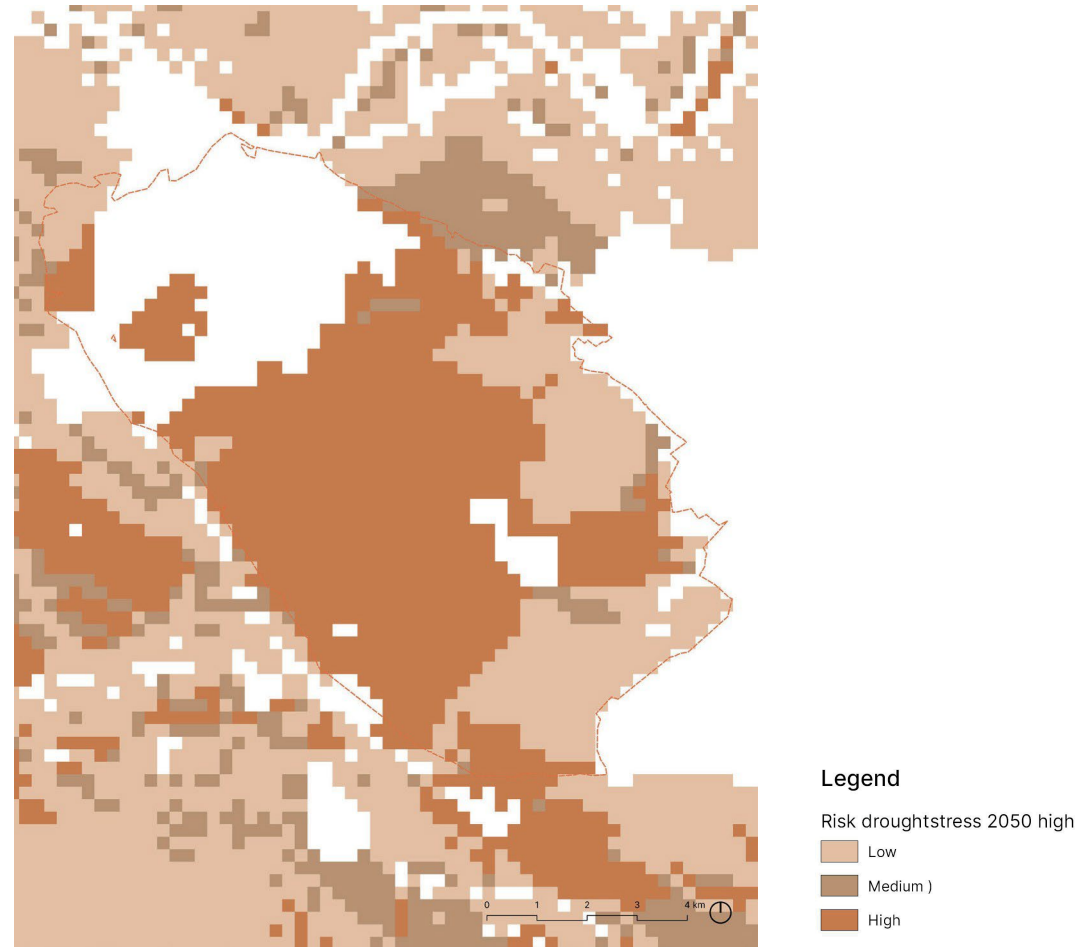


## THREATS

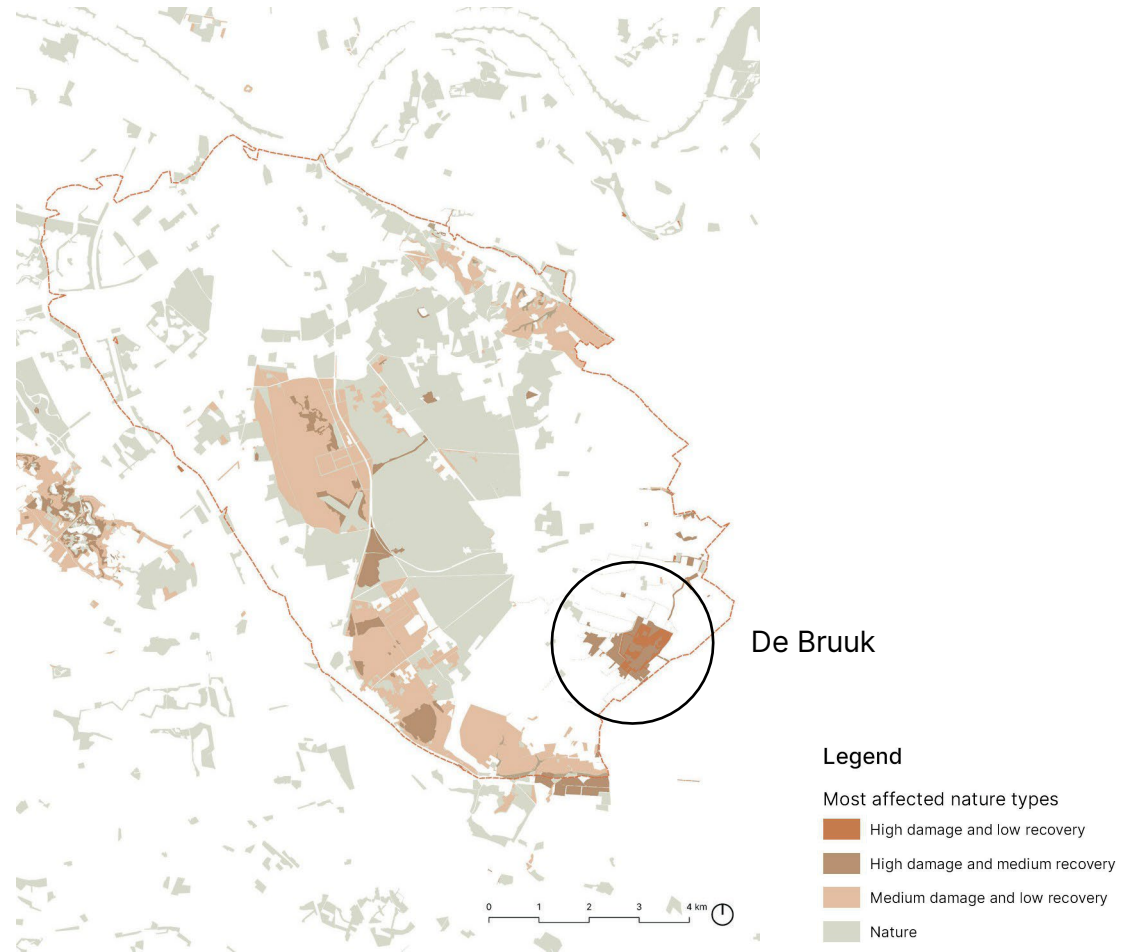
## Influence on soil-water system



# Droughtstress



## Damage to nature





## Risk of wildfires



## Pine forest



Photo taken during site visit march 16th 2022

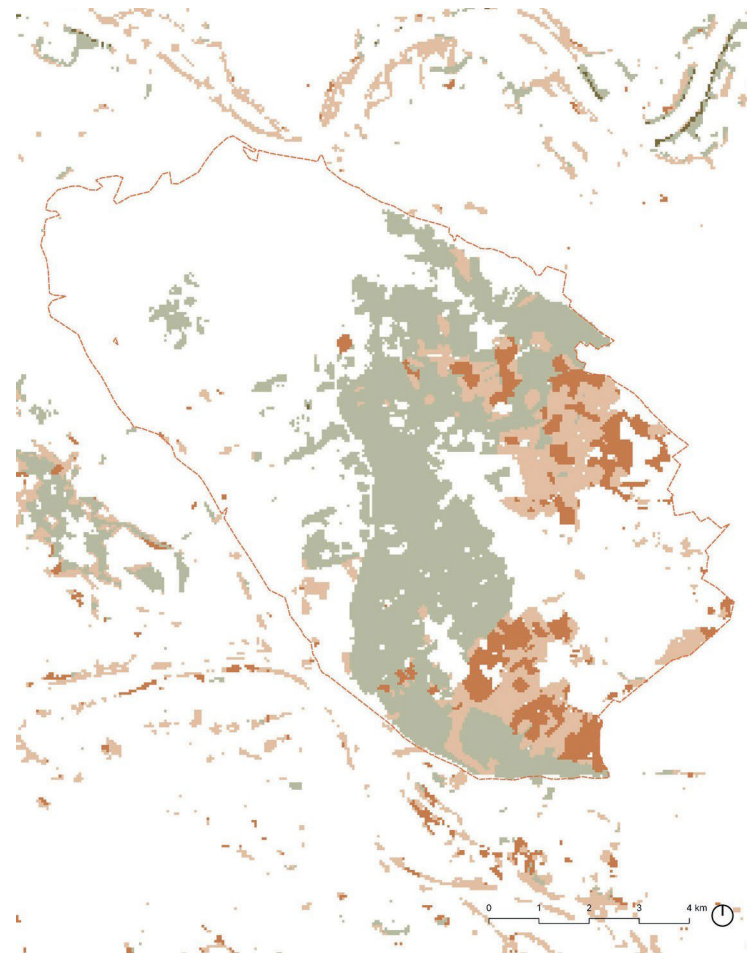
## Water nuisance



### Legend





Flood depth 70 mm downpour/2 hours  
once every 100 years

- 5 - 10 cm
- 10 - 15 cm
- 15 - 20 cm
- 20 - 30 cm
- > 30 cm

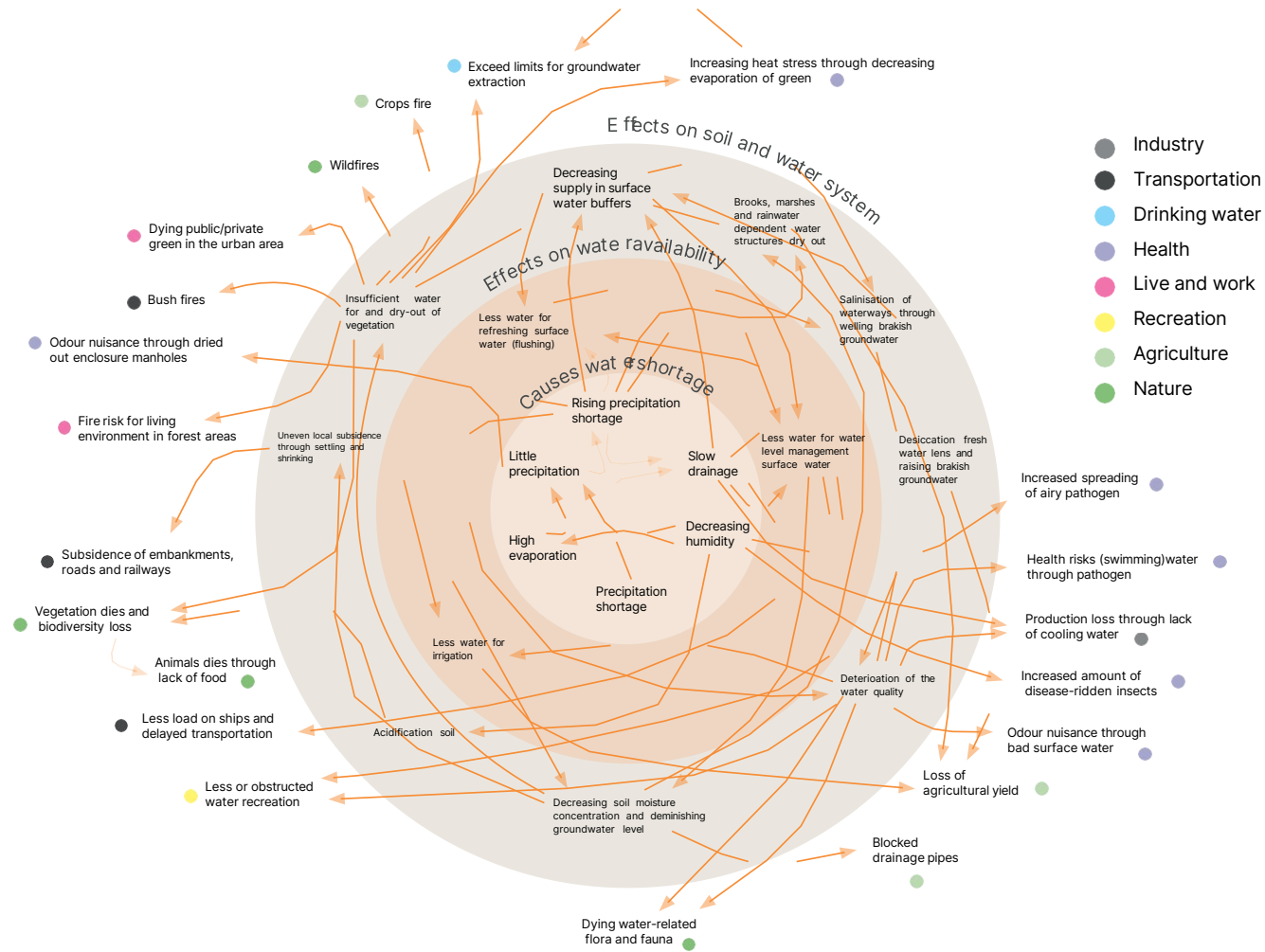


**Legend**

Sensitivity water erosion

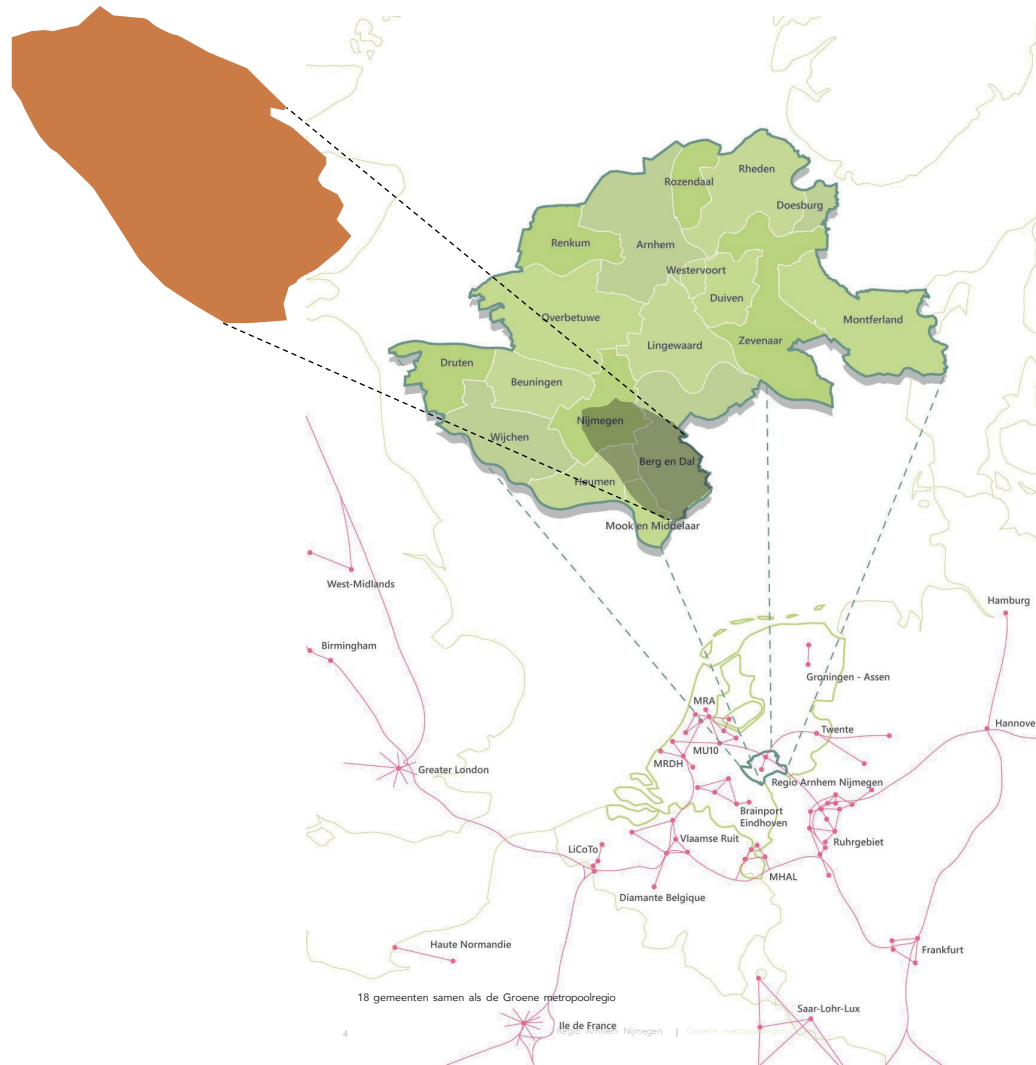
-  Sensitive - Agriculture protected by vegetation
-  Sensitive - Agriculture temporarily protected by vegetation
-  Sensitive - Nature protected by vegetation
-  Sensitive - Nature unprotected by vegetation

# Threats and their causes



## VALUES

## Moraine, nature pearl of the region



## Moraine, nature pearl of the region

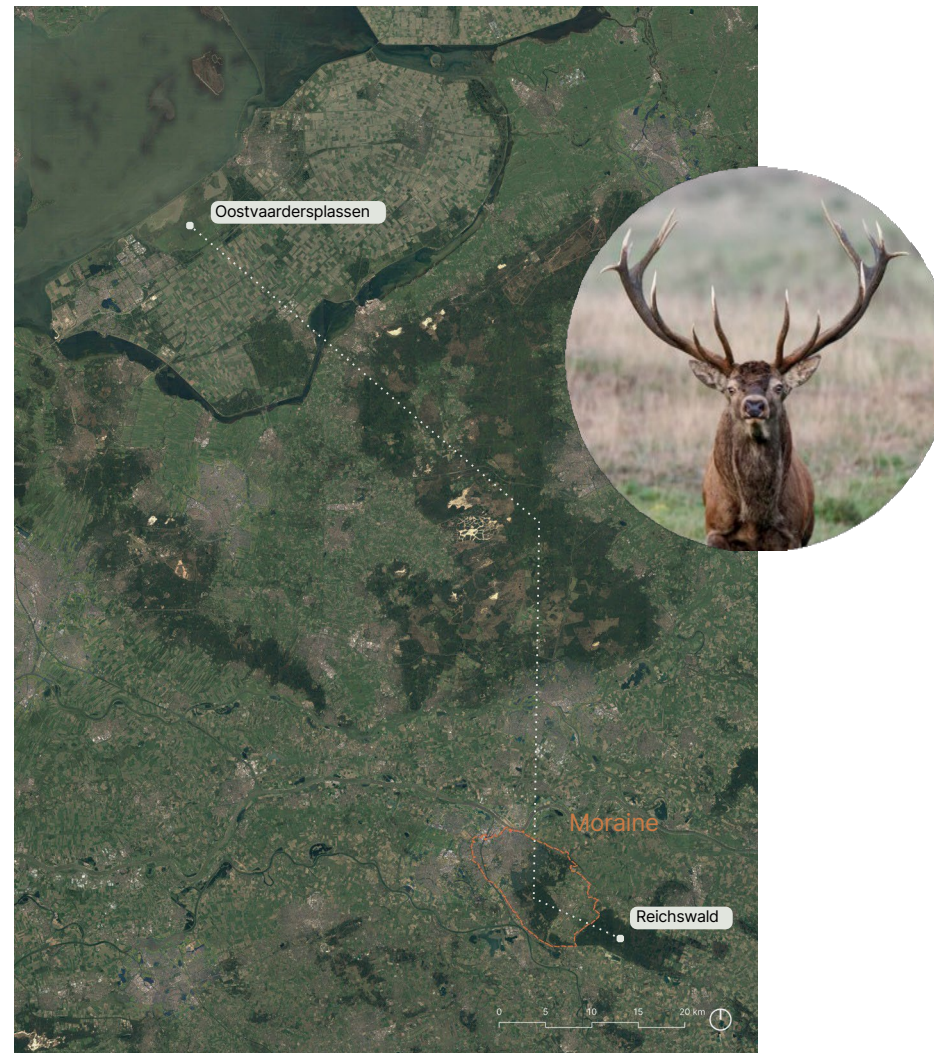


Source:  
Left top: IndebuurtNijmegen  
Left bottom: Natuurmonumenten

Right top: Staatsbosbeheer  
Right bottom: VakantiebijMeeussen



## Ecological corridor red deer



## Vierdaagse Nijmegen

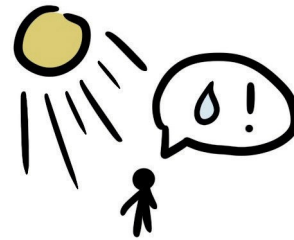


## Problem statement

The Netherlands is going to be confronted with **drought more frequently**.

**Humans strengthen the water shortage** through spatial planning and water use, causing **desiccation**

**Nature suffers** from structural water shortages.



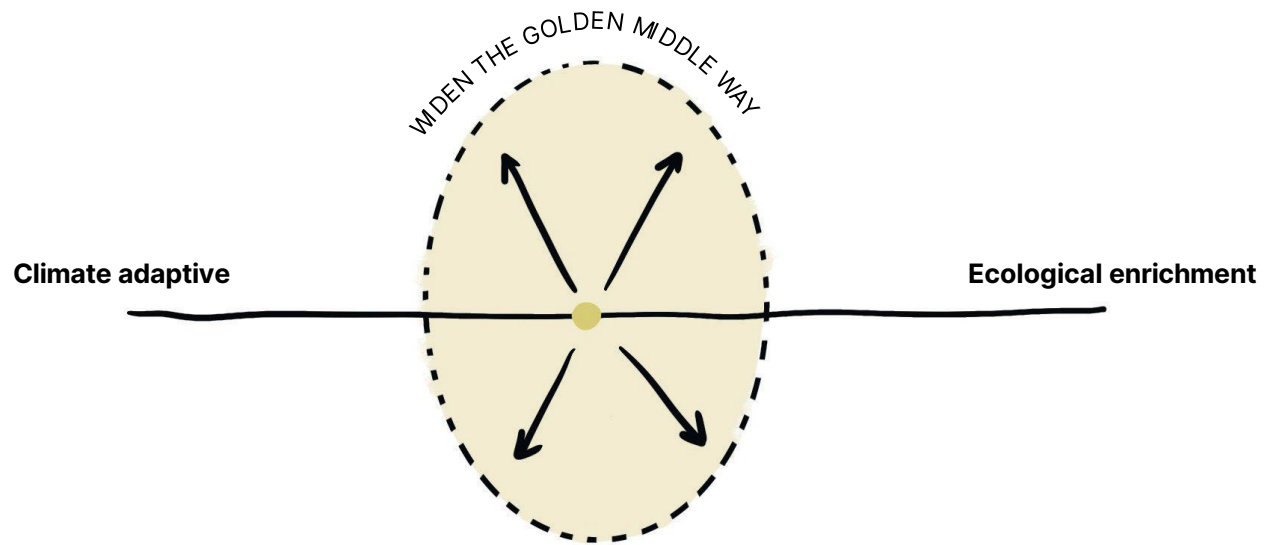
DROUGHTLAND

## Research question

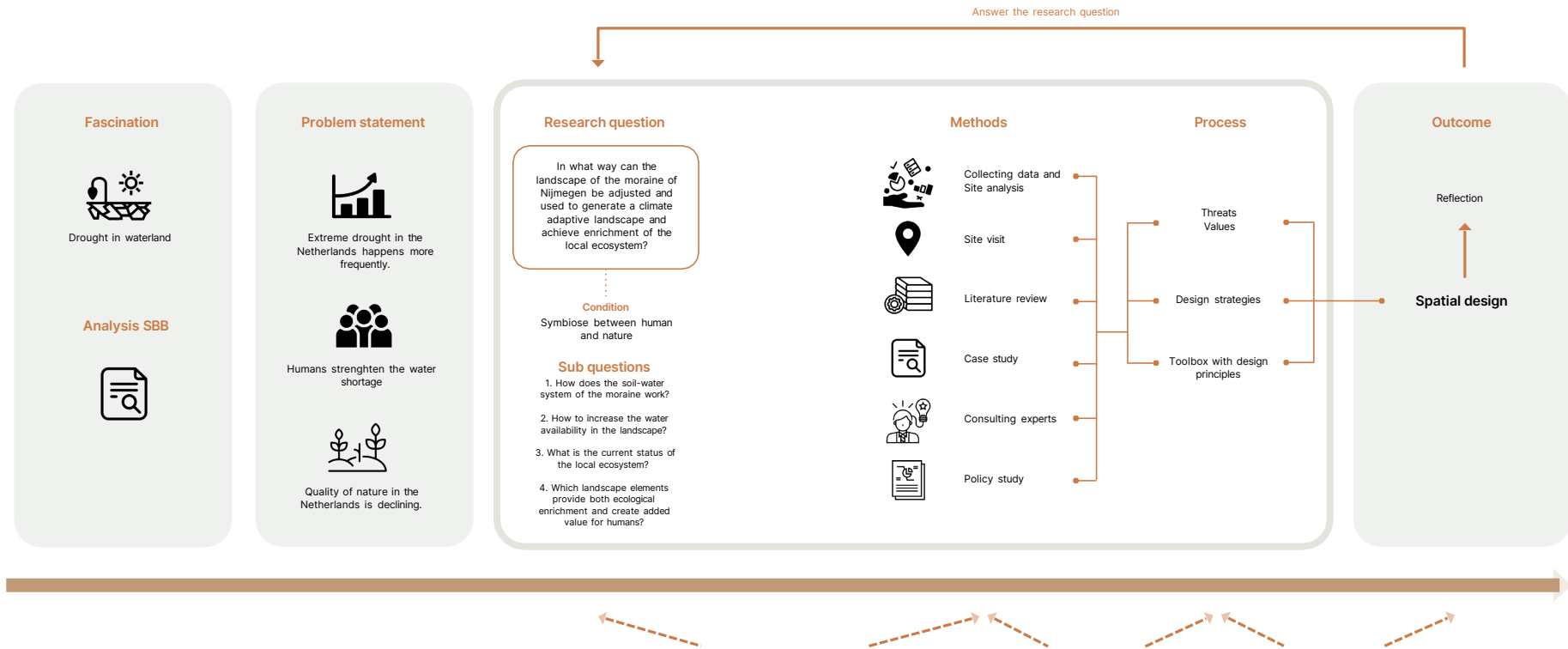
**In what way can the moraine landscape of Nijmegen be used and adjusted to achieve a climate adaptive landscape and provide enrichment of the local ecosystem?**

## Design objective

Increase the spatial quality



# Methodology framework



**“While we are drowning in this Age of Information,  
we are starving for wisdom.”**

Julia Watson, 2019

# Theory and principles

Lo-TEK

Designing for sustainable, climate-resilient infrastructures..



# Theory and principles

## Lo-TEK

Designing for sustainable, climate-resilient infrastructures..

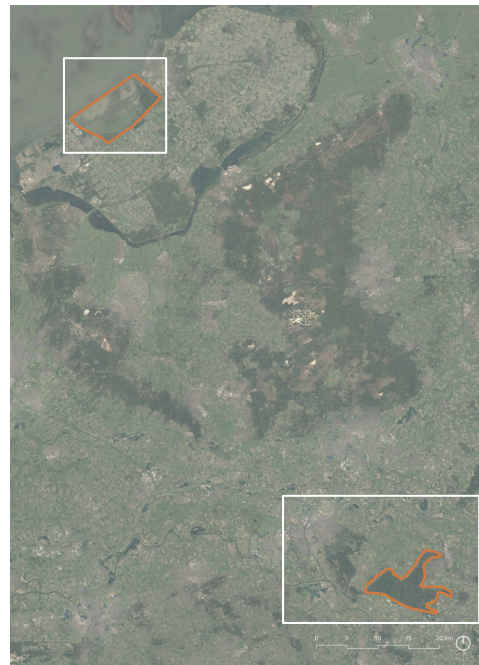
### Principles

- .. working together with nature instead of trying to conquer it in the name of progress (symbiosis).
- .. renew the relationship between place, nature and the physical places humans construct and inhabit.
- .. use of simple, local materials.

## Design scales



MACRO +  
Netherlands - Germany

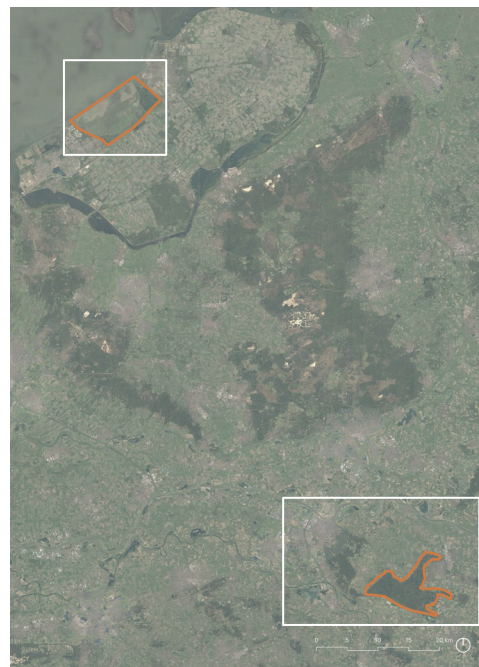


# Design scales



MACRO +  
Netherlands - Germany

MACRO  
Moraine



# Design scales



MACRO +  
Netherlands - Germany



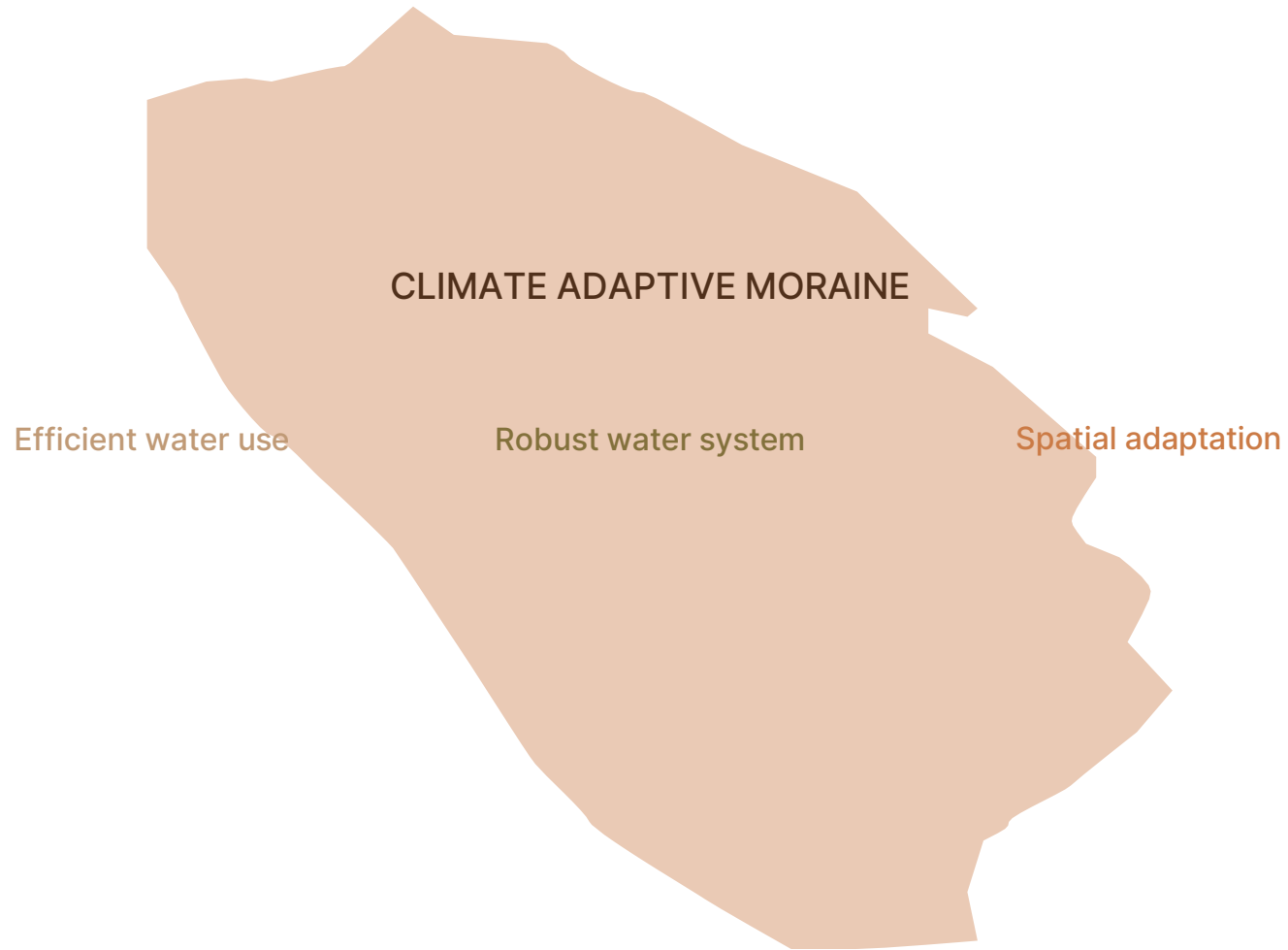
MACRO  
Moraine



MESO + MICRO  
Forest Groesbeek

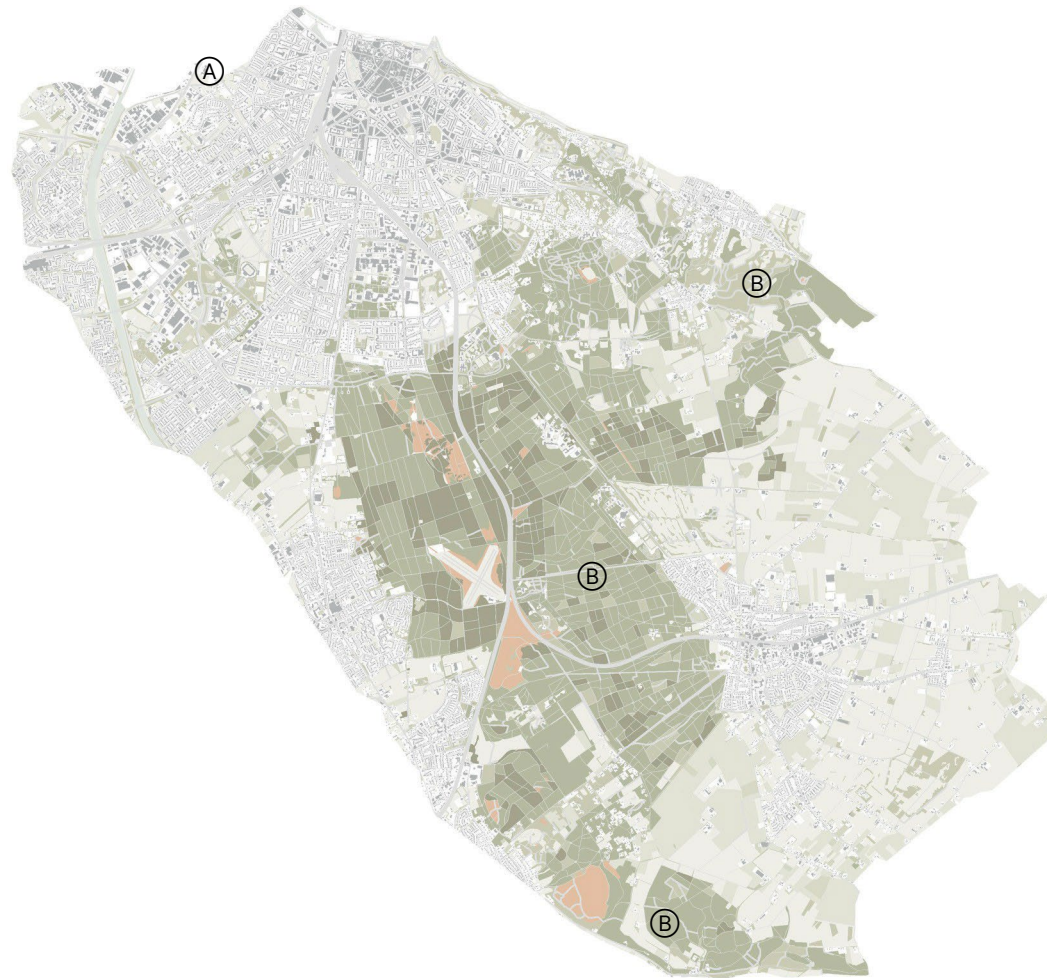


## Strategies

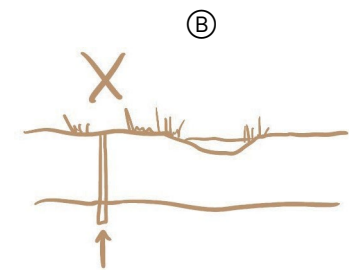


# The climate adaptive moraine

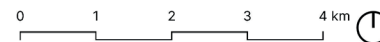
## Efficient water use



Re-use water

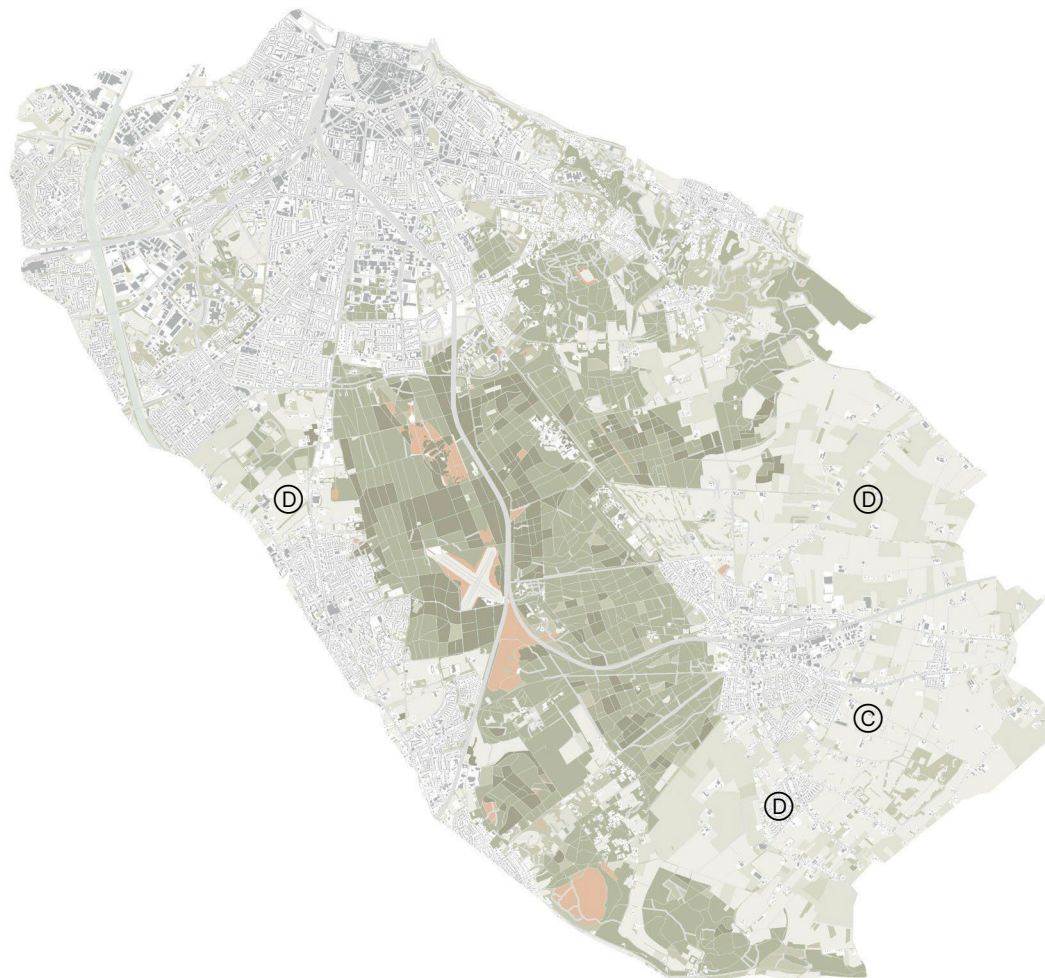


Reduce groundwater extraction in areas which are sensitive for drought damage or desiccation

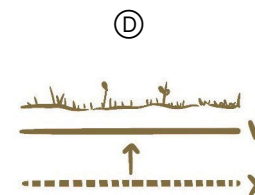


# The climate adaptive moraine

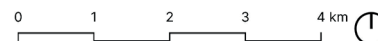
## Robust water system



Restore brooks and other waterways

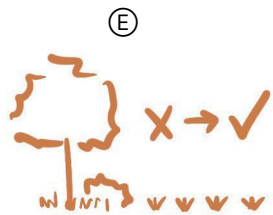


Raise or maintain groundwater level

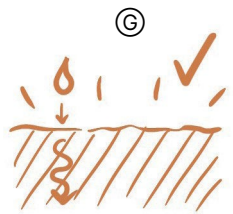


# The climate adaptive moraine

## Spatial adaptation



Enlarge water availability



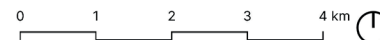
Make soil and surface suitable for water absorption



Hold water



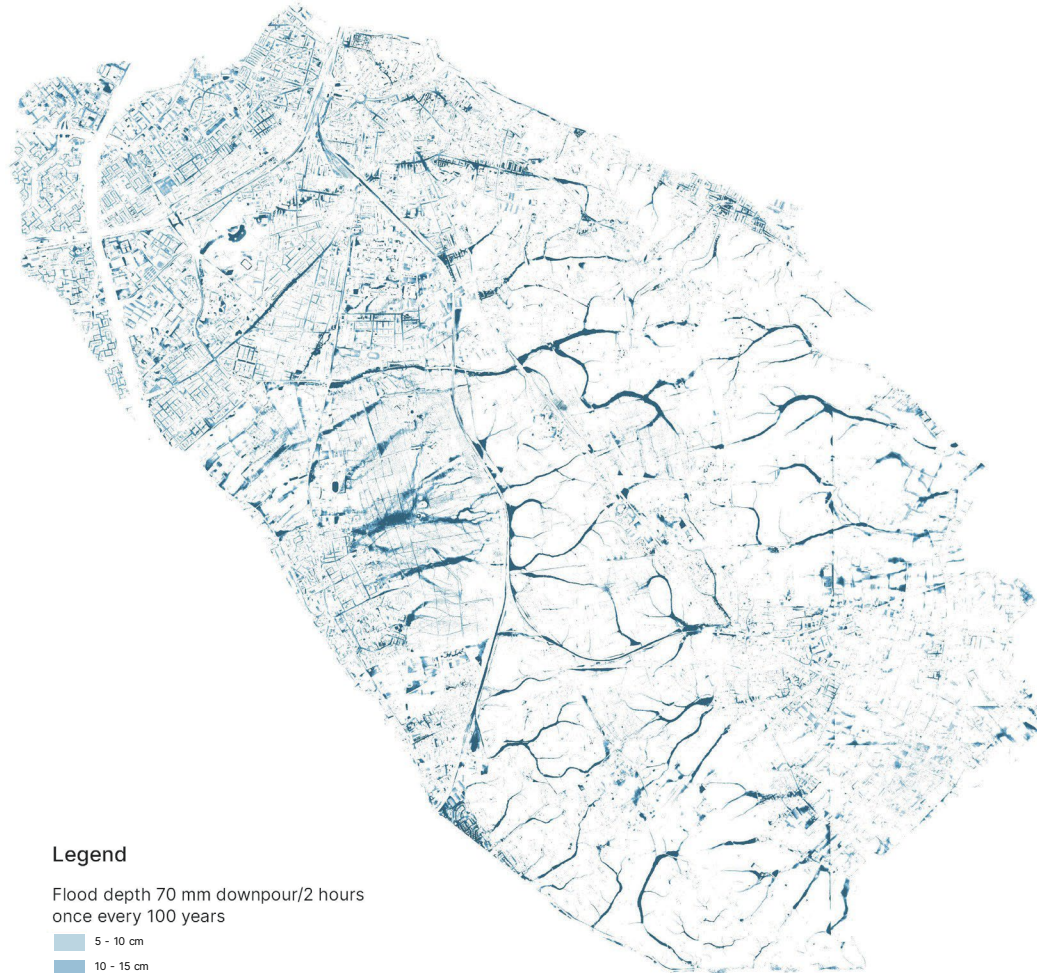
Take water nuisance into account





# The climate adaptive moraine

## Spatial adaptation



Ⓔ



Enlarge water availability

Ⓒ



Make soil and surface suitable for water absorption

Ⓕ



Hold water

Ⓖ

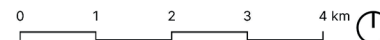


Take water nuisance into account

### Legend

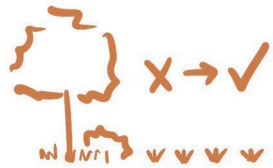
Flood depth 70 mm downpour/2 hours once every 100 years

- 5 - 10 cm
- 10 - 15 cm
- 15 - 20 cm
- 20 - 30 cm
- > 30 cm



# Forest Groesbeek

Spatial adaptation



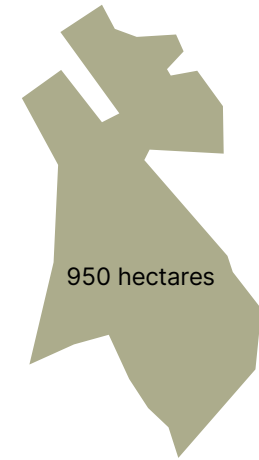
Enlarge water availability



Hold water



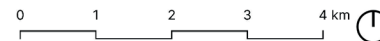
Take water nuisance into account



950 hectares

Legend

- Forest Groesbeek
- buildings
- roads
- railway
- terrain
  - evergreen forest
  - mixed forest
  - deciduous forest
  - other
  - heathland
  - cropland
  - grassland
  - water



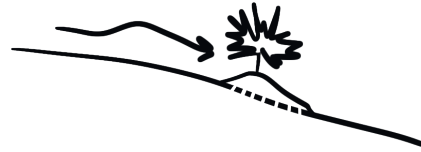
## Present relationship



# Masterplan 2050



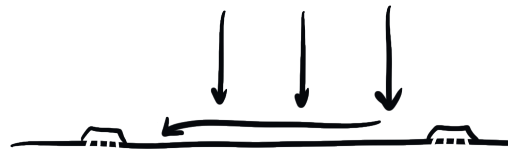
## Landscape system



Wooded bank

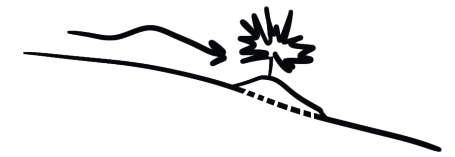


Pool



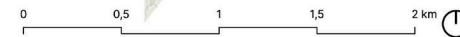
Micro basin

# Wooded banks



## Legend

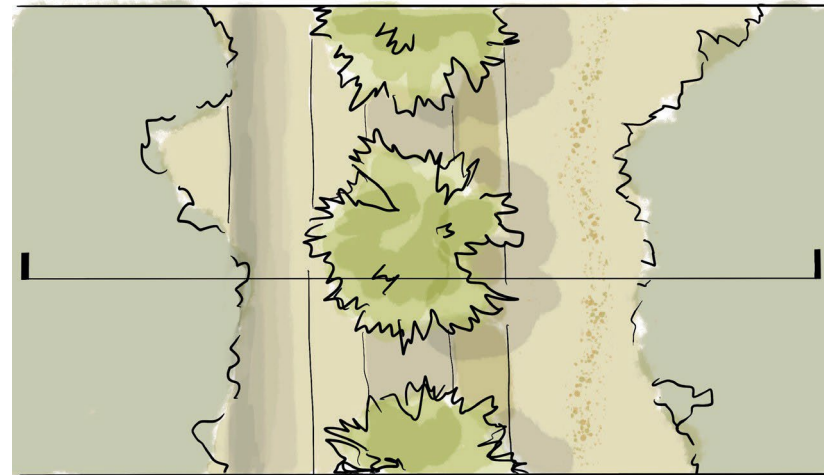
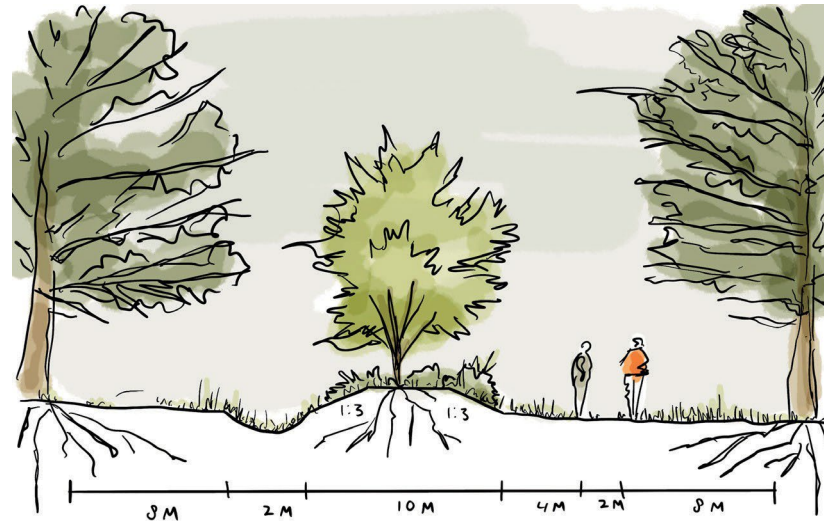
-  Pond
-  Route
-  Wooded bank
-  Road
-  Heathland
-  Meadow forest
-  Nature reserve
-  Deciduous forest
-  Mixed forest



## Wooded banks

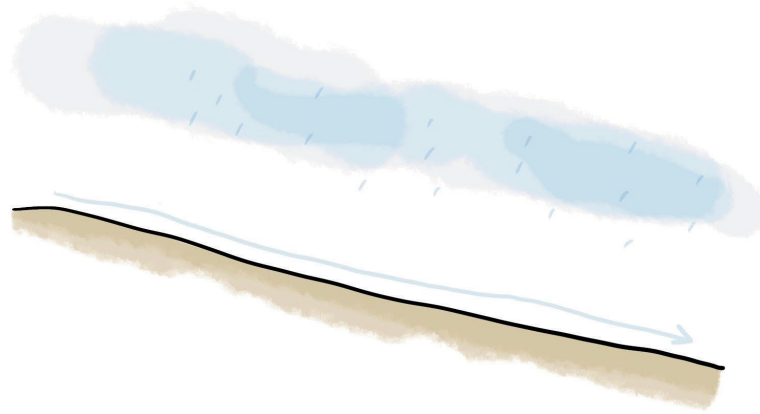


## Wooded banks

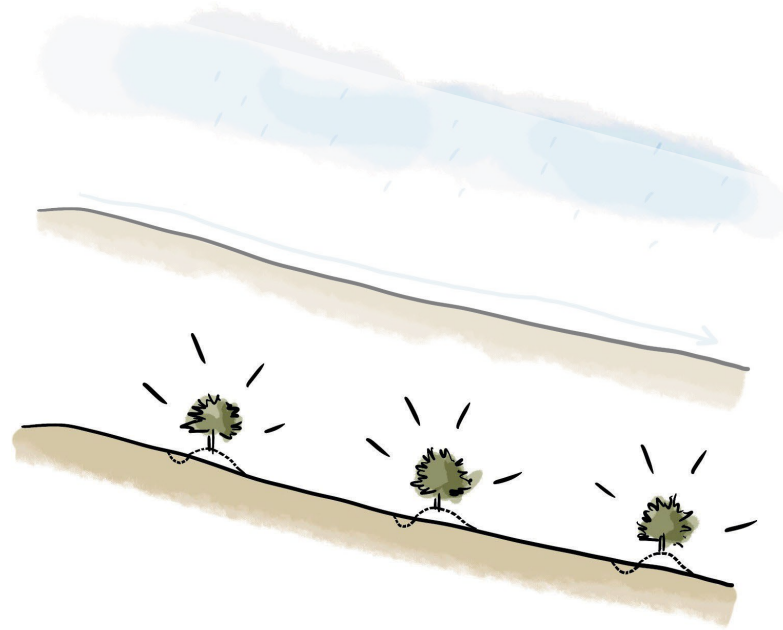




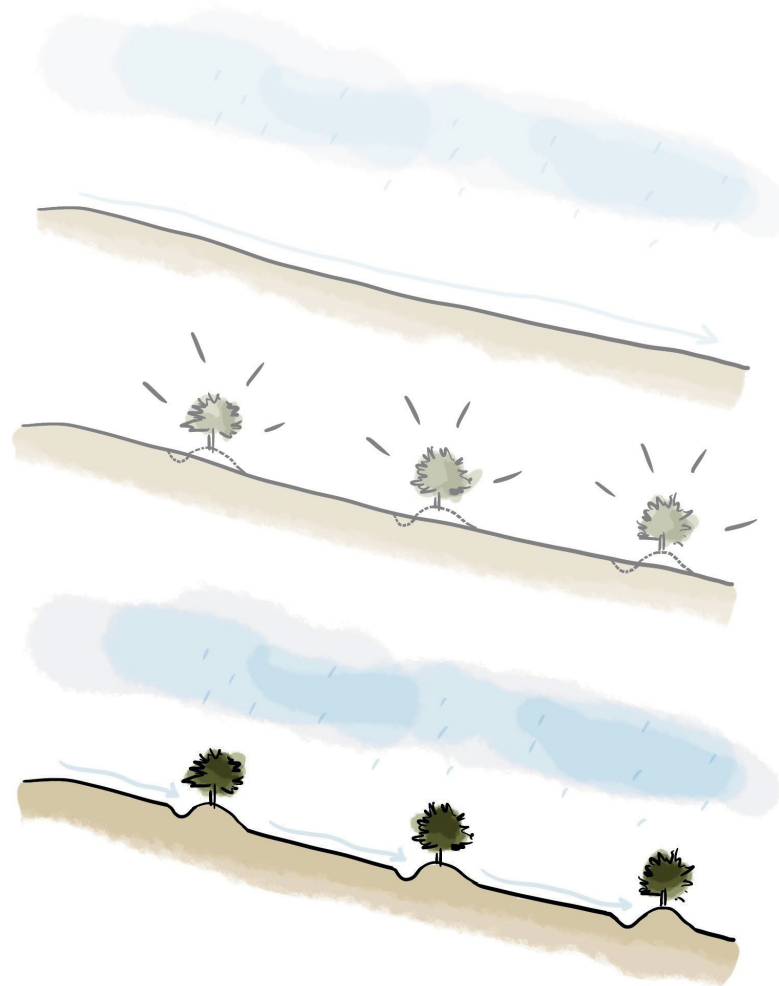
## Wooded banks



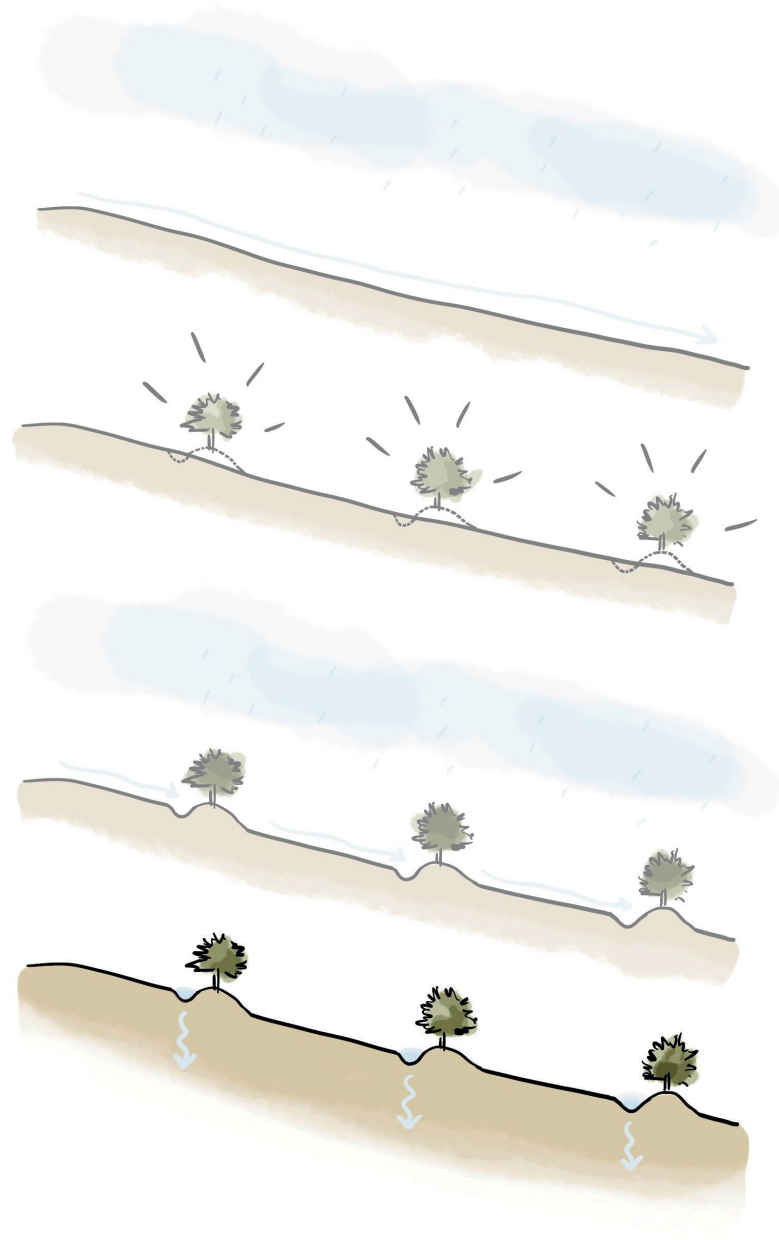
## Wooded banks



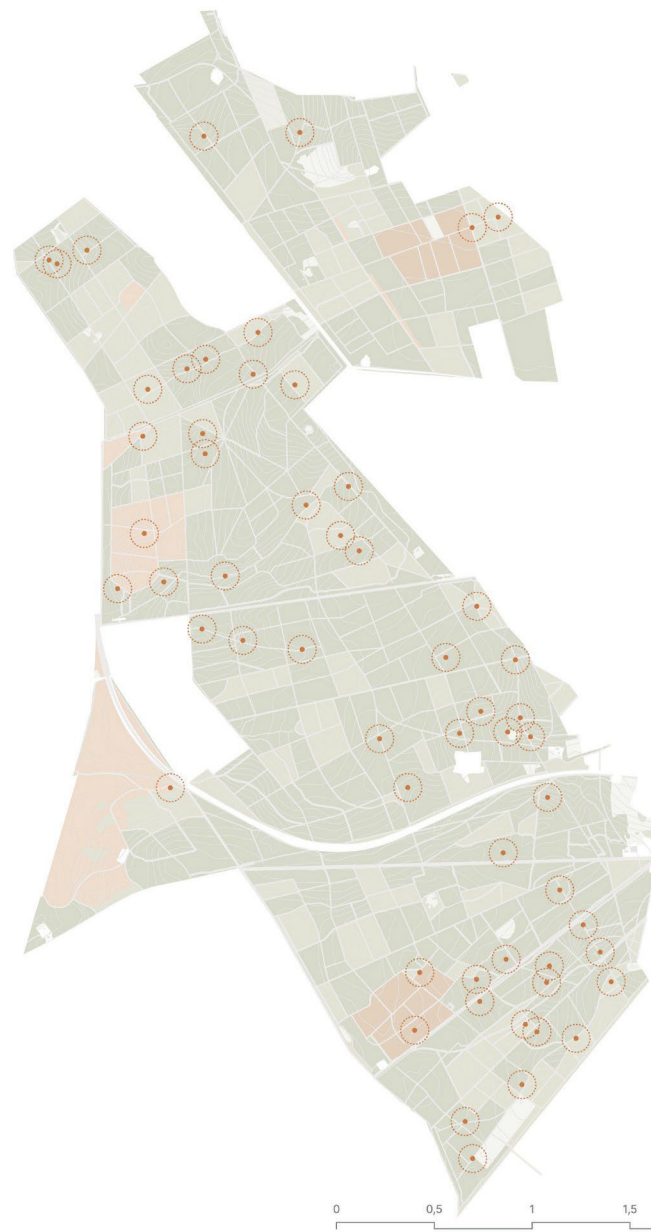
## Wooded banks











## Wooded banks



# Pools



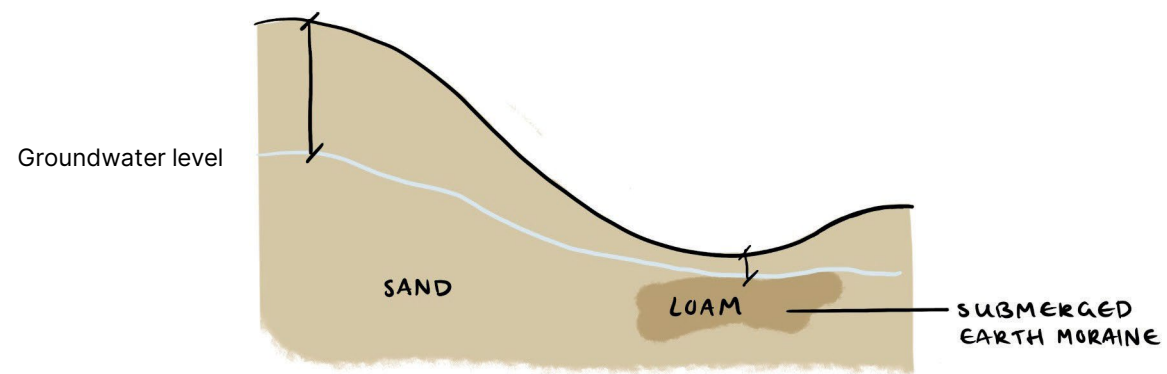
## Legend

-  Pond
-  Route
-  Wooded bank
-  Road
-  Heathland
-  Meadow forest
-  Nature reserve
-  Deciduous forest
-  Mixed forest

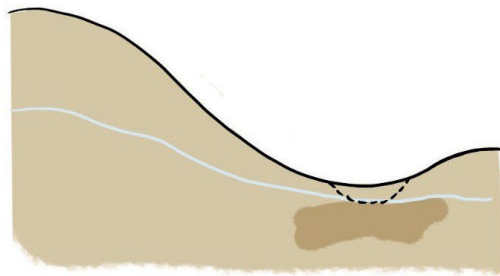
## Intersection dry valley and wooded bank



## Dry valley

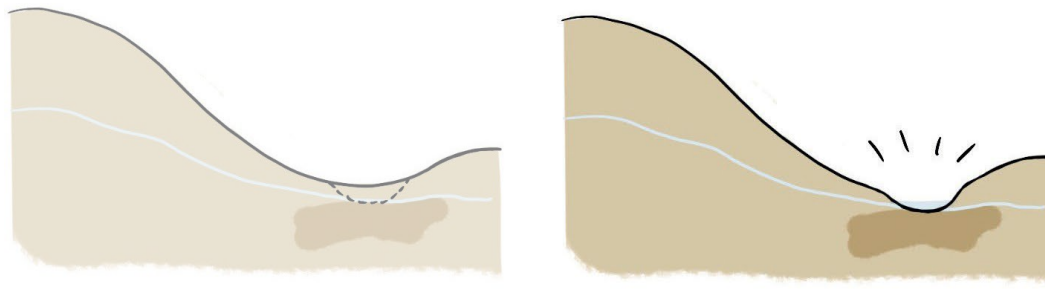


## Dry valley

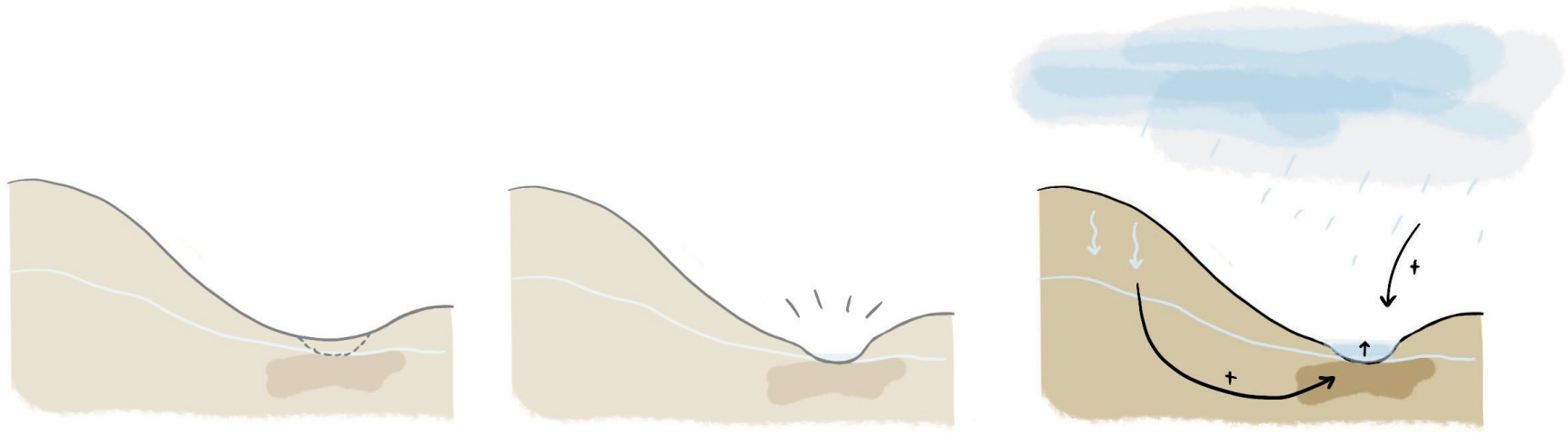




## Dry valley

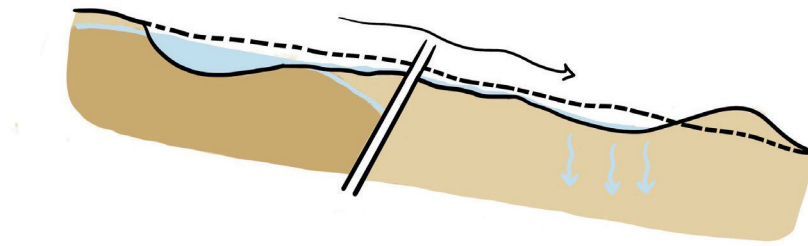


## Dry valley



# Spreng

Flowing water

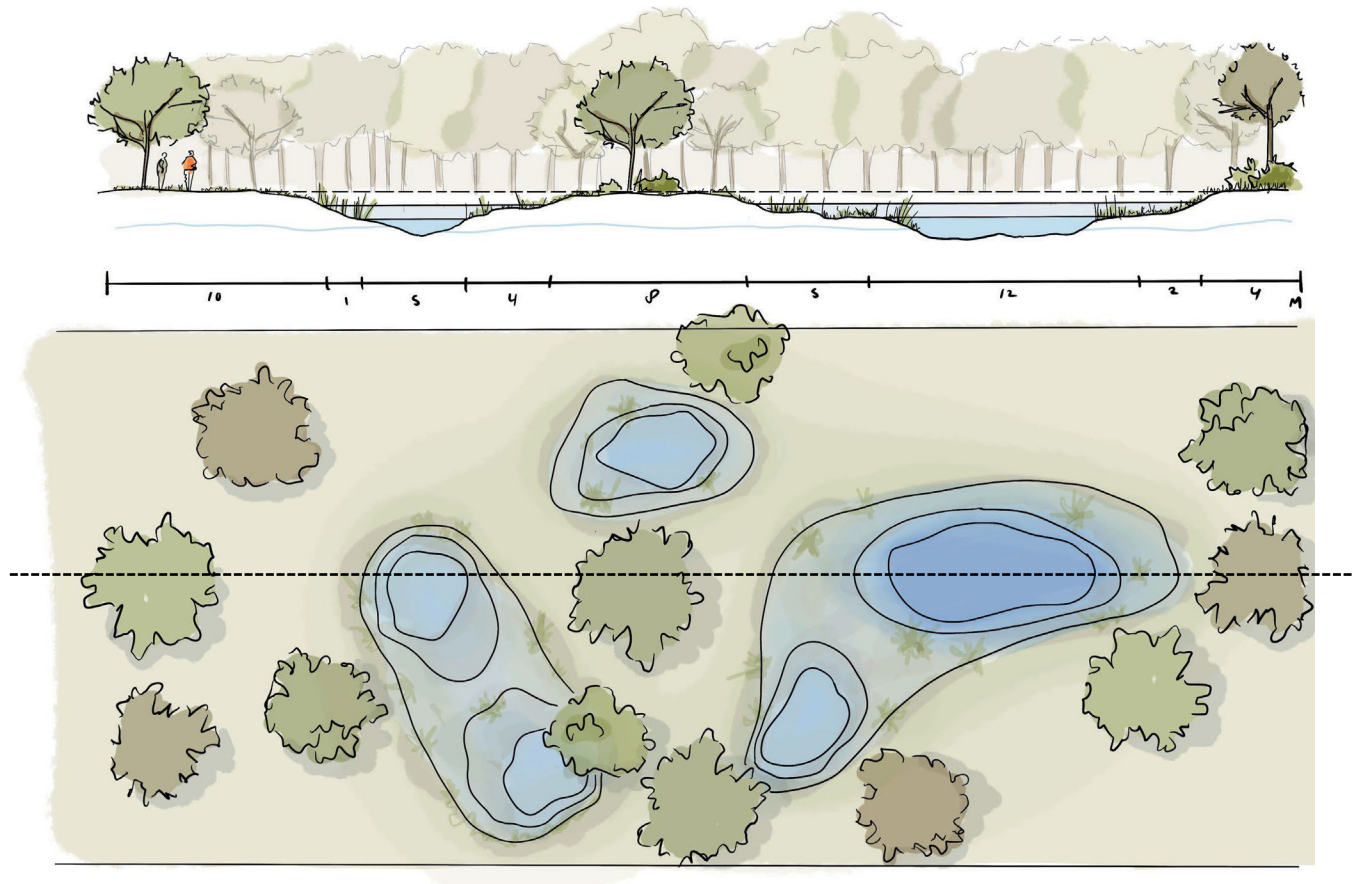


## Spreng

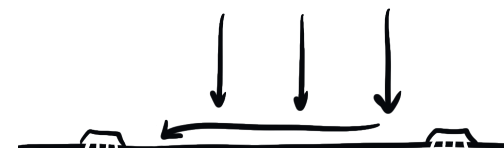


# Pools










Change over the year



## Micro basins



### Legend

-  Pond
-  Route
-  Wooded bank
-  Road
-  Heathland
-  Meadow forest
-  Nature reserve
-  Deciduous forest
-  Mixed forest

## Micro basin

### Soil disturbance through logging



Area after logging

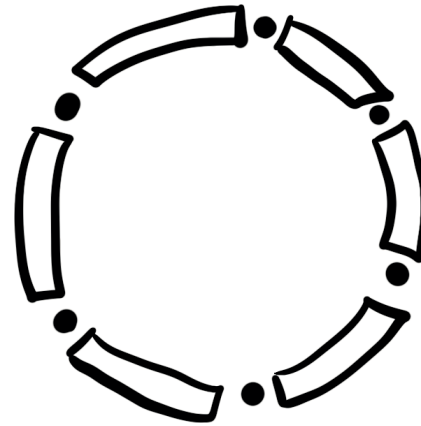


Micro basin

Source:  
Left: Meldpunt bomenkap  
Right: SSWM.info

# Landscape system

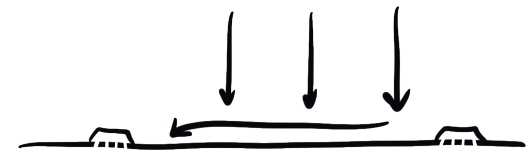
## Catch and Hold



Wooded bank



Pool



Micro basin



# Evergreen forest



## Legend

- Heathland
- Deciduous forest
- Mixed forest forest
- Evergreen forest
- Roads

# Heathland and meadow forest



## Heathland and meadow forest



Heathland forest

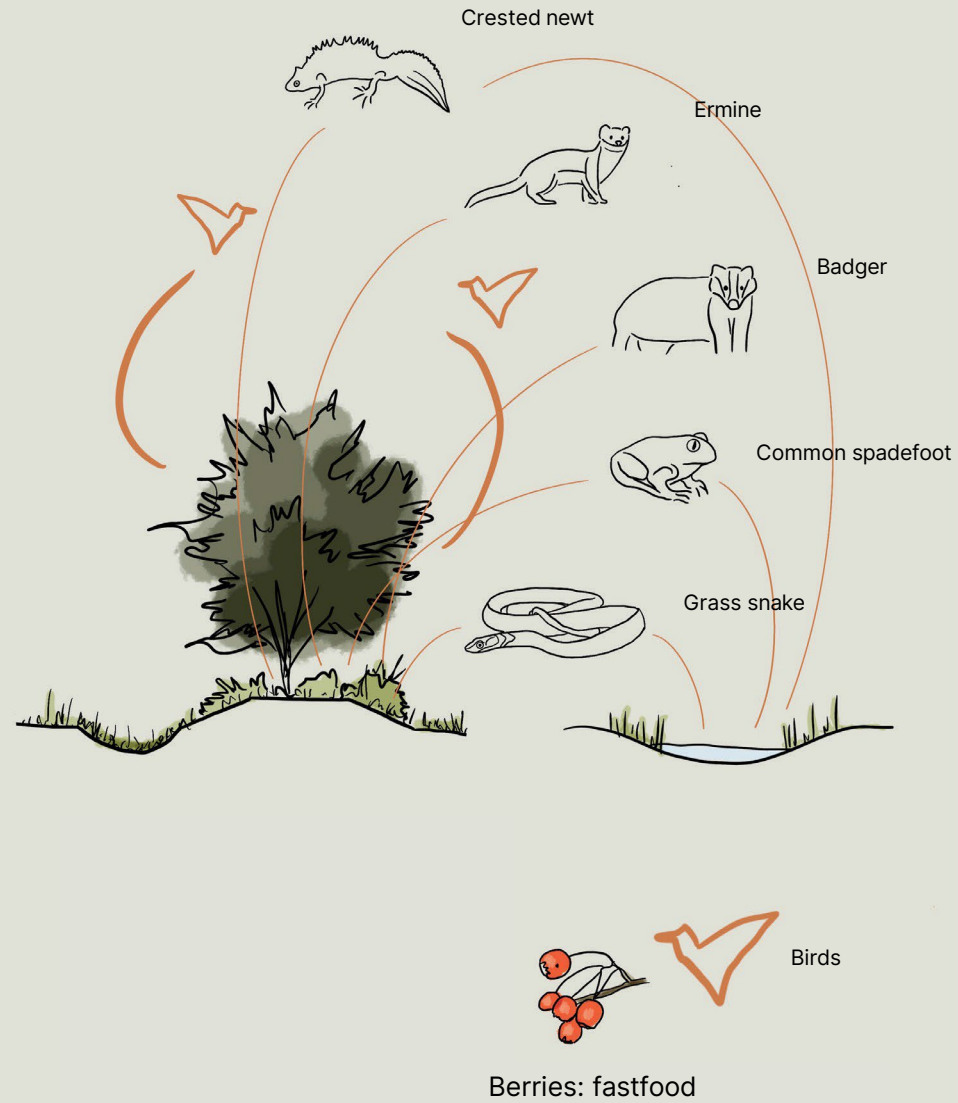


Meadow forest

Source:  
Left: Heidebos  
Right: Flickr - R. Hiemstra

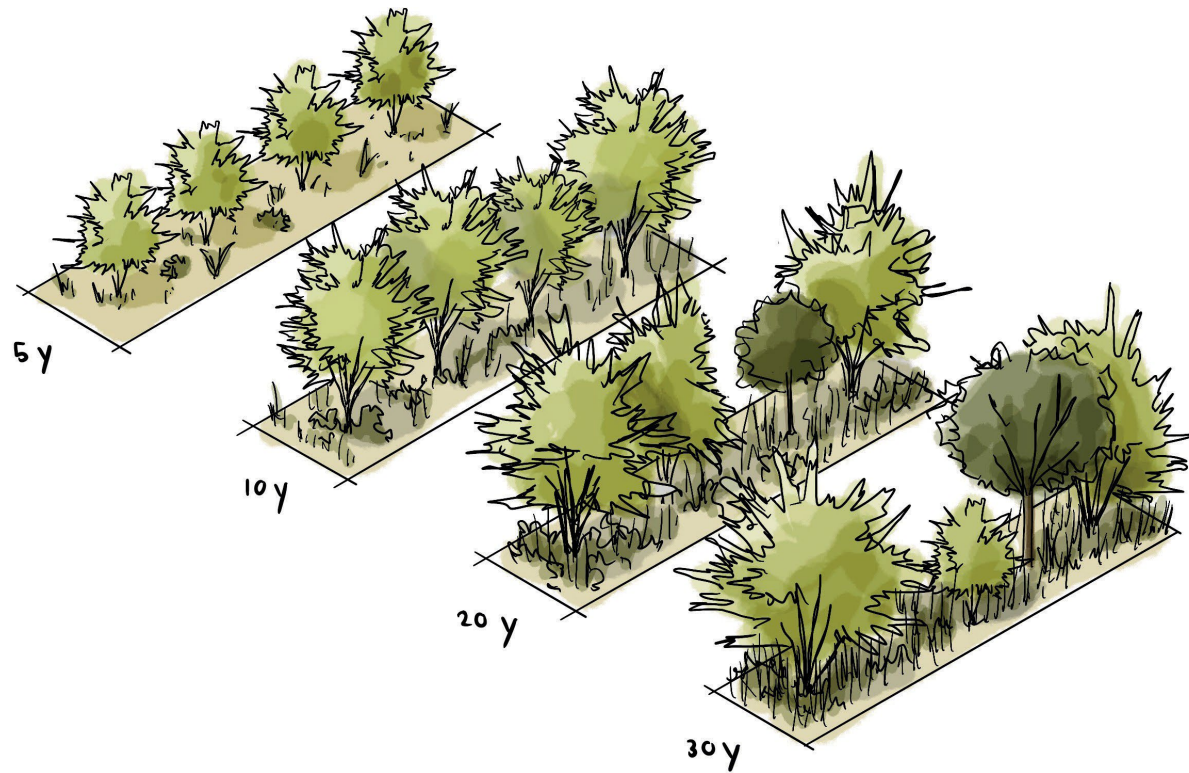
## Landscape system x Ecology

## Key species

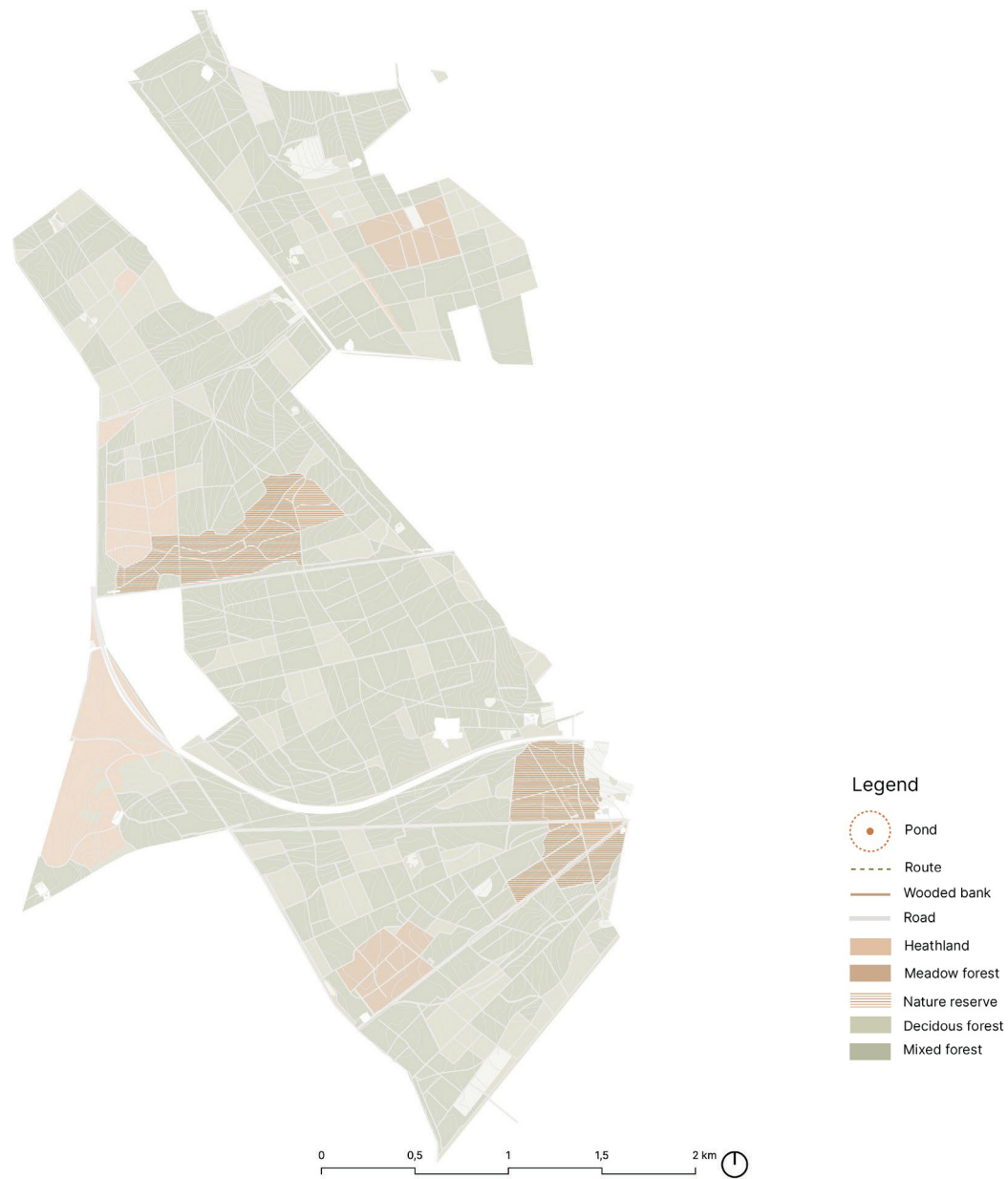


## Process wooded banks

Over the years more diverse



## Nature reserves



## Landscape system x Perception



# Sport route



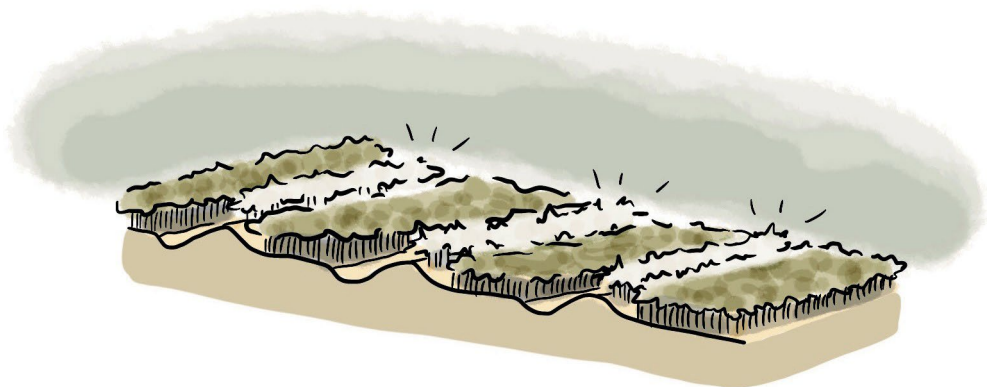
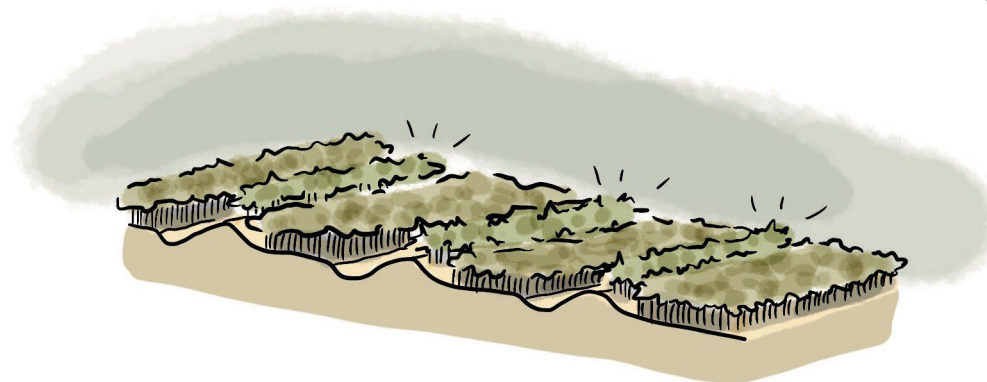
## Sport route



Reference: het Lint, Maximpark Utrecht - West 8

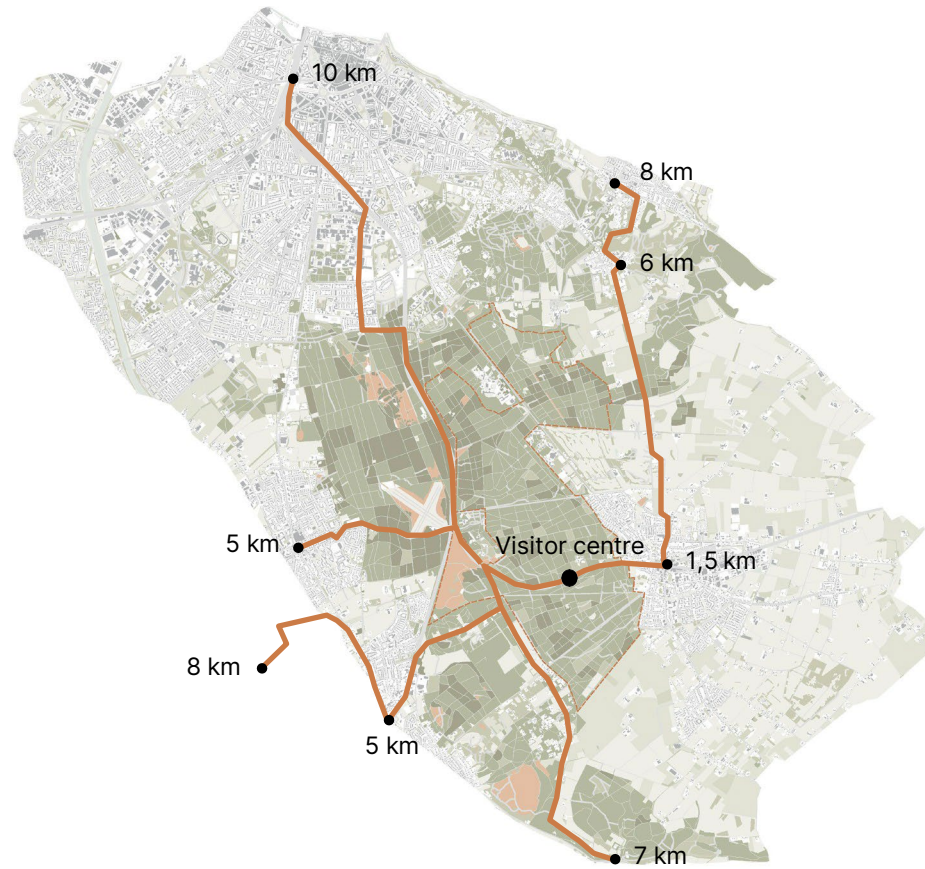
## Wooded bank

White flowers

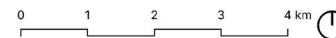


# Cycle roads

## Relation city - park



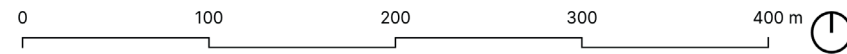
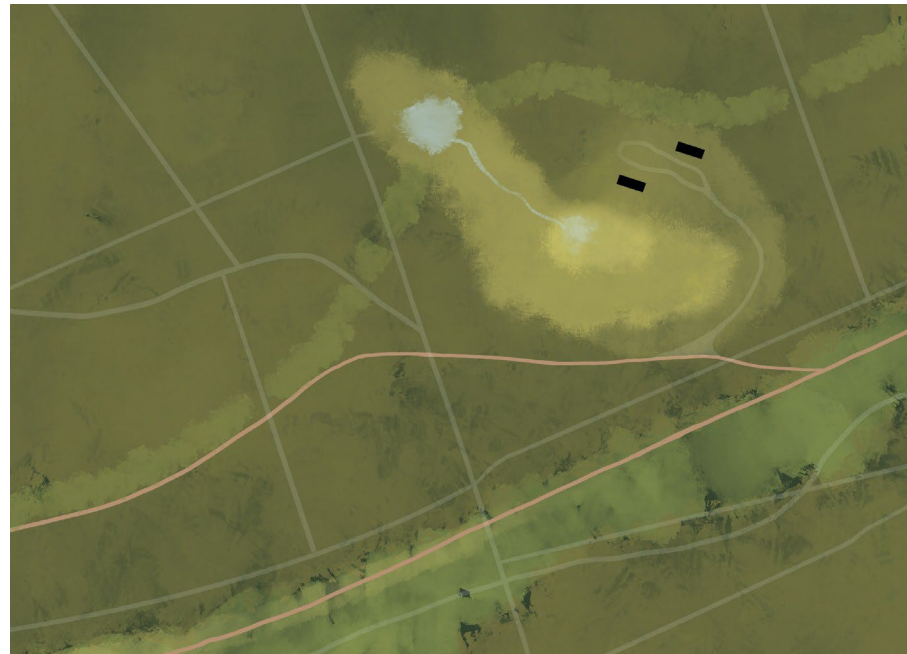
Small deepened ditch



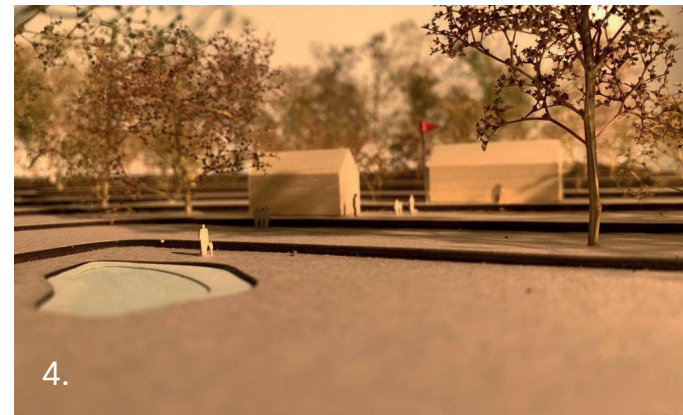
# Ensemble



# Ensemble



## Ensemble



# Development over time

Start

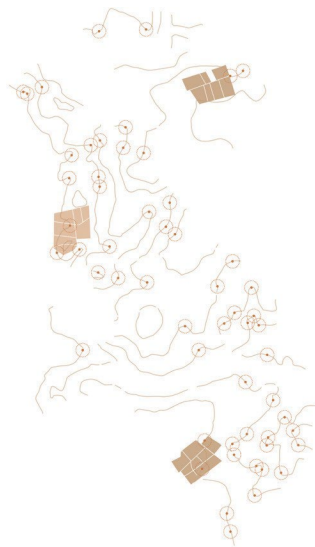
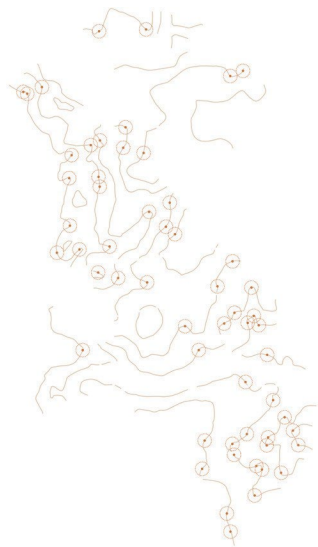
2050

Wooded banks and pools

Heathland and meadow forest

Routes

Nature reserves and ensemble



Development micro basins

Legend

- Pond
- Route
- Wooded bank
- Road
- Heathland
- Meadow forest
- Nature reserve
- Deciduous forest
- Mixed forest



## Research question

**In what way can the moraine landscape of Nijmegen be used and adjusted to achieve a climate adaptive landscape and provide enrichment of the local ecosystem?**

# Conclusion

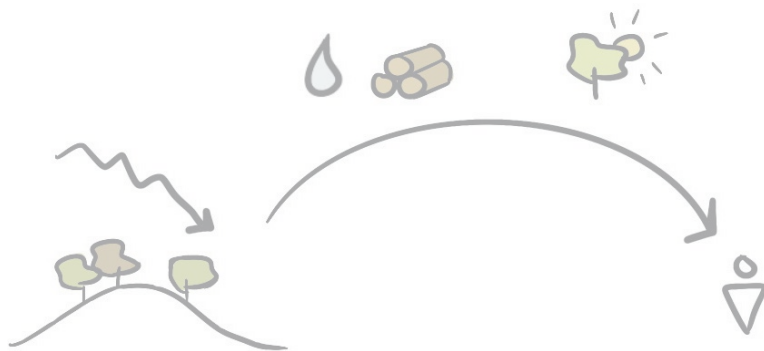


MACRO +  
Netherlands - Germany

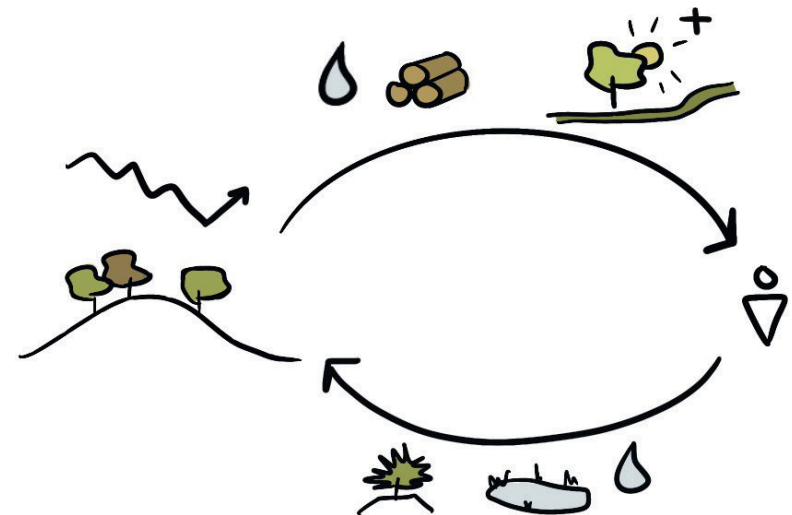
MESO + MICRO  
Forest Groesbeek



## Reflection



Before



After

## Reflection





# WATERING DRY LANDSCAPES

Thank you