

# A NEW LINGE ZONE

Redesigning the Linge area in Stadsregio Arnhem-Nijmegen using  
a diversity of forest types

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4614127

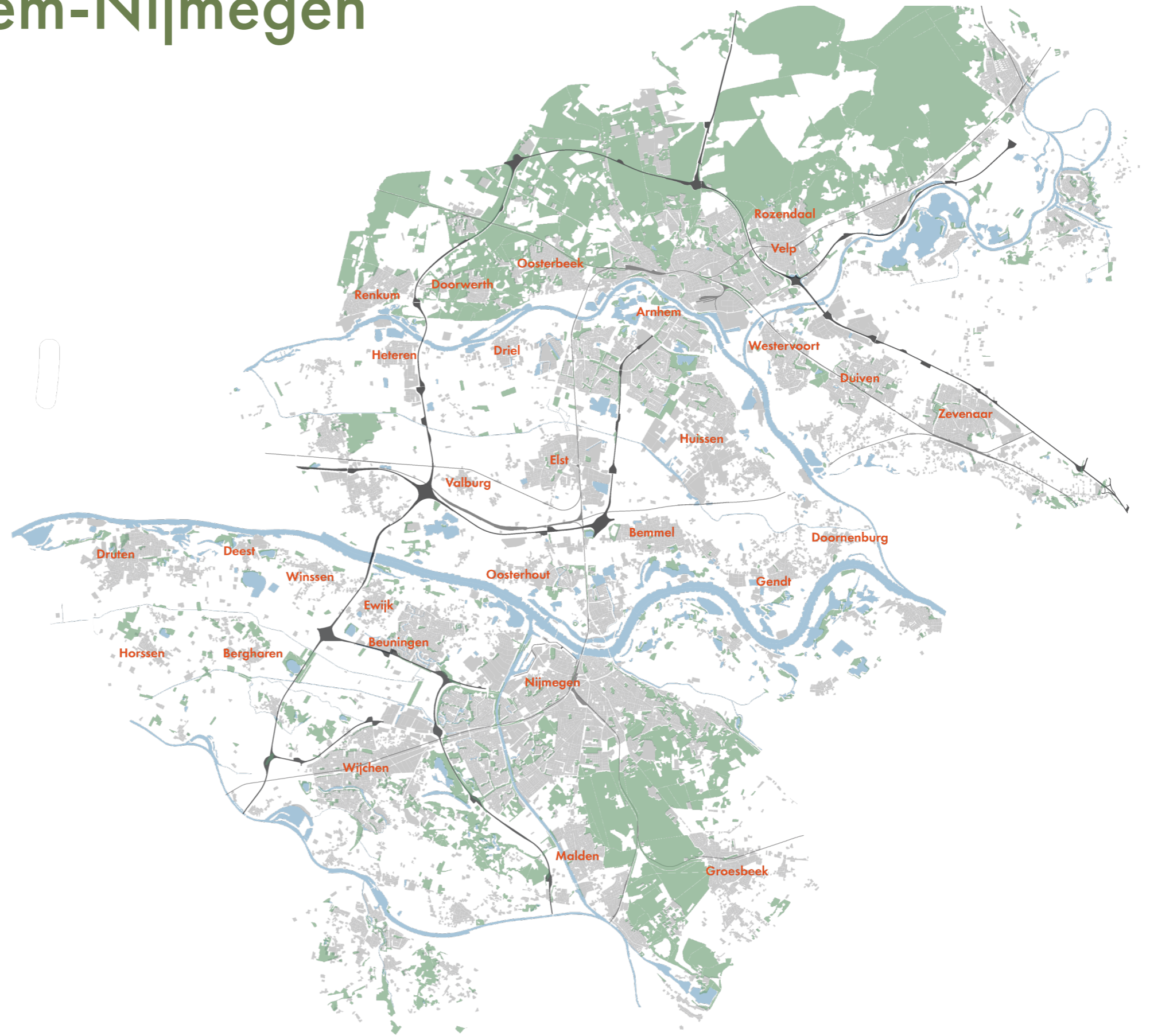
27-6-2024

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UF-FU Lab

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Ronald van Warmerdam  
André Mulder

MSc Thesis Presentation  
Delft University of Technology

# Stadsregio Arnhem-Nijmegen



# Timeline



1923



1973



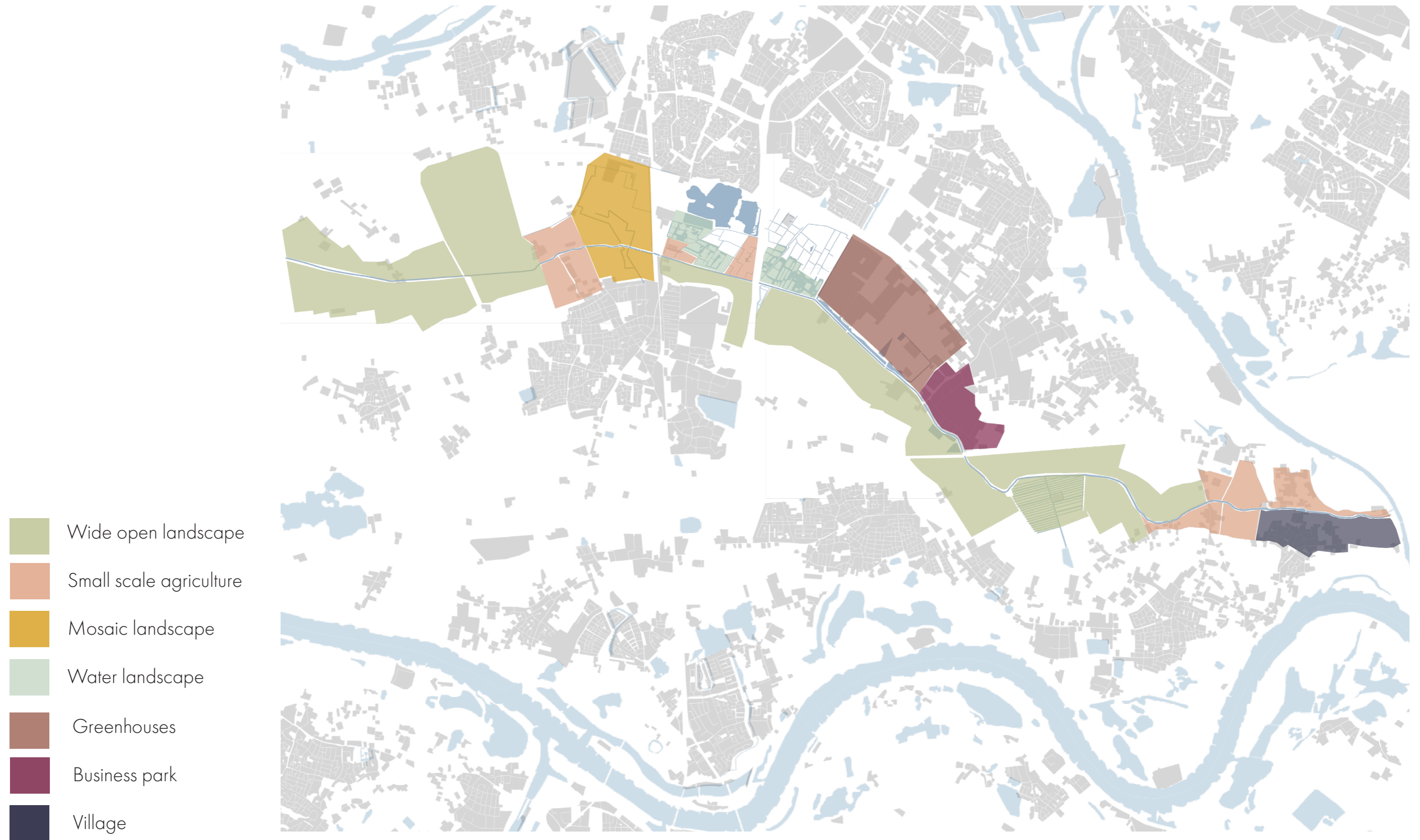
2023

Images from Topotijdreis (2023)

# Design location



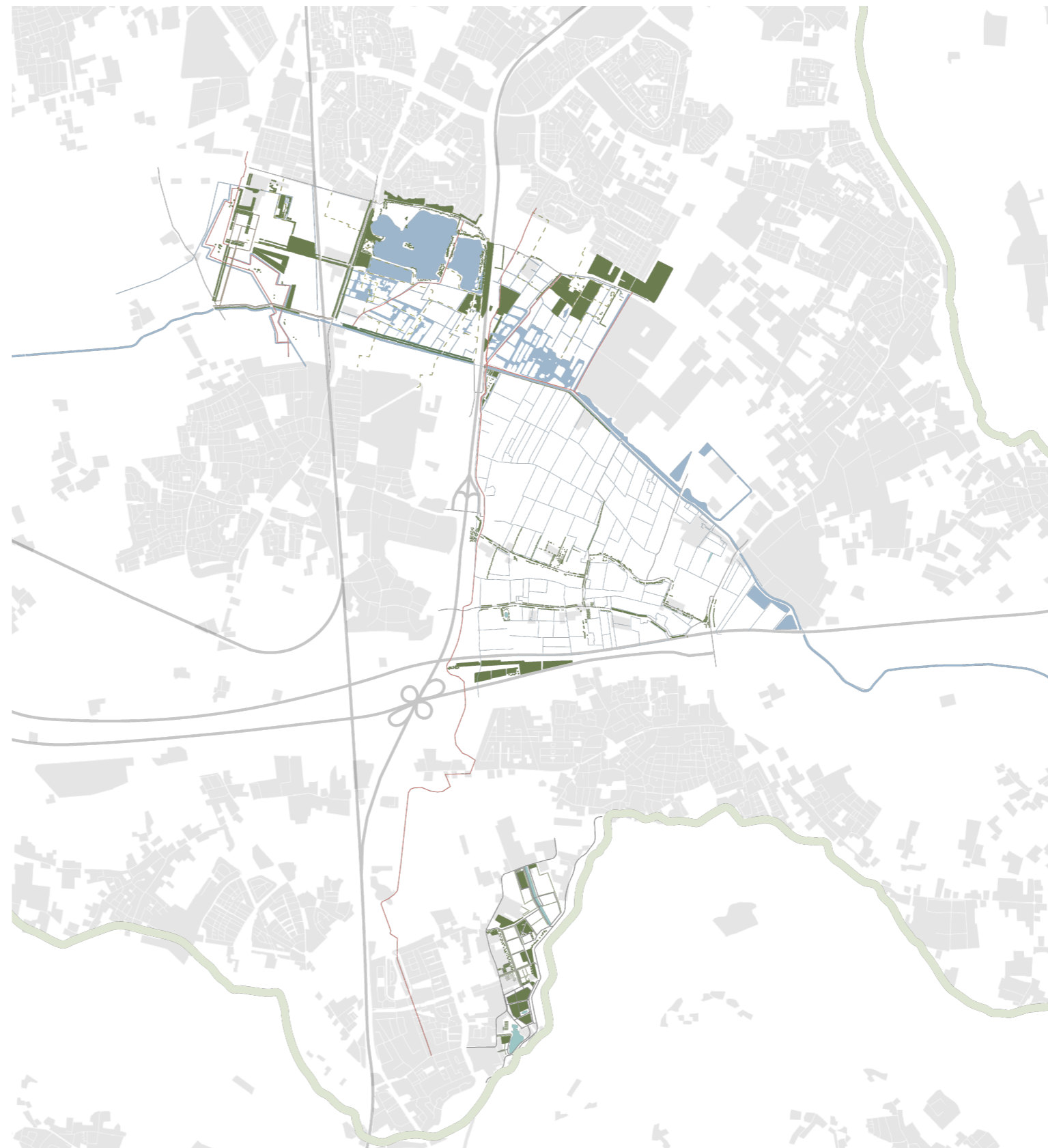
# Functional layout



# Fragments of "Park" Lingezegen

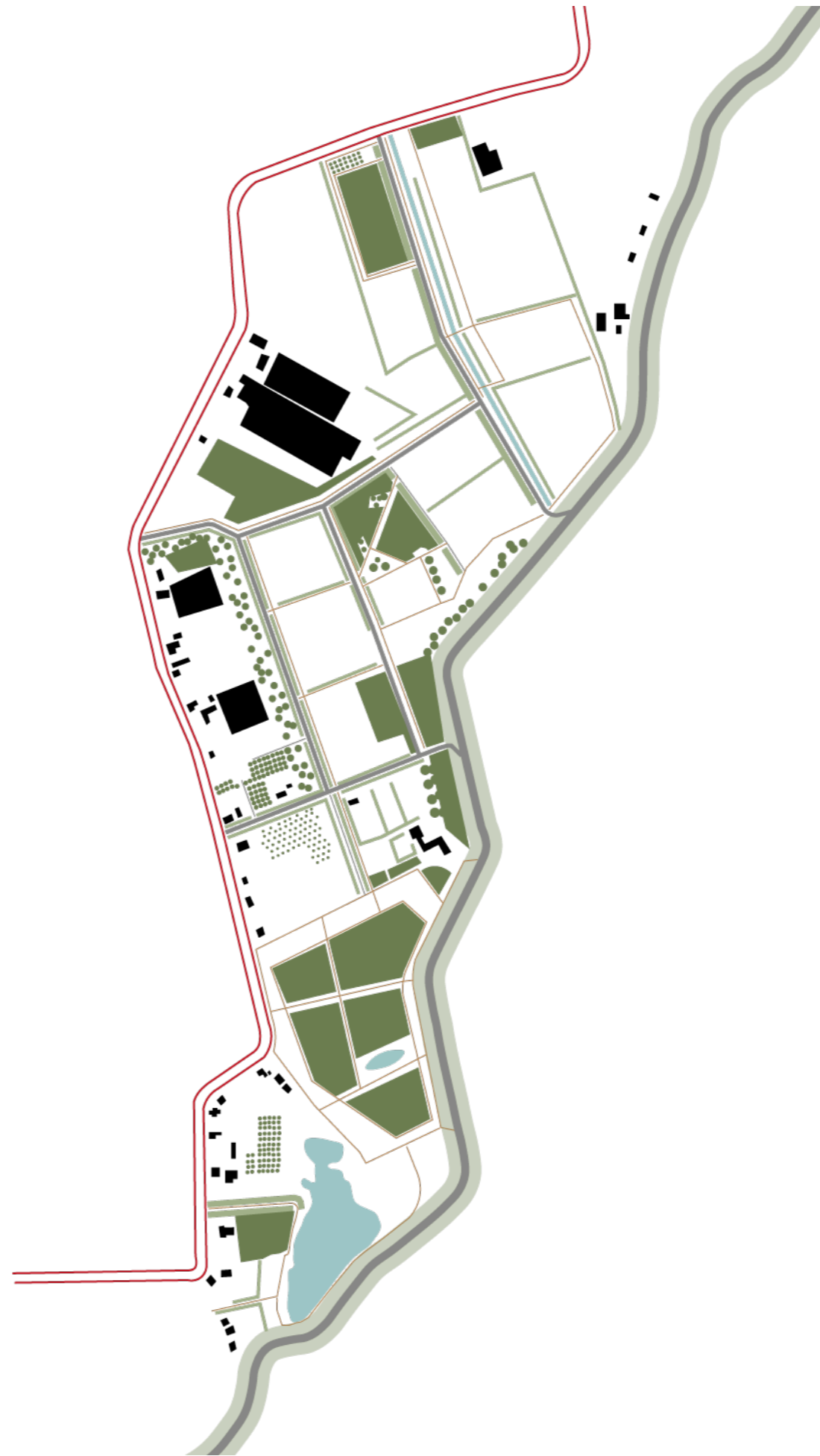


Image from De Gelderlander (2019)



# Park Lingezegen

De Woerdt



# Park Lingezege

Landbouwland and De Buitens





# Park Lingezege

De Park and Waterrijk



# Context

Climate change

Agriculture reform

General health

Bos voor de  
Toekomst  
2030

Urban sprawl

# Research questions

“

*How can forestry be applied to create an interurban green structure in the Stadsregio Arnhem-Nijmegen to structure the existing polycentric metropolitan landscape, while simultaneously providing a solution to future climate and ecological challenges and improve the health and well-being of the inhabitants?*

”

# Research questions

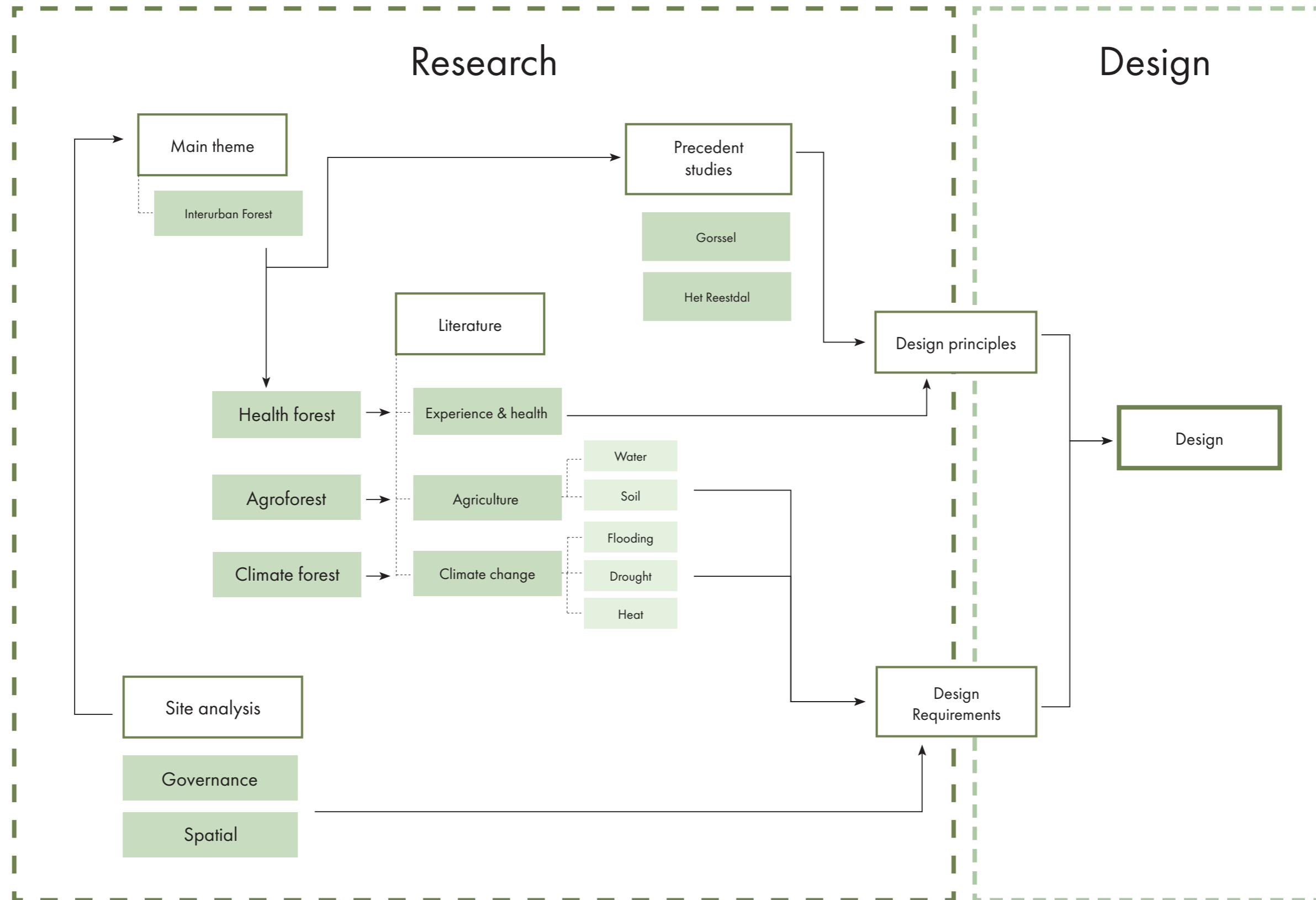
“

*How can forestry be applied to create an interurban green structure in the Stadsregio Arnhem-Nijmegen to structure the existing polycentric metropolitan landscape, while simultaneously providing a solution to future climate and ecological challenges and improve the health and well-being of the inhabitants?*

”

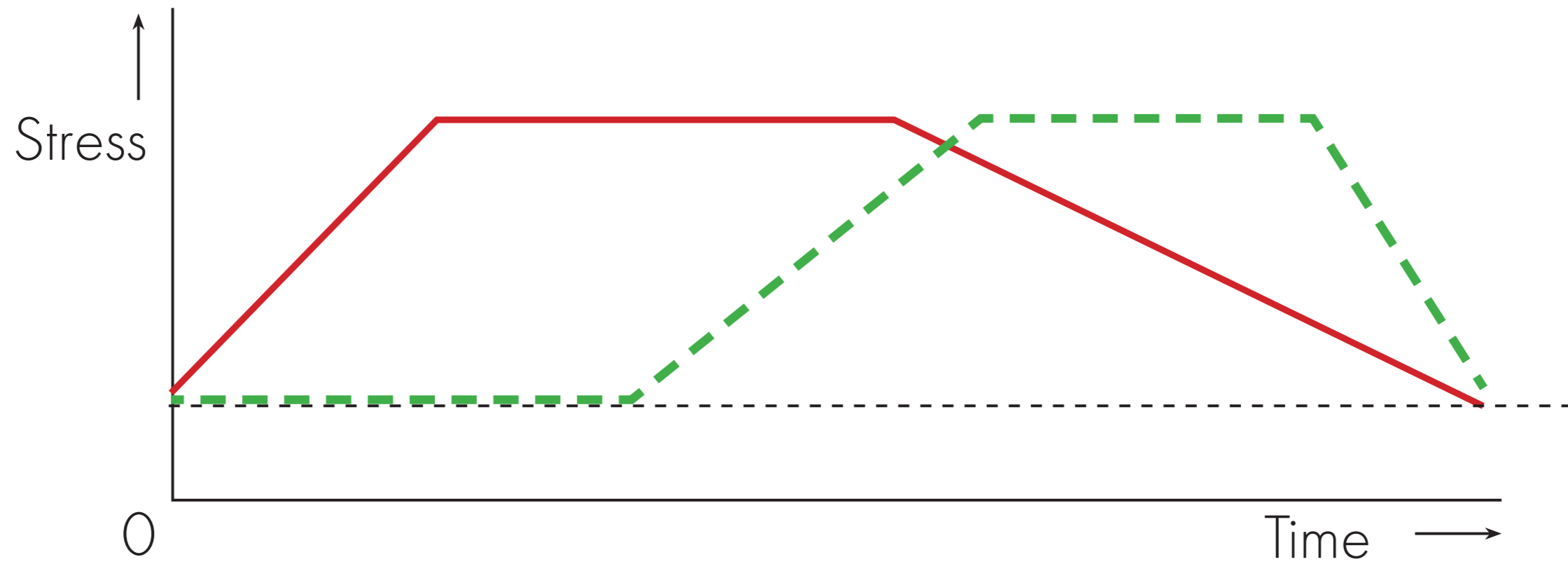
- *What are the climate challenges of the Stadsregio Arnhem-Nijmegen?*
- *How do natural environments improve health and well-being?*
- *What is agroforestry and how can it be applied?*

# Research plan



# Literature research

Experience & Health



- Directed attention
- - - Involuntary attention
- - - - Normal level

# Literature research

## Experience & Health

Kaplan (1995):

1. Compatability between the environment and the goal
2. The feeling of being away
3. The extent of the area

Too blocked



Too open



Spatial definition, visual access



Images from Kaplan & Kaplan (1989)

# Literature research

## Climate change

The main consequences of climate change in the Netherlands are:

Based on KNMI (2021)

### Flooding

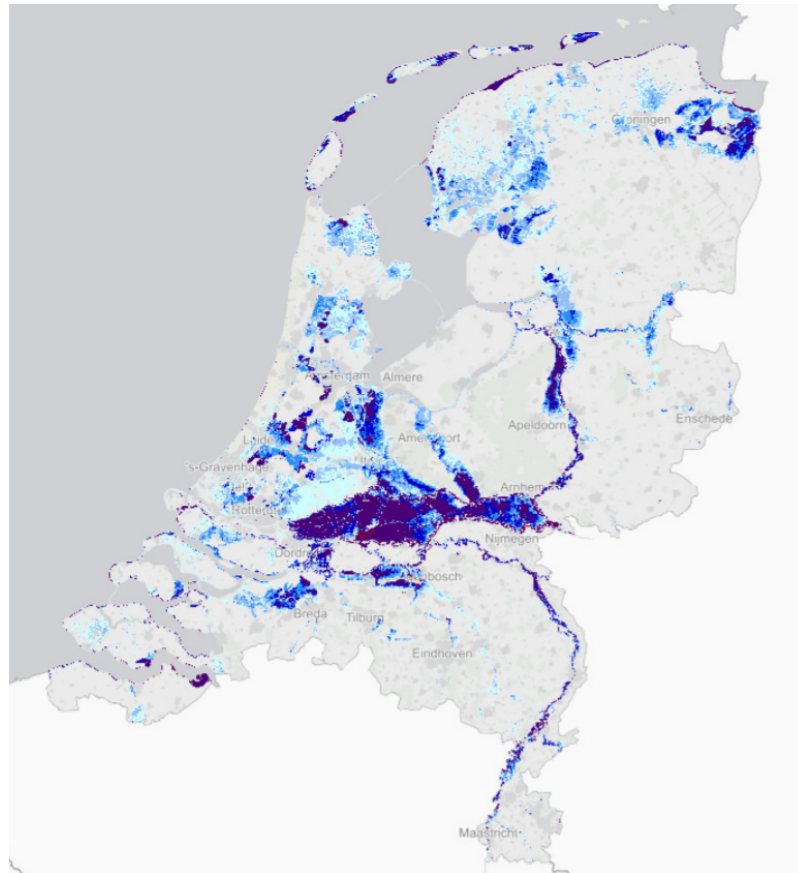


Image from Klimateffectatlas (2023)

### Drought

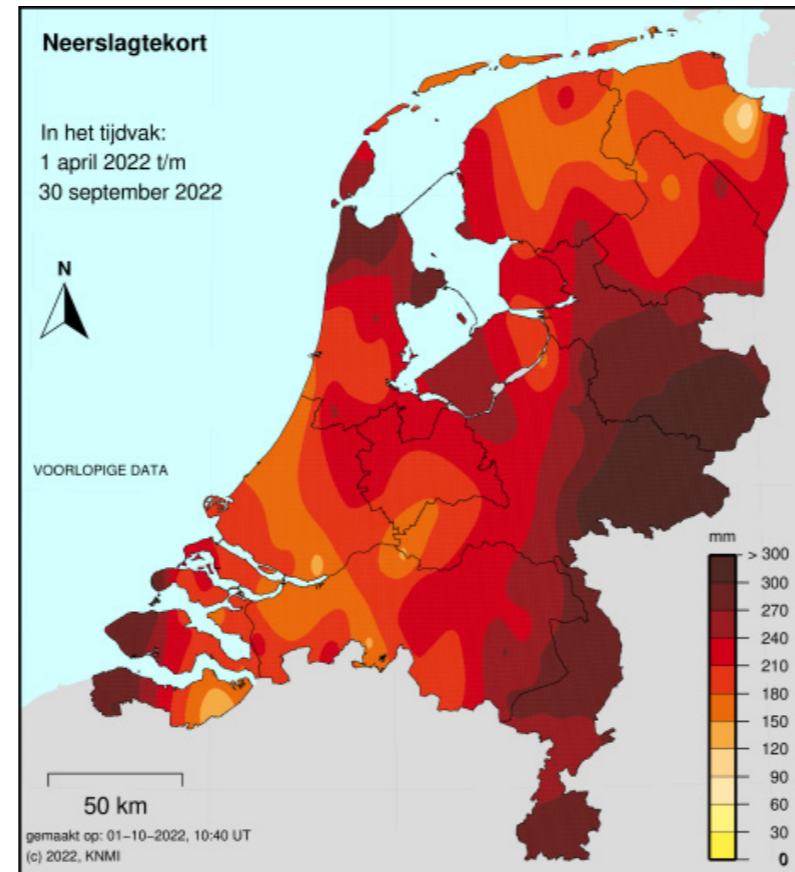


Image from KNMI (2021)

### Heat

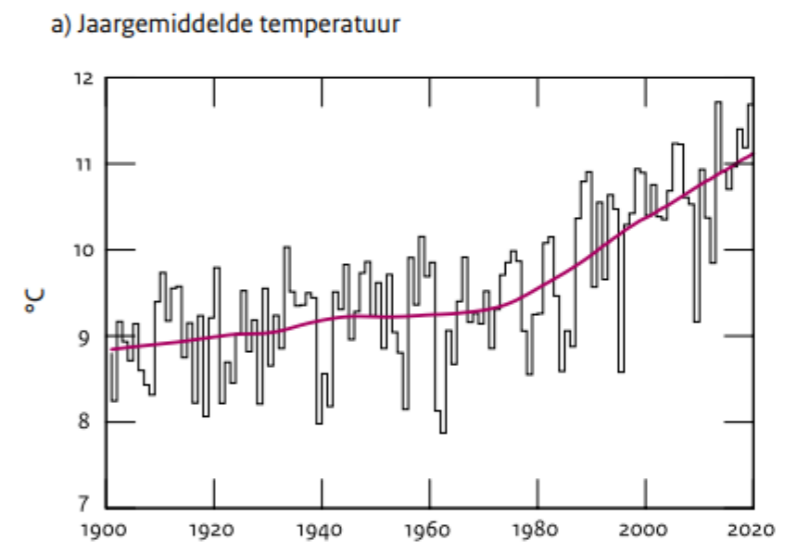


Image from KNMI (2021)



# Literature research

## Agriculture reform

### Nitrogen crisis



Image from De Volkskrant

### Biodiversity loss



Image from degeneeskrachtigekeuken.nl

### Climate adaptation



Image from Akkerwijzer

# Literature research

## Agroforestry



Image from CivilEats (2024)



Image from WUR (2024)

# Literature research

## Agroforestry: pros and cons

- Climate adaptation
  - Water retention
  - Water infiltration
  - Cooler during summers
- Climate mitigation
  - Carbon replacement
  - Reduction of emissions
  - Carbon capture
- Ecology
  - Better soil life
  - Biodiversity increase
  - Microclimate
- Higher crop yield
  - Lower windstress

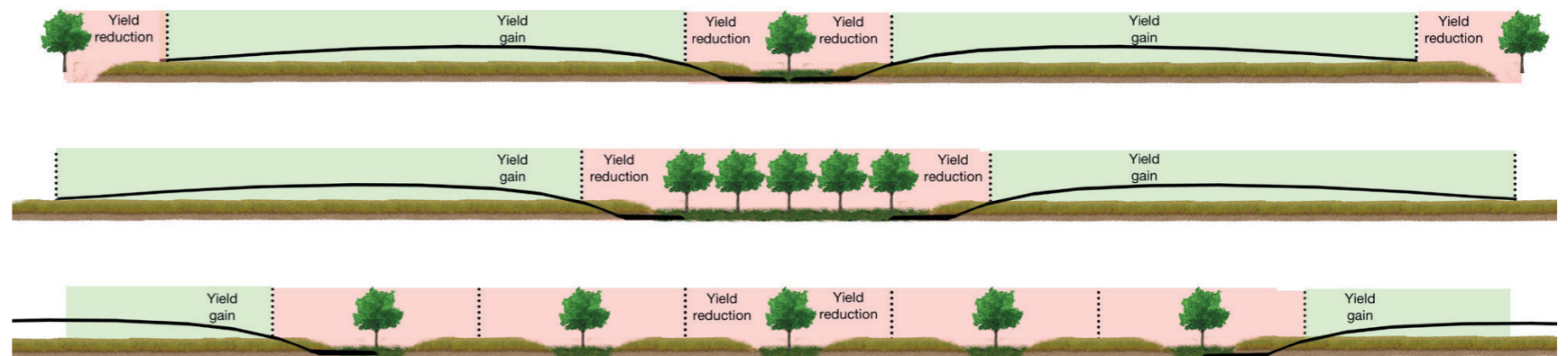


Image from Selin-Noren (2022)

# Precedent research

Het Reestdal



## Legend

- Forest
- Pastures
- Flood planes
- Fen
- River

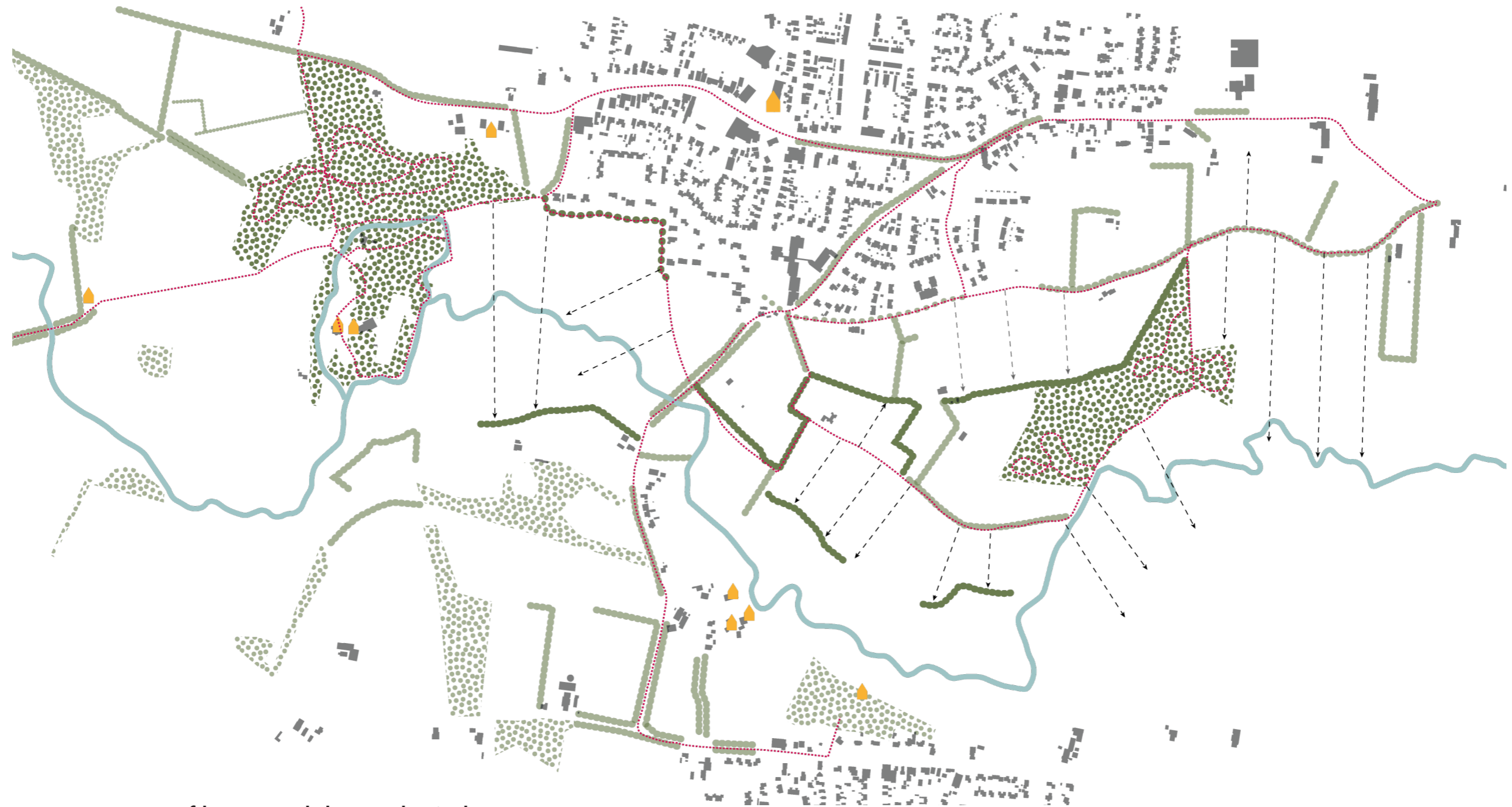
# Precedent research

Het Reestdal



# Precedent research

Het Reestdal



Cognitive map of het Reestdal near de Wijk

- Water
- Path
- Landmark
- Tree line
- Sight line
- Tree canopy

# Precedent research

Het Reestdal



# Precedent research

Gorssel



## Legend

- Forest
- Pastures
- Tree lanes Joppelaan en Elfuursweg
- River



# Precedent research

Gorssel



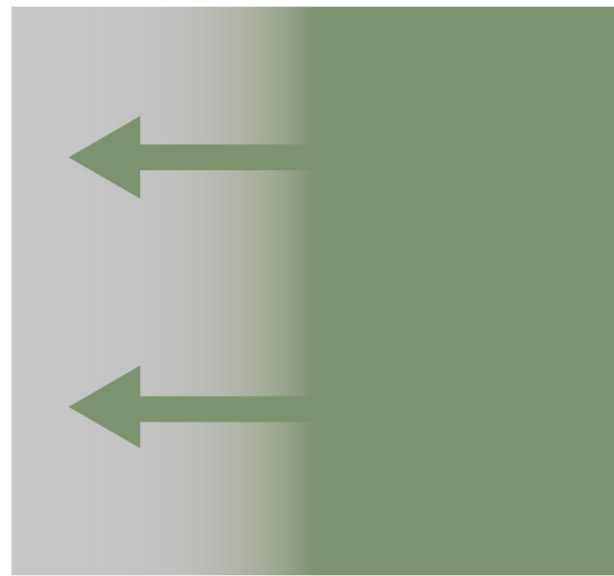
Joppelaan



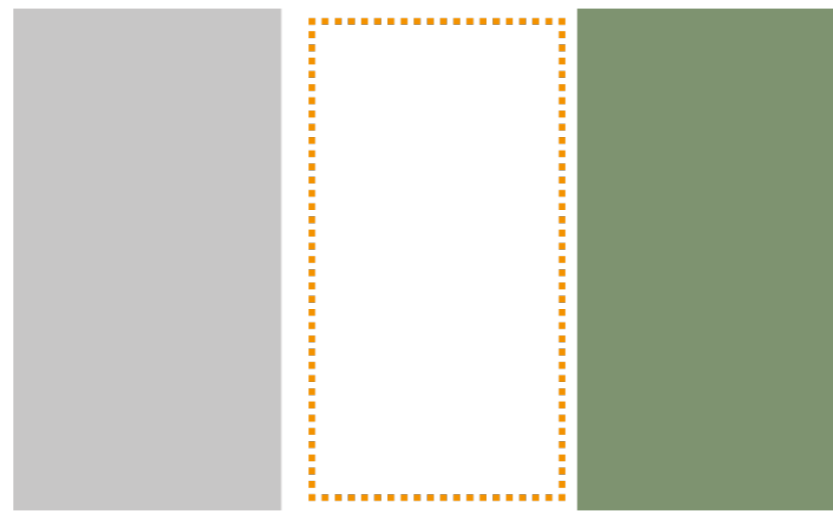
Elfuursweg

# Precedent research

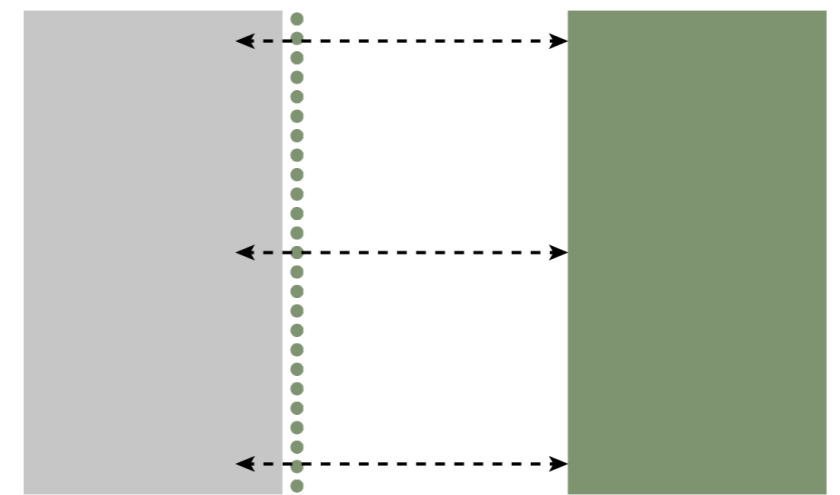
## Conclusion



Connection from forest to urban



Arcadian empty space



Two step transition

# VISION + DESIGN

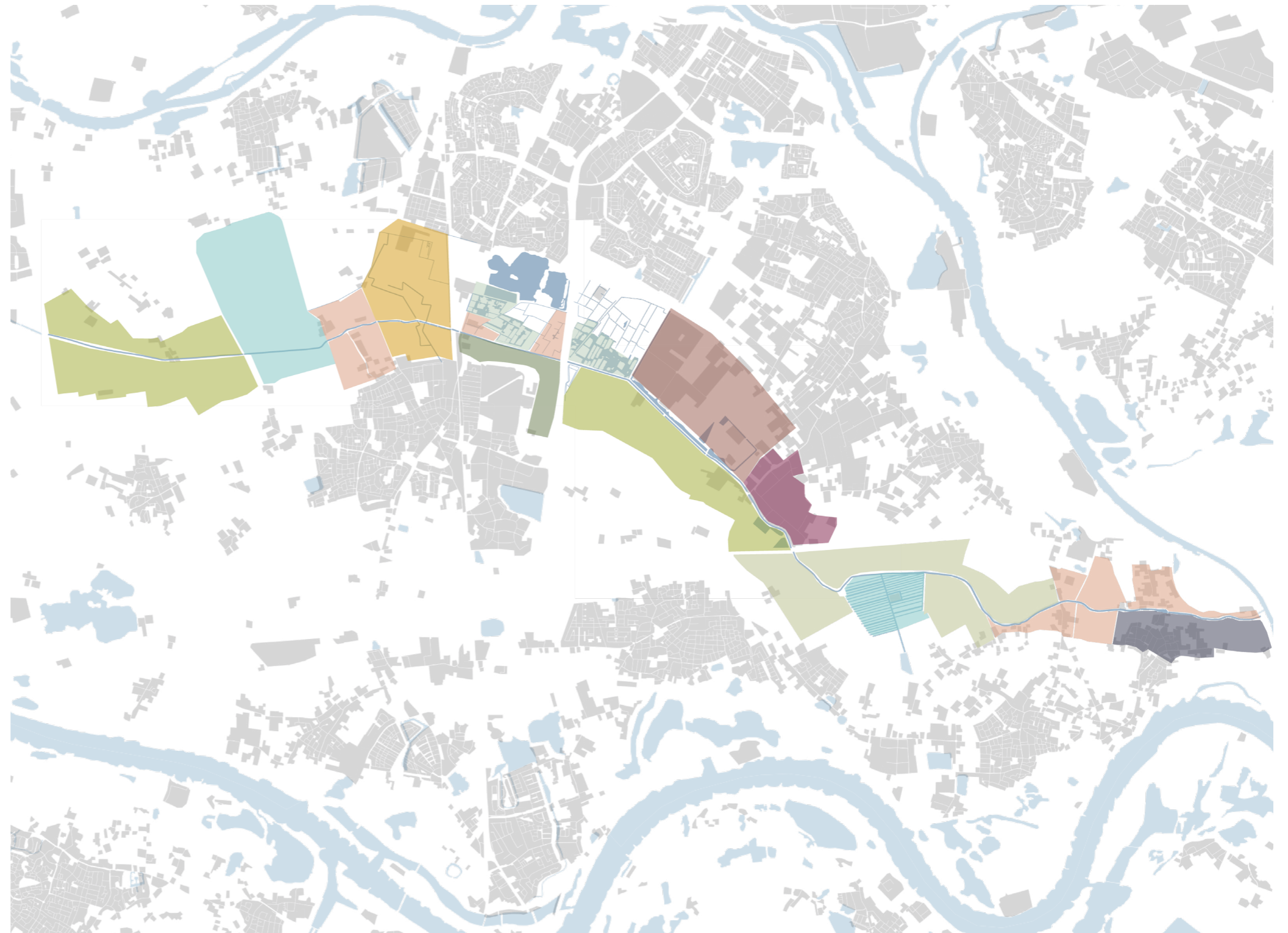
## PRINCIPLES

1. Regional scale
2. Health forest
3. Climate forest
4. Agroforest

# New functional layout

## Legend

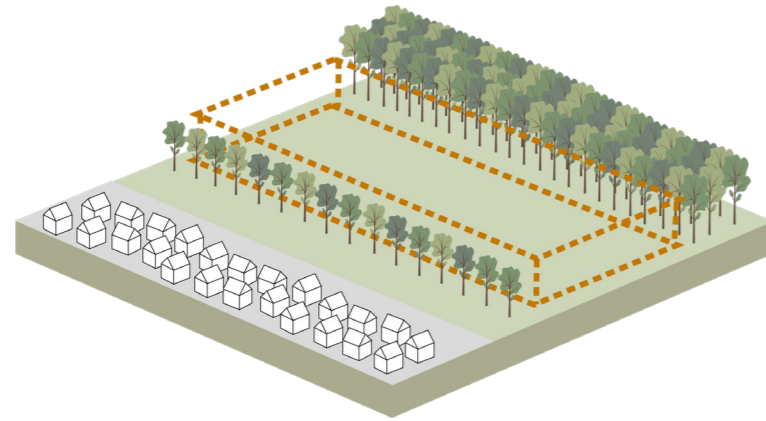
- Agroforest
- Climate forest
- Small scale agriculture
- Mosaic
- Health forest
- Water landscape
- Greenhouses
- Business park
- Village



New function layout of the area

# Design principles

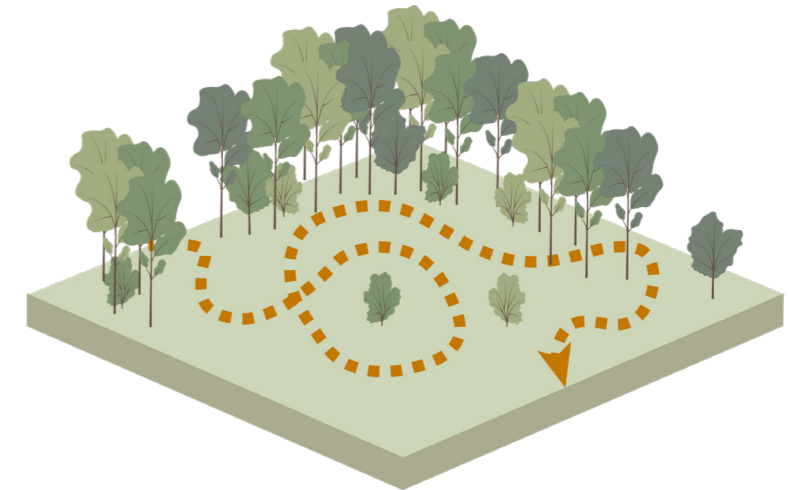
## Health forest



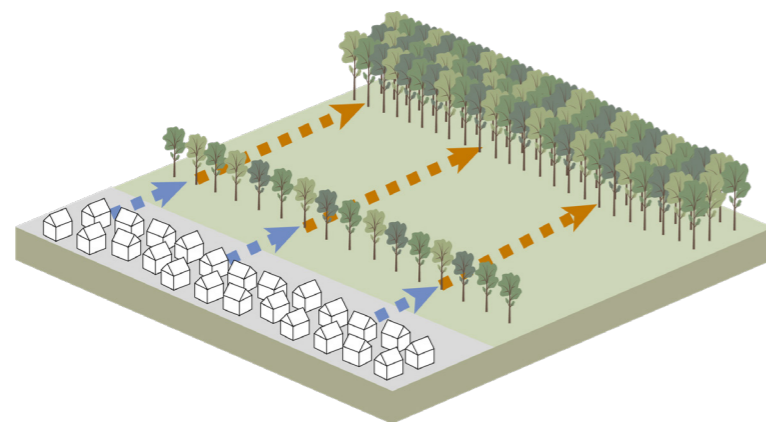
Arcadian emptiness



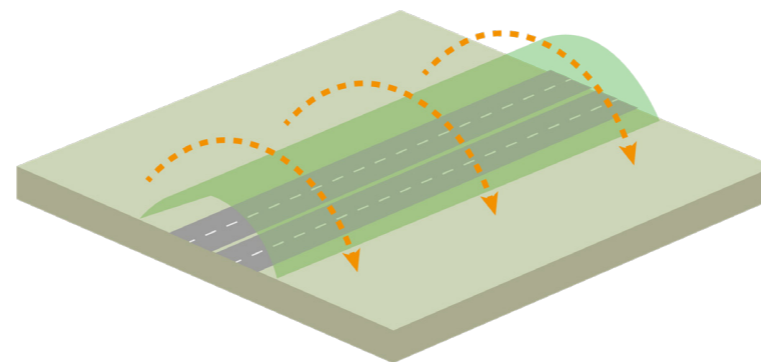
Being away



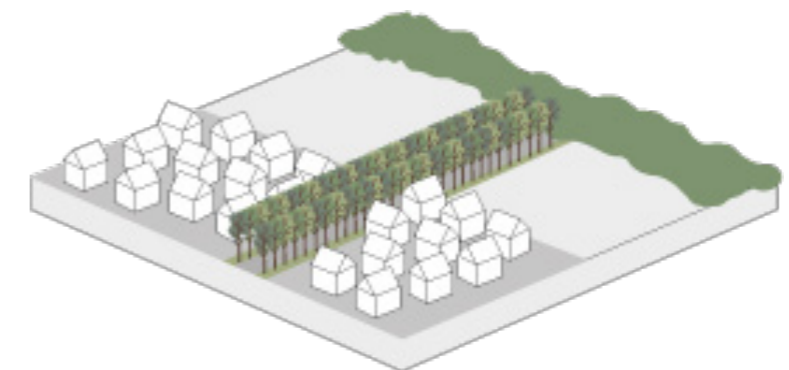
Wandering around



Two-step sightlines



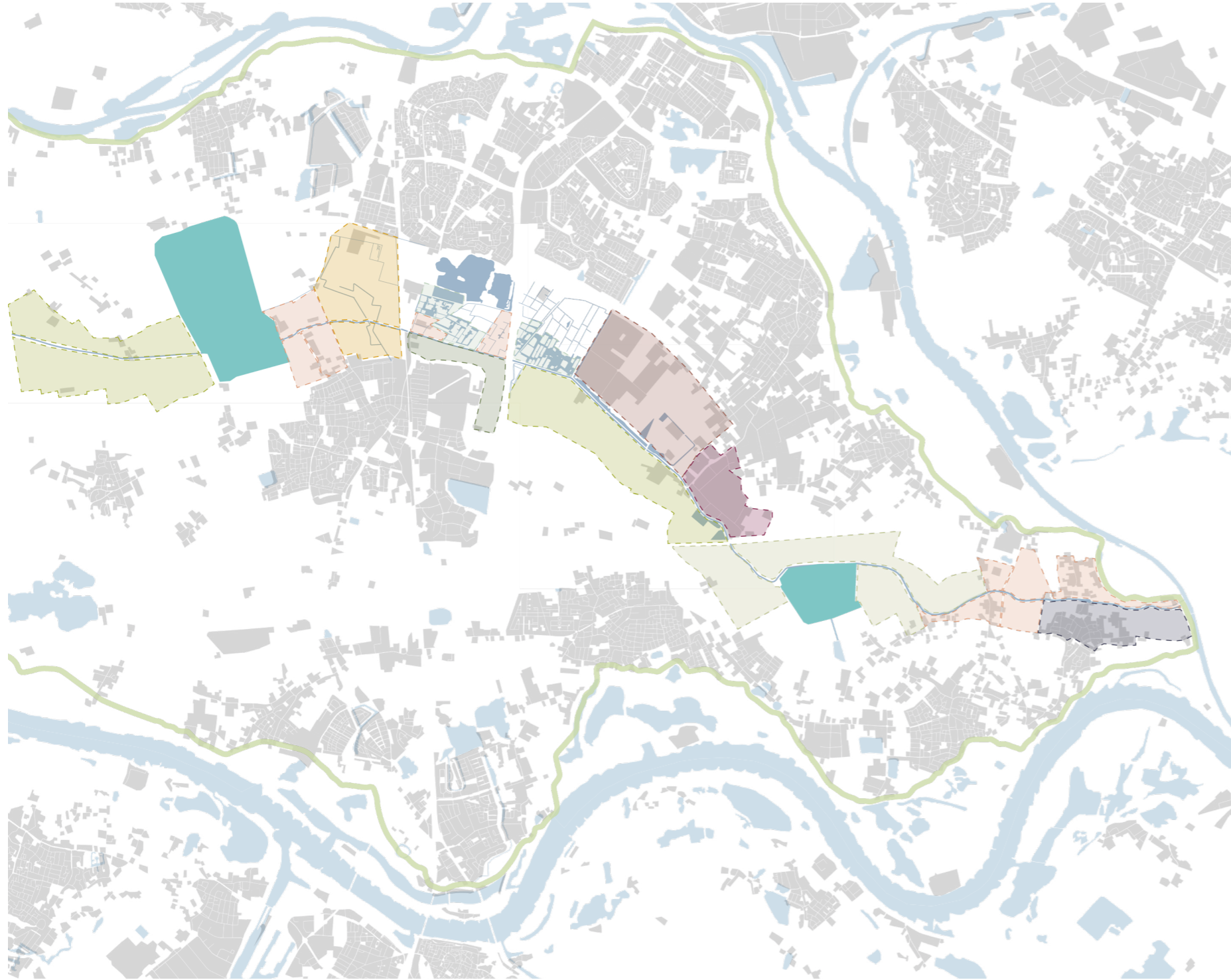
Bridging the highway



Connect village and forest

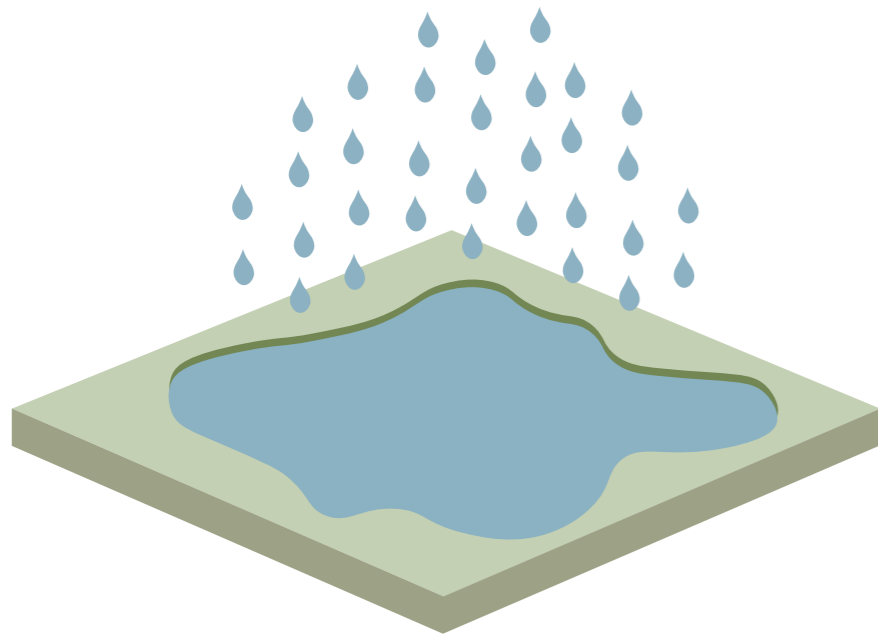
# Design principles

Climate forest location

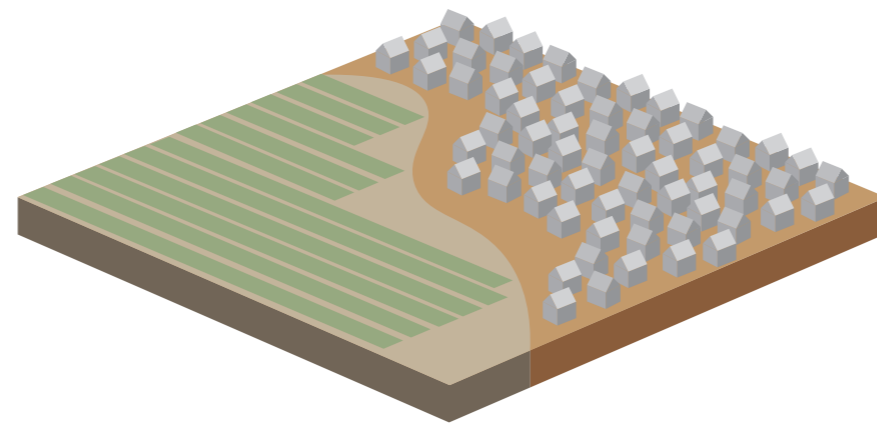


# Design principles

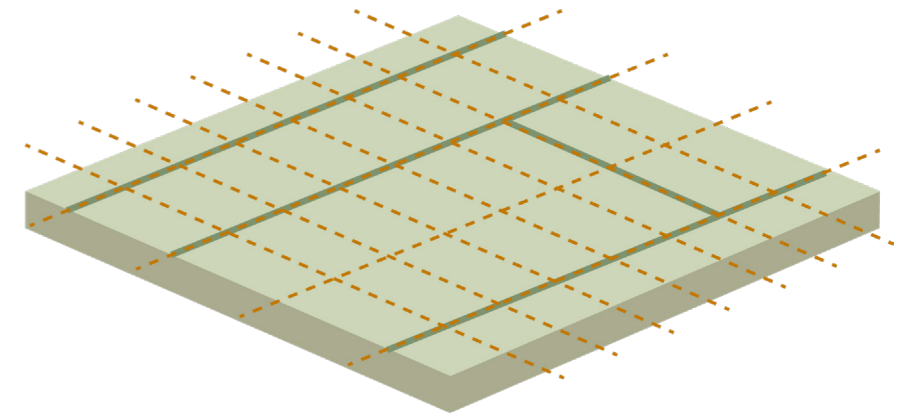
Climate forest



Water storage



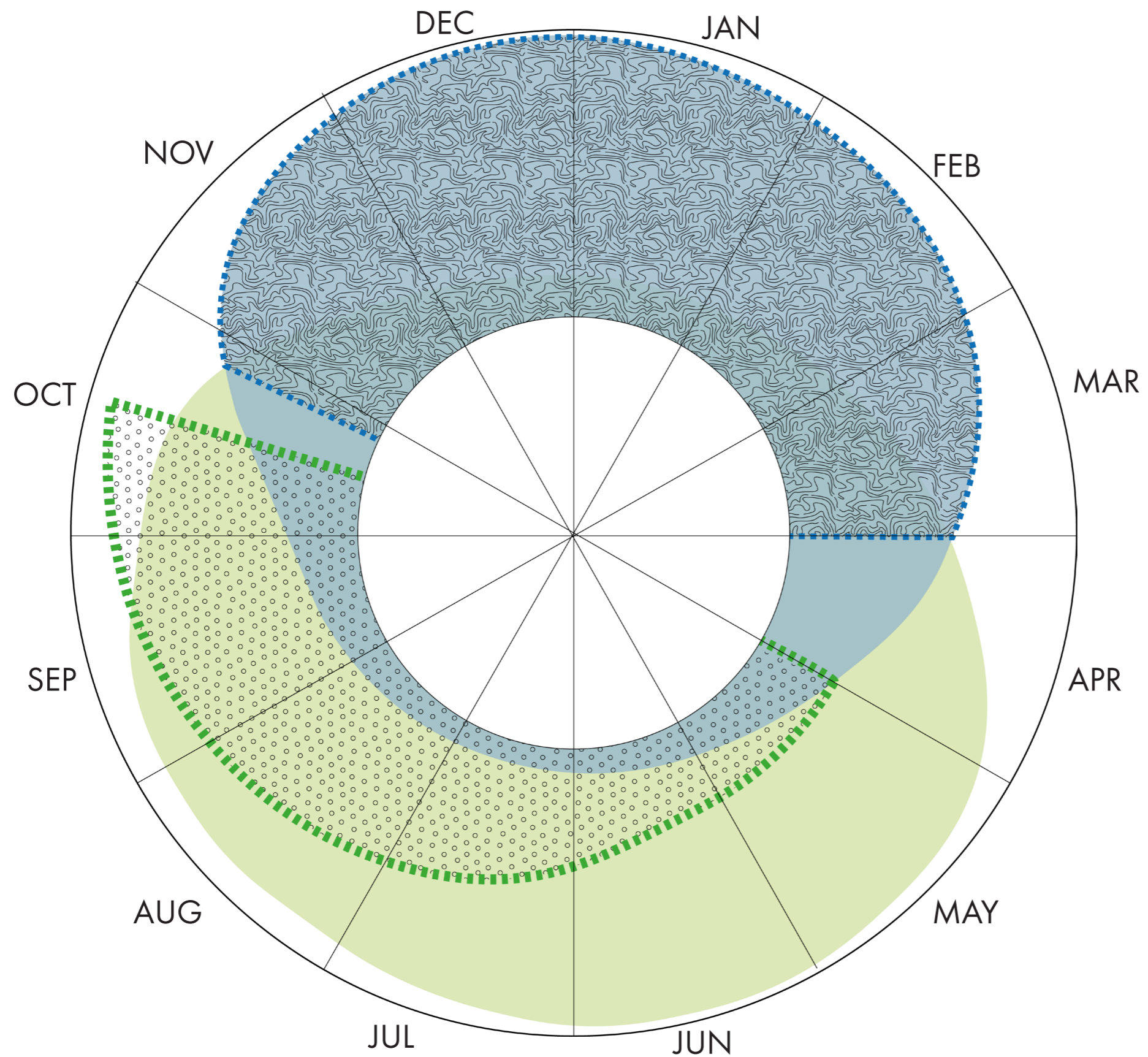
Position of functions based on underlying soil type



Grid based on underlying plot structure

# Design principles

Climate forest



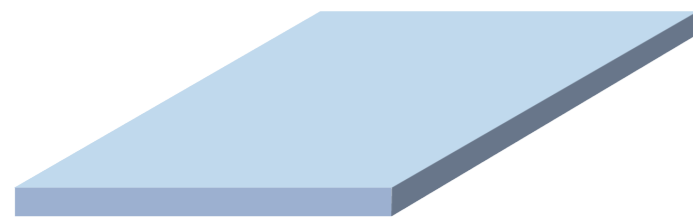
## Legend

- Heavy rainfall period
- Crop growth period
- Water collection
- Water use

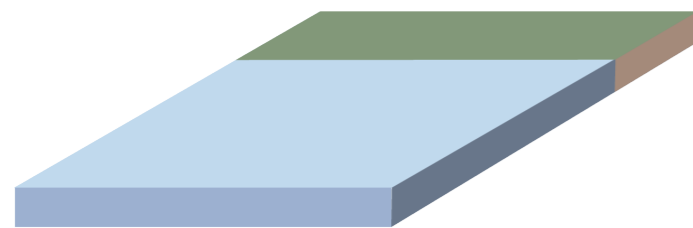


# Design principles

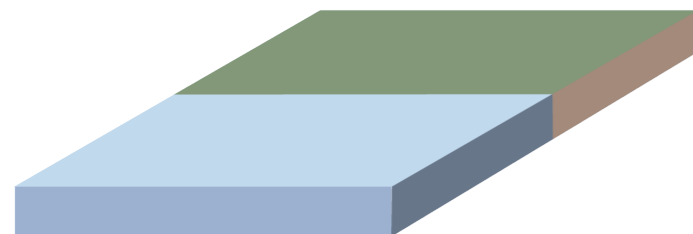
## Groundwater



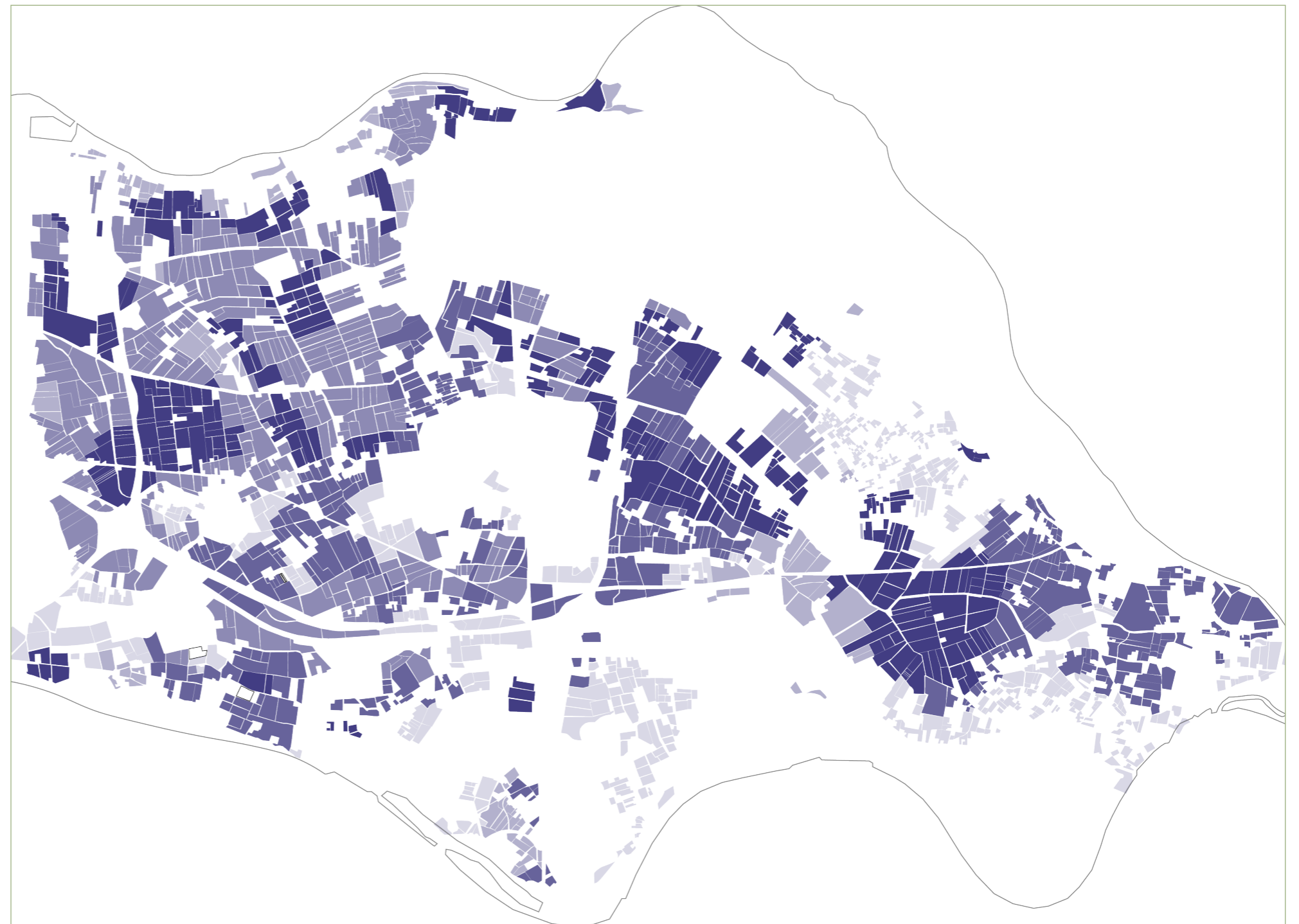
100%



70%

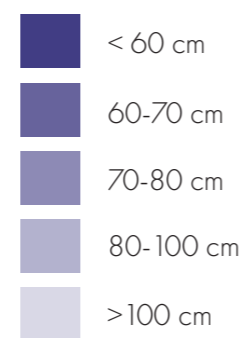


50%



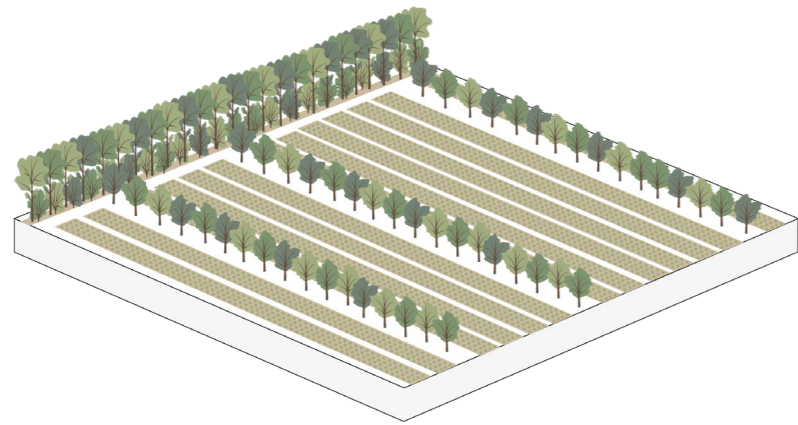
Groundwater levels on agricultural lands

### Legend

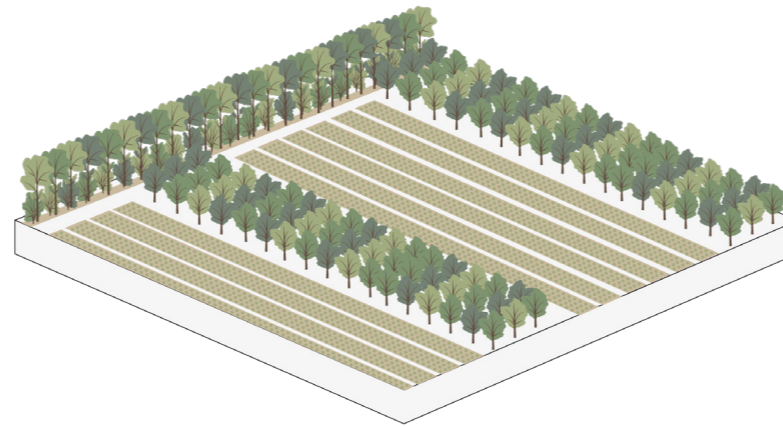


# Design principles

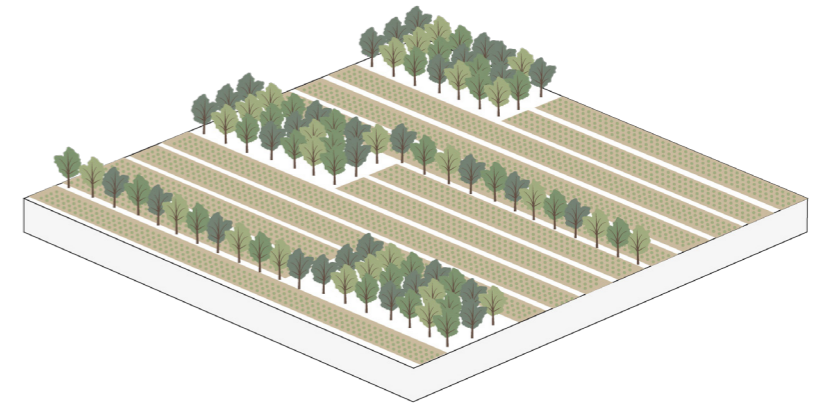
## Agroforest



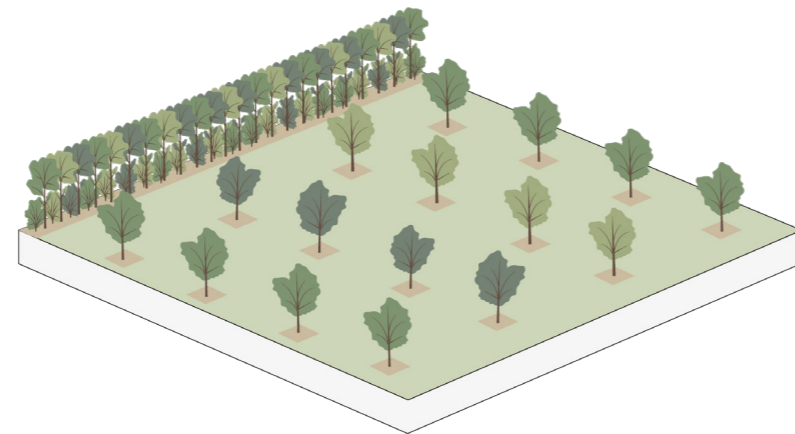
1. Single rows



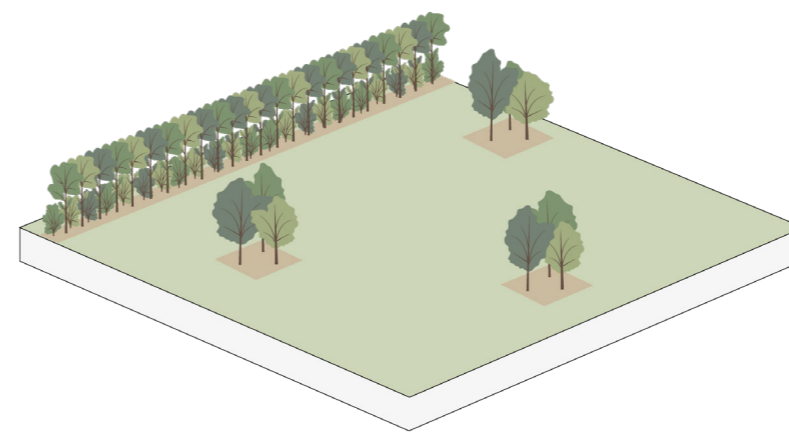
2. Double rows



3. Volumes



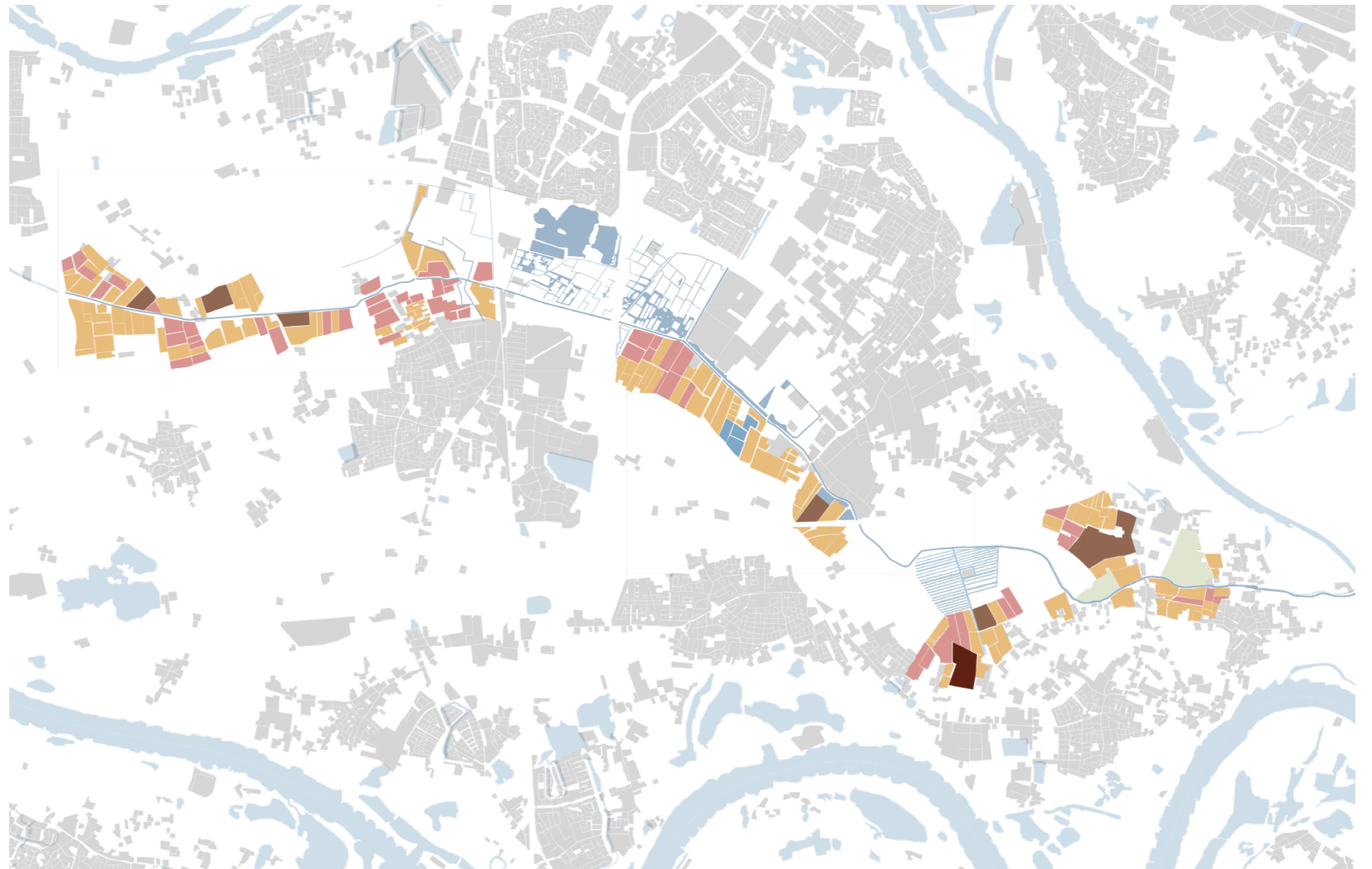
4. Single trees



5. Groups of trees

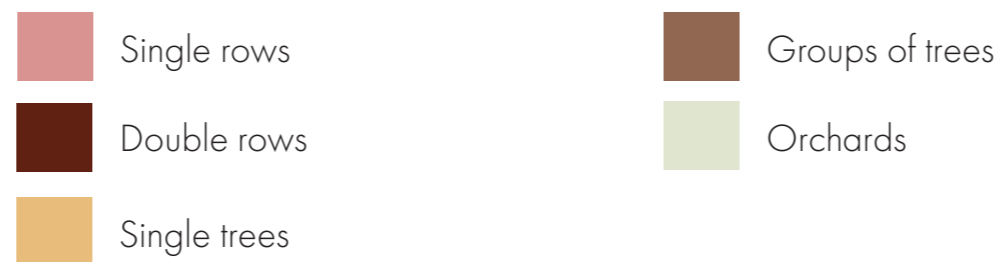
# Design principles

## Agroforest

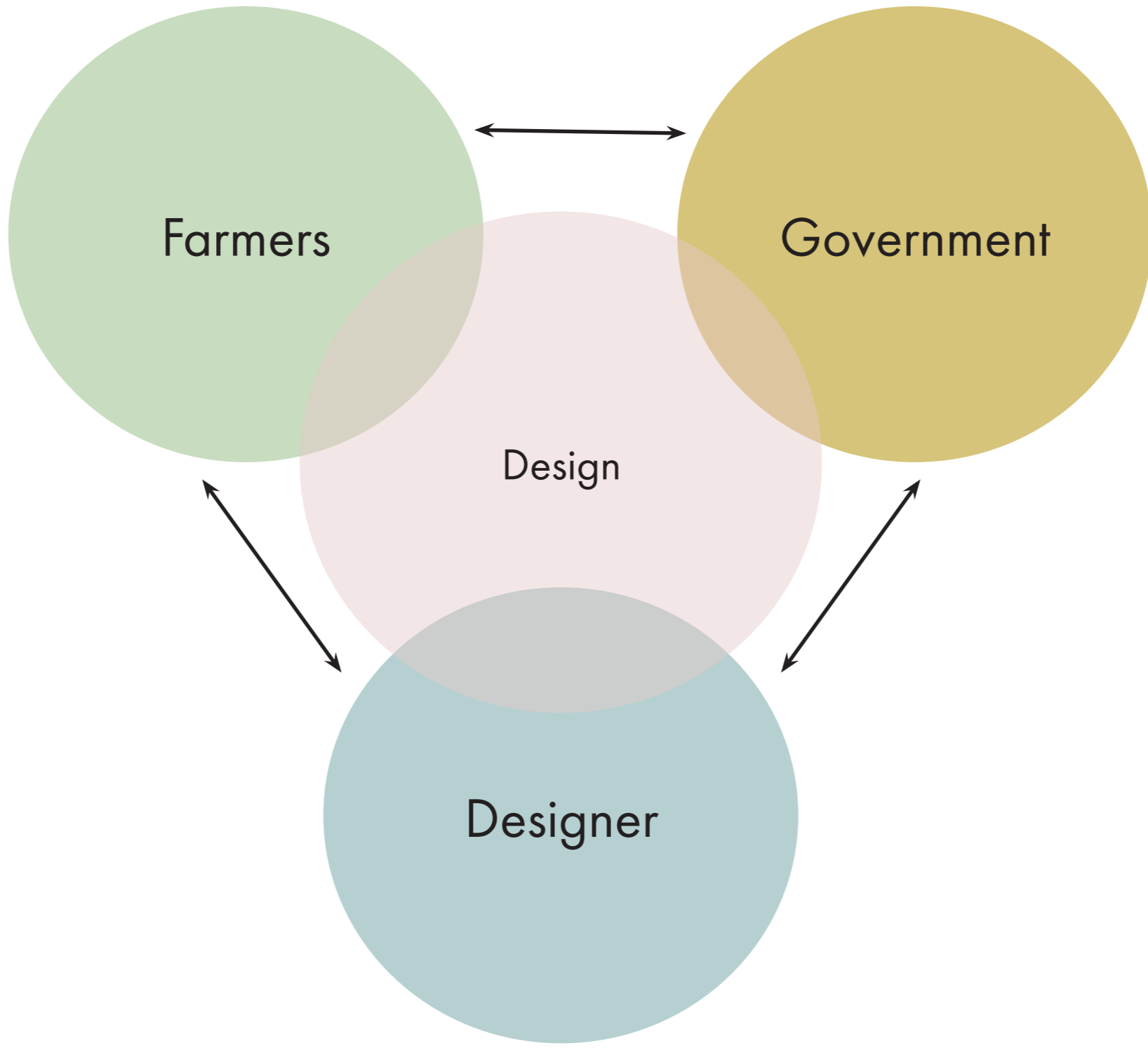


Agroforestry types around the Linge

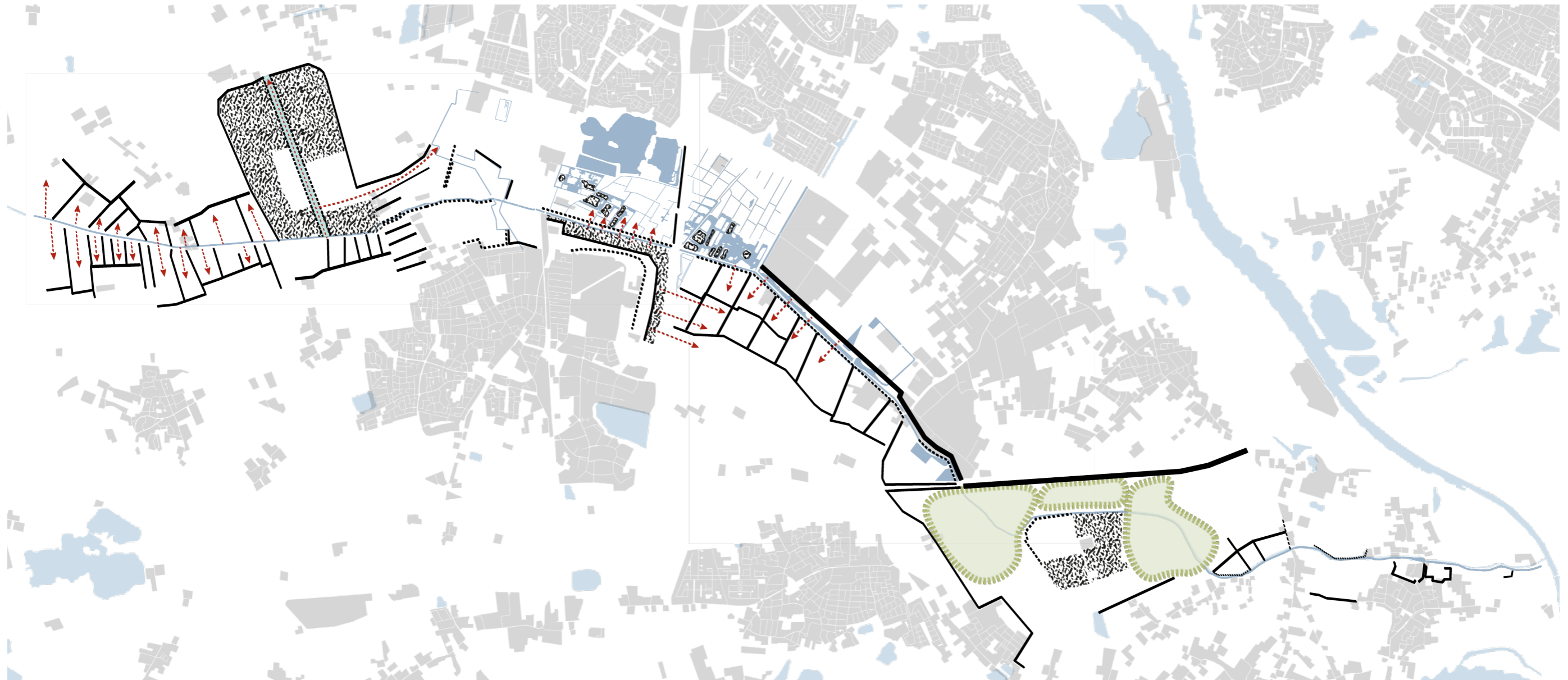
### Legend



# Agroforest conclusion



# Spatial vision



Spatial vision for the new Linge area

## Legend

— Wall

- - Discontinuous wall

- - -> Sight line



Open landscape



Canopy ceiling

# DESIGN

1. Regional scale
2. Health forest
3. Climate forest

# Design

Regional scale



# Design

Zoom in regional scale





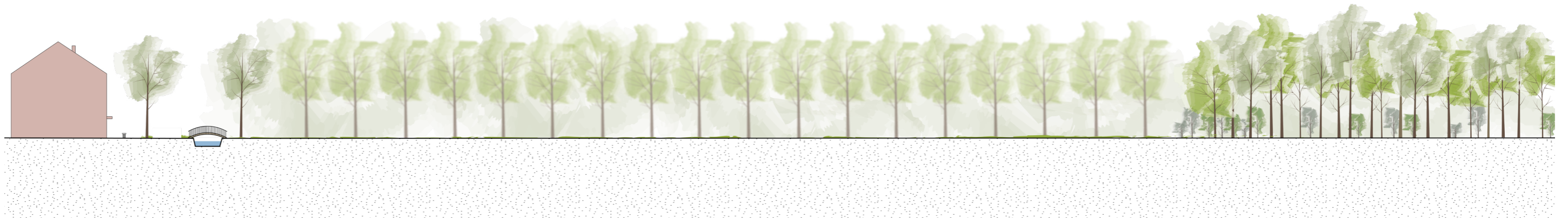
# Design

Health forest



# Design

## Health forest section



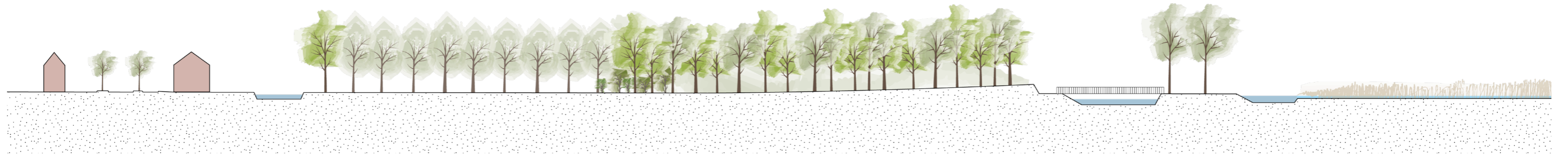
# Design

Impression tree lane



# Design

Health forest section



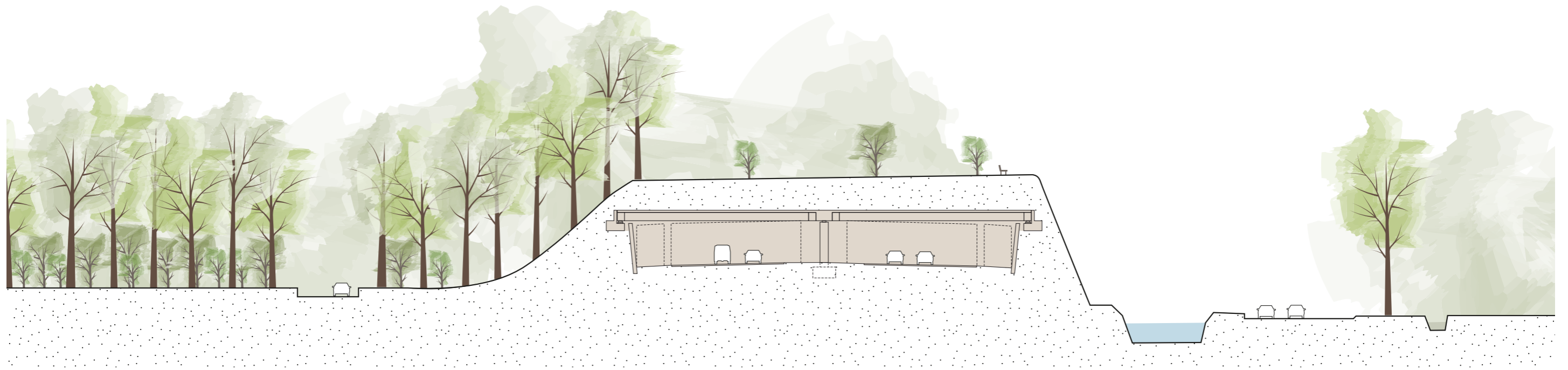
# Design

Impression Linge



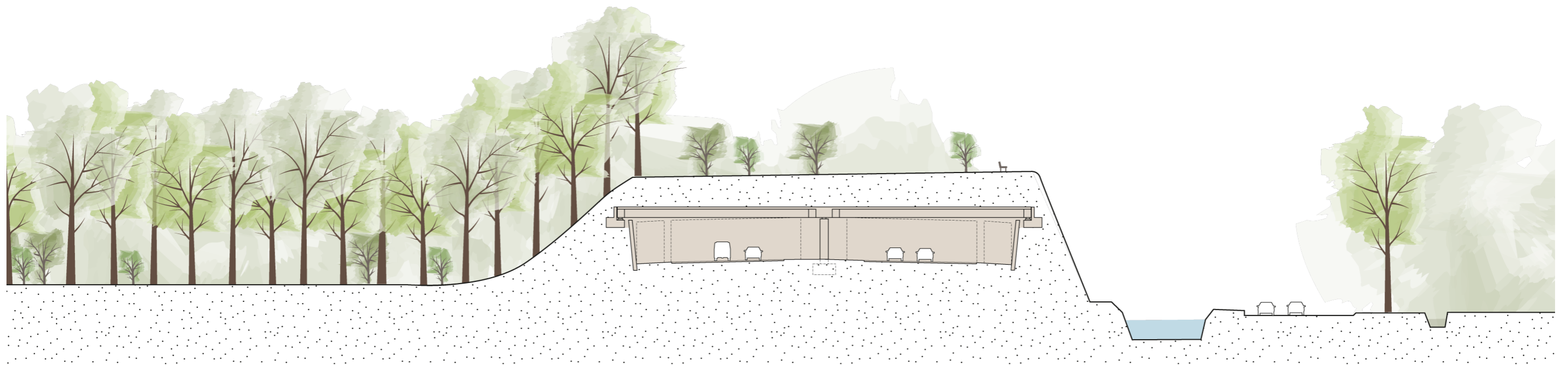
# Design

## Health forest section



# Design

## Health forest section



# Design

Impression health forest





# Design

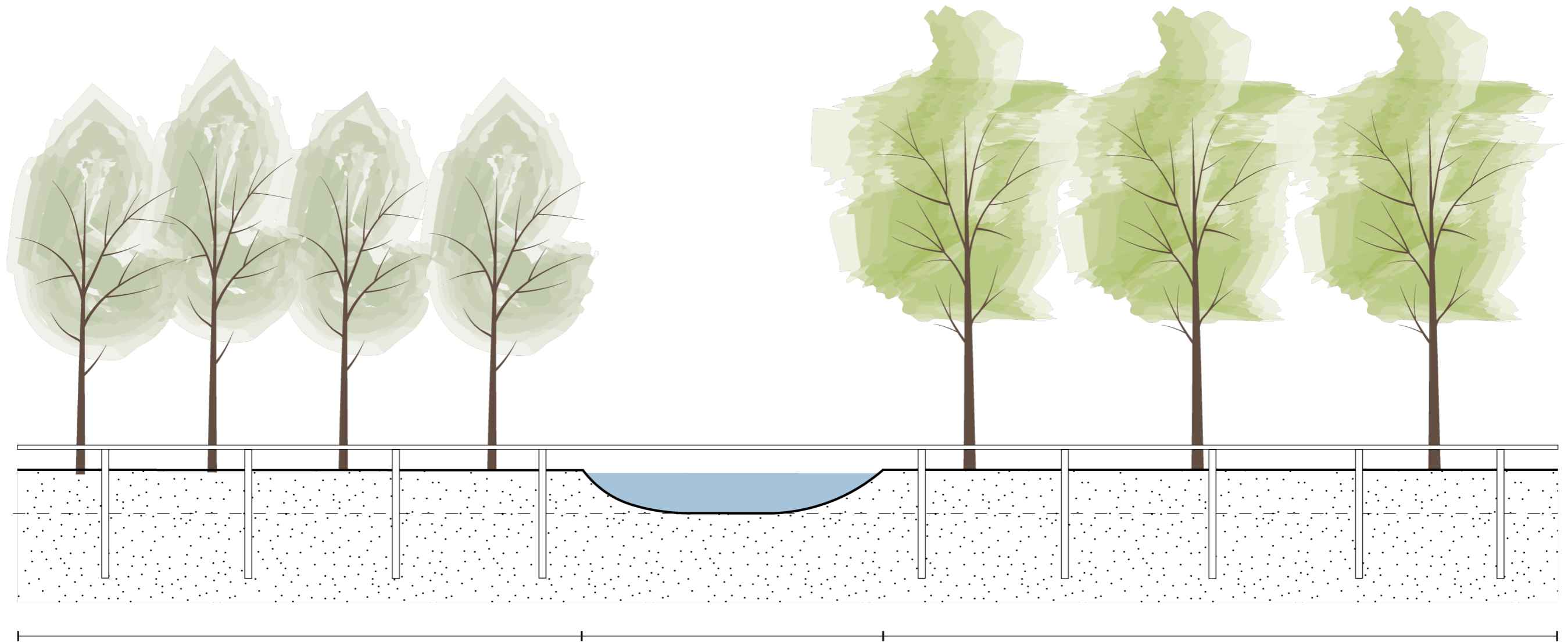
Climate forest

- Trees
- Water
- Buildings
- Routing



# Design

## Climate forest section



# Design

Climate forest impression



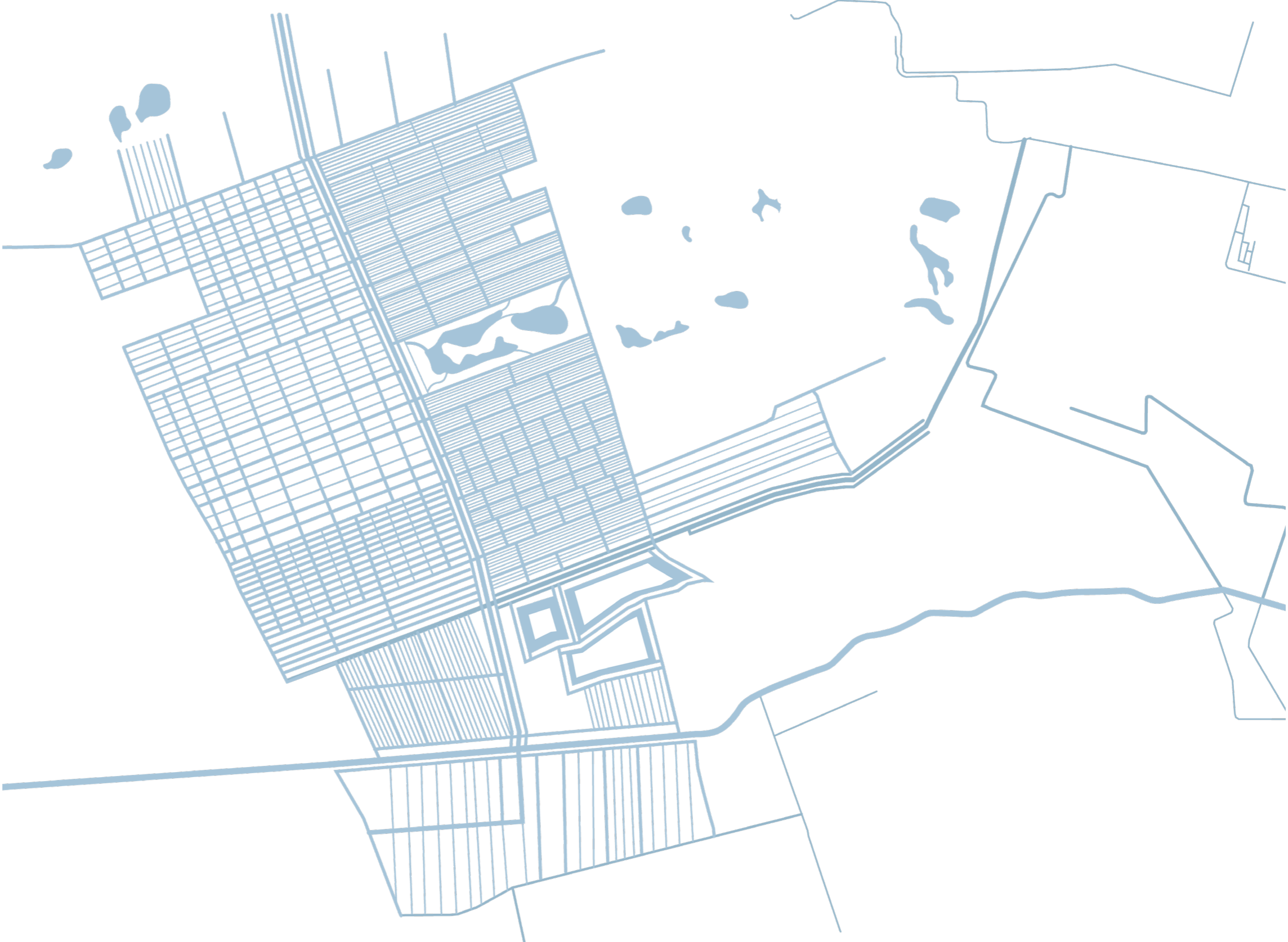
# Design

Climate forest impression



# Design




Climate forest water pattern



# Design

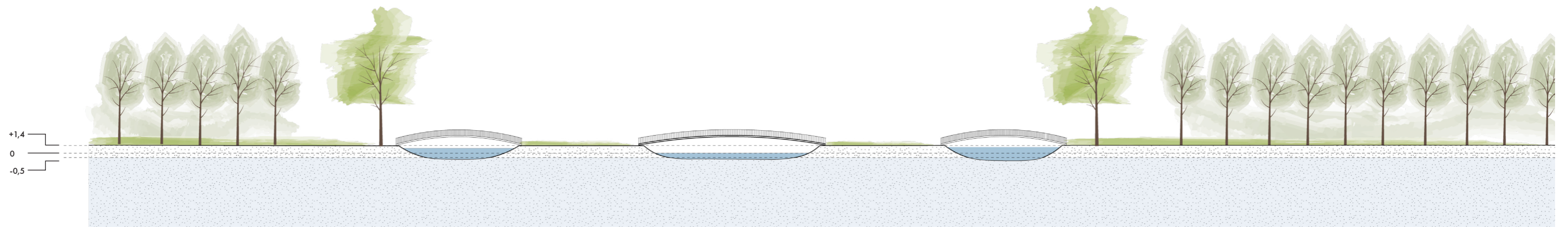
Climate forest new water system



-  Small dike
-  Water
-  Pump

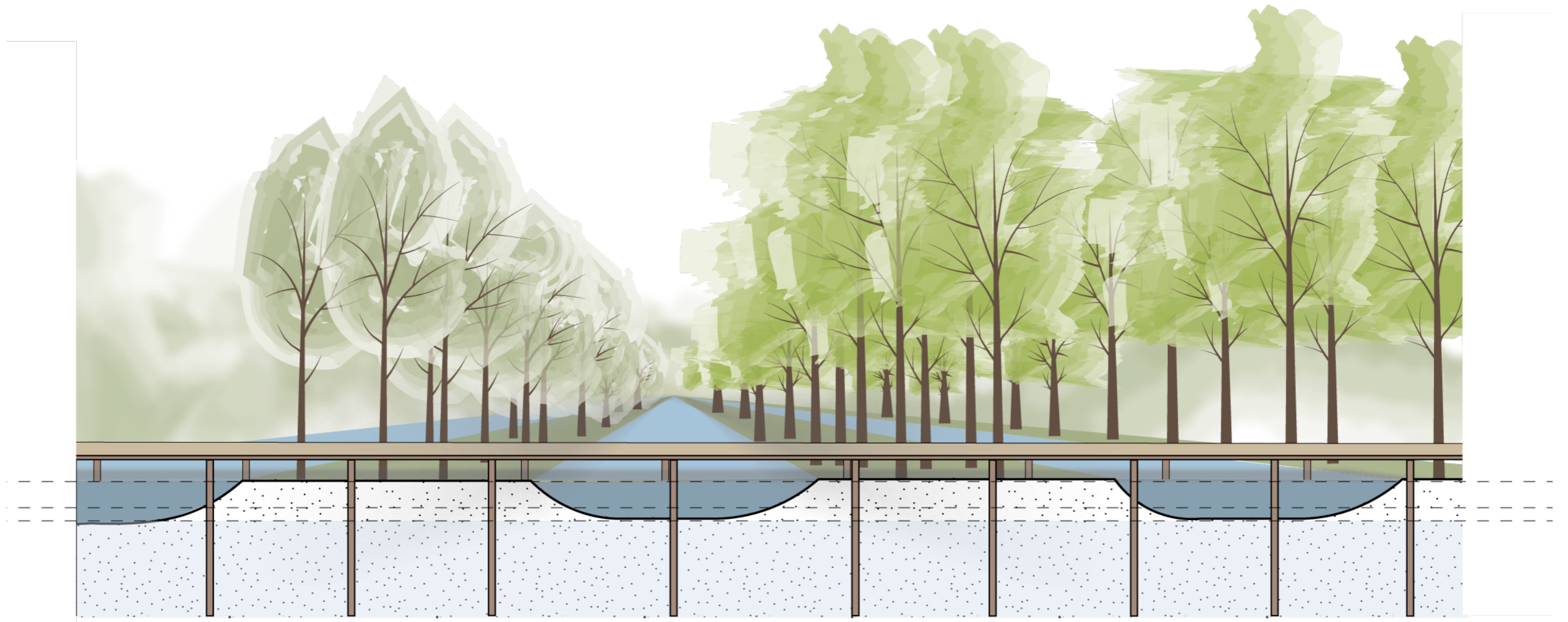
# Design

## Climate forest section



# Design

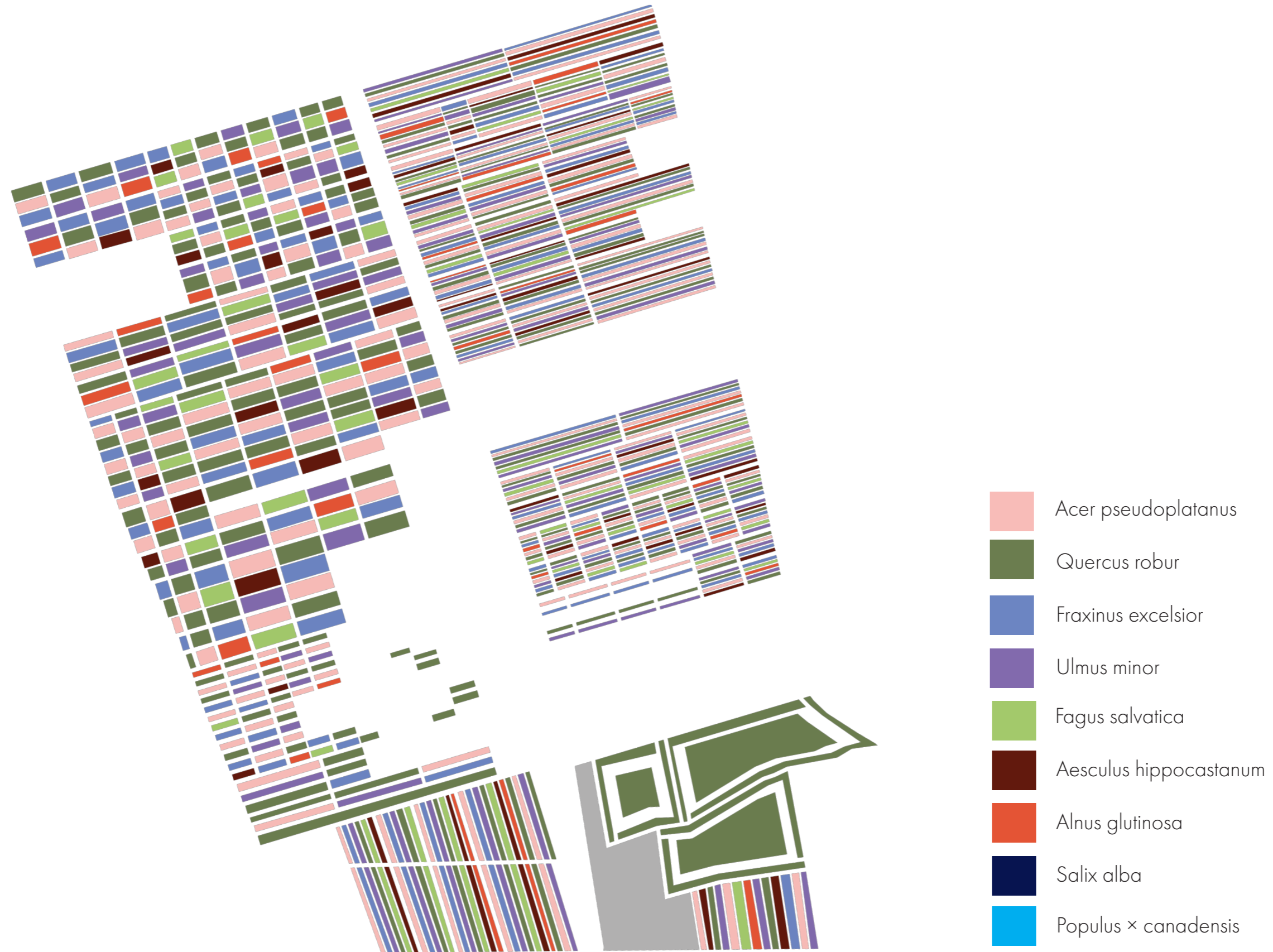
## Climate forest section





# Design

Climate forest tree species



# Conclusion

“

*How can forestry be applied to create an interurban green structure in the Stadsregio Arnhem-Nijmegen to structure the existing polycentric metropolitan landscape, while simultaneously providing a solution to future climate and ecological challenges and improve the health and well-being of the inhabitants?*

”

- Trees can provide ecosystem services
- Forest can have multiple functions
- Linge as backbone



**THANK YOU**