

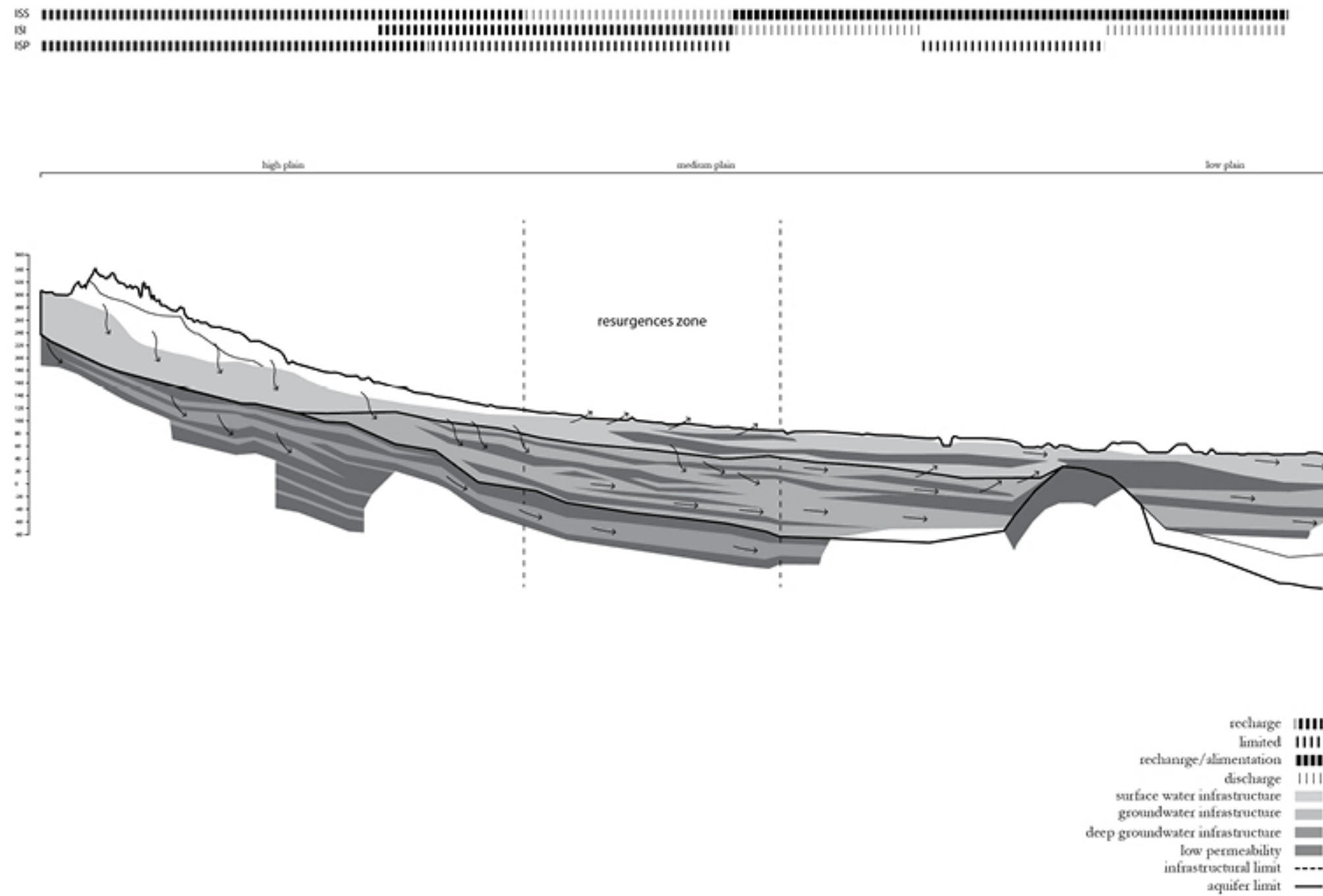
The rebirth of the resurgence belt:
the floodplain as a complex human-water system



The Po Valley



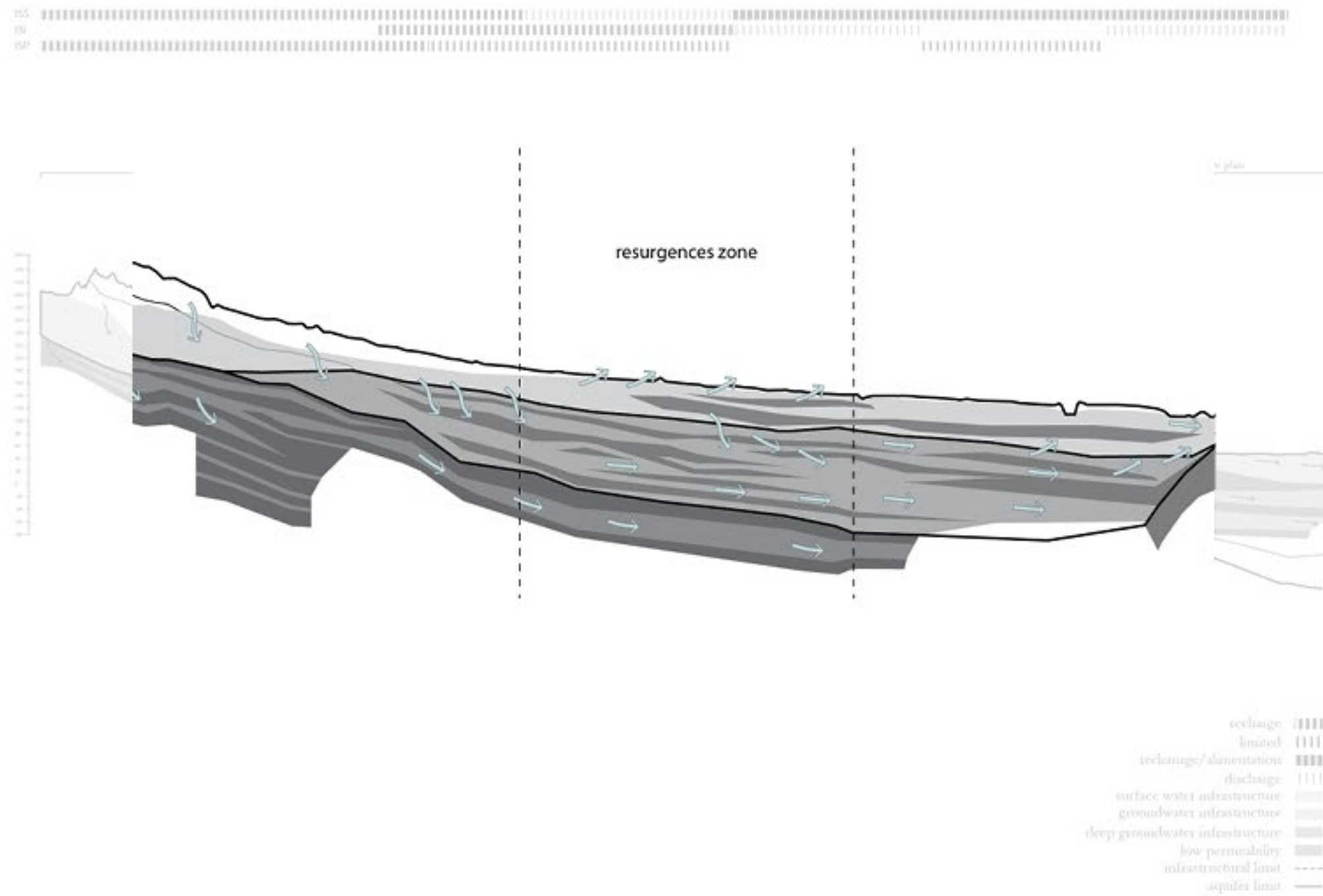
Formation of resurgences



Source: Progetto di accompagnamento a supporto del processo di revisione del piano di tutela delle acque, 2015

The rebirth of the resurgence belt

Formation of resurgences



Source: Progetto di accompagnamento a supporto del processo di revisione del piano di tutela delle acque, 2015

The rebirth of the resurgence belt

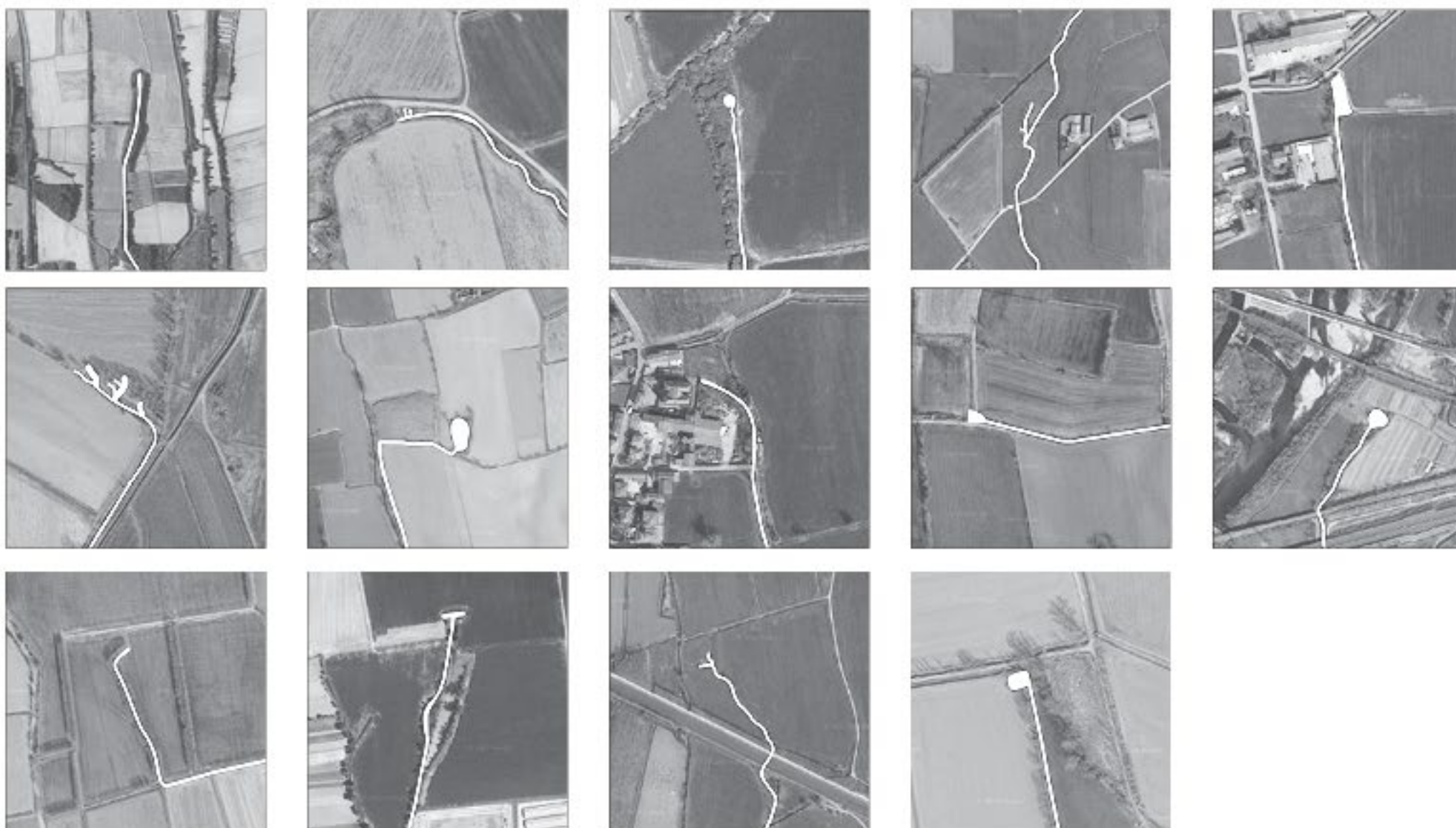
A resurgence



The anatomy of a resurgence



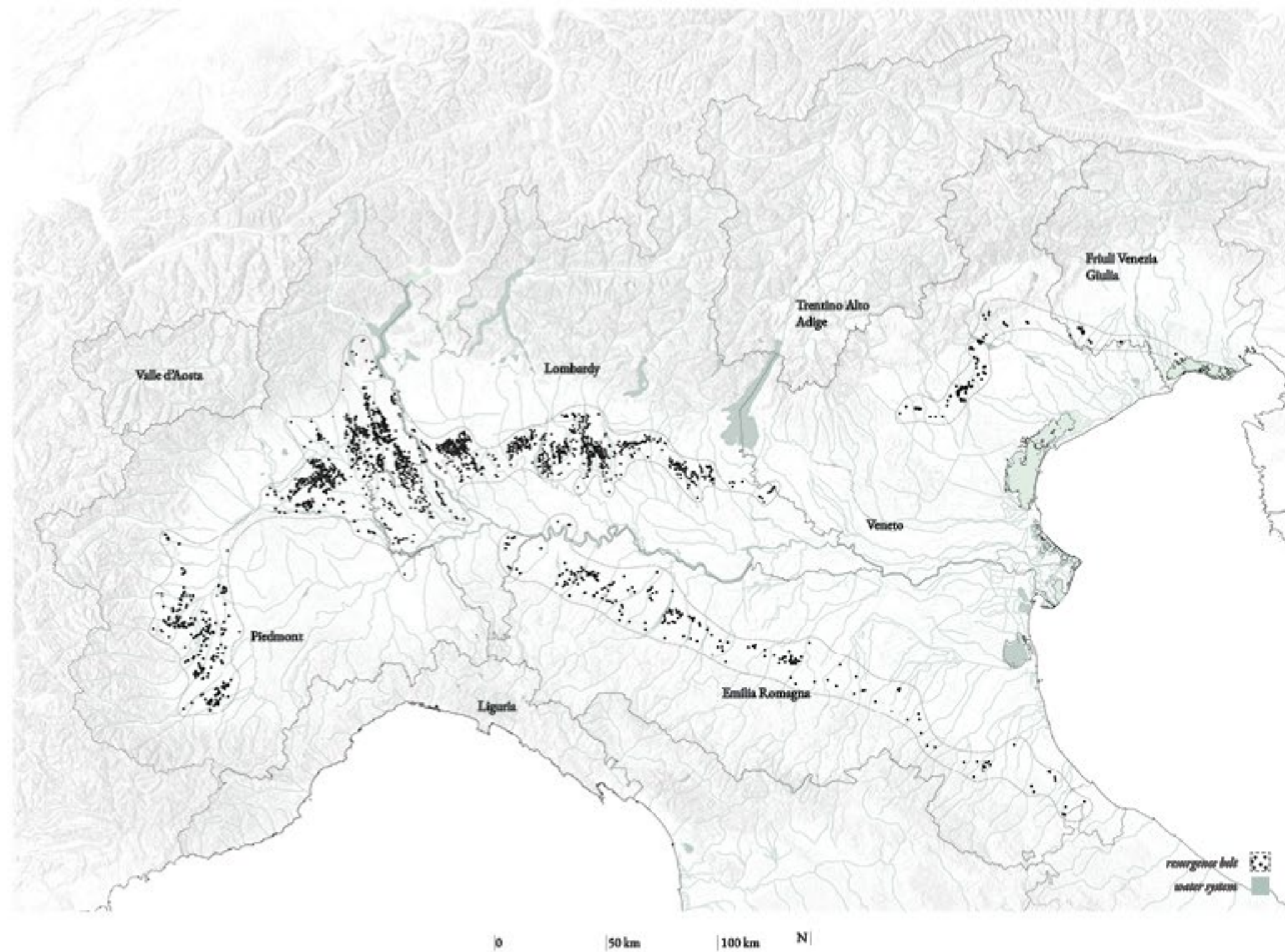
The shapes of resurgences



Source: Google Earth, 2022. Regione Emilia Romagna, 2022. Regione Liguria, 2022. Regione Lombardia, 2022. Regione Piemonte, 2022. Regione Trentino Alto Adige, 2022. Regione Valle D'Aosta, 2022. Regione Veneto, 2022.

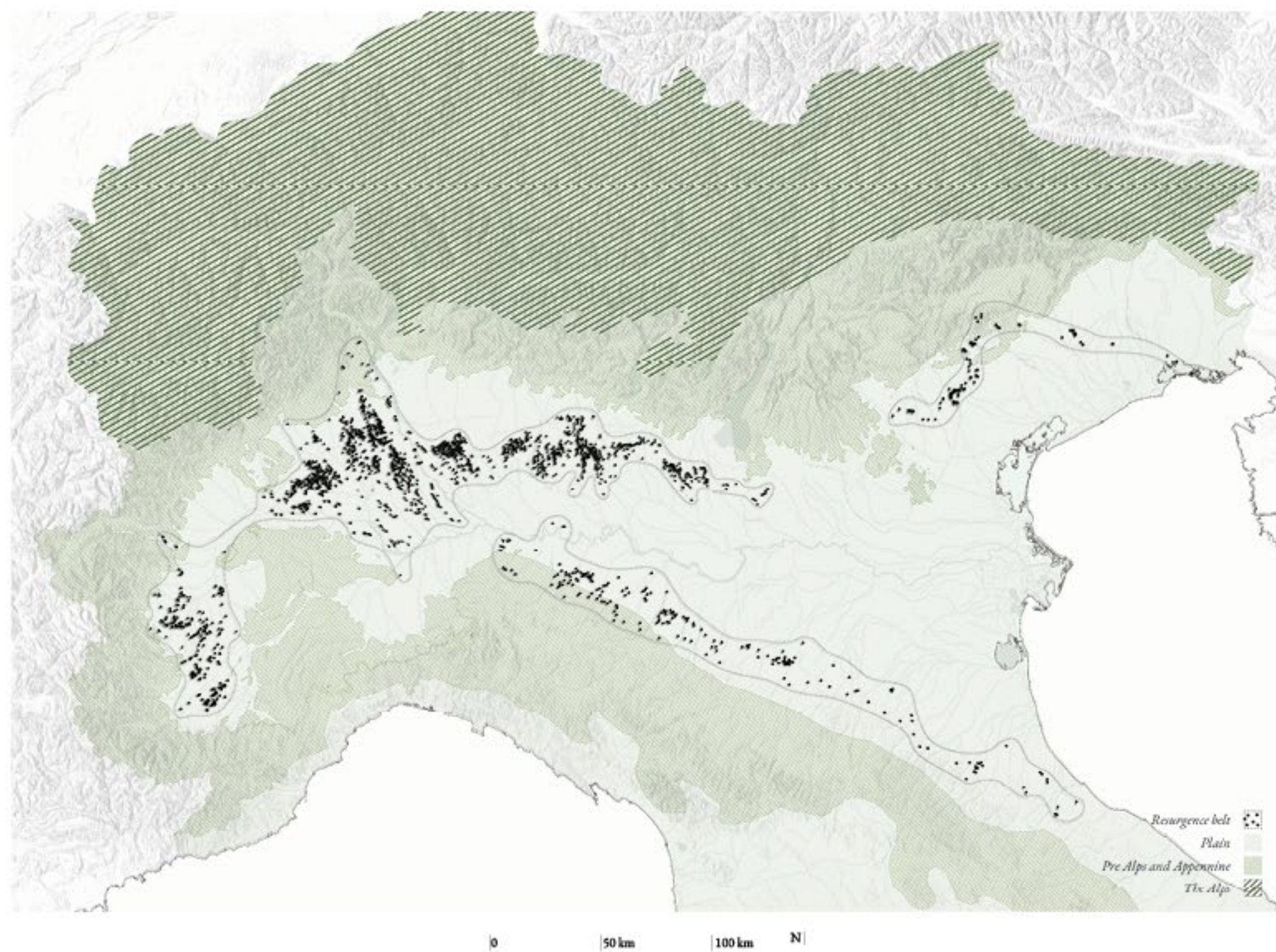
The rebirth of the resurgence belt

Regions crossed by resurgences



Source: AIPO, 2022; GeoFabrik, 2022; OSM, 2022; Regione Emilia Romagna, 2022; Regione Liguria, 2022; Regione Lombardia, 2022; Regione Piemonte, 2022; Regione Trentino Alto Adige, 2022; Regione Valle D'Aosta, 2022; Regione Veneto, 2022.

Topography of the area



Source: AIPO, 2022; GeoFabrik, 2022; OSM, 2022; Regione Emilia Romagna, 2022; Regione Liguria, 2022; Regione Lombardia, 2022; Regione Piemonte, 2022; Regione Trentino Alto Adige, 2022; Regione Valle D'Aosta, 2022; Regione Veneto, 2022.

The landscapes of resurgences



The landscapes of resurgences



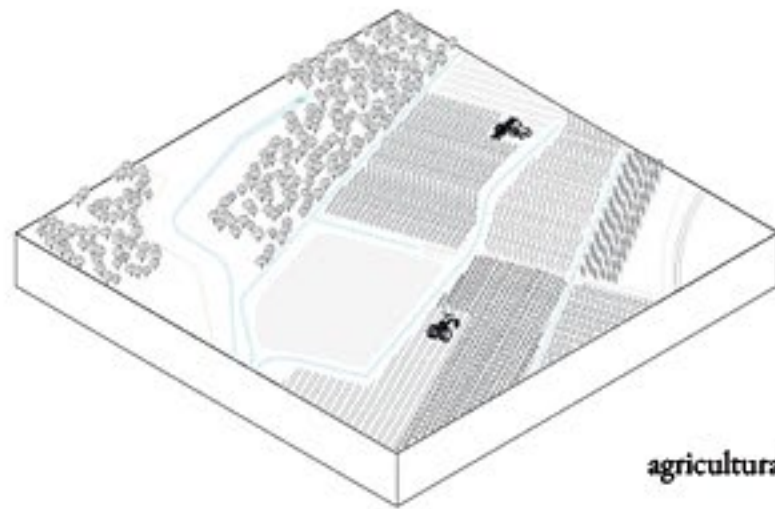
Source: Riserva San Massimo. Source: <https://riservasannmassimo.net/il-ciclo-dellaqua/>

The rebirth of the resurgence belt

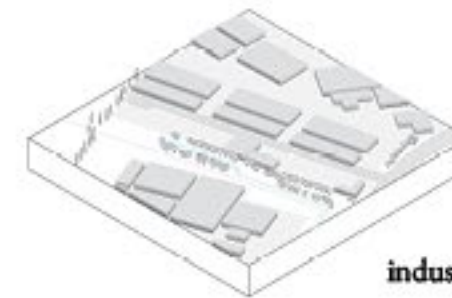
The landscapes of resurgences



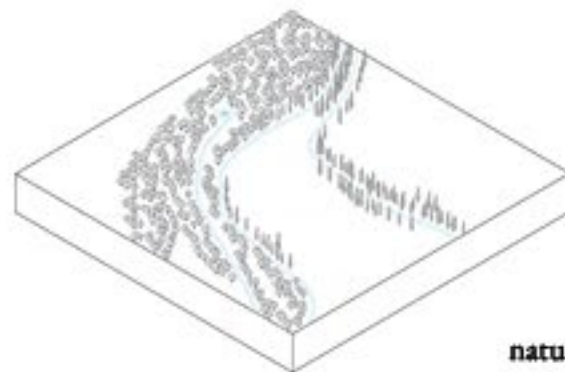
Resurgences as main irrigation sources



agricultural area: 82,5 %



industrial area: 4 %



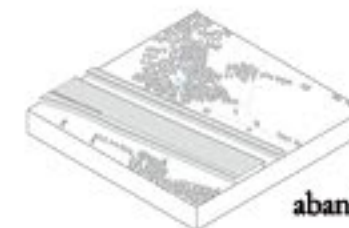
natural area: 4,4 %



mining area



urban area: 8 %



abandoned area

Source: Google Earth, 2022

The rebirth of the resurgence belt

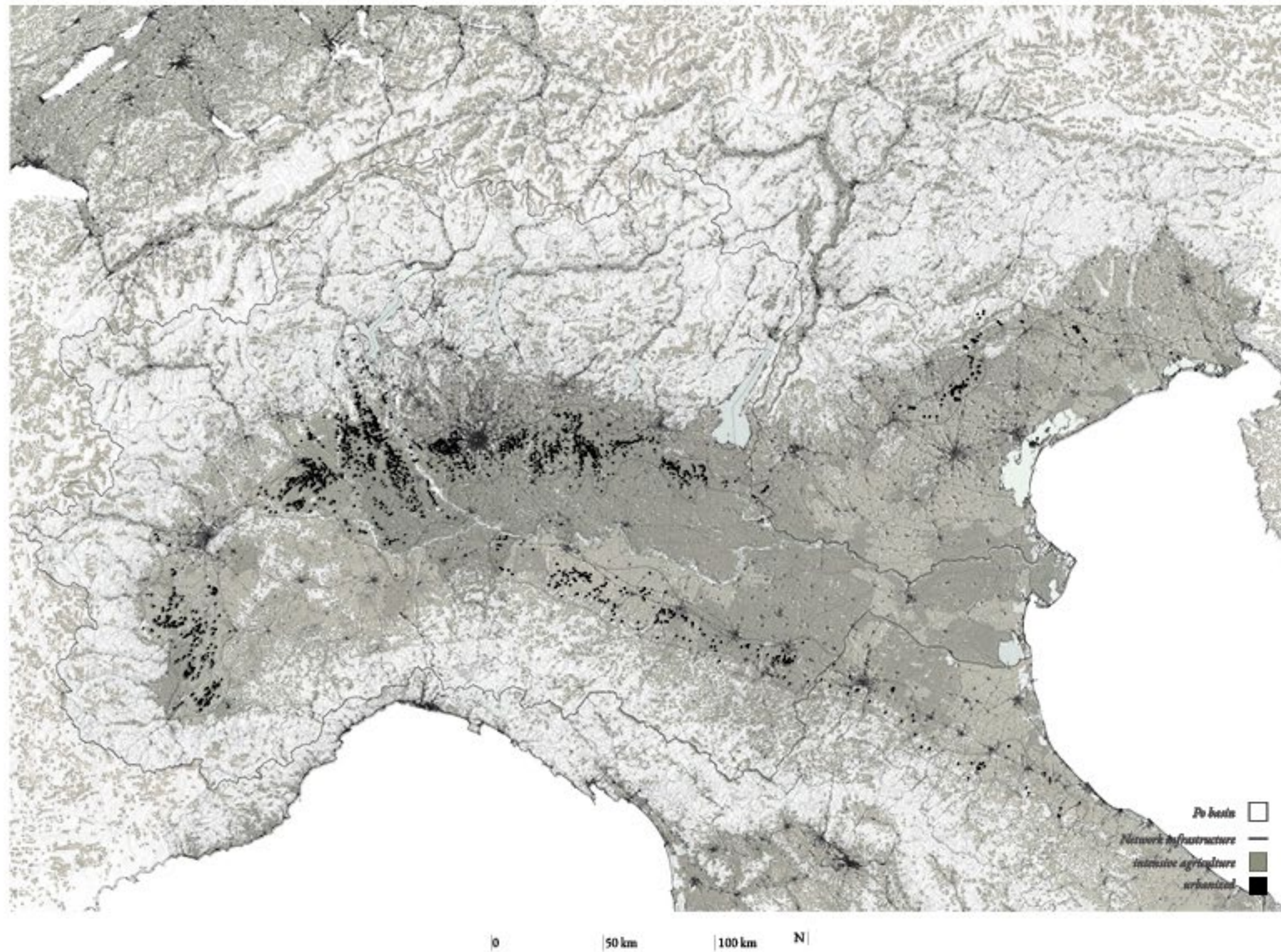
Garden of Europe and Christianity



Source: Perinigo, Santuario della Madonna d'Oropa. Source: Finestre sull'Arte. (2022).

The rebirth of the resurgence belt

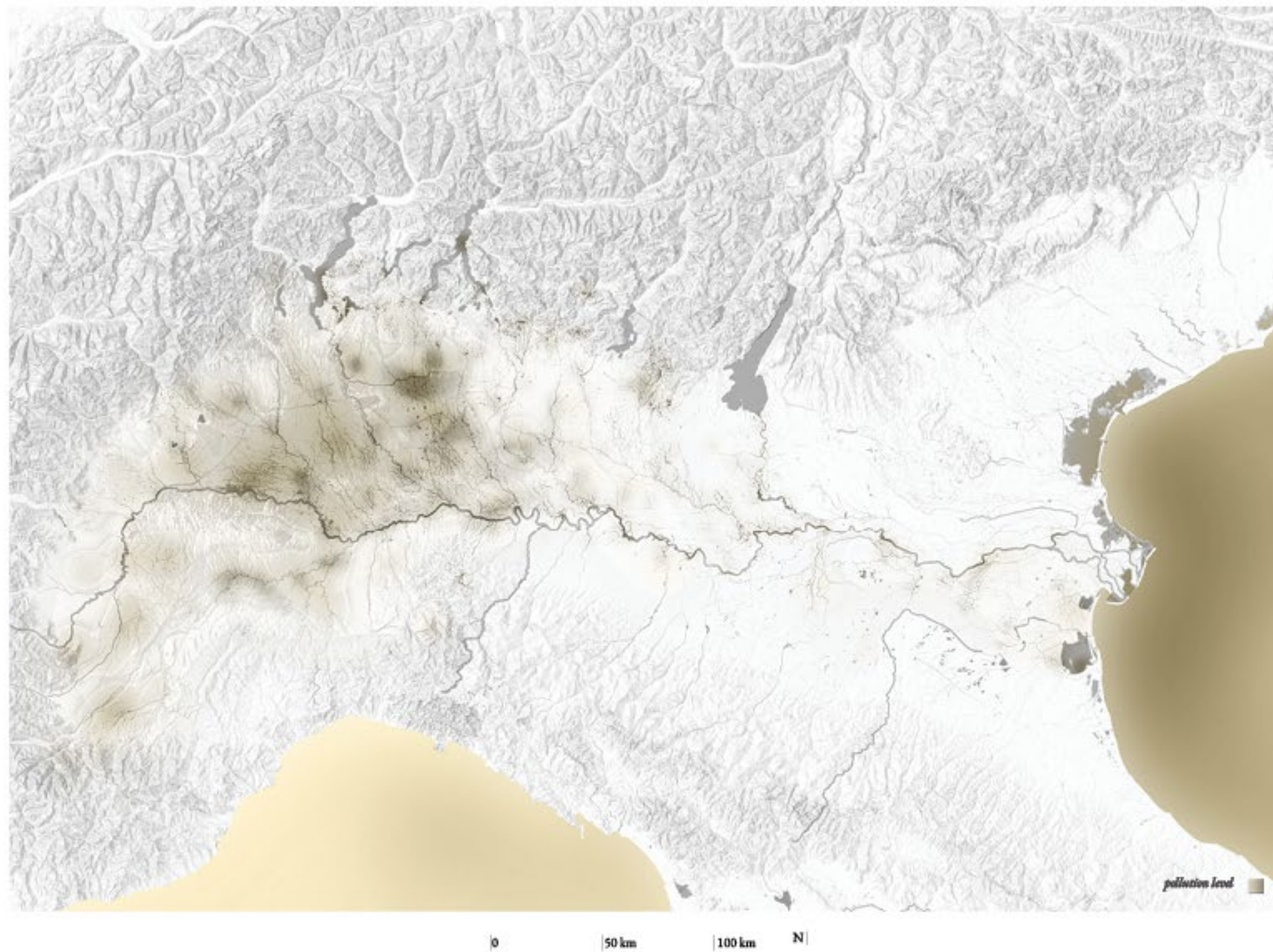
Urbanization phenomena



Source: AIPQ, 2022. GeoFisick, 2022. OSM, 2022.

The rebirth of the resurgence belt

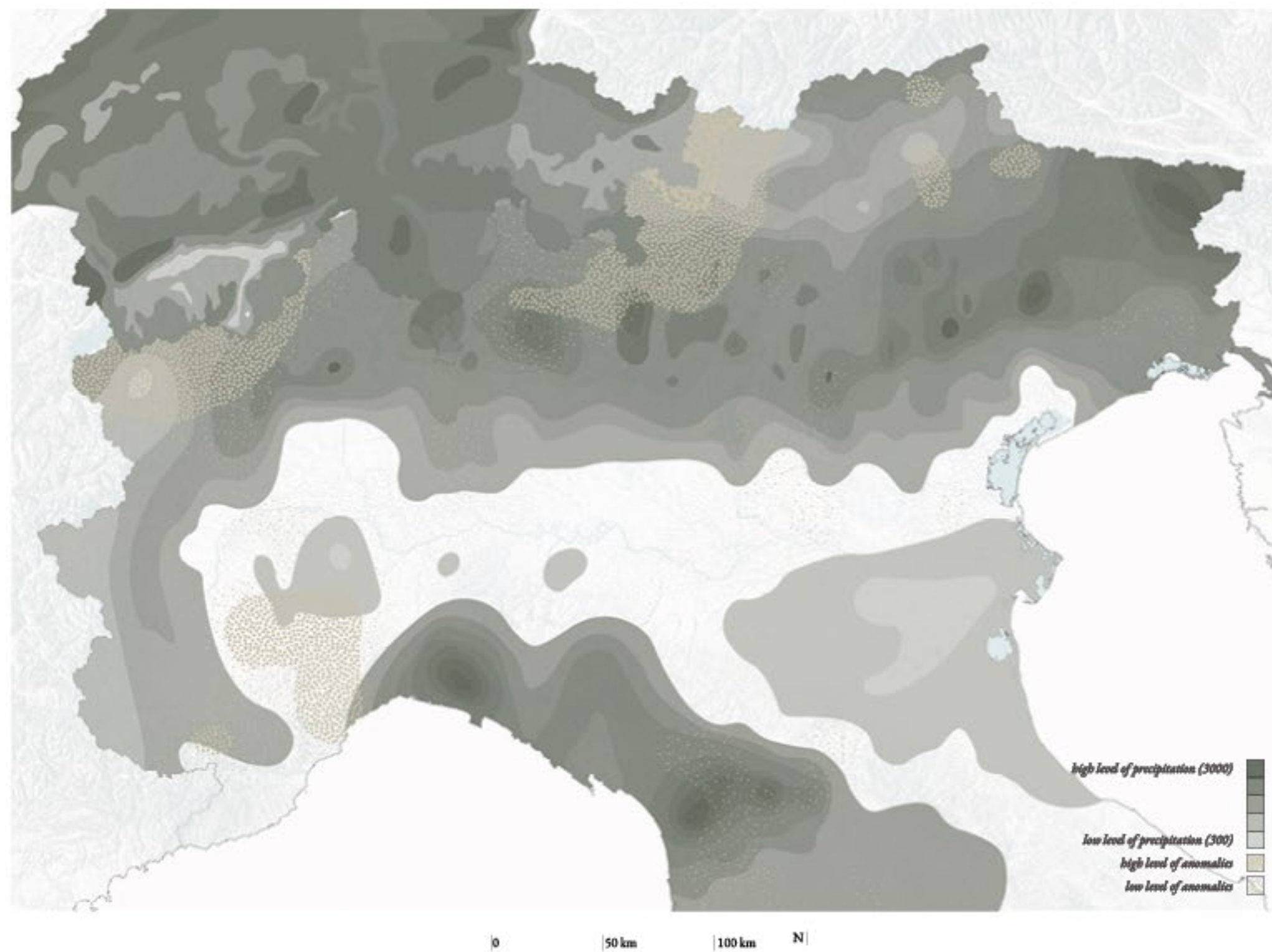
Pollution levels



Sources: Elevation/World_Hillshade, 2022. OpenStreetMap, 2022. AIPQ, 2022. Copernicus Marine Service, 2022.

The rebirth of the resurgence belt

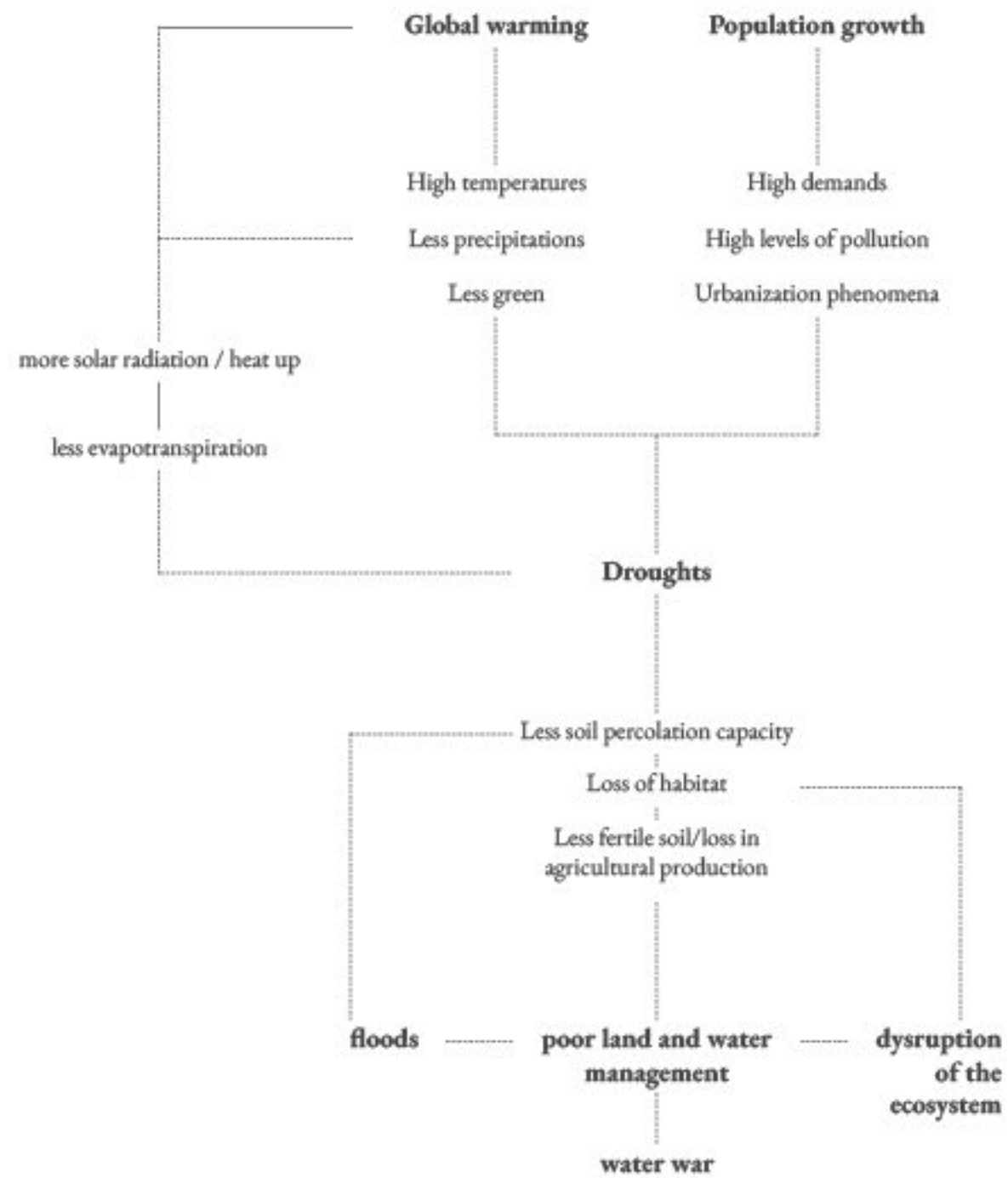
The precipitation tragedy



Source: Cepernik, 2022

The rebirth of the resurgence belt

The vicious cycle of a system in crisis



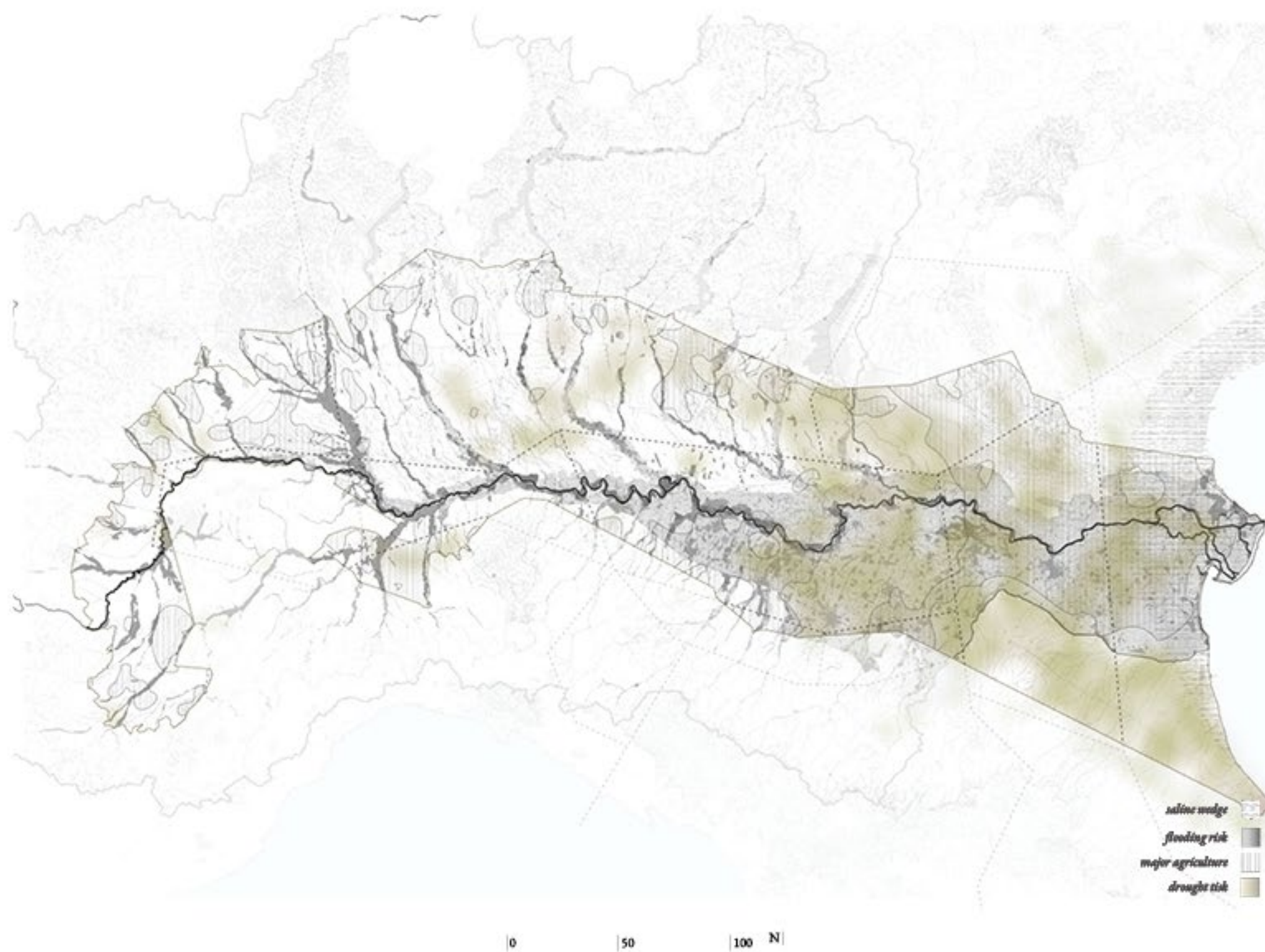
Source: image produced by the author

The rebirth of the resurgence belt

The rebirth of the resurgence belt



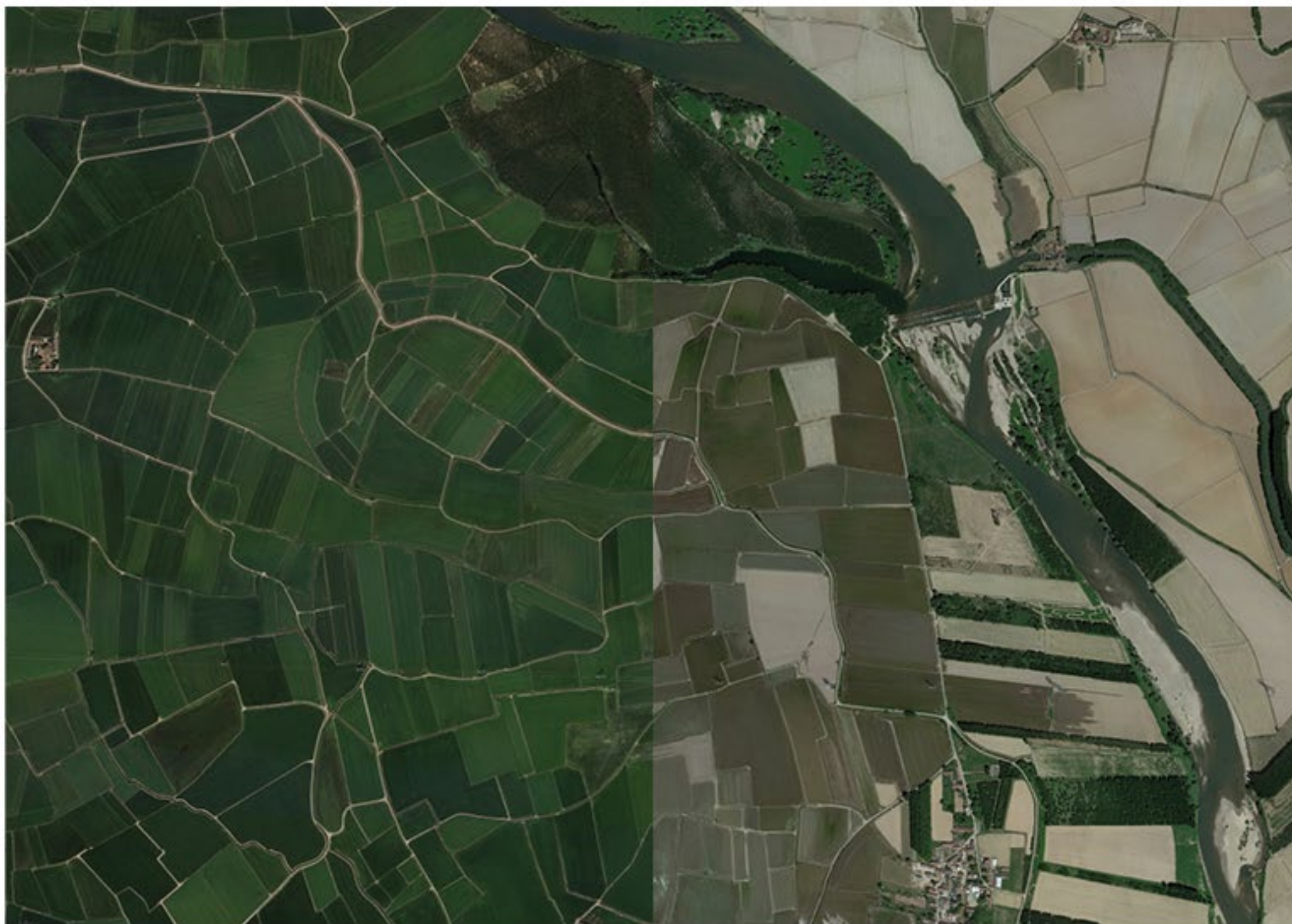
Hydrological risks



Source: Natura 2000, 2022. ADRPO, 2022. Elevation/World_Hillshade, 2022. OpenStreetMap, 2022. Regione Lombardia, 2022. ARPA Lombardia, 2022. Regione Veneto, 2022. ARPA Veneto, 2022. Regione Piemonte, 2022. ARPA Piemonte, 2022. Regione Emilia Romagna, 2022. ARPA Emilia Romagna, 2022. Regione Friuli Venezia Giulia, 2022. ARPA Friuli Venezia Giulia.

The rebirth of the resurgence belt

Droughts through colors



2019



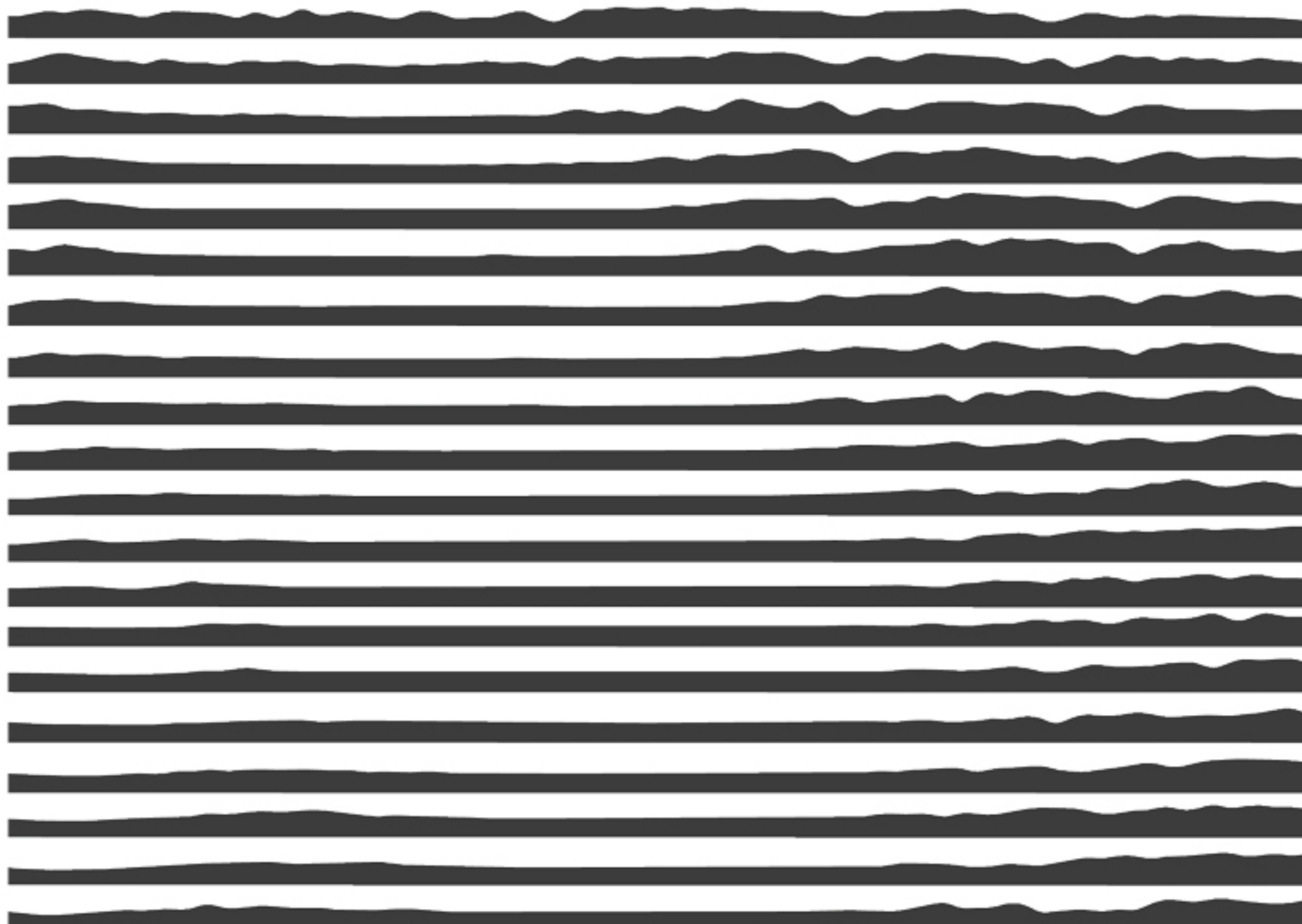
2023



Source: Google Earth, 2023.

The rebirth of the resurgence belt

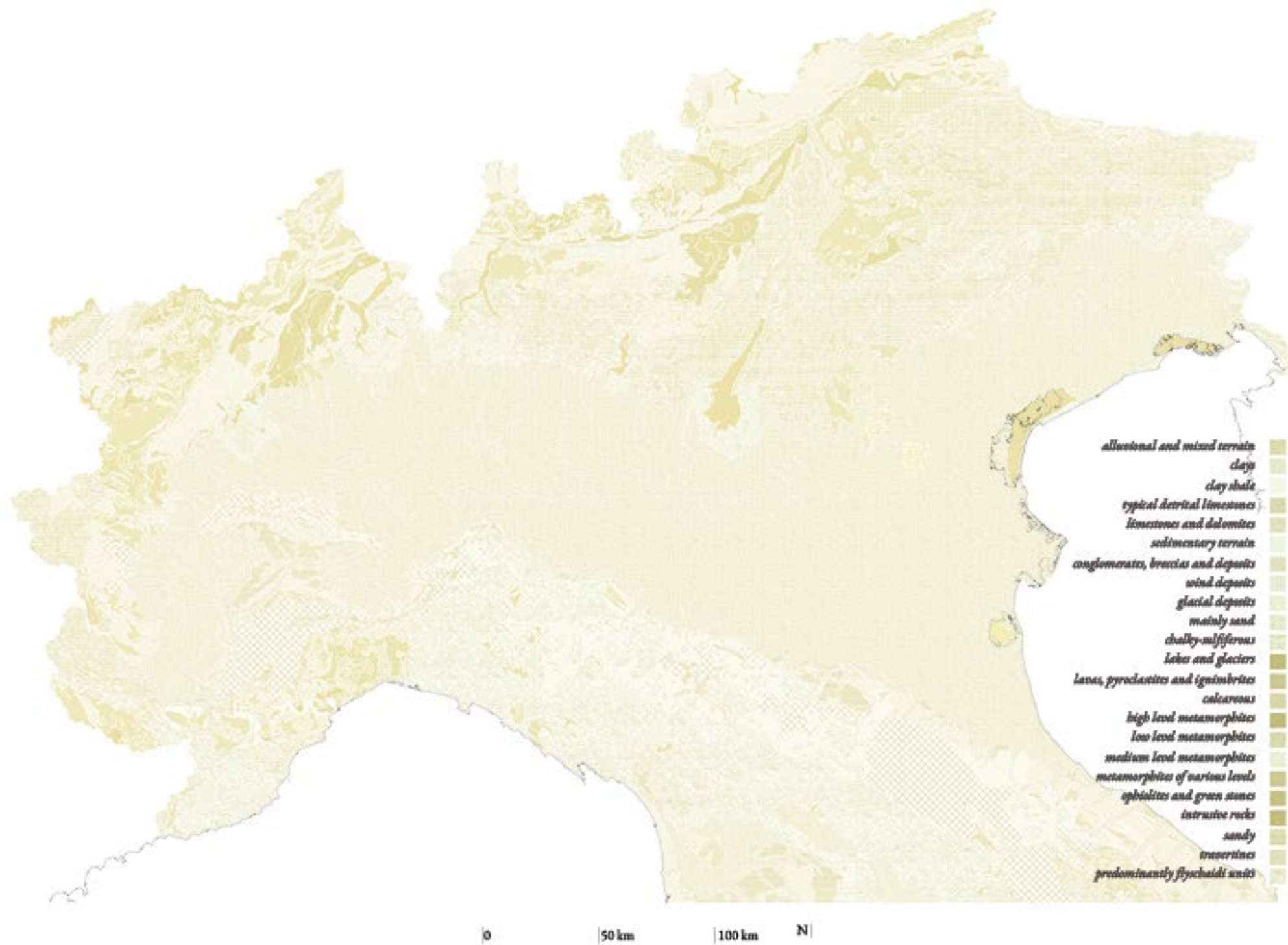
Topography



Source: AIPQ, 2022. LIDAR, 2022.

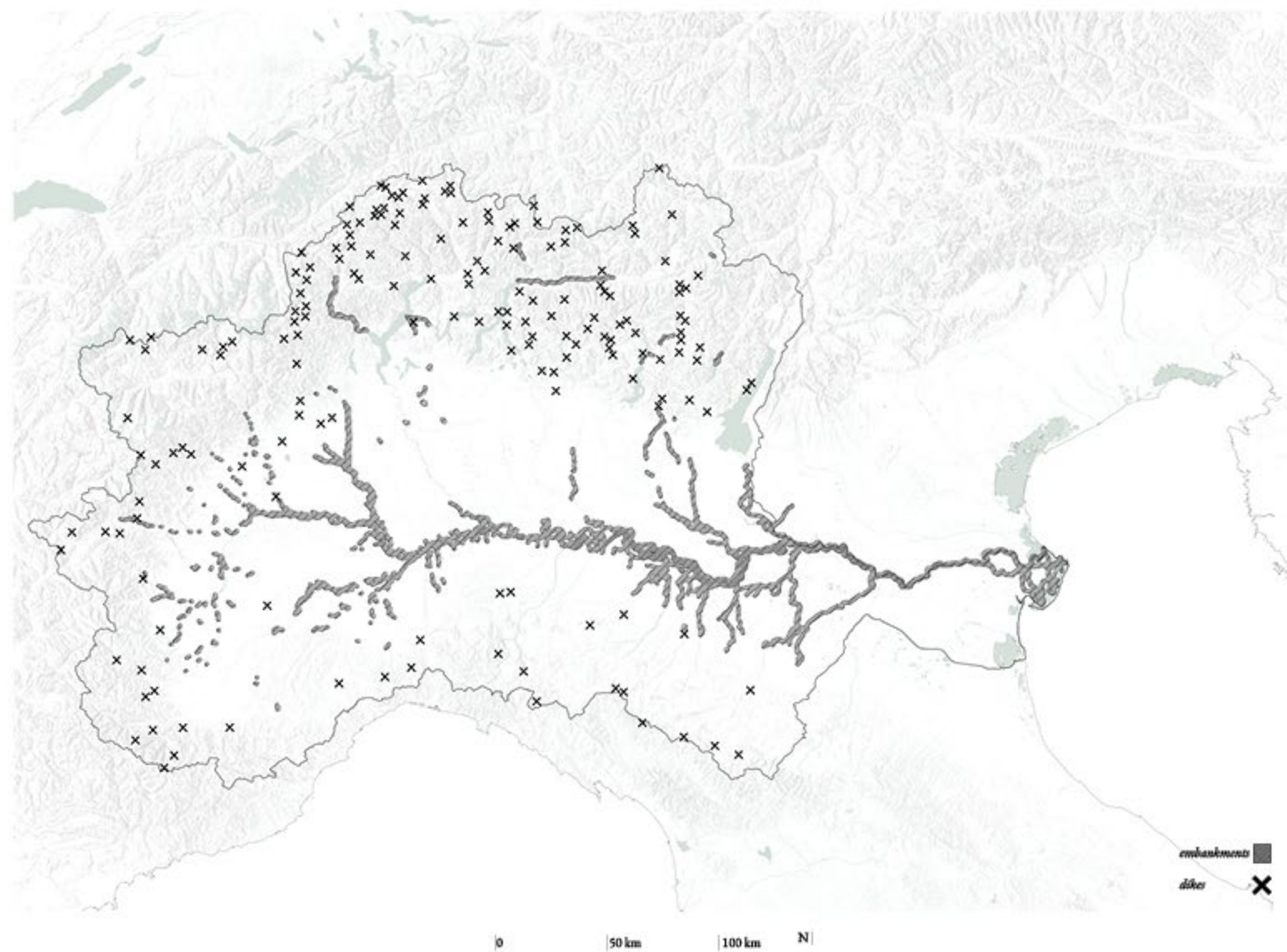
The rebirth of the resurgence belt

Geology map



Source: AIPO, 2022; GeoFrahk, 2022; OSM, 2022; Regione Emilia Romagna, 2022; Regione Liguria, 2022; Regione Lombardia, 2022; Regione Piemonte, 2022; Regione Trentino-Alto Adige, 2022; Regione Valle D'Aosta, 2022; Regione Veneto, 2022.

Water management



Water management of the Po Basin, Source: Elevation/World_Hillshade, 2022. OpenStreetMap, 2022. ADBPO, 2022. Regione Lombardia, 2022. Regione Emilia Romagna, 2022. Regione Piemonte, 2022. Regione VDA, 2022. ARPA Lombardia, 2022

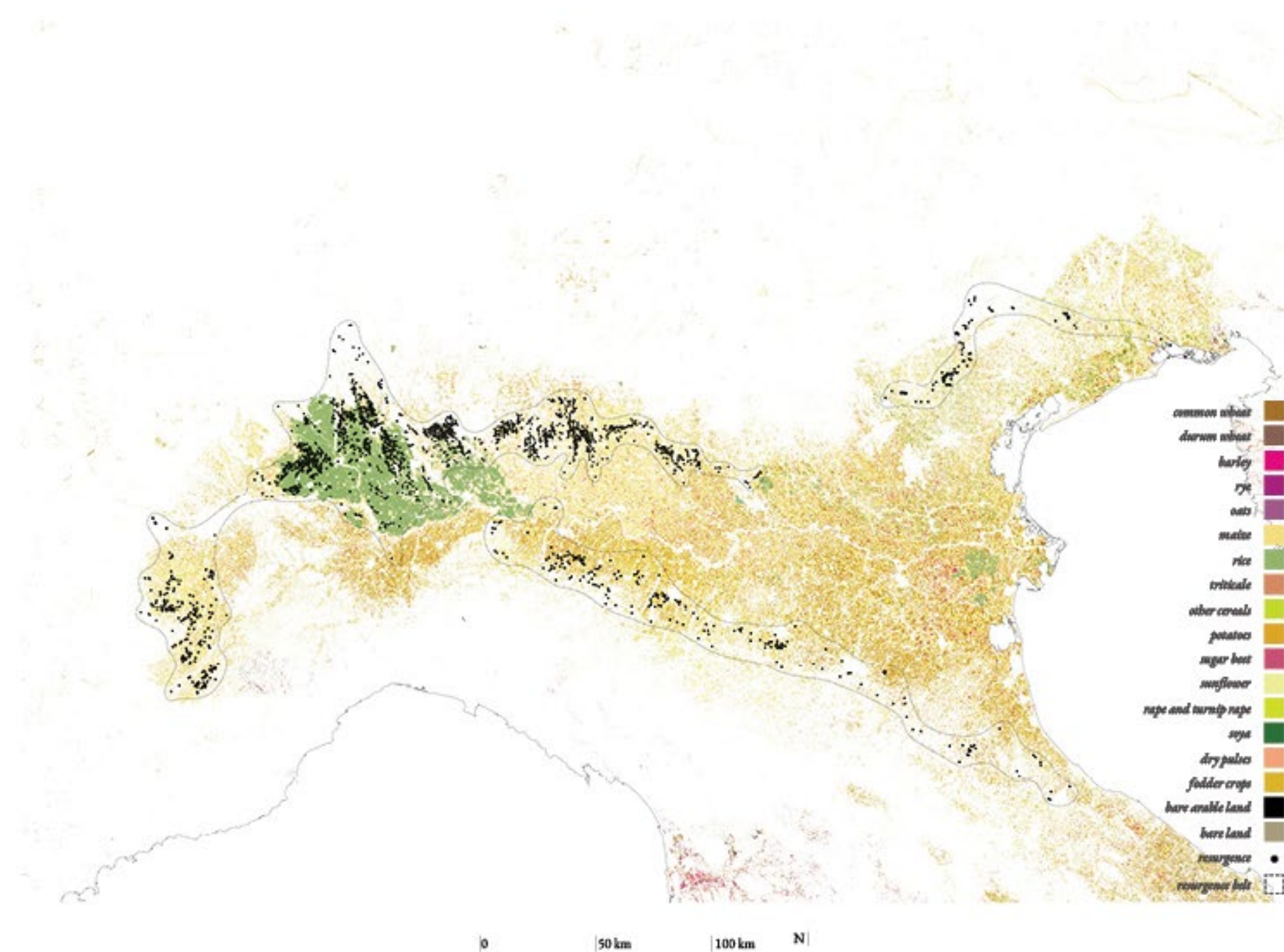




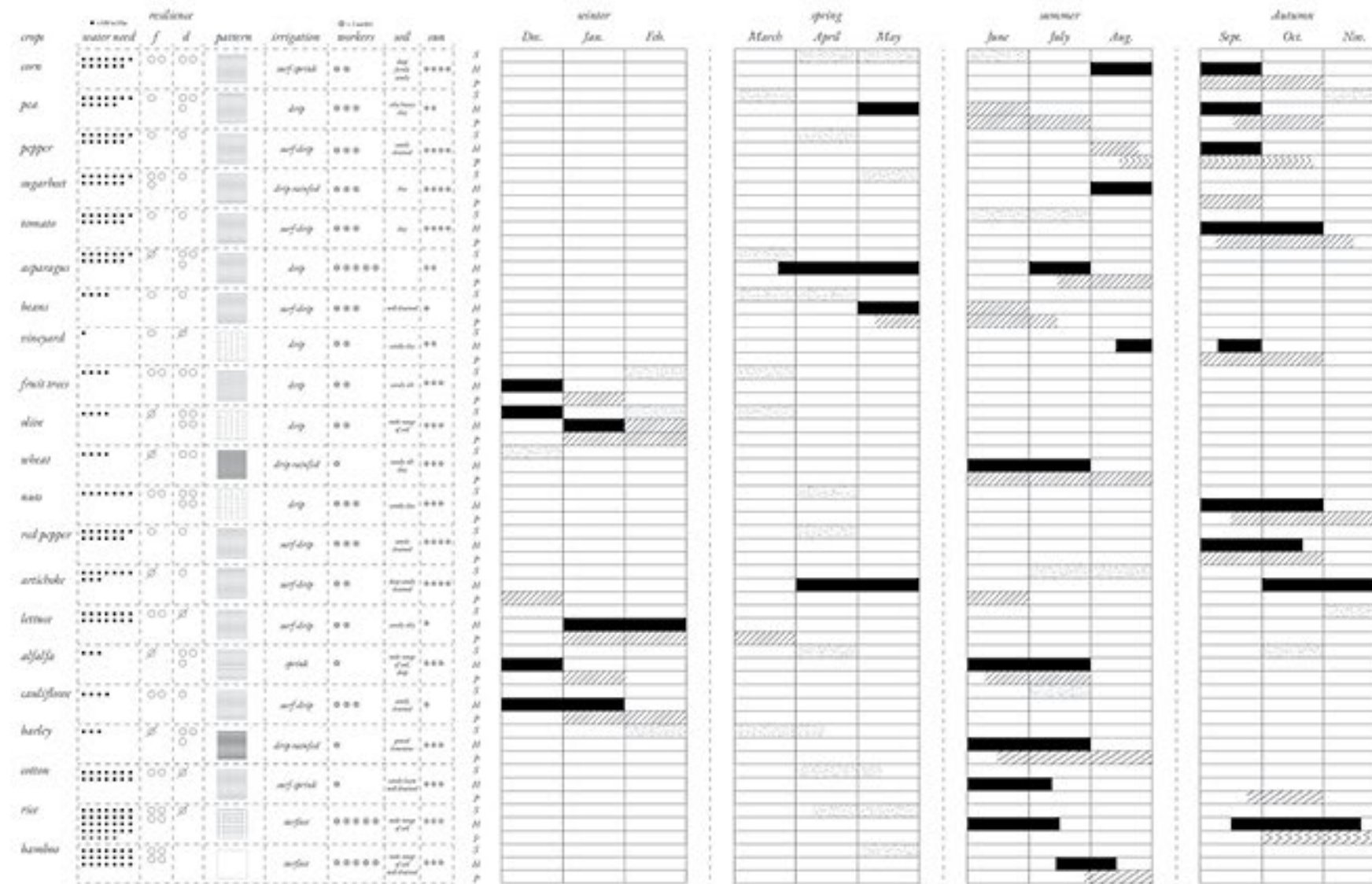
*...within 20 years we will see the drying up of most of the existing
resurgences*

What if the resurgence belt disappears?

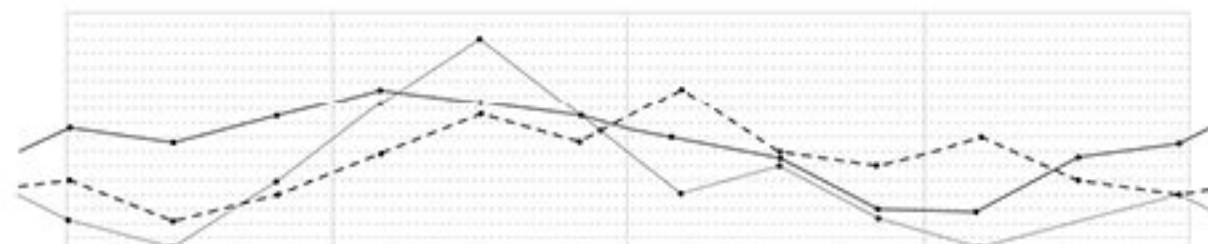
The crops of the Po Valley



The crops of the Po Valley



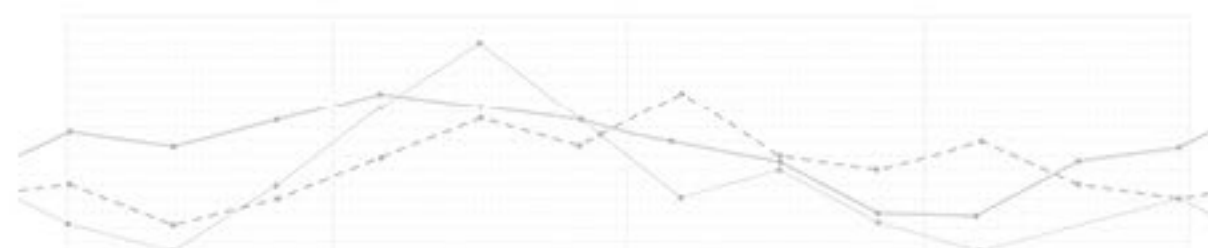
water flow ———
 self-irrigation - - -
 drop irrigation ———



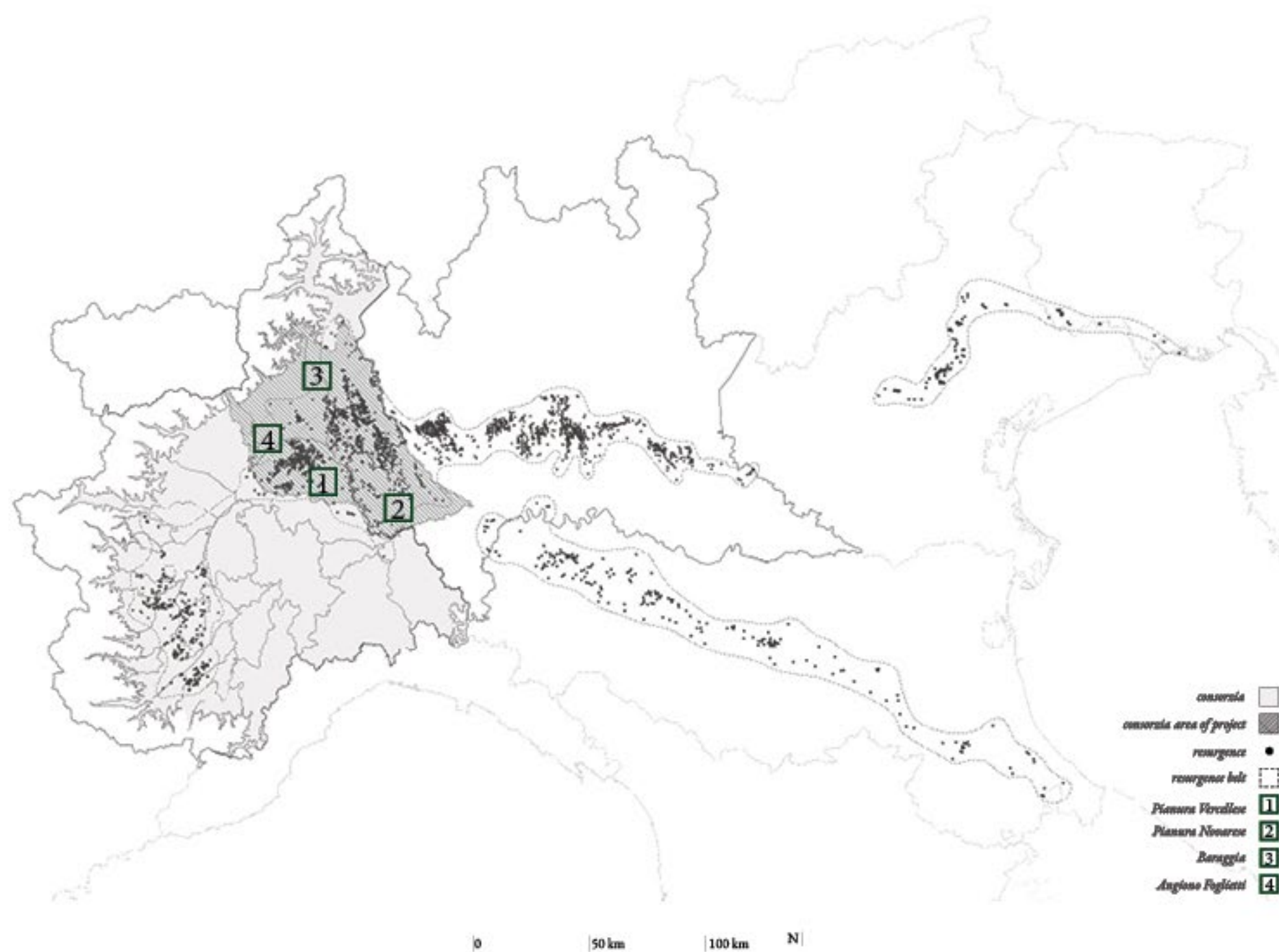
The crops of the Po Valley



rice fine
 not irrigating
 many water and



Zoning - area of study

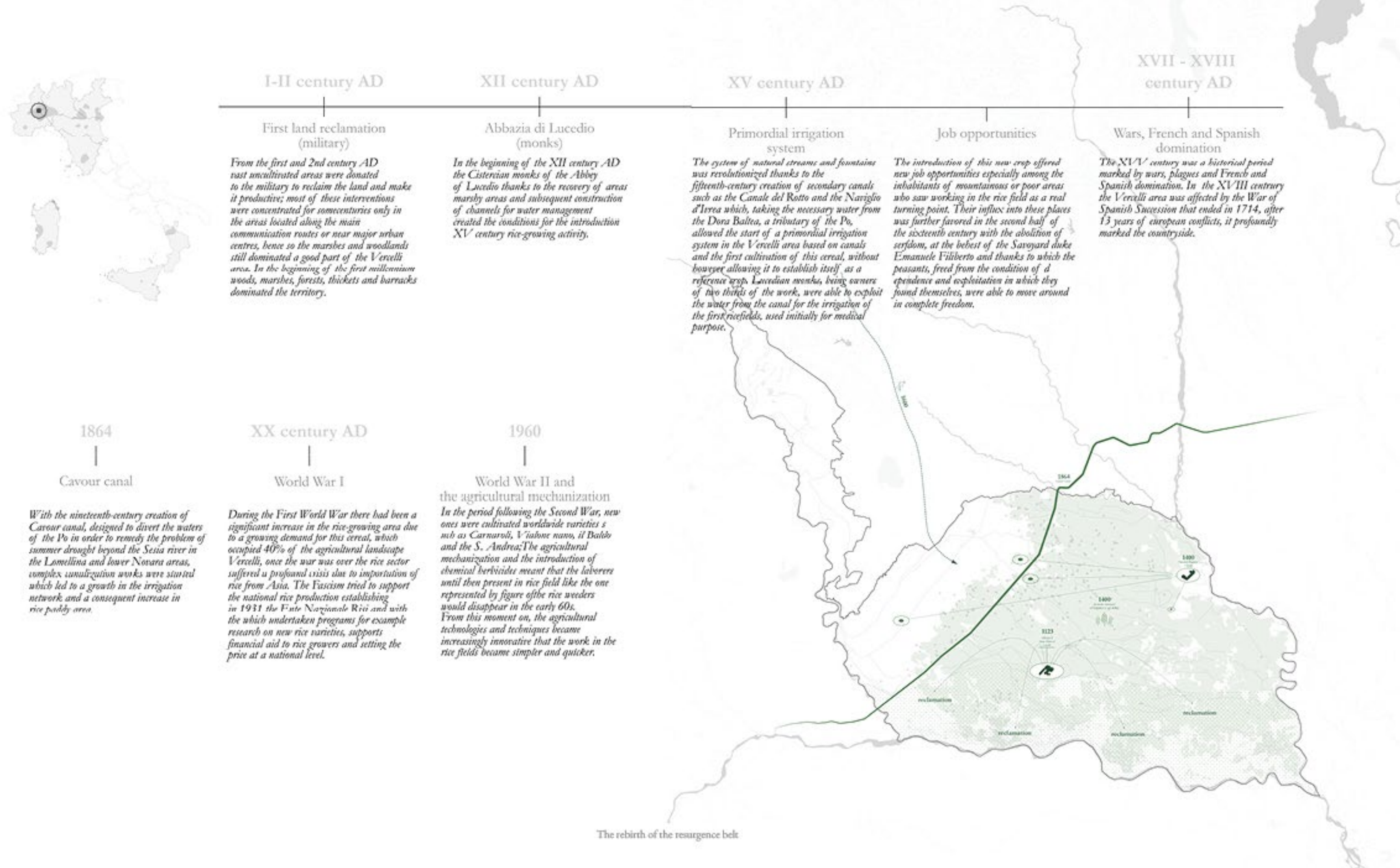


Source: AIPO, 2022; GeoFabrik, 2022; OSM, 2022; Regione Emilia Romagna, 2022; Regione Liguria, 2022; Regione Lombardia, 2022; Regione Piemonte, 2022; Regione Trentino Alto Adige, 2022; Regione Valle D'Aosta, 2022; Regione Veneto, 2022.

The origin of rice



The history of rice in North Italy - Vercelli

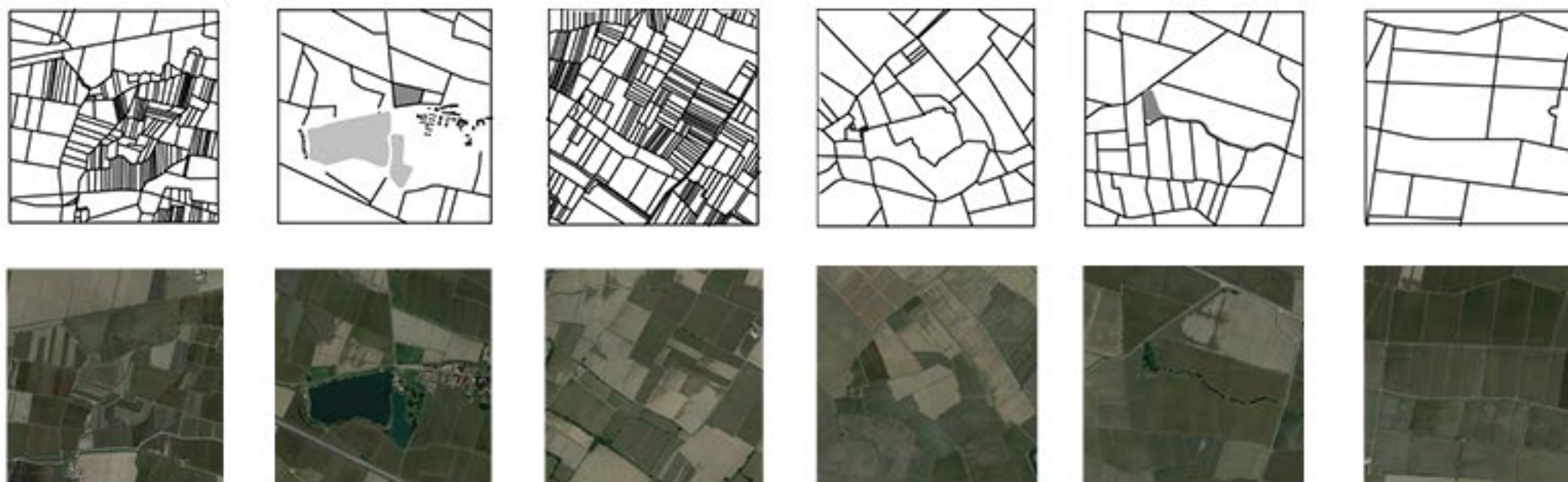


Comparing parcellation



1960

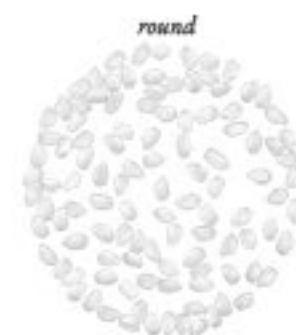
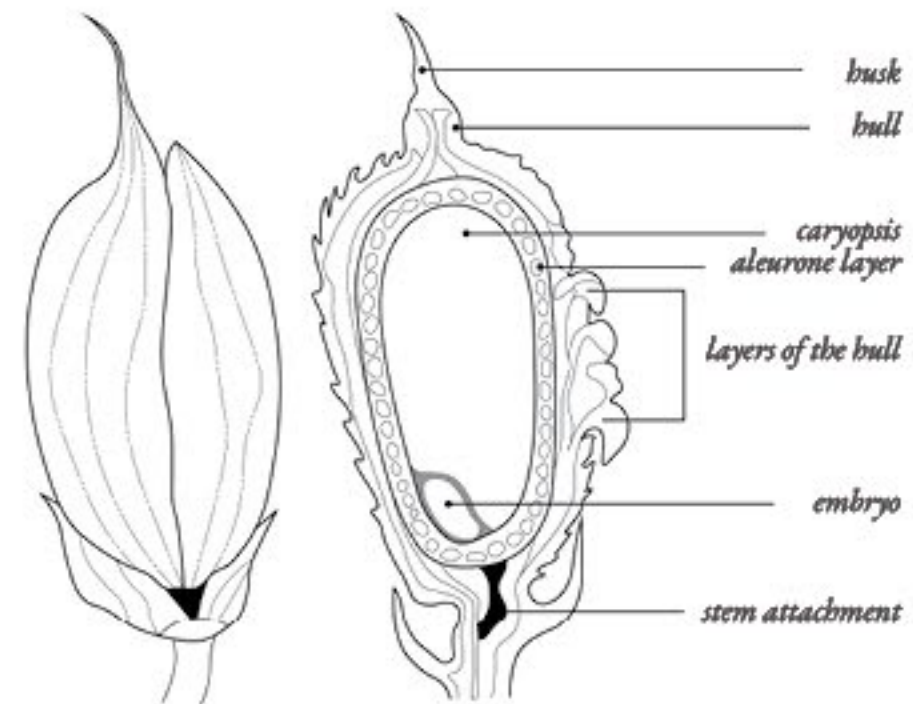
2023



Source: Google Earth, 2022

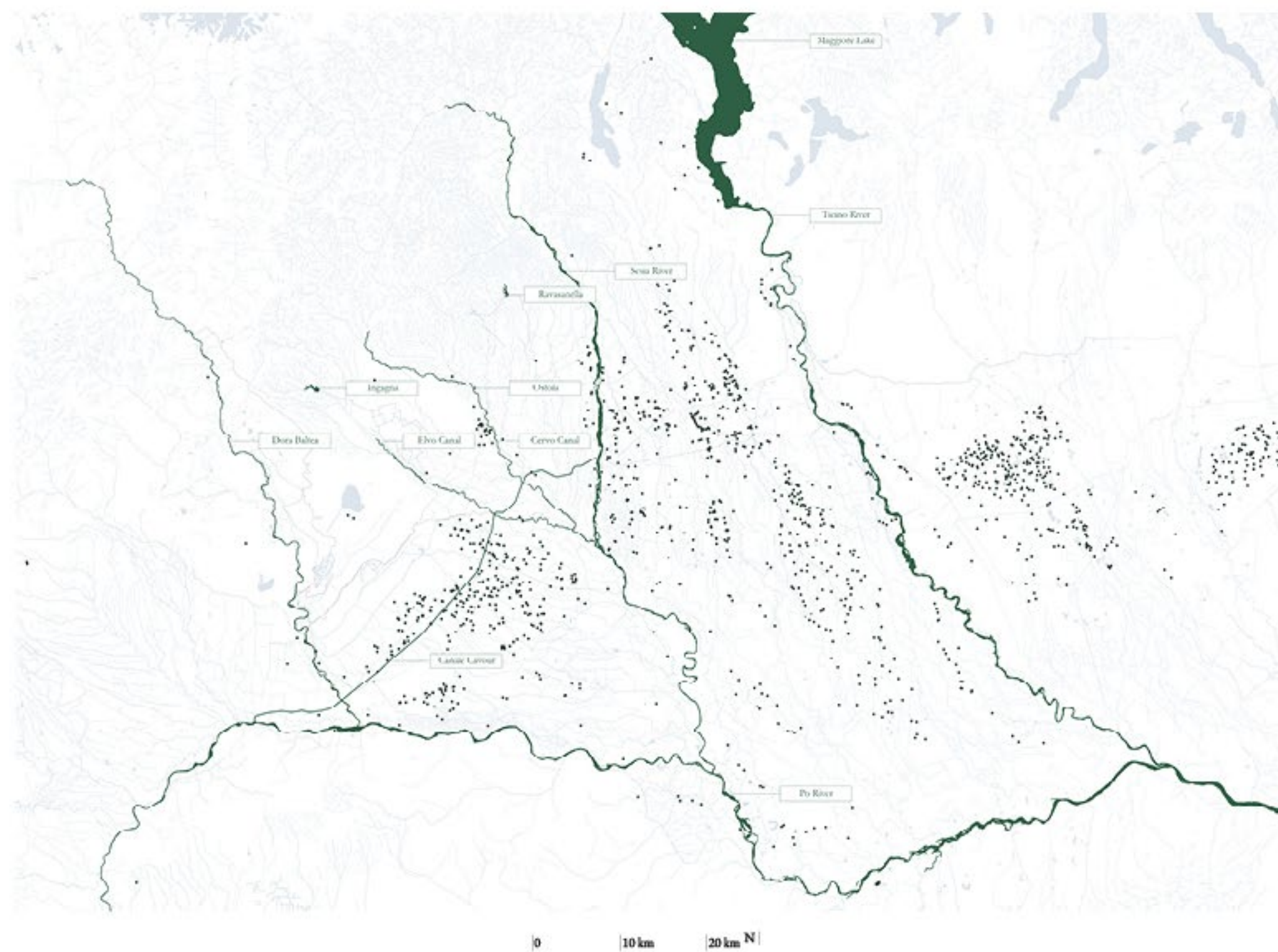
The rebirth of the resurgence belt

Anatomy of rice



Source: images made by the author

Area of study - main water sources

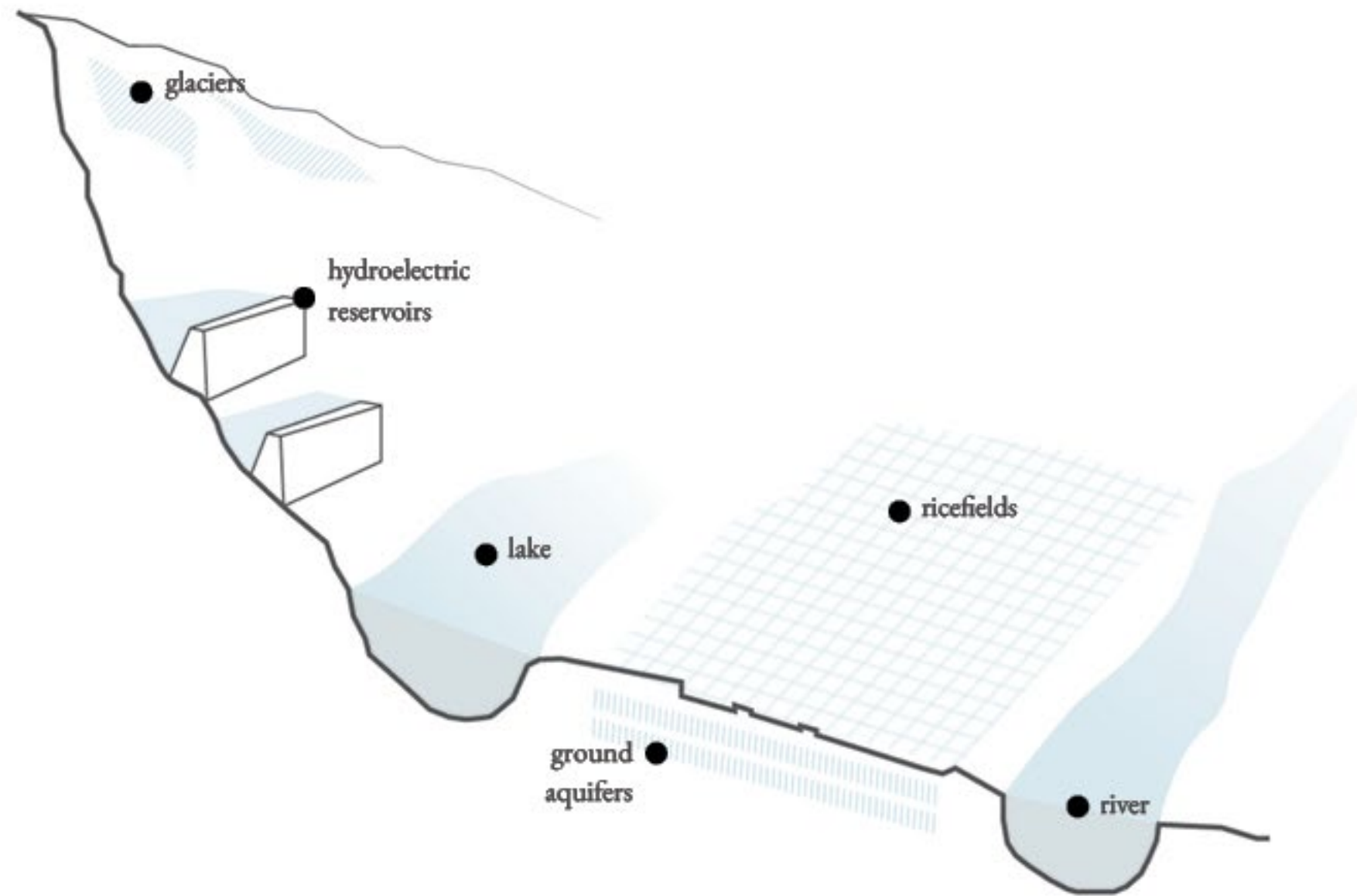


Source: AIPQ, 2022; OSM, 2022; Regione Piemonte, 2022.

The rebirth of the resurgence belt



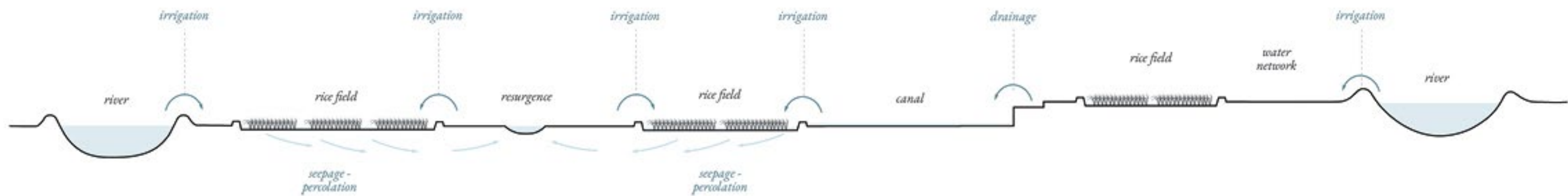
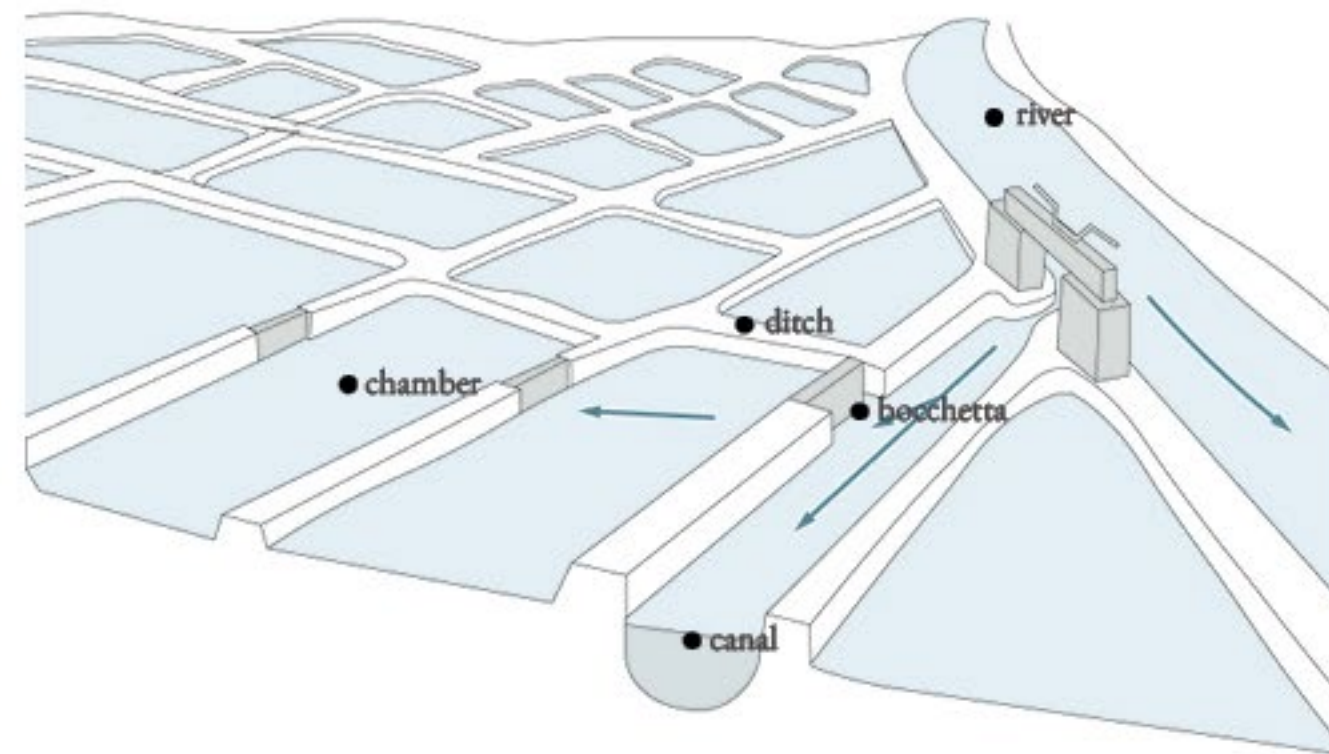
What is the role of ricefields in the natural water management regulation?



Source: images made by the author

The rebirth of the resurgence belt

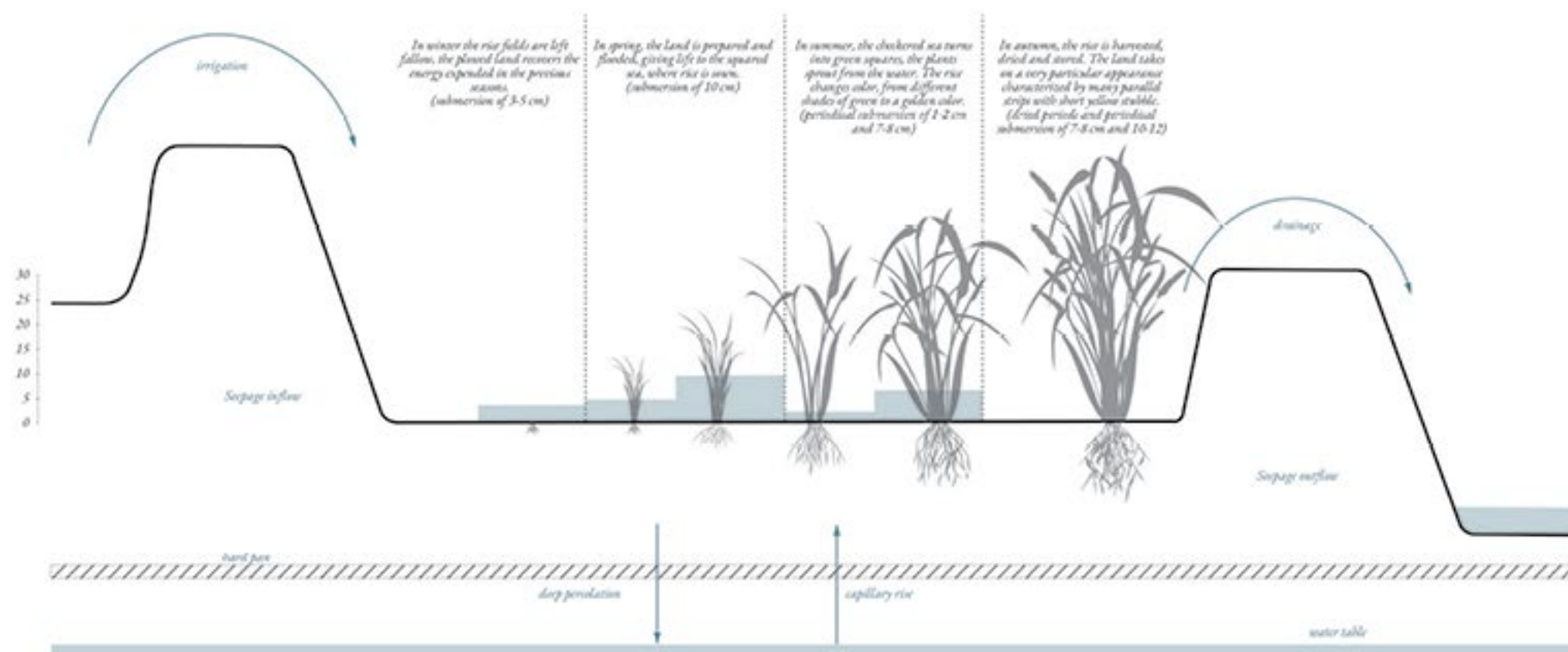
What is the role of ricefields in the natural water management regulation?



Source: images made by the author

The rebirth of the resurgence belt

Submersion of ricefields

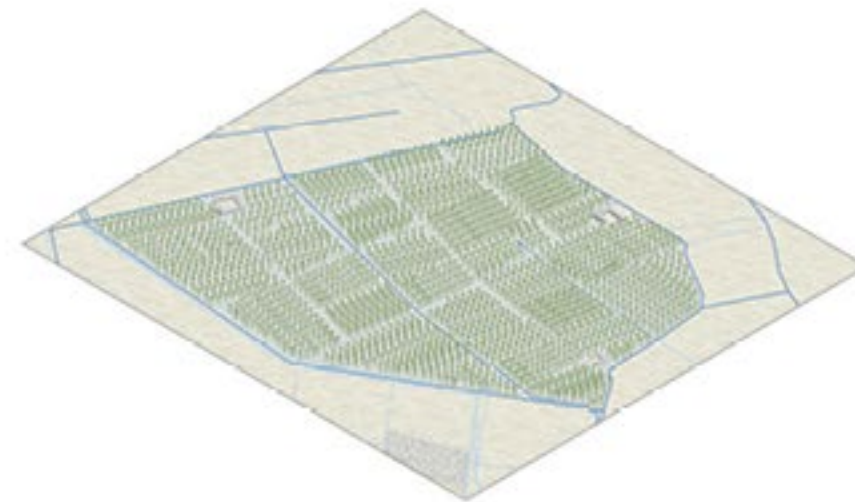


Seasonality of ricefields

Submerged | winter



Submerged | summer



Submerged | spring

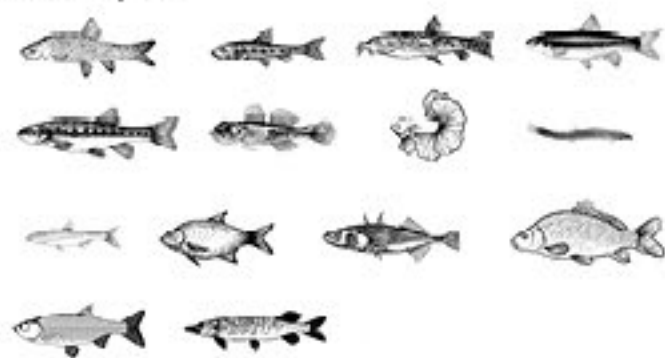


Submerged | autumn





Fishes 60+ species



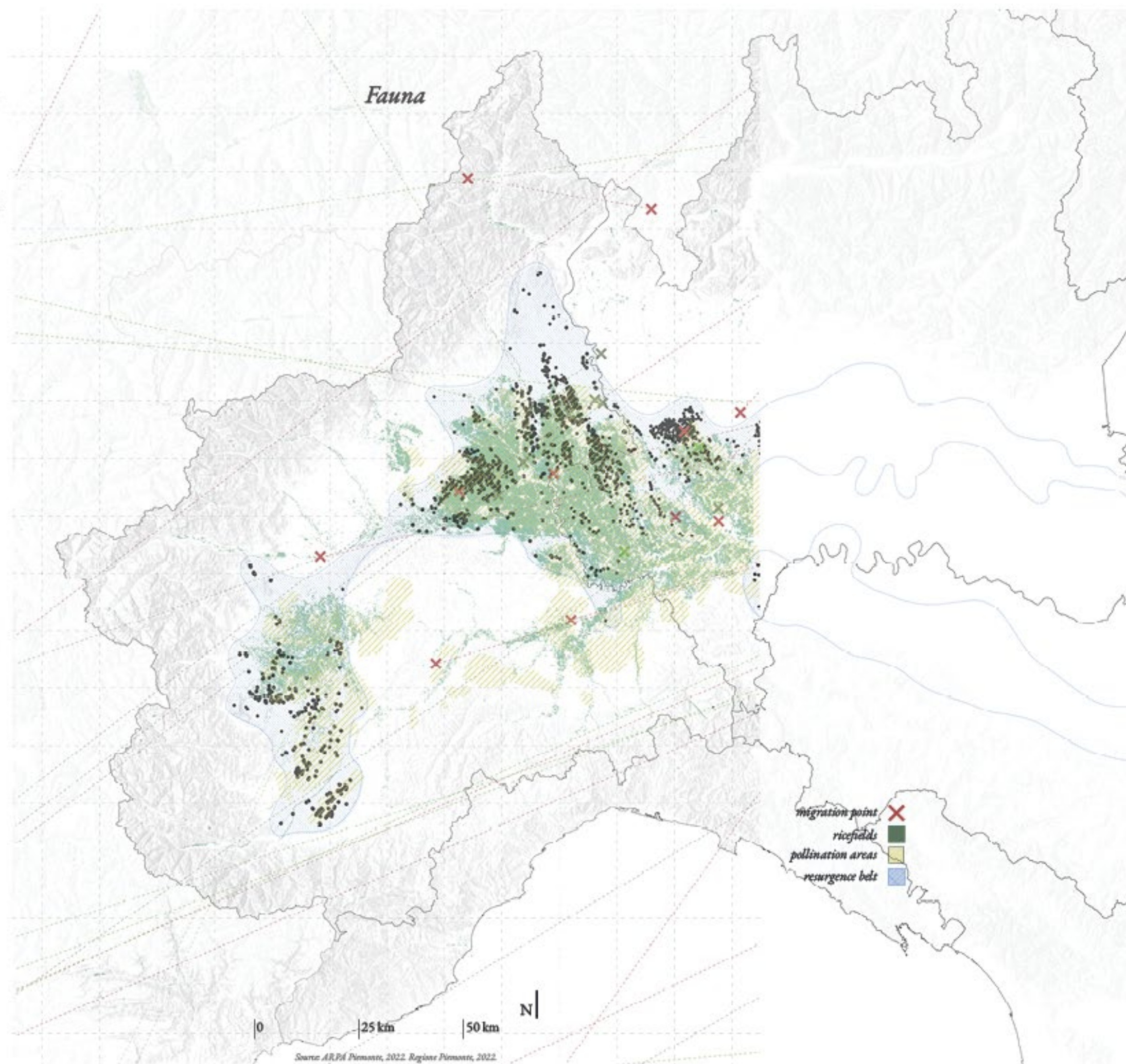
Birds 95+ species

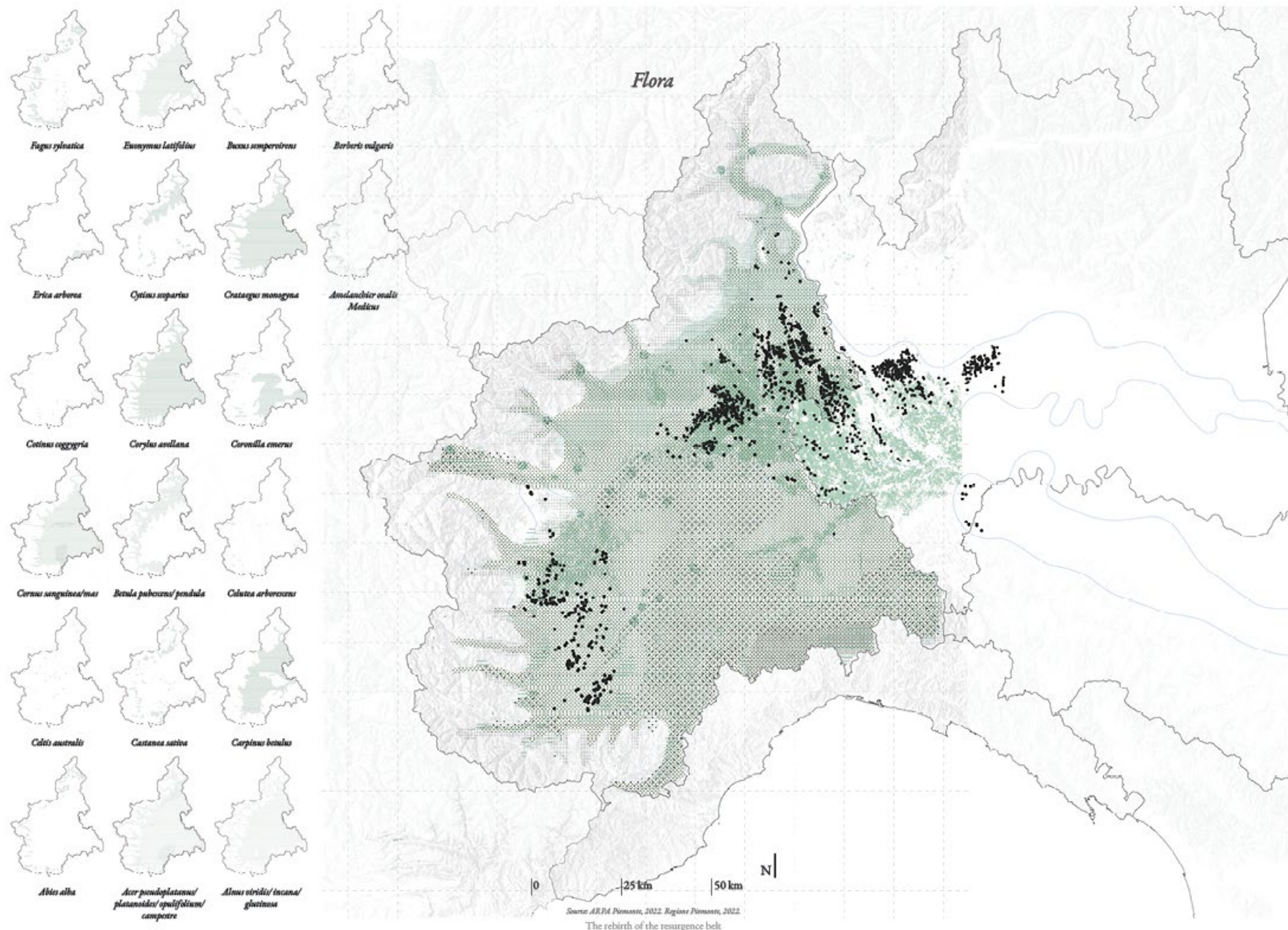


Mammals 50+ species



Amphibians, reptiles and insects 70+ species

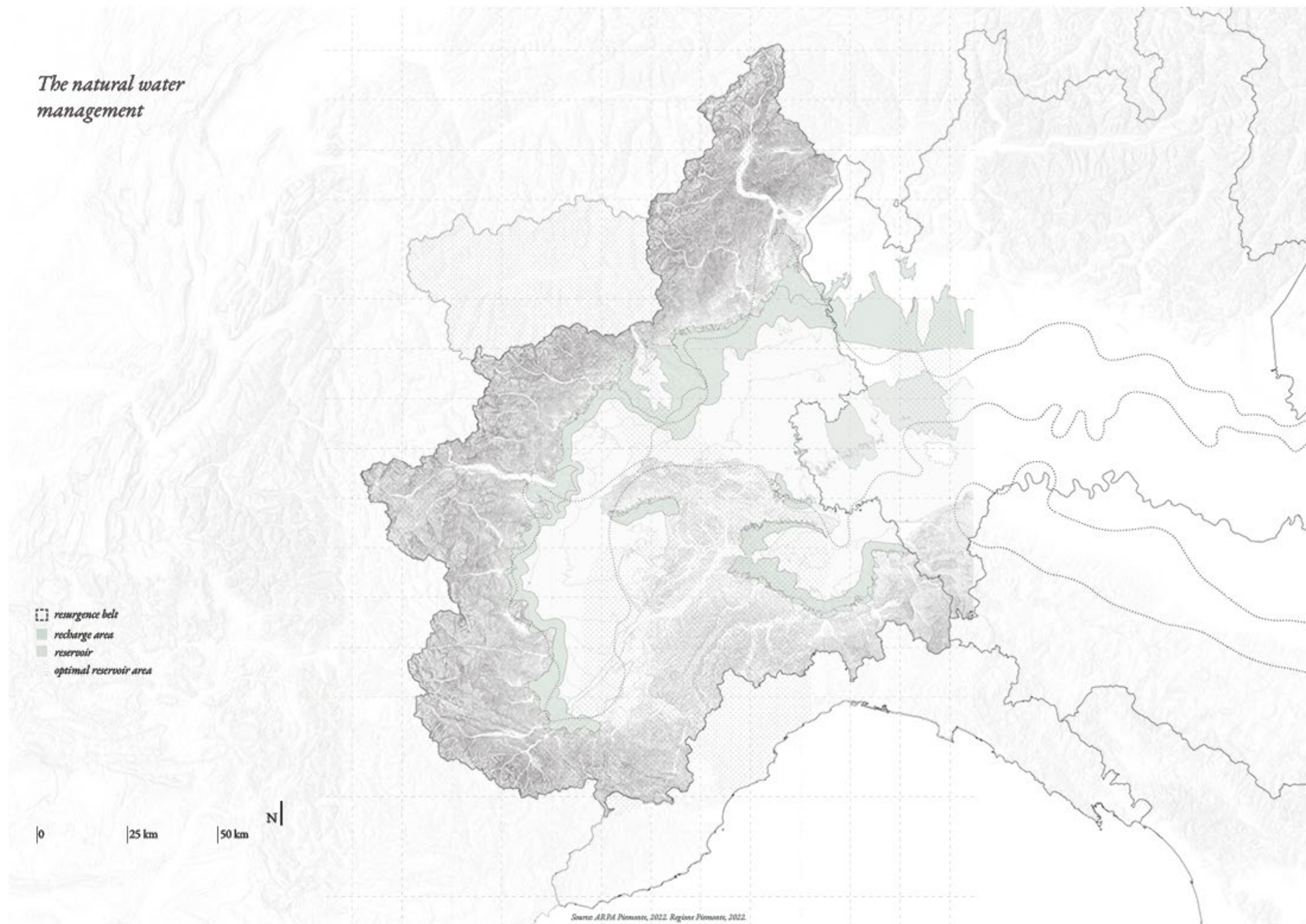




The natural water management

-  *resurgence belt*
-  *recharge area*
-  *reservoir*
-  *optimal reservoir area*

0 25 km 50 km N



The natural water system - risks

- resurgence belt
- water system
- buffer areas - resurgences
- water system at risk

0

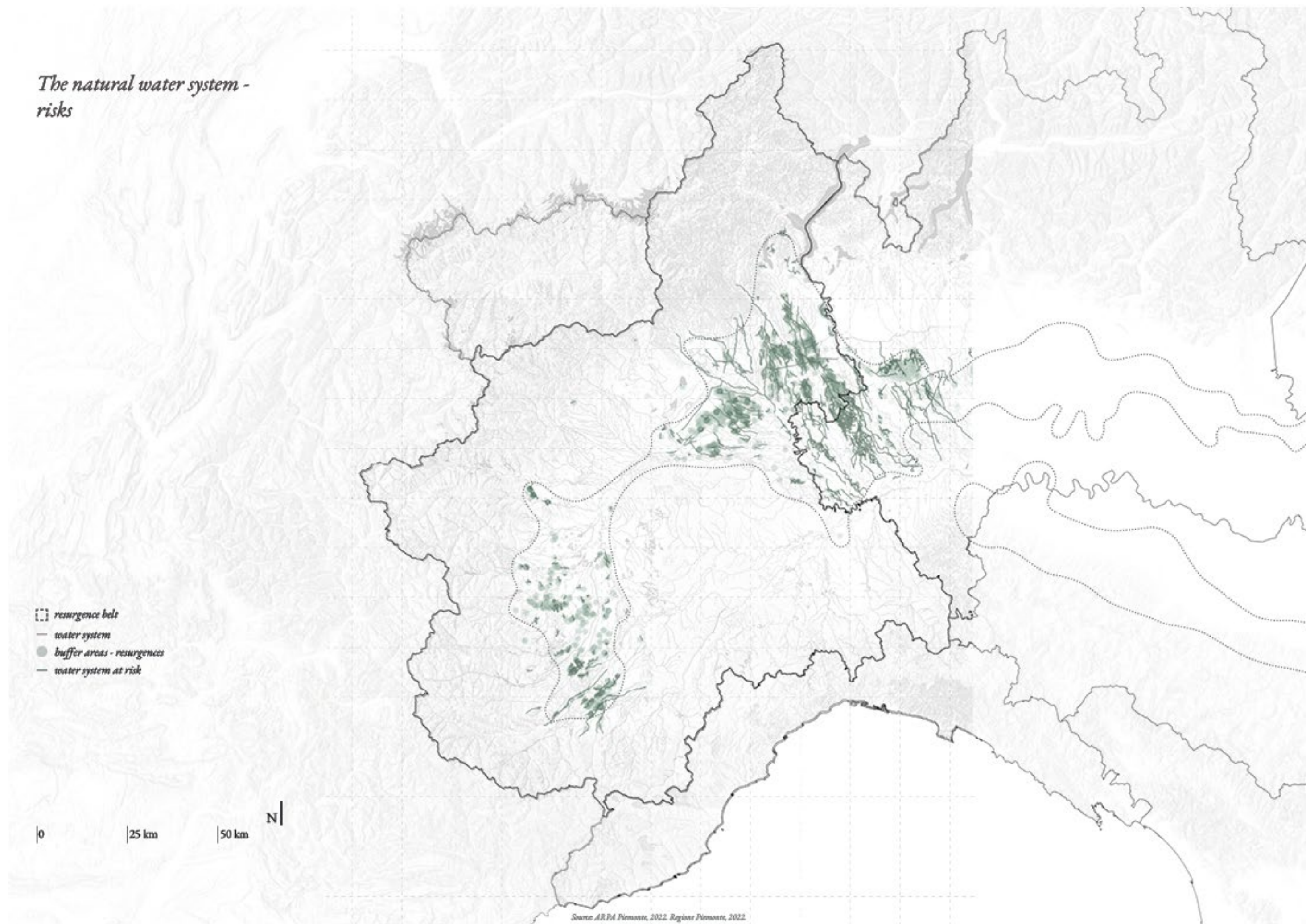
25 km

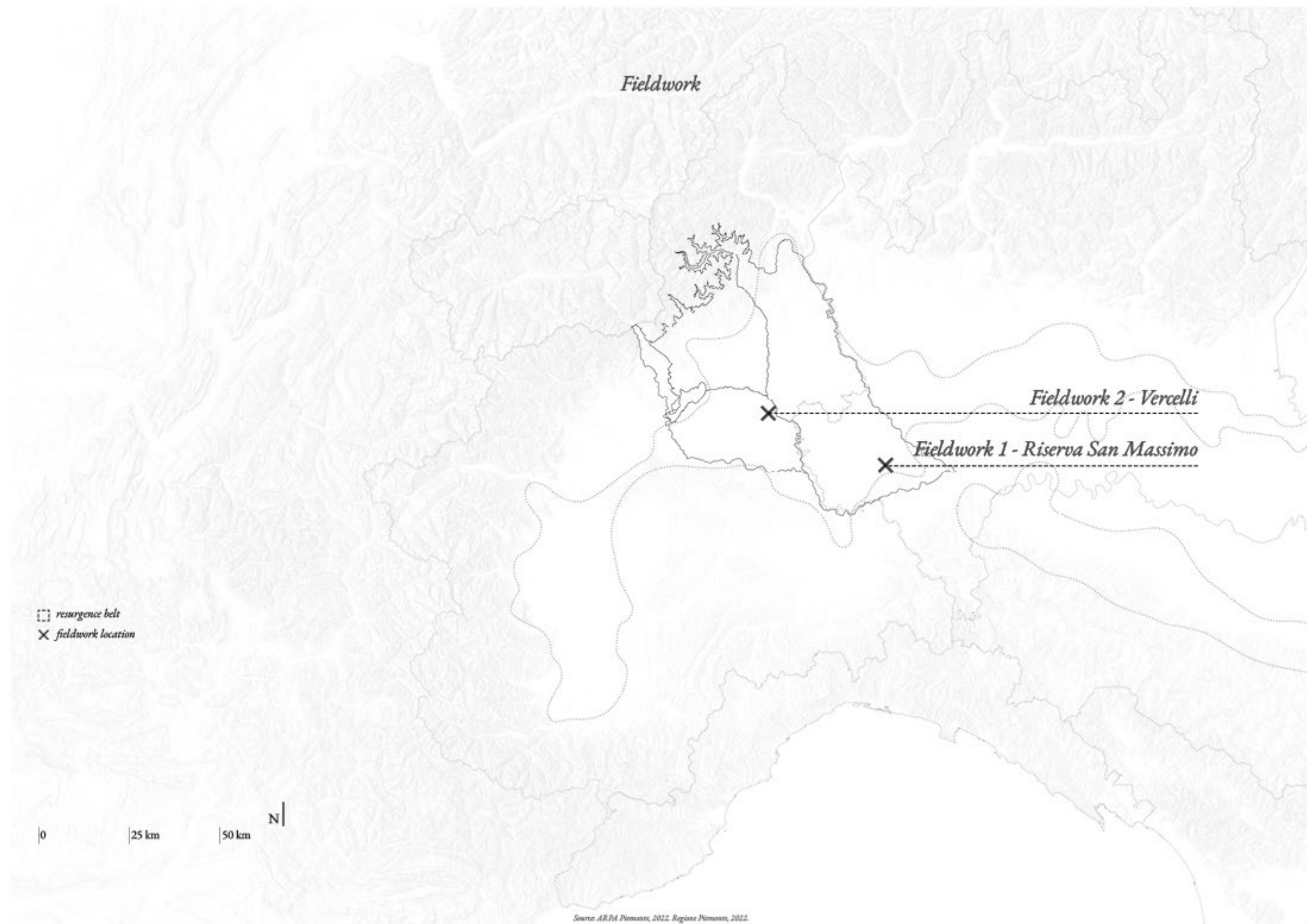
50 km

N

Source: ARPA Piemonte, 2022; Regione Piemonte, 2022.

The rebirth of the resurgence belt





Fieldwork 1 - La Riserva San Massimo



Dino Massignani
Manager of Riserva San Massimo

"The company enjoys total water self-sufficiency. The water supplies all the fields, reaching every cultivated land directly, and therefore always equally pure and rich in organic substances.

In this unique environmental alternation, wildlife finds ideal conditions to complete its life cycle, satisfying all its needs in that state of natural freedom that characterizes it without depending on direct human management."

Fieldwork 1 - Riserva San Massimo



Source: AIPO, 2022. Google Earth, 2022. OSM, 2022. Regione Lombardia, 2022.

The rebirth of the resurgence belt



Fieldwork 1 - Riserva San Massimo



Fieldwork 1 - Riserva San Massimo



Fieldwork 2 - Vercelli



Fieldwork 2 - Vercelli



Shifting the paradigm

linear economy



circular economy

compete with nature



partner with nature

disturb soil



protect soil

monoculture



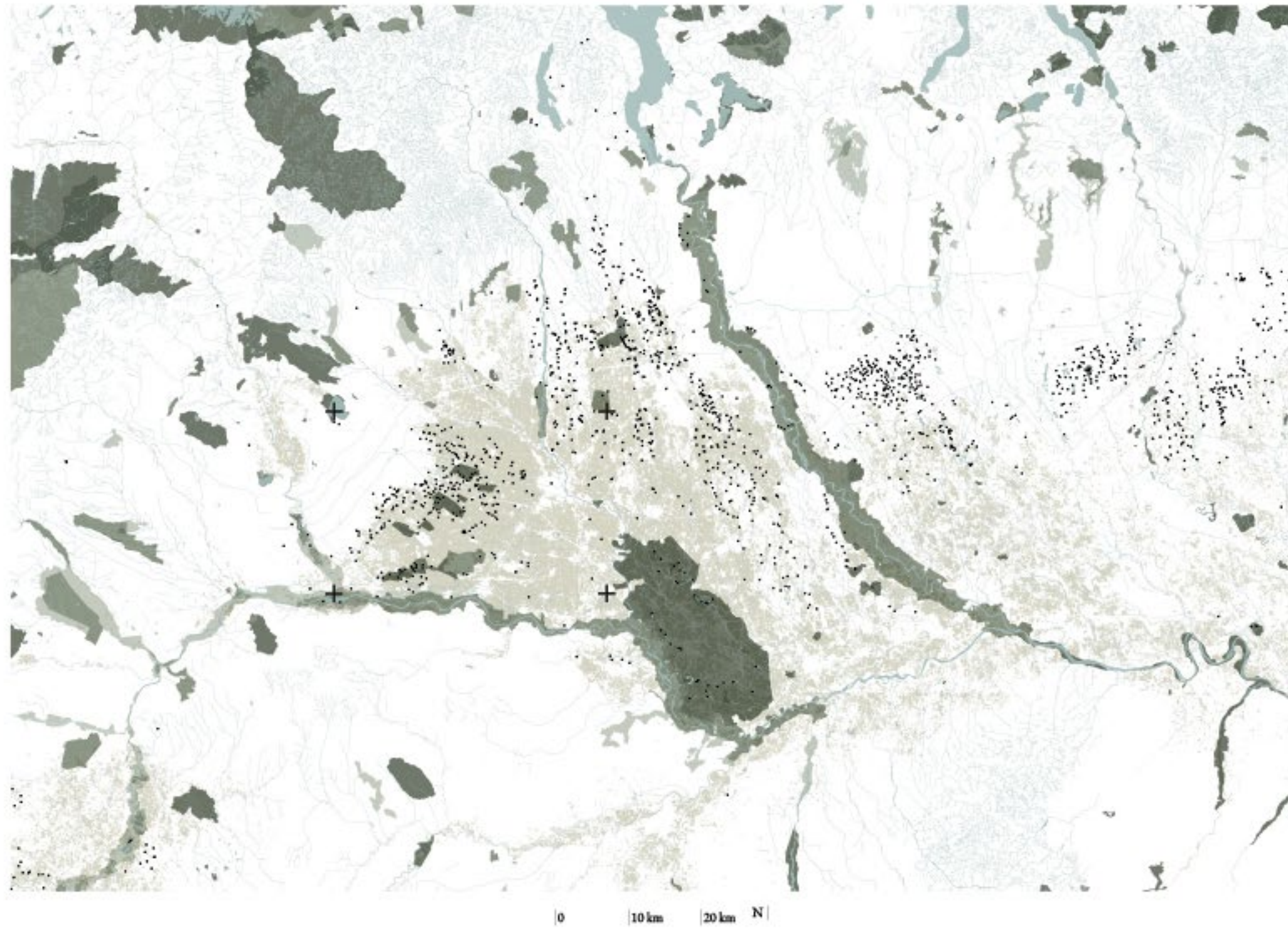
polyculture

reductionist



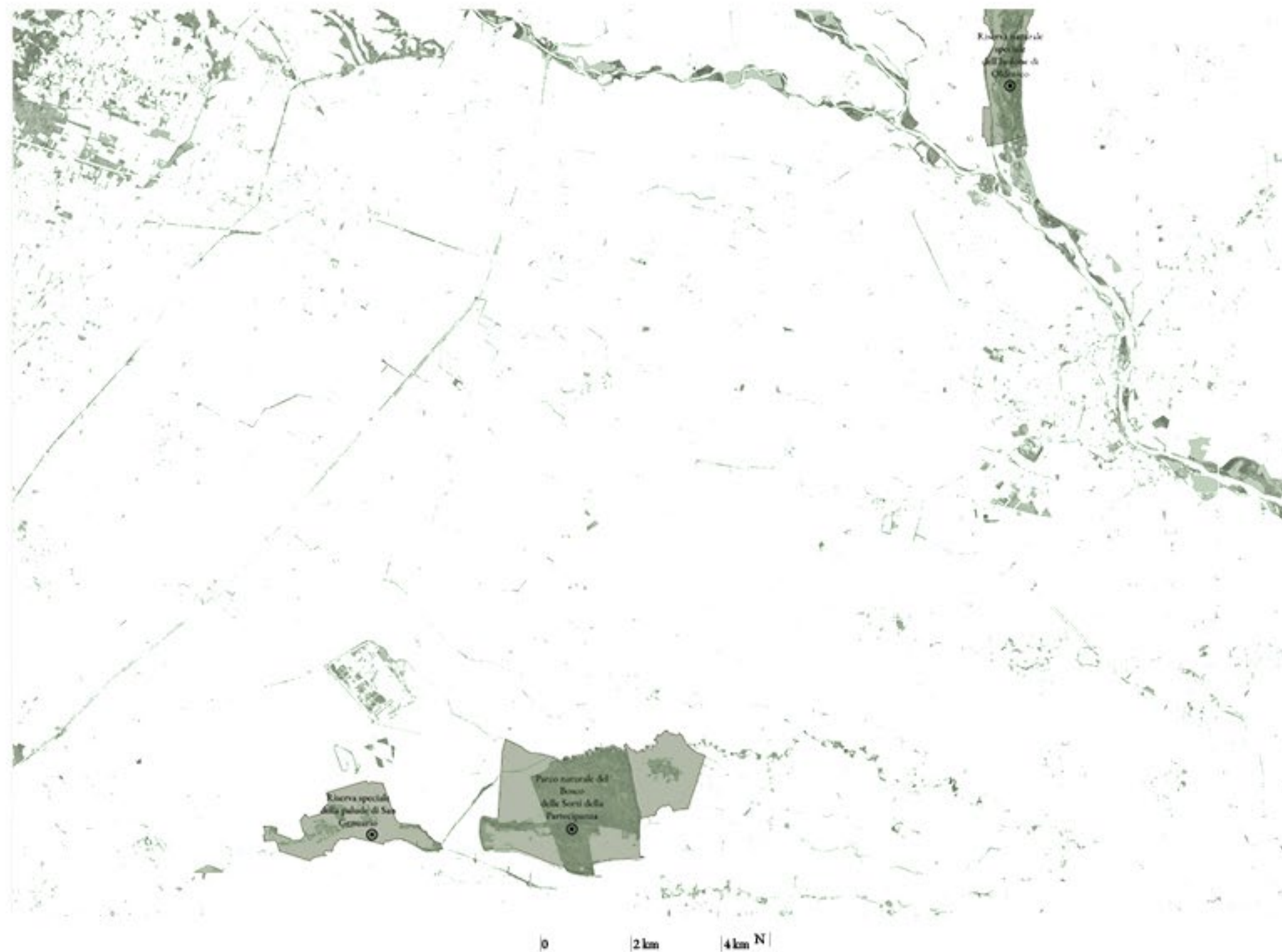
holistic

Current situation of (un-)existing green infrastructure



Source: Natura 2000, 2022. ARPA Lombardia, 2022. ARPA Piemonte, 2022. Regione Lombardia, 2022. Regione Piemonte, 2022.

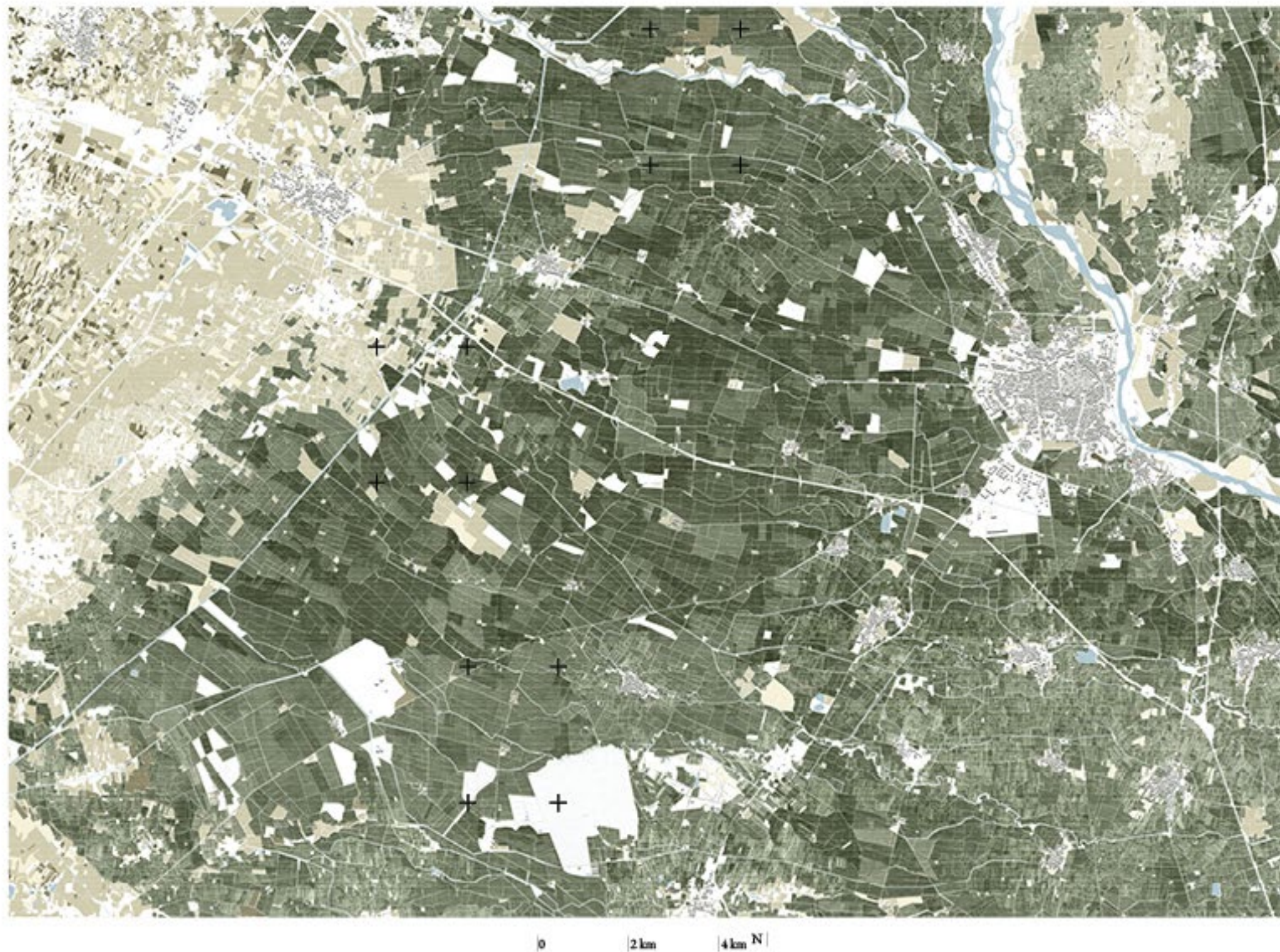
Current situation of (un-)existing green infrastructure in Vercelli



Current situation of monoculture in Vercelli



Existing situation of cultivated crops in Vercelli



The 3 landscapes of 2023

1. Wilderness



2. Productive landscape



3. Culture



The 3 landscapes of 2023

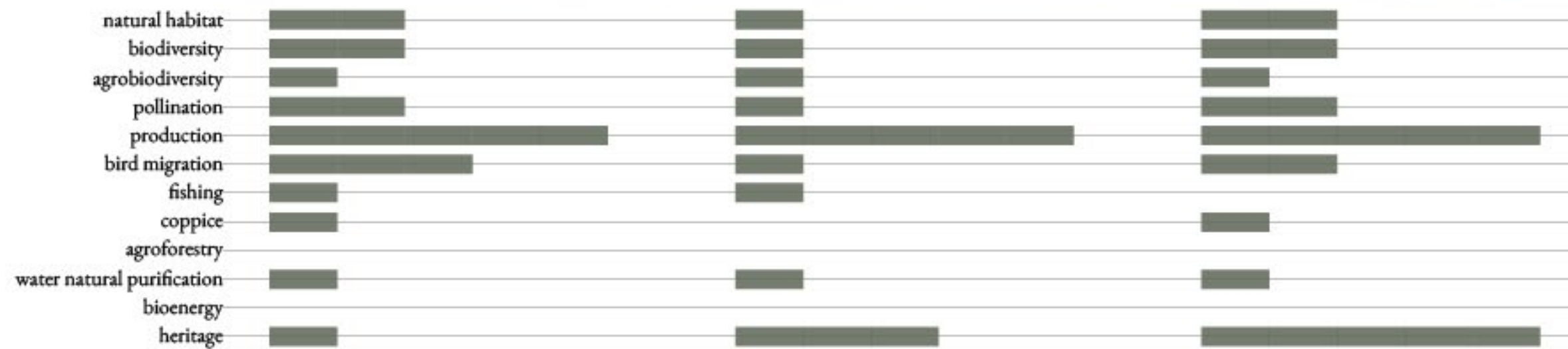
1. Wilderness



2. Productive landscape



3. Culture



The rebirth of the resurgence belt

Soil - impermeable layer



Soil typology. Source: *Région Piémonte*, 2022.

The rebirth of the resurgence belt

Soil - semipermeable layer



Soil typology. Source: *Région Provence-Alpes-Côte d'Azur*, 2022.

The rebirth of the resurgence belt

Soil - permeable layer



Soil typology. Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

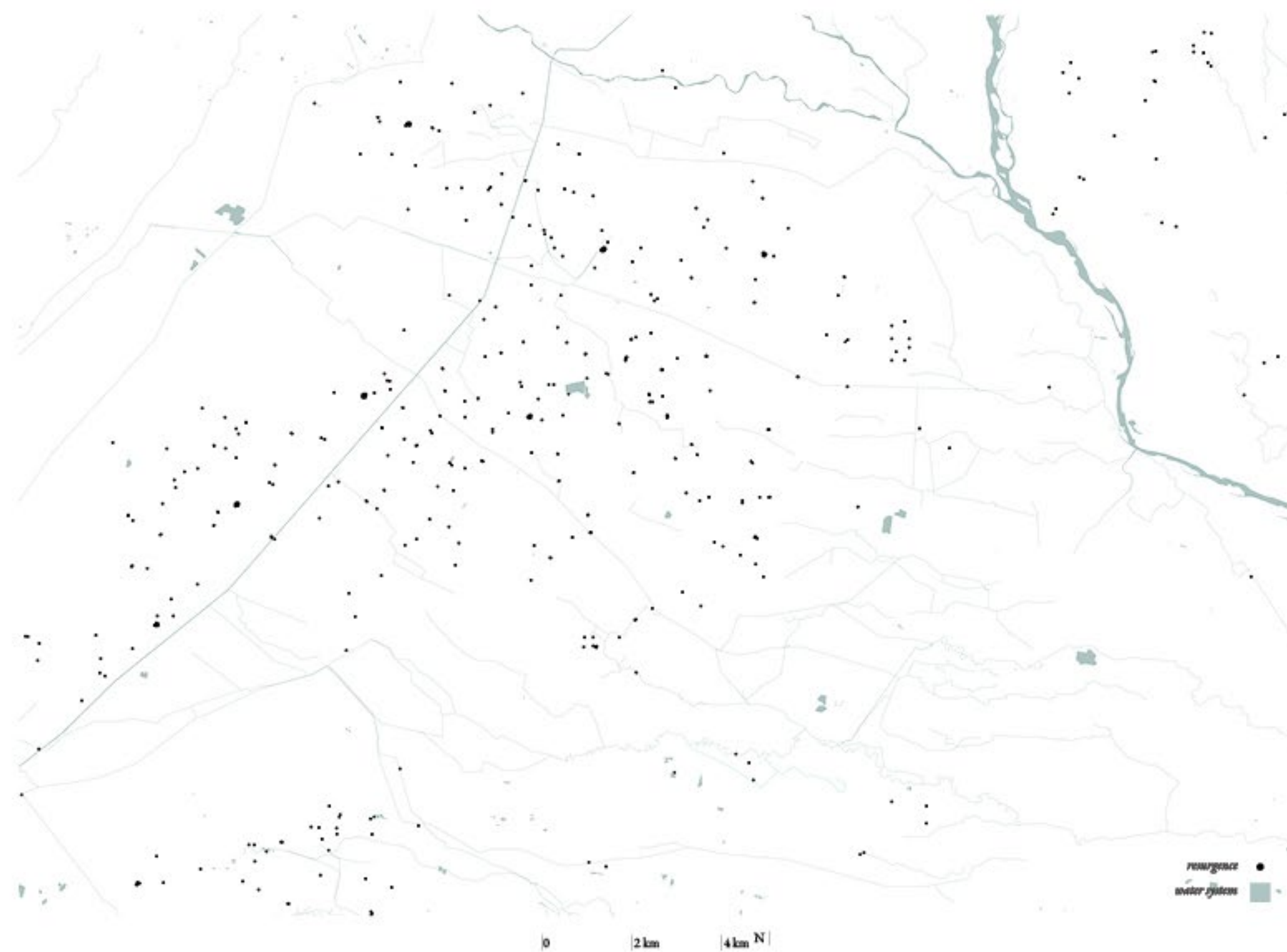
Soil



Soil typology. Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

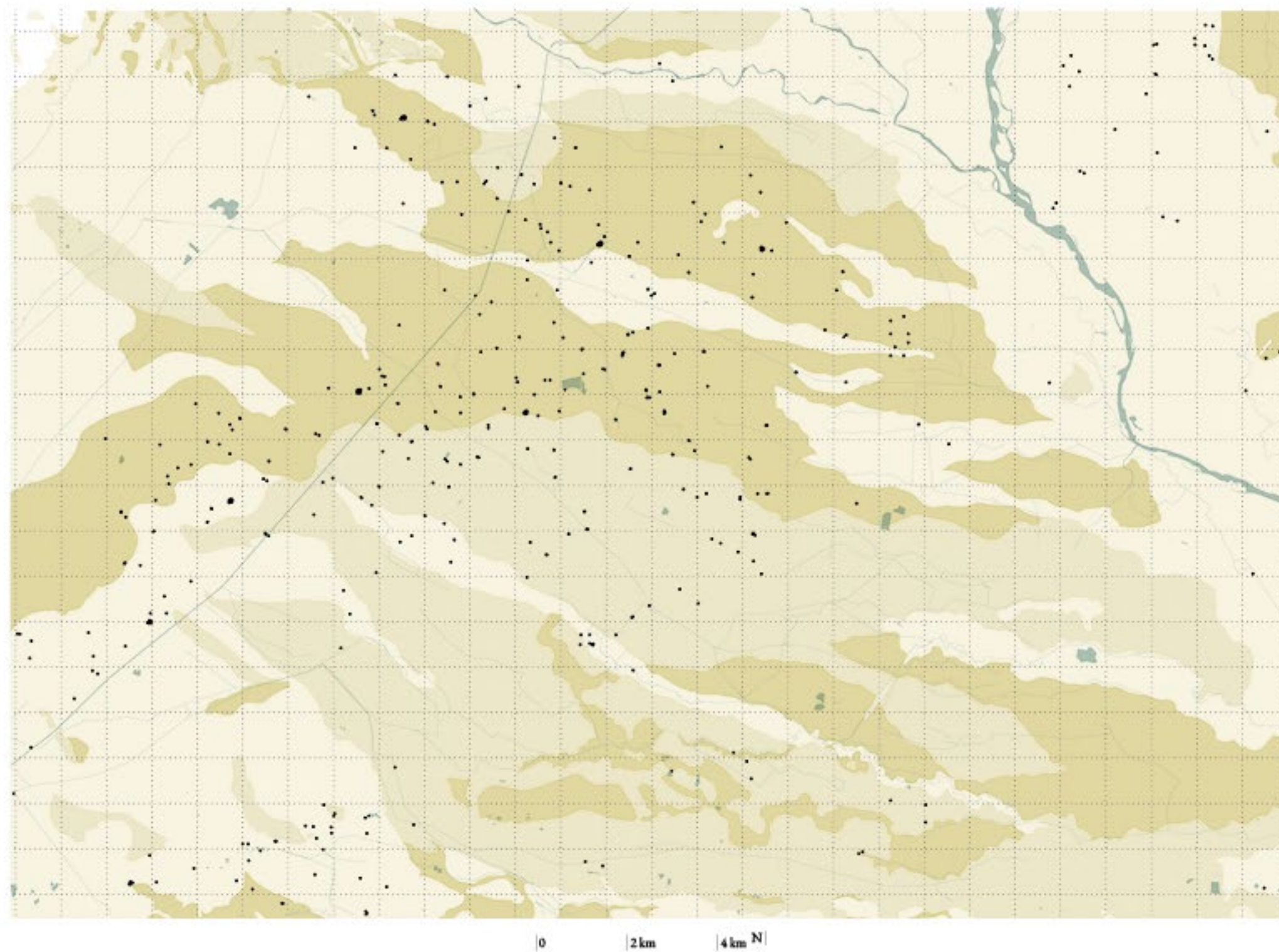
Water elements - current situation



Source: Région de la Savoie, 2022.

The rebirth of the resurgence belt

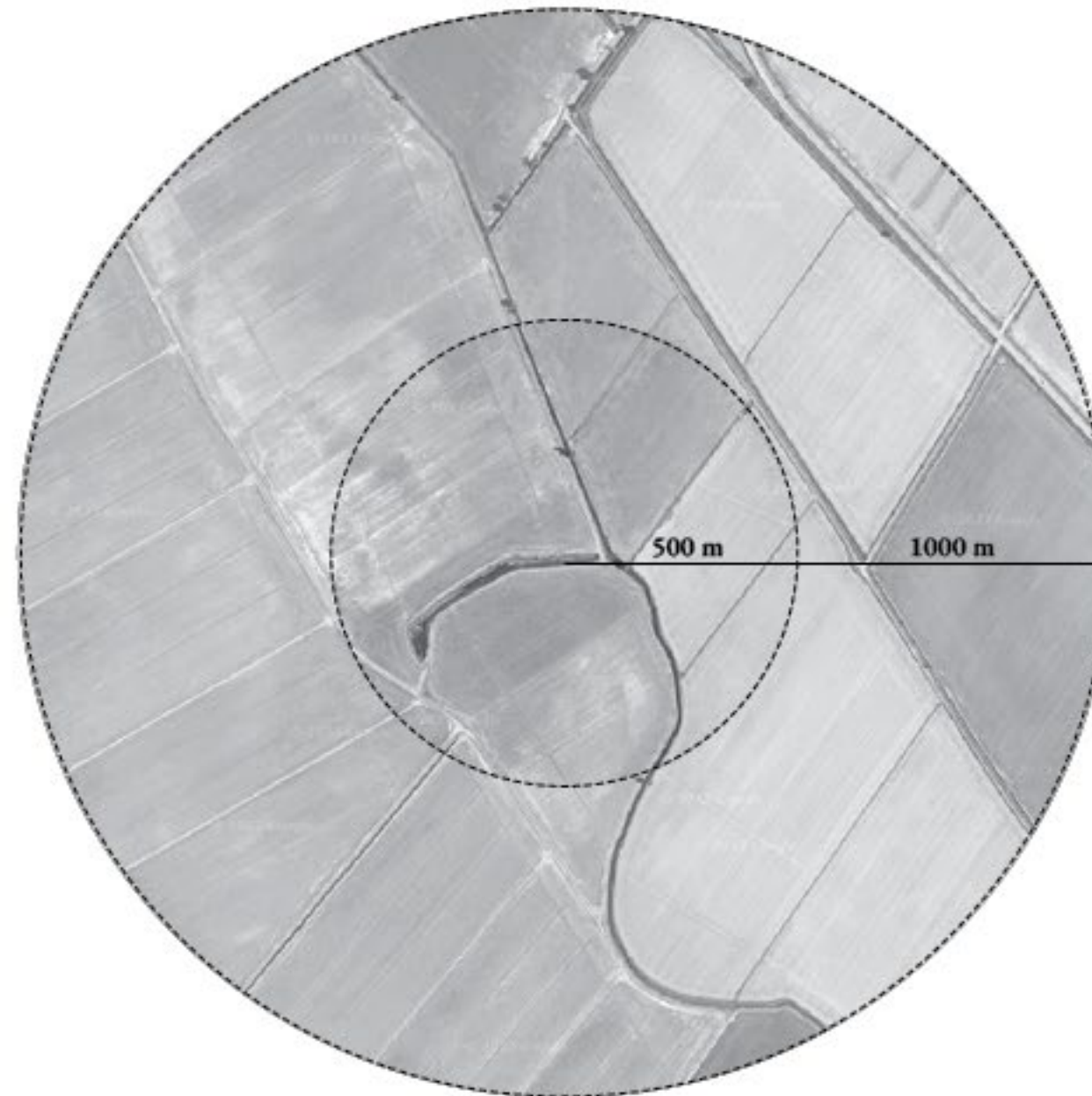
Soil and water system



Soil typology. Source: *Région Piémonte*, 2022.

The rebirth of the resurgence belt

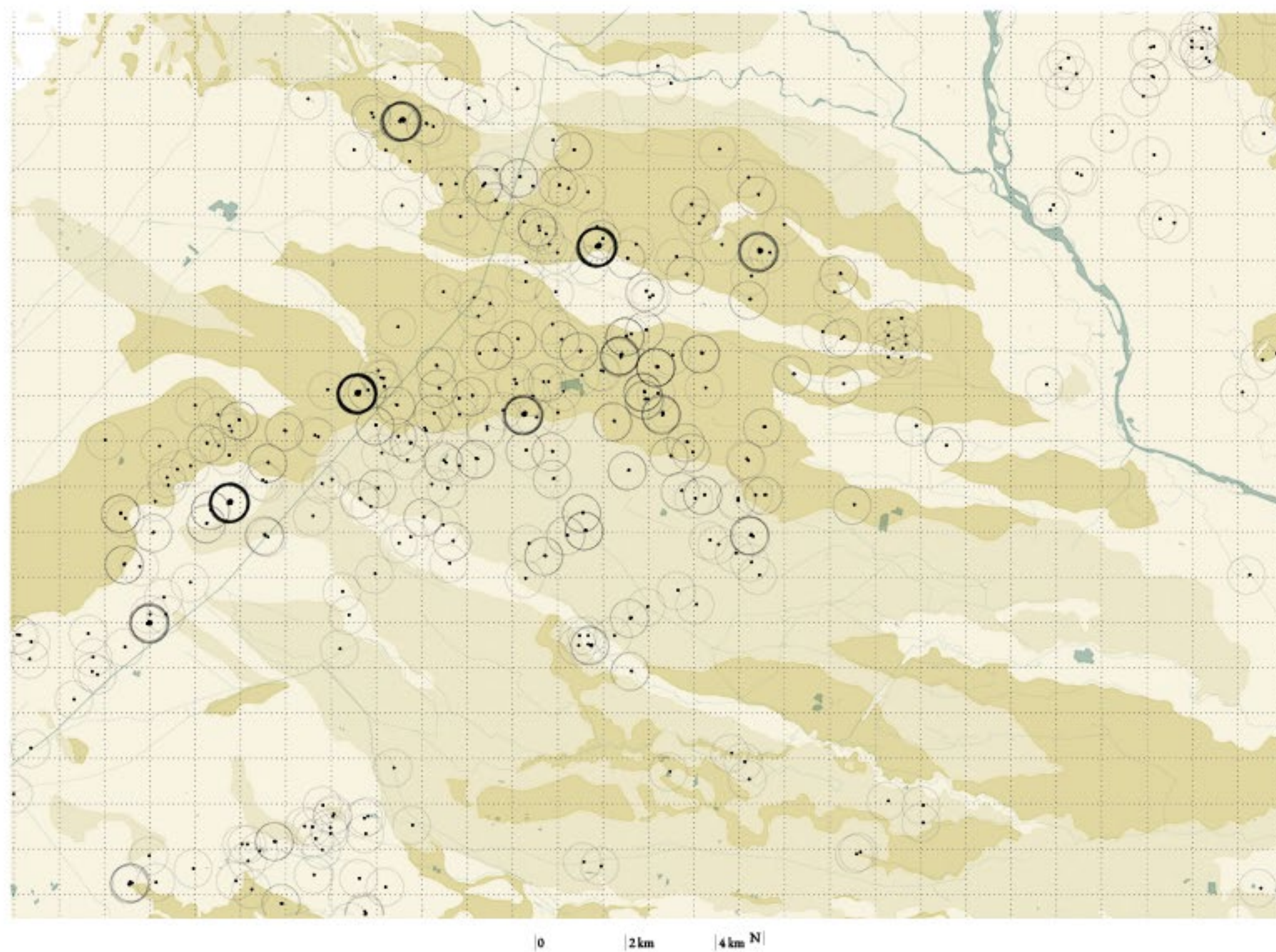
Buffer areas of resurgences



Source: Google Earth, 2022.

The rebirth of the resurgence belt

Soil and water system and buffer areas



Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

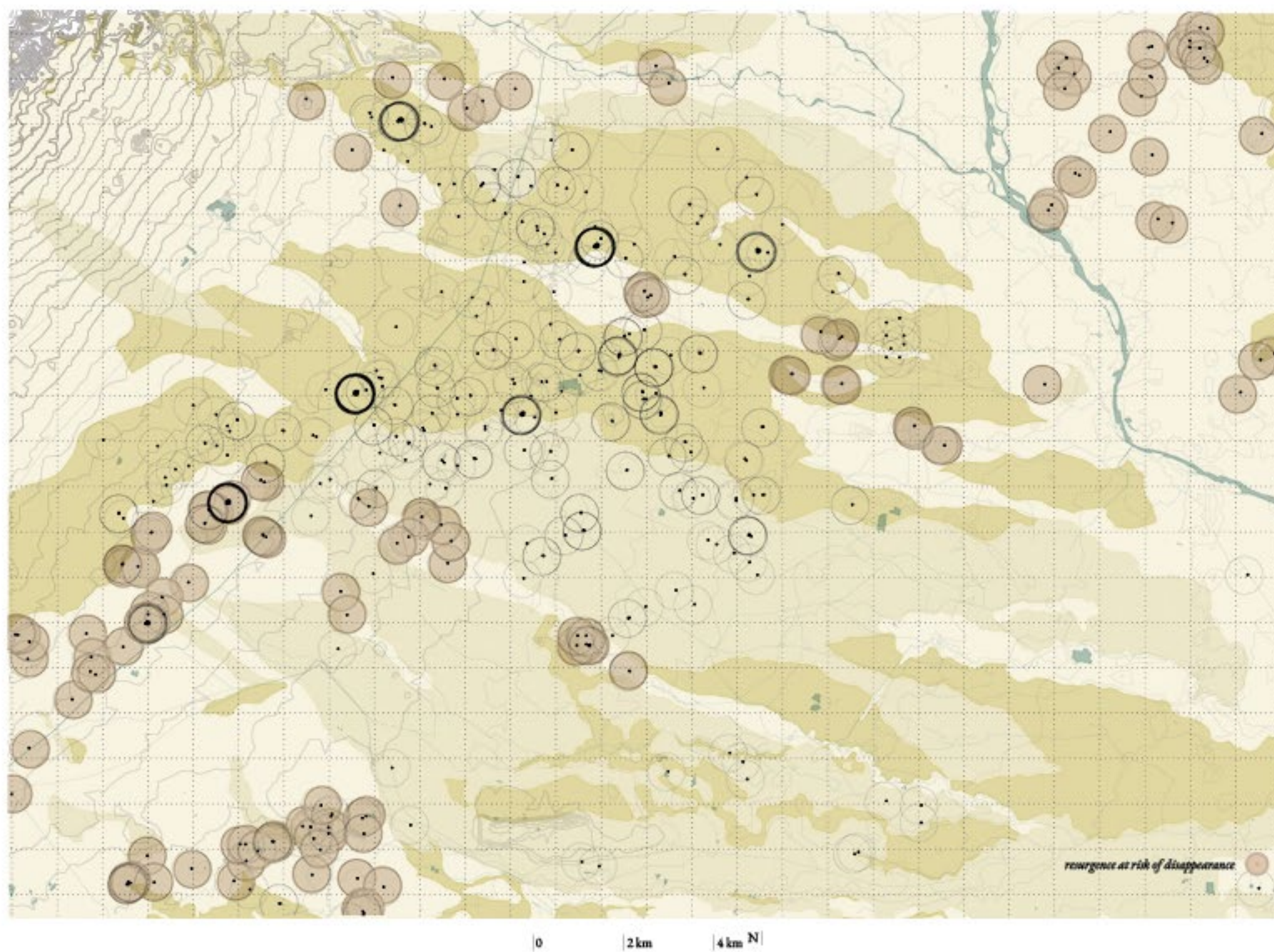
Resurgences at risk of disappearing



Soil typology. Source: *Régione Piemonte*, 2022.

The rebirth of the resurgence belt

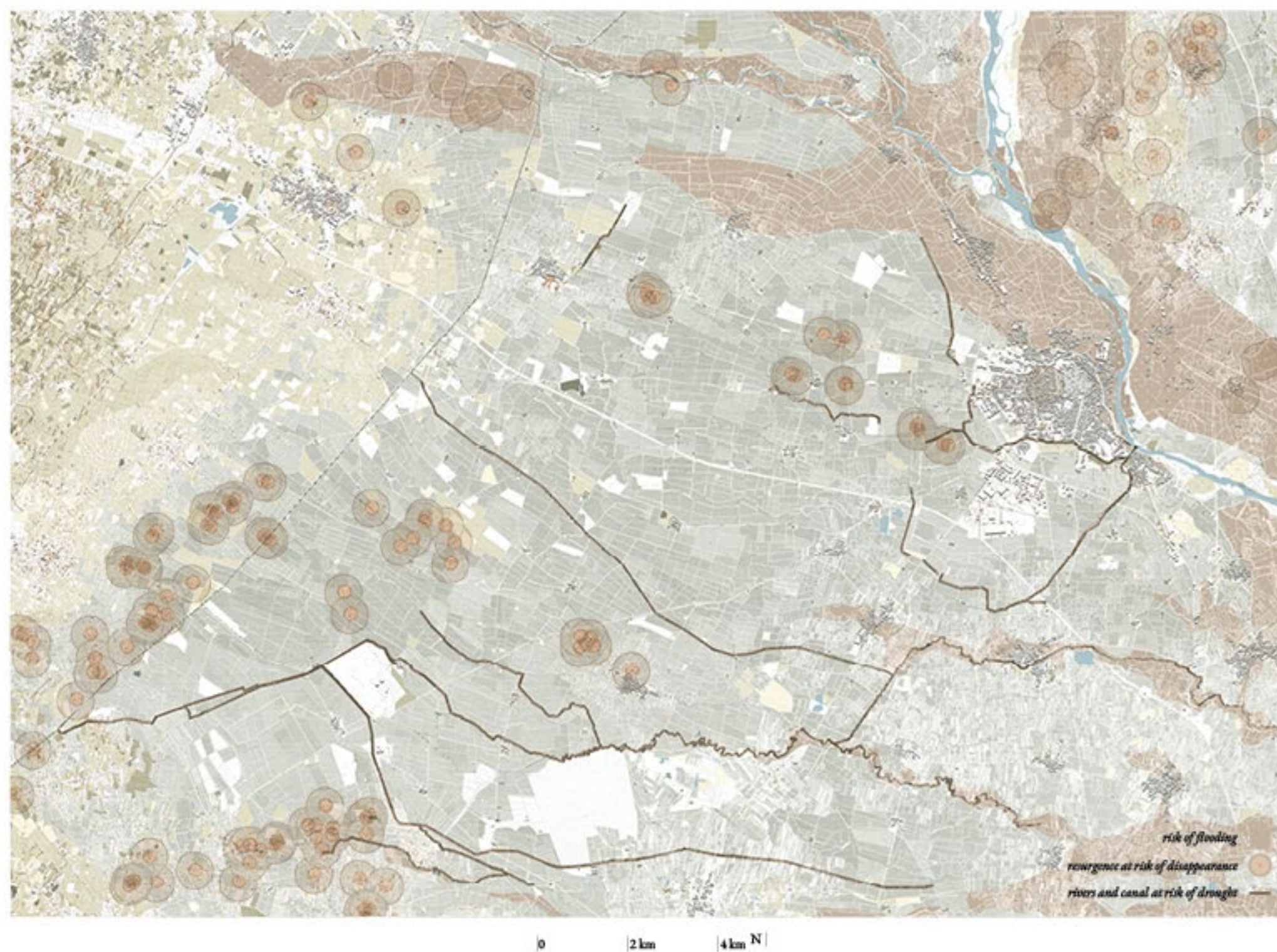
Soil and water system and buffer areas



Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

Current situation of possible hydrological risks



Source: Région Provence-Alpes-Côte d'Azur, 2022.

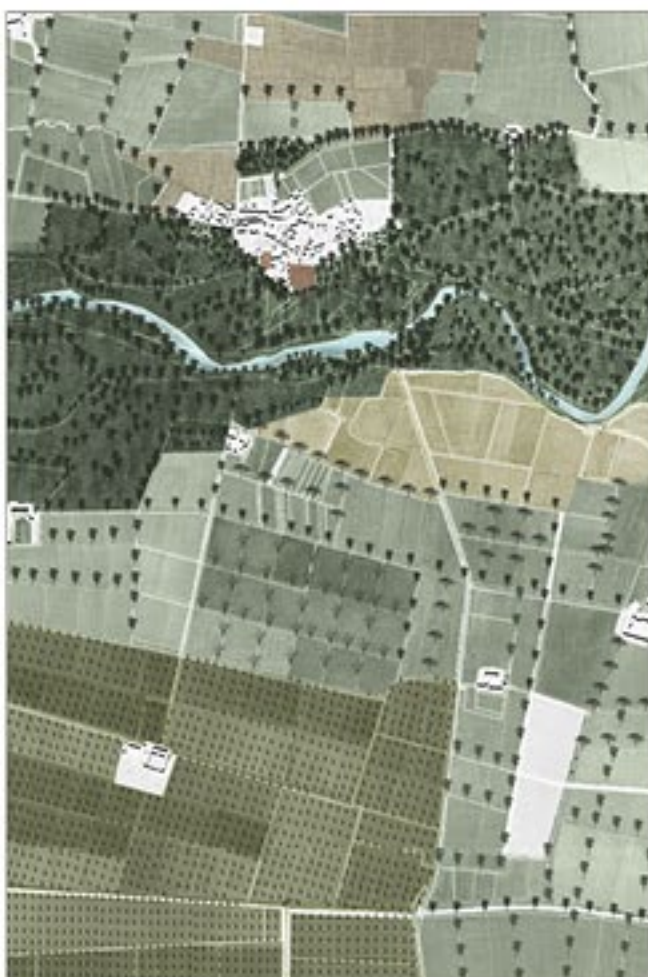
The rebirth of the resurgence belt

Polyculture
alternative future for 2030



The 3 landscapes of 2030
alternative future

1. Wilderness



2. Productive landscape



3. Culture



The 3 landscapes of 2030
alternative future

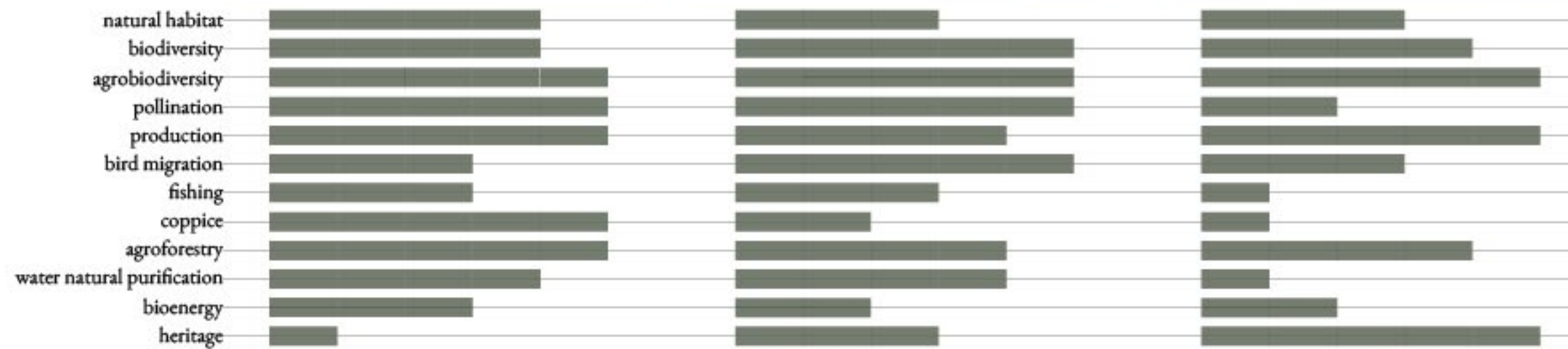
1. Wilderness



2. Productive landscape



3. Culture



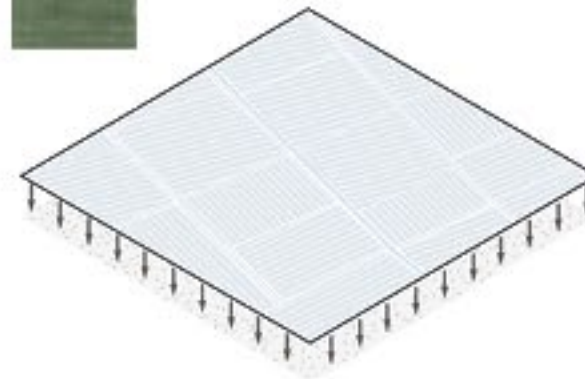
Actions
alternative future for 2030



reserve



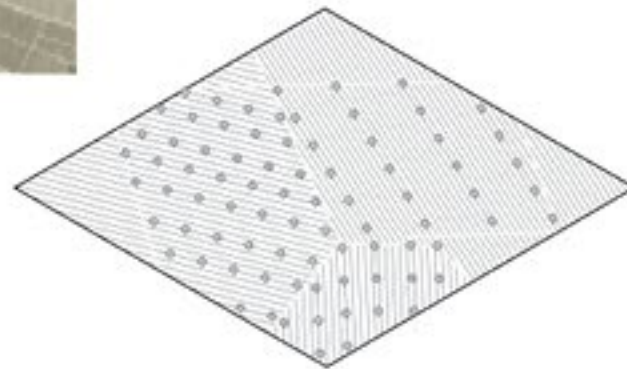
ricefields/winter submersion



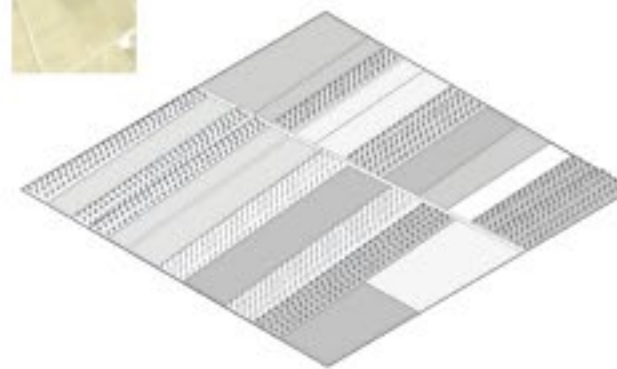
crops rotation



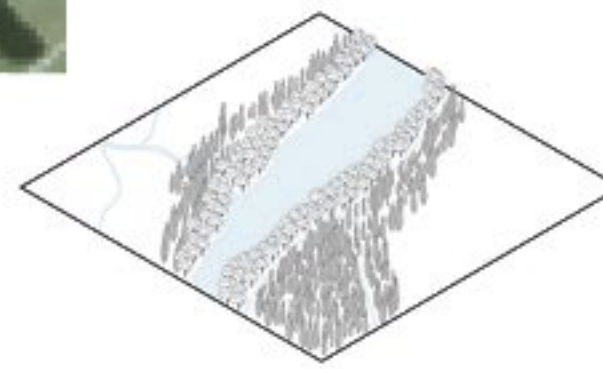
ricefields and agroforestry



change in cultivation



wilderness



urban



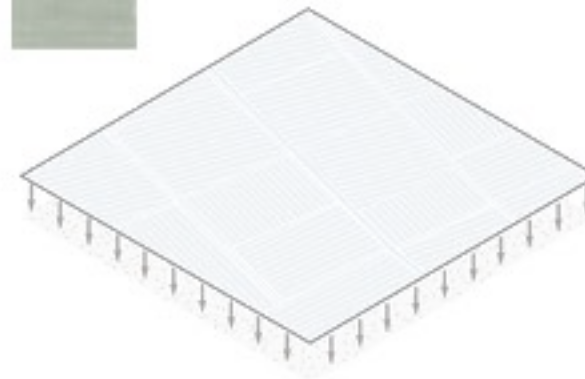
*Actions
alternative future for 2030*



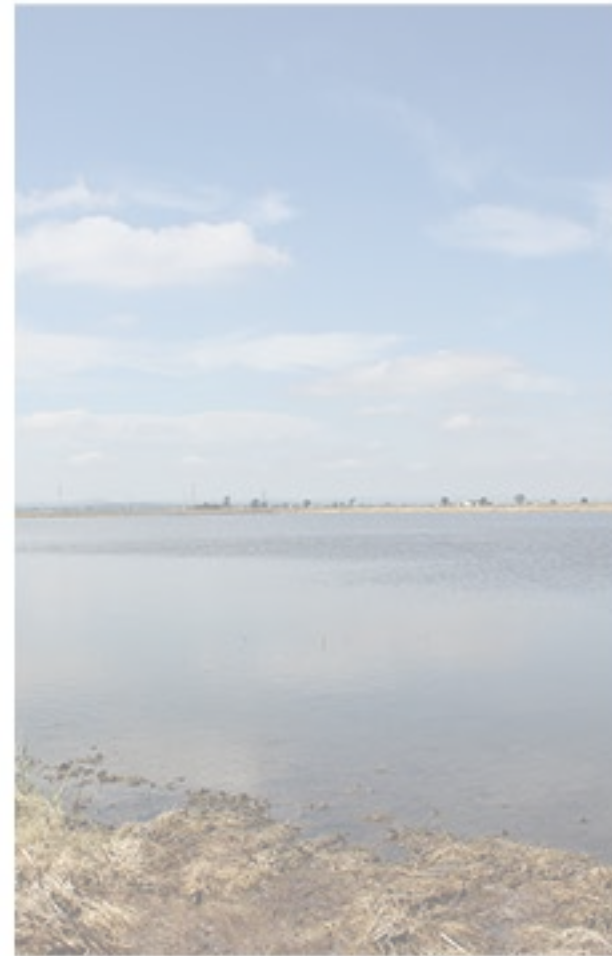
reserve



ricefields/winter submersion



crops rotation



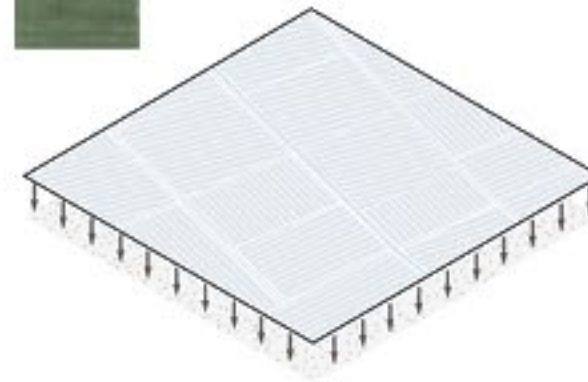
*Actions
alternative future for 2030*



reserve



ricefields/winter submersion



crops rotation



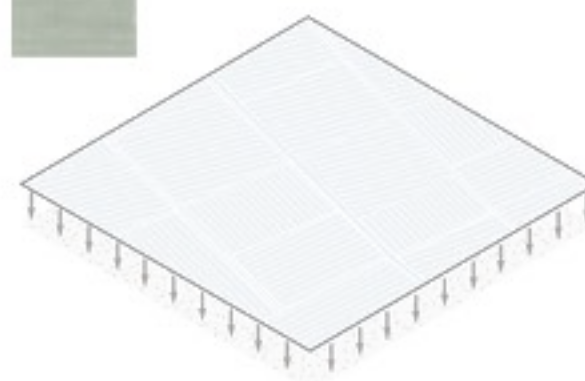
*Actions
alternative future for 2030*



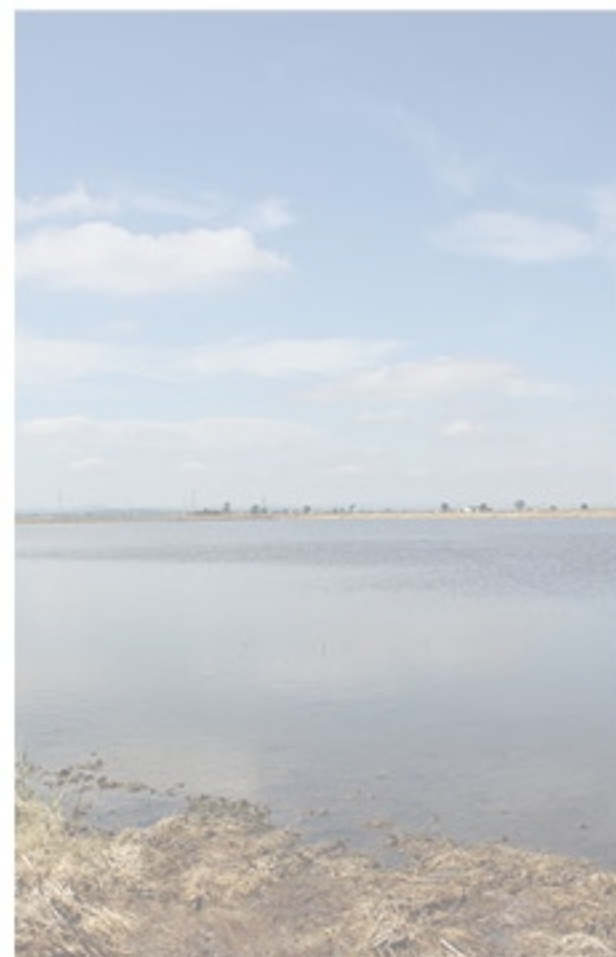
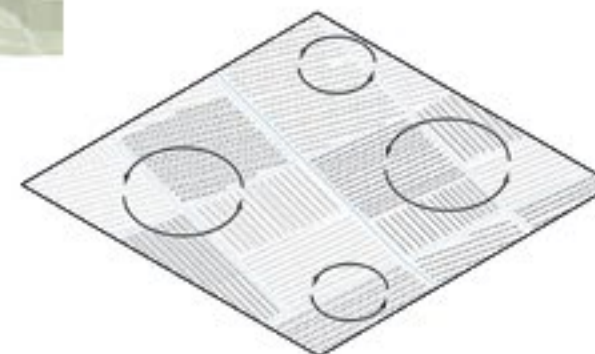
reserve



ricefields/winter submersion



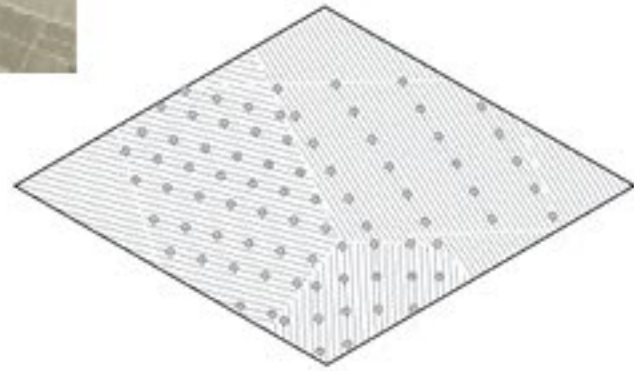
crops rotation



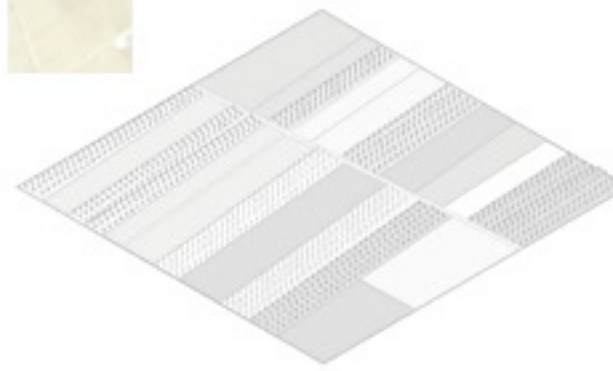
*Actions
alternative future for 2030*



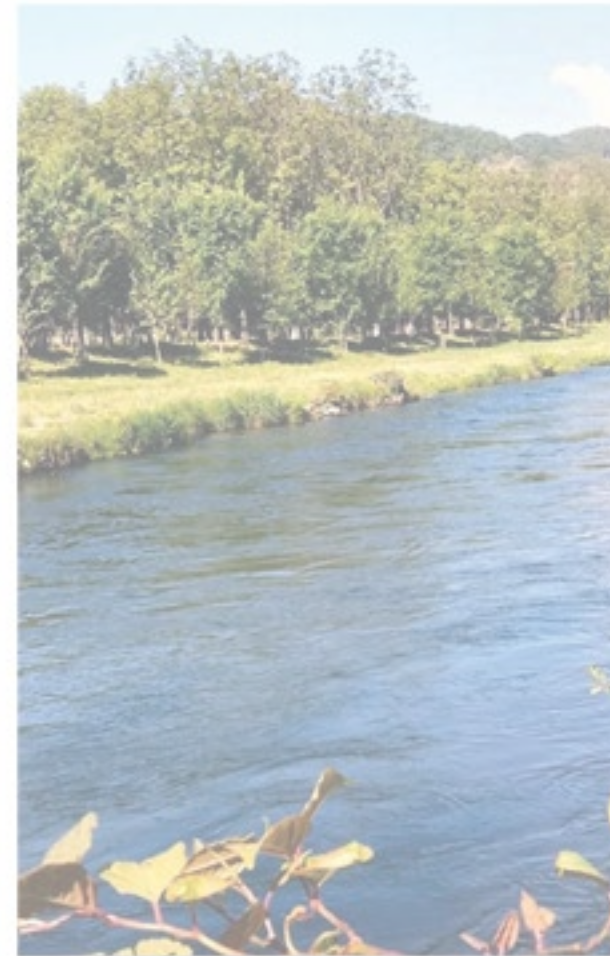
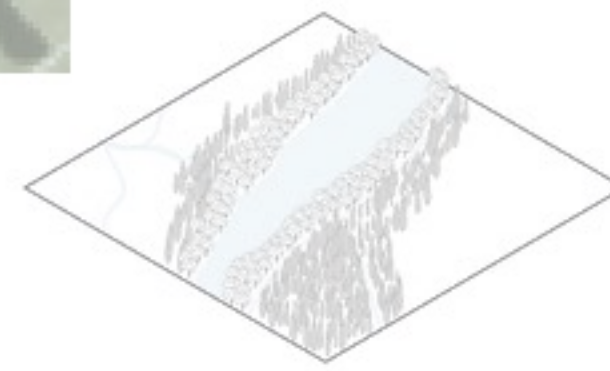
ricefields and agroforestry



change in cultivation



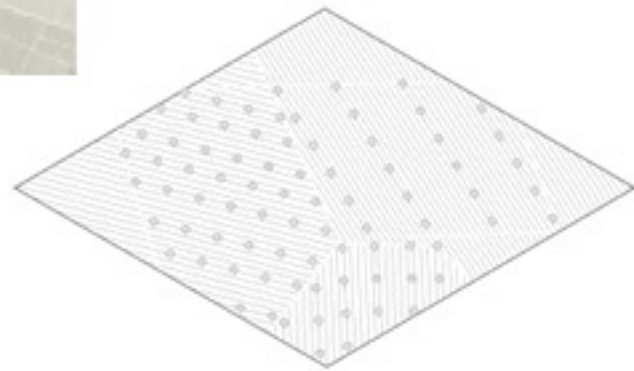
wilderness



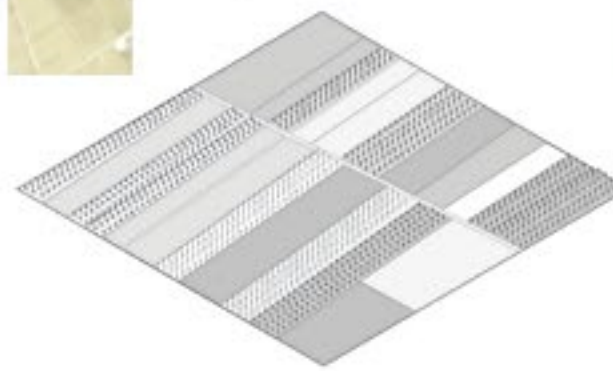
*Actions
alternative future for 2030*



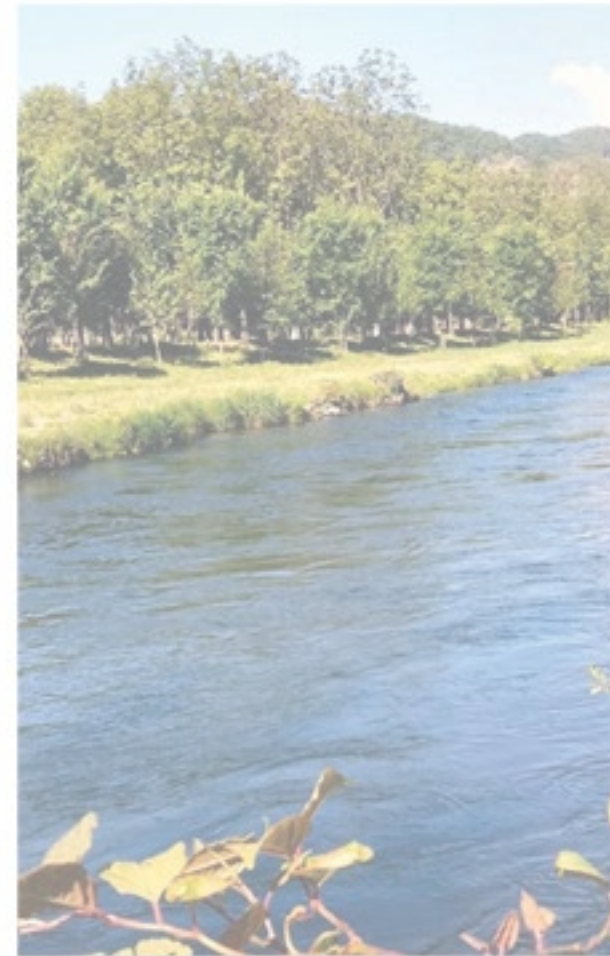
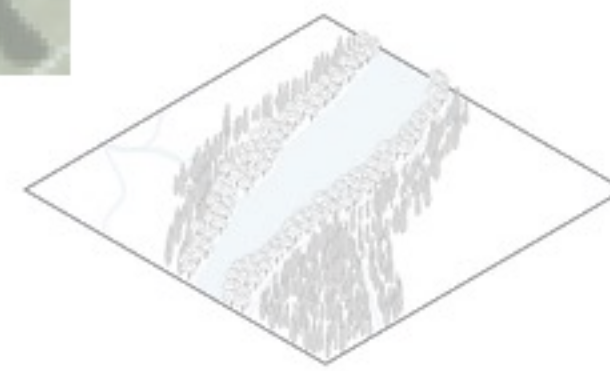
ricefields and agroforestry



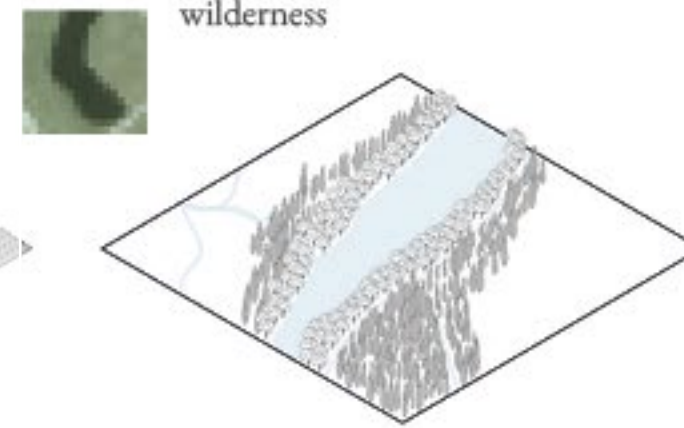
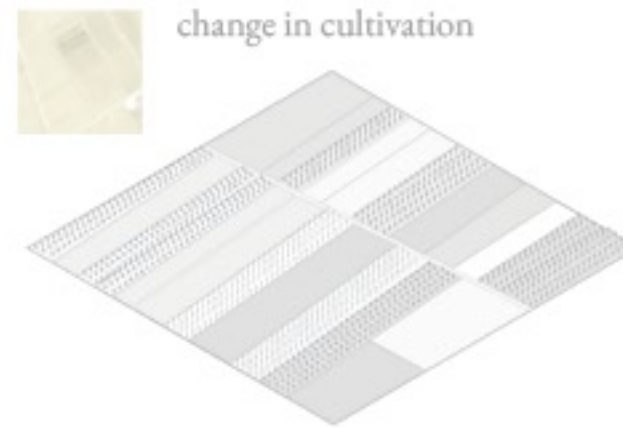
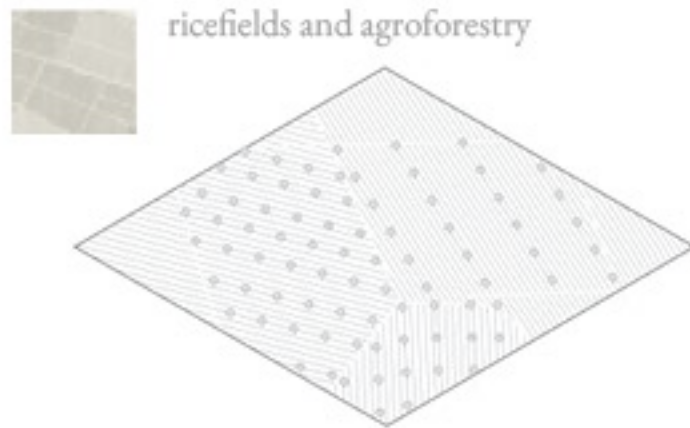
change in cultivation



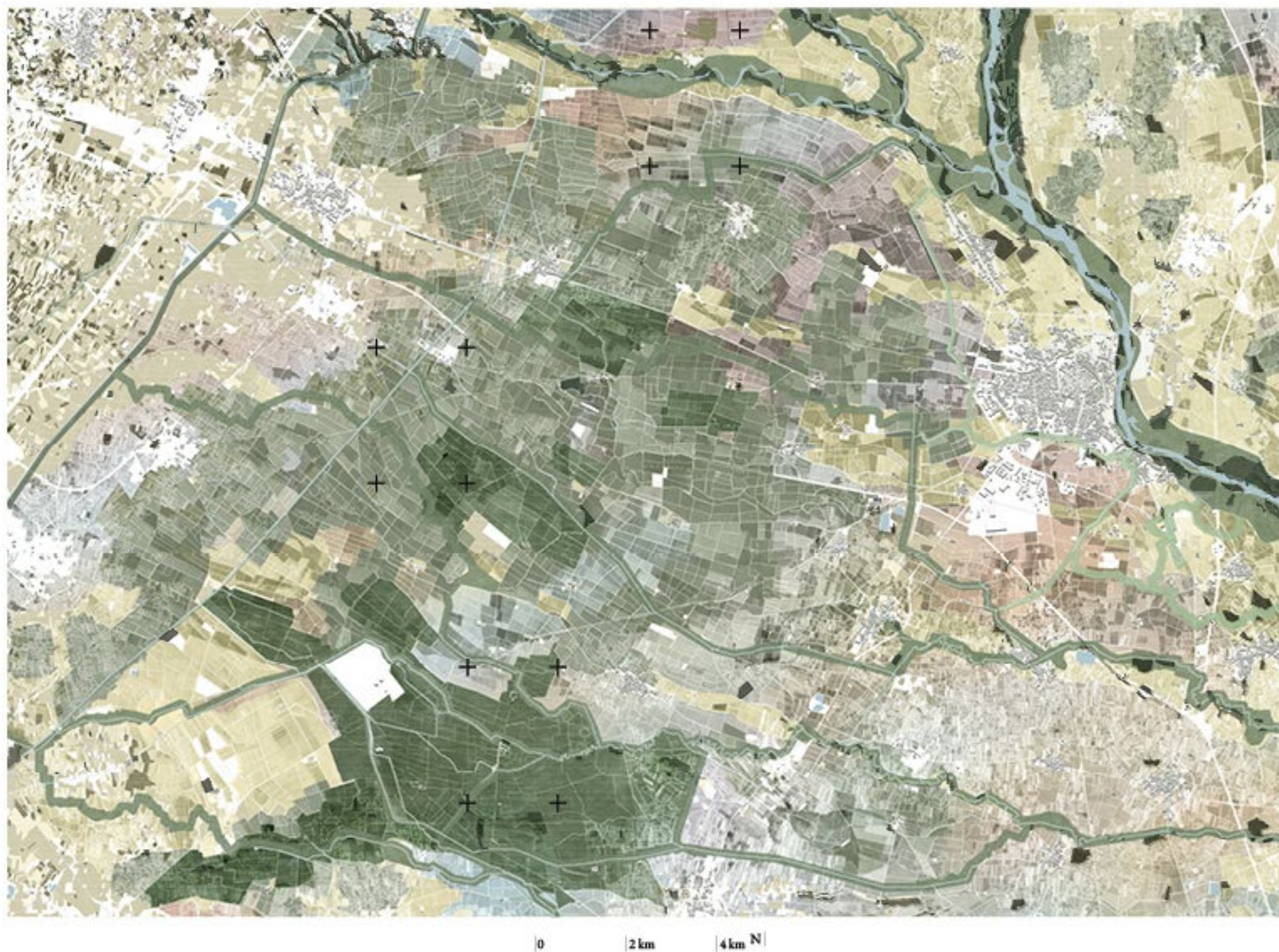
wilderness



*Actions
alternative future for 2030*



Polyculture
alternative future for 2040



The 3 landscapes of 2040
alternative future

1. Wilderness



2. Productive landscape



3. Culture



The 3 landscapes of 2040
alternative future

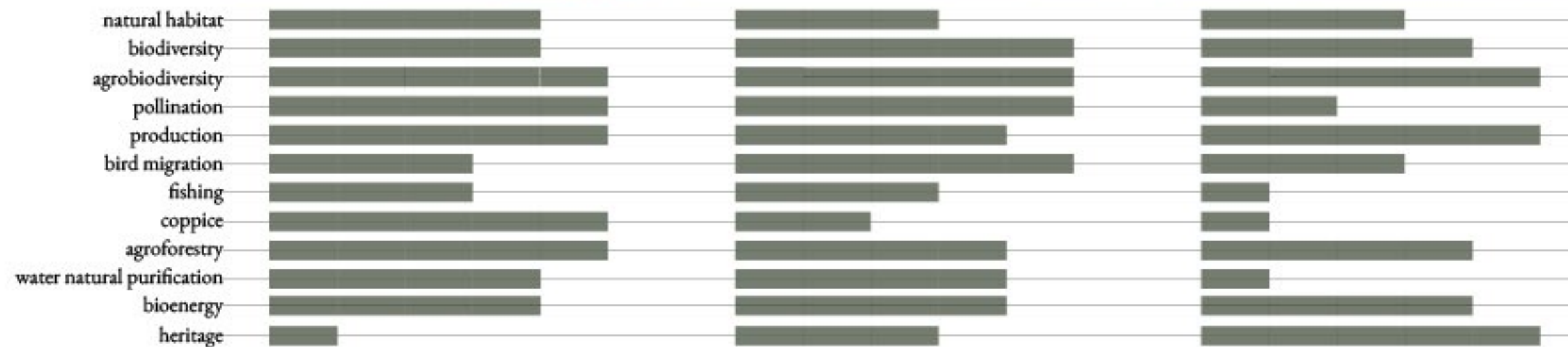
1. Wilderness



2. Productive landscape



3. Culture



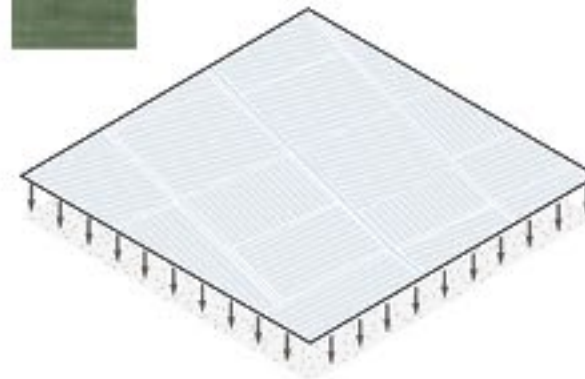
Actions
alternative future for 2040



reserve



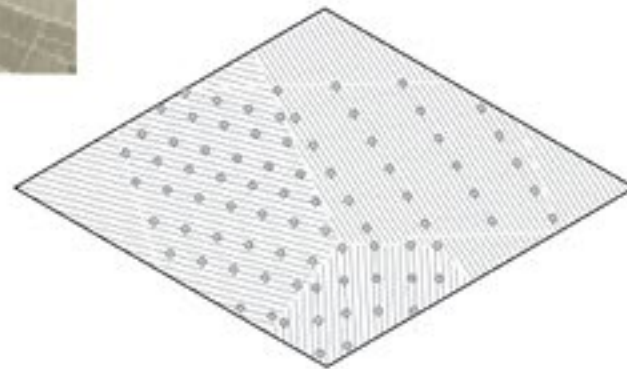
ricefields/winter submersion



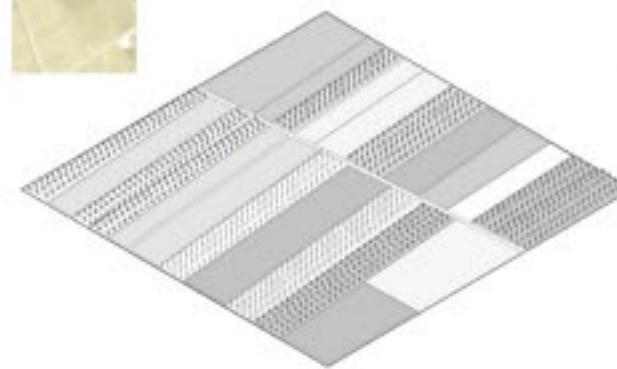
crops rotation



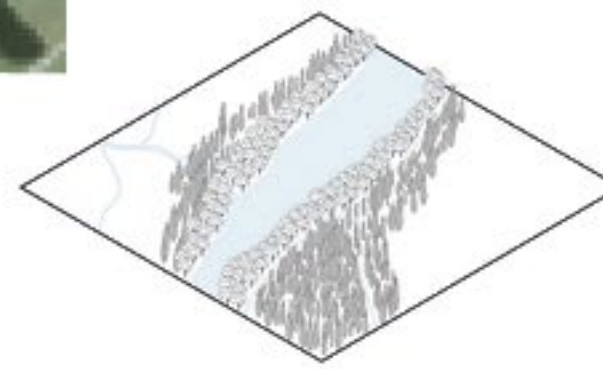
ricefields and agroforestry



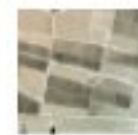
change in cultivation



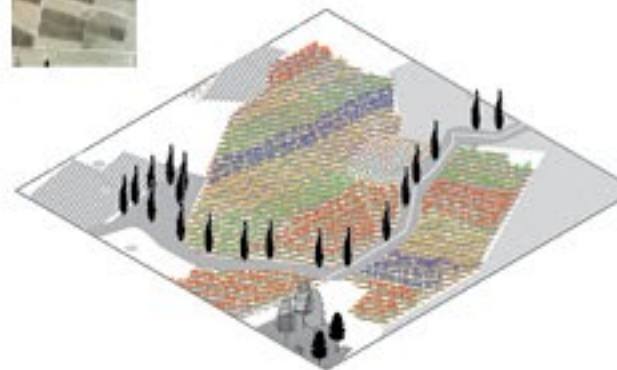
wilderness



urban



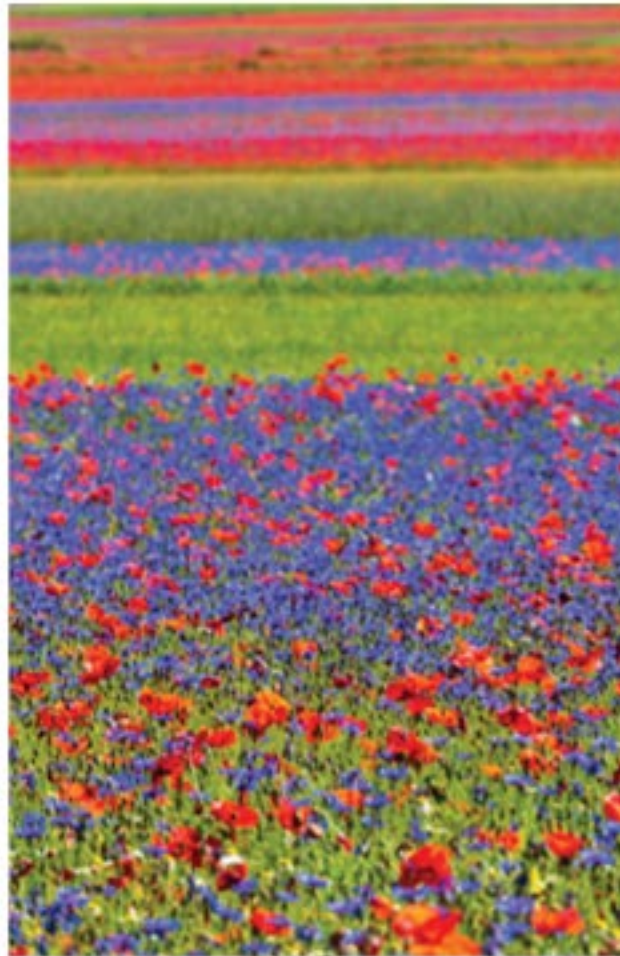
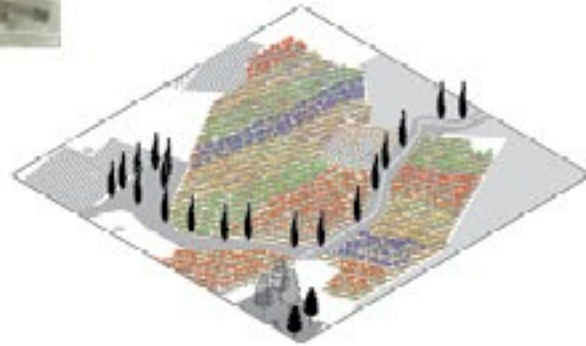
lentils cultivation



Actions
alternative future for 2040



lentils cultivation



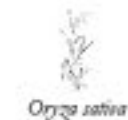
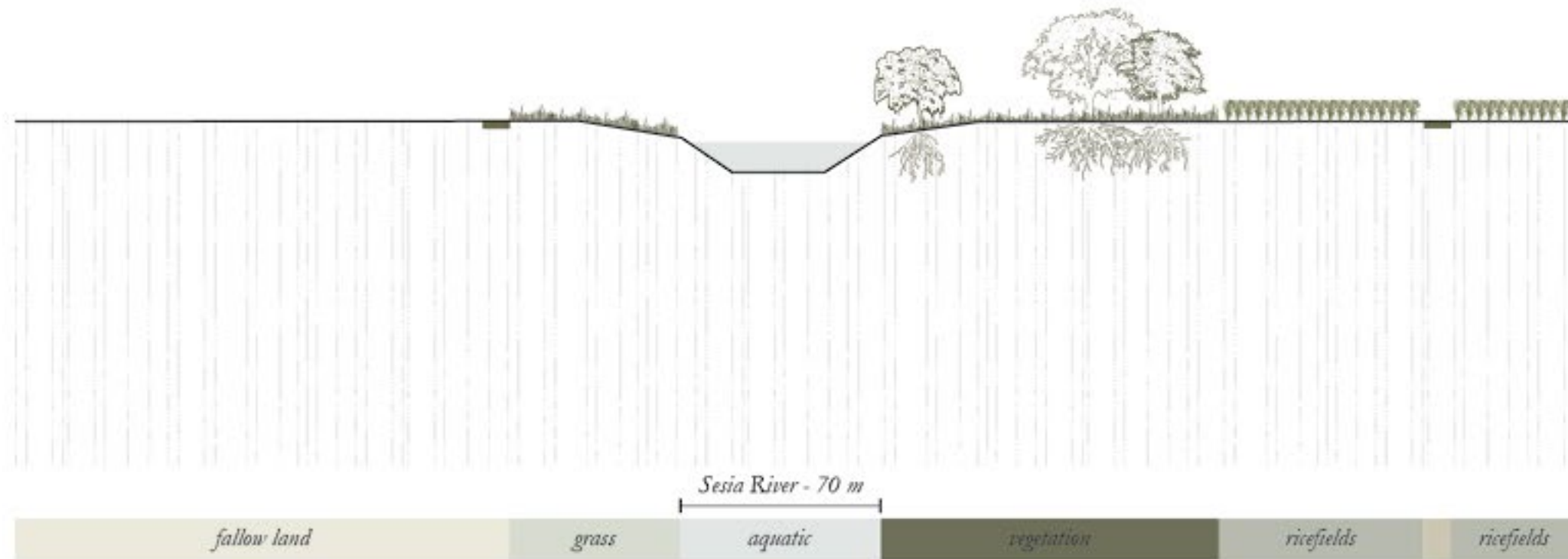
Source: <https://laggi.carriera.it/titineuri-e-lughe/lands/fortuna-castellaccio-nervio-cou-de-espero/imag6>

The rebirth of the resurgence belt

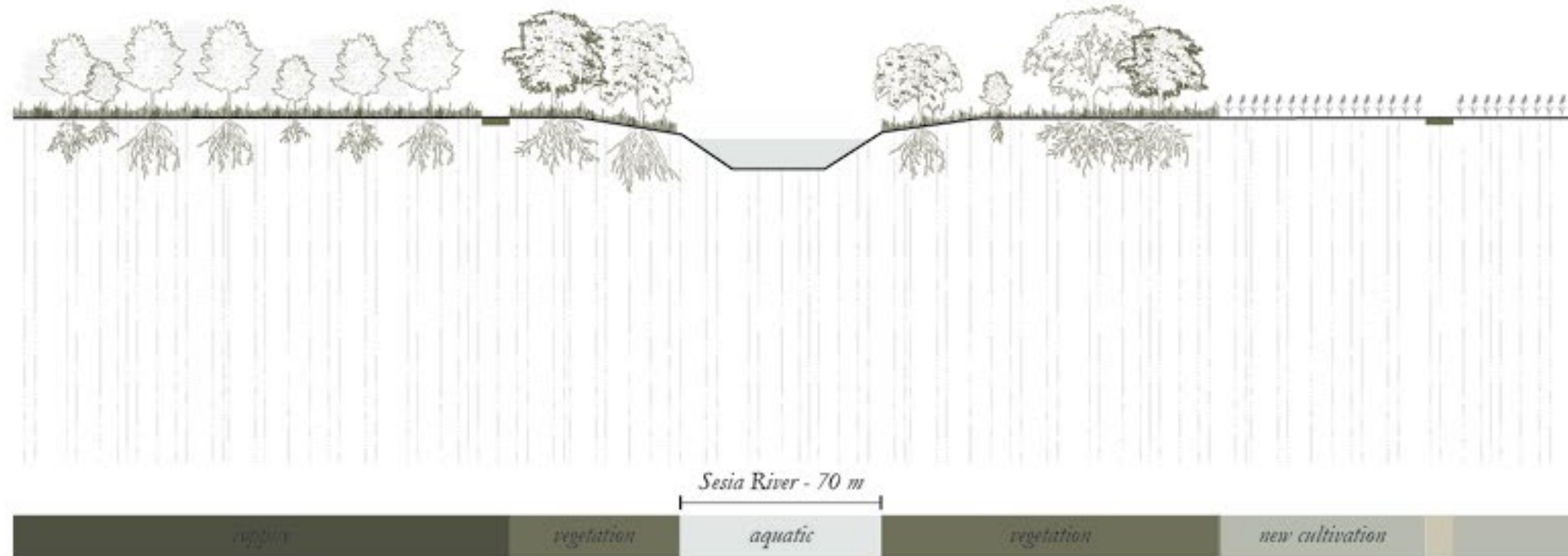
*Ecological corridors
alternative future for 2040*



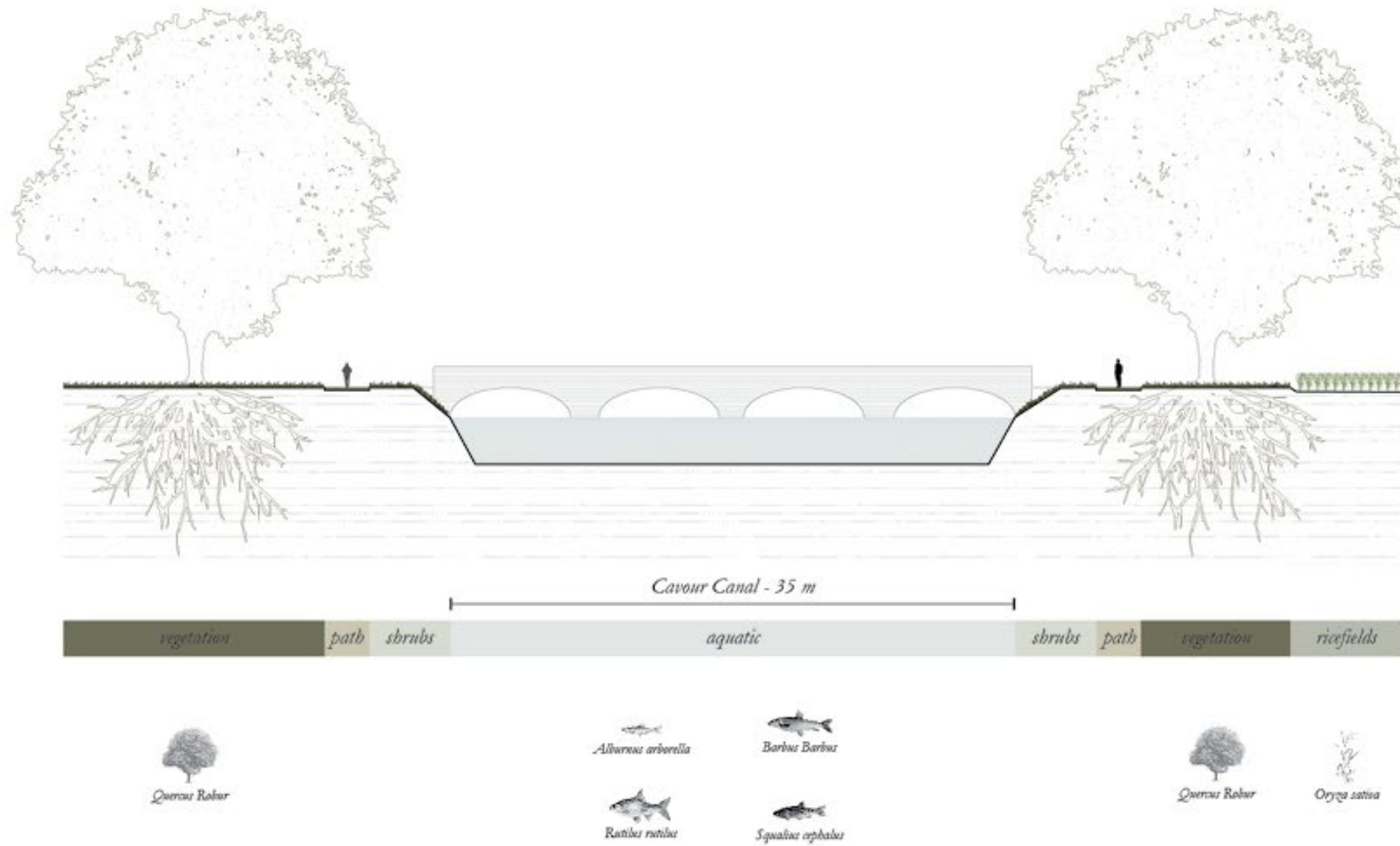
*Primary corridor
alternative future for 2030*



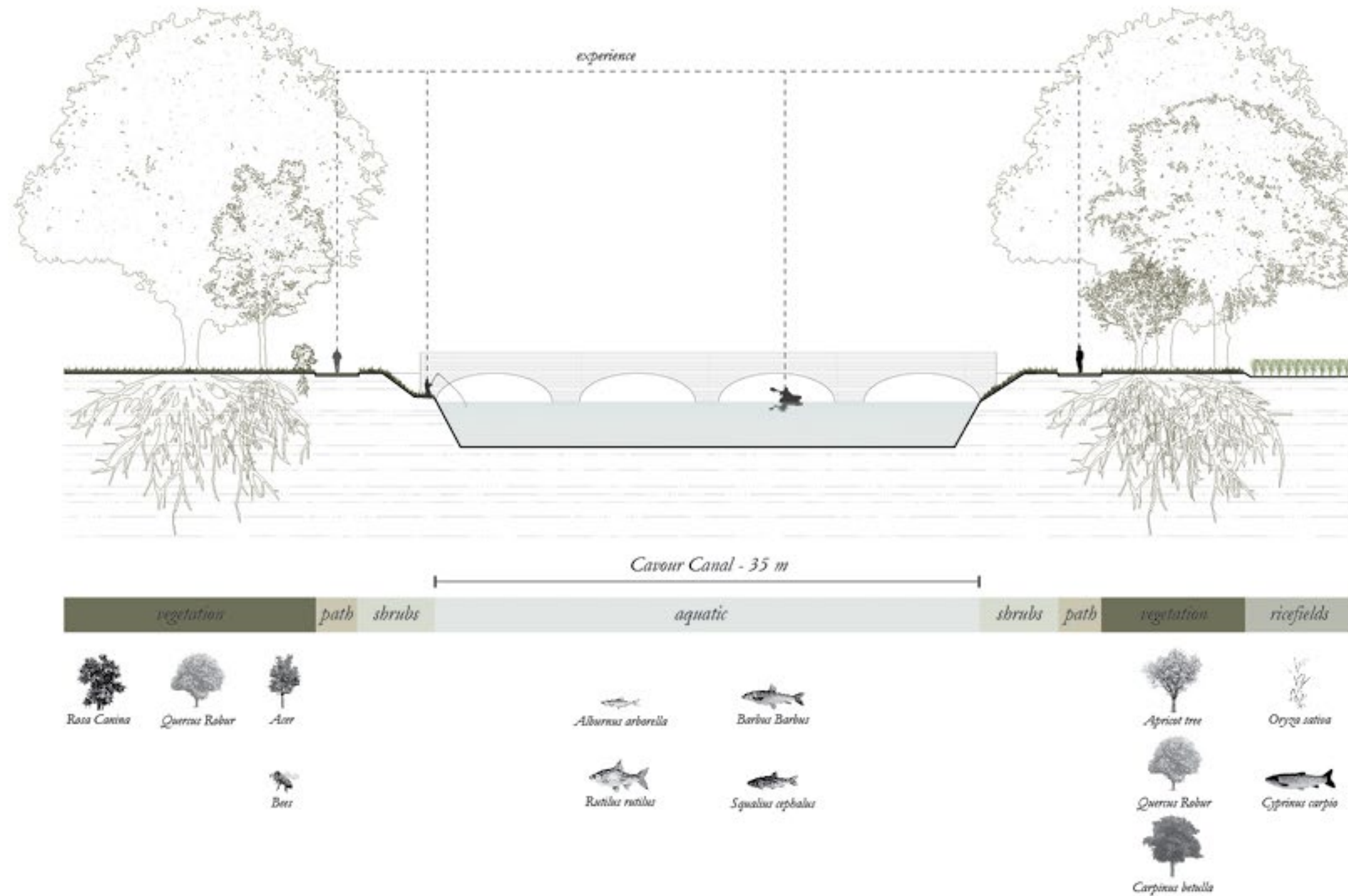
Primary corridor
alternative future for 2030



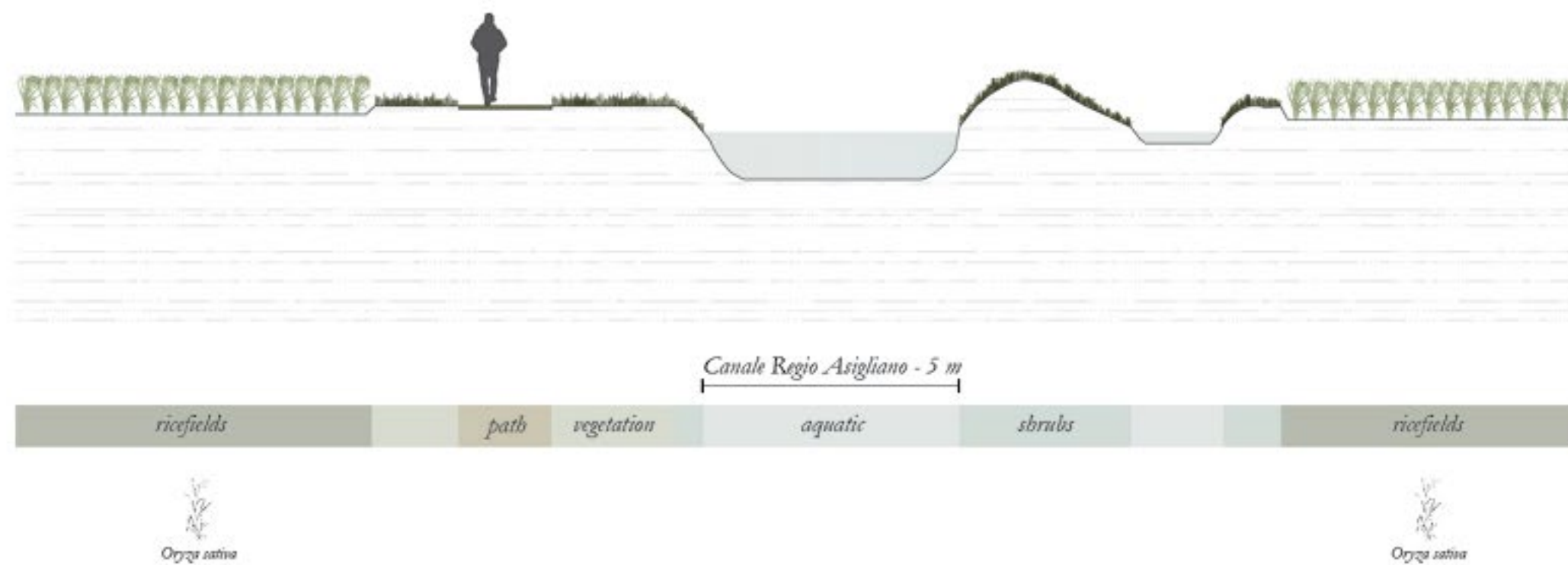
Secondary corridor
Existing



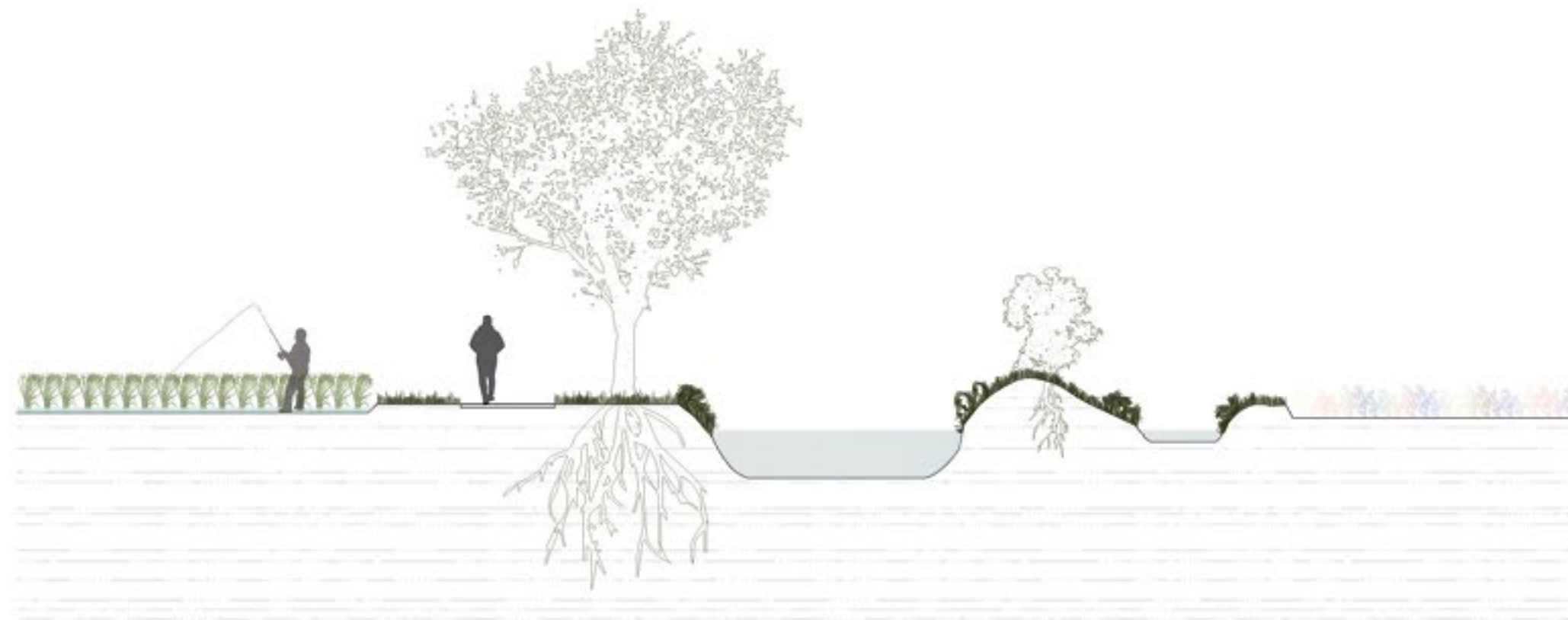
*Secondary corridor
alternative future for 2030*



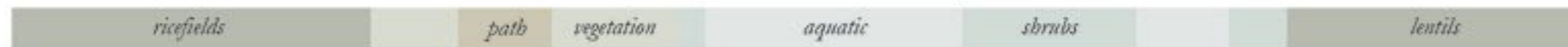
Secondary corridor
Existing



*Secondary corridor
alternative future for 2030*



Canale Regio Asigliano - 5 m



Oryza sativa

Cyprinus carpio

Cornus sanguinea

*Juncus
effusus*

Lens culinaris

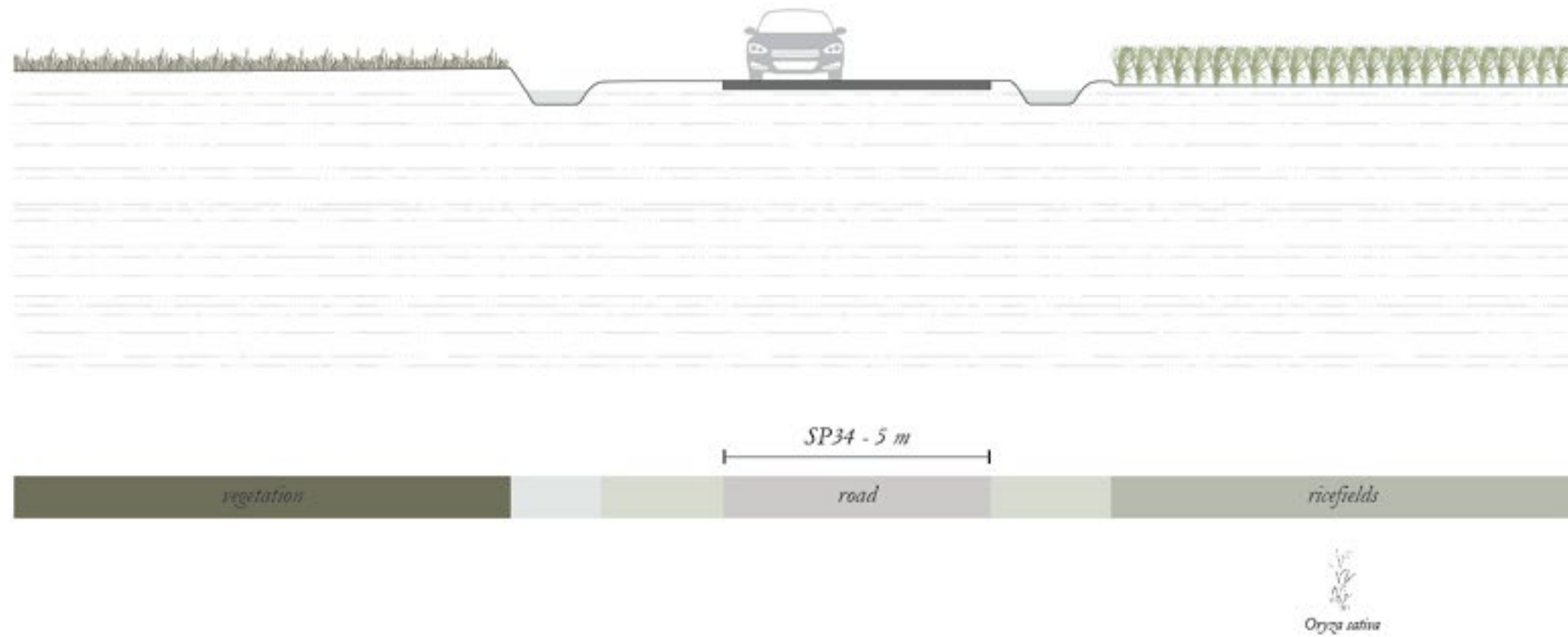
Rosa canina

*Carex
pseudocyperus*

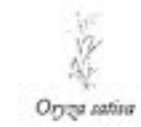
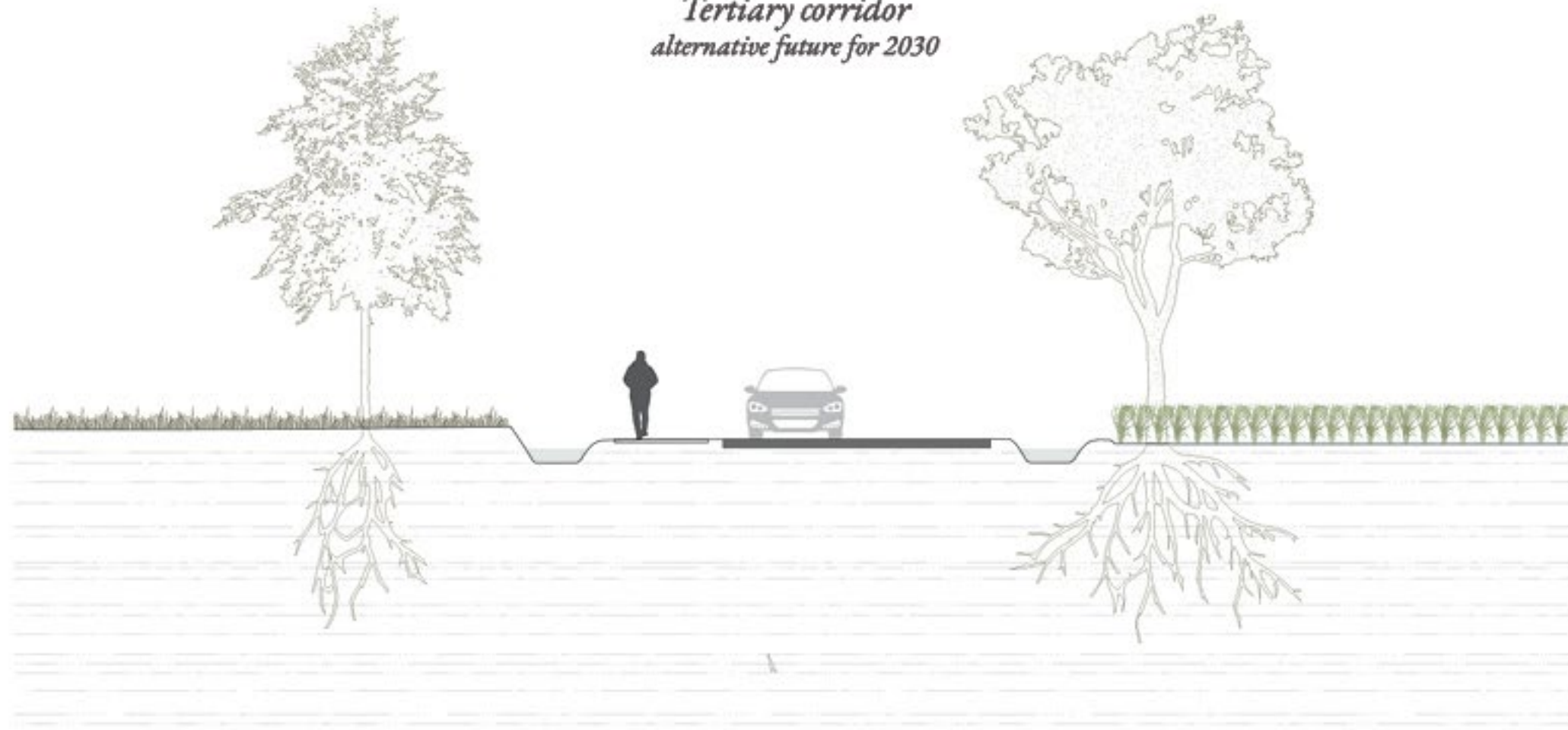
*Cyperus
erulentus*

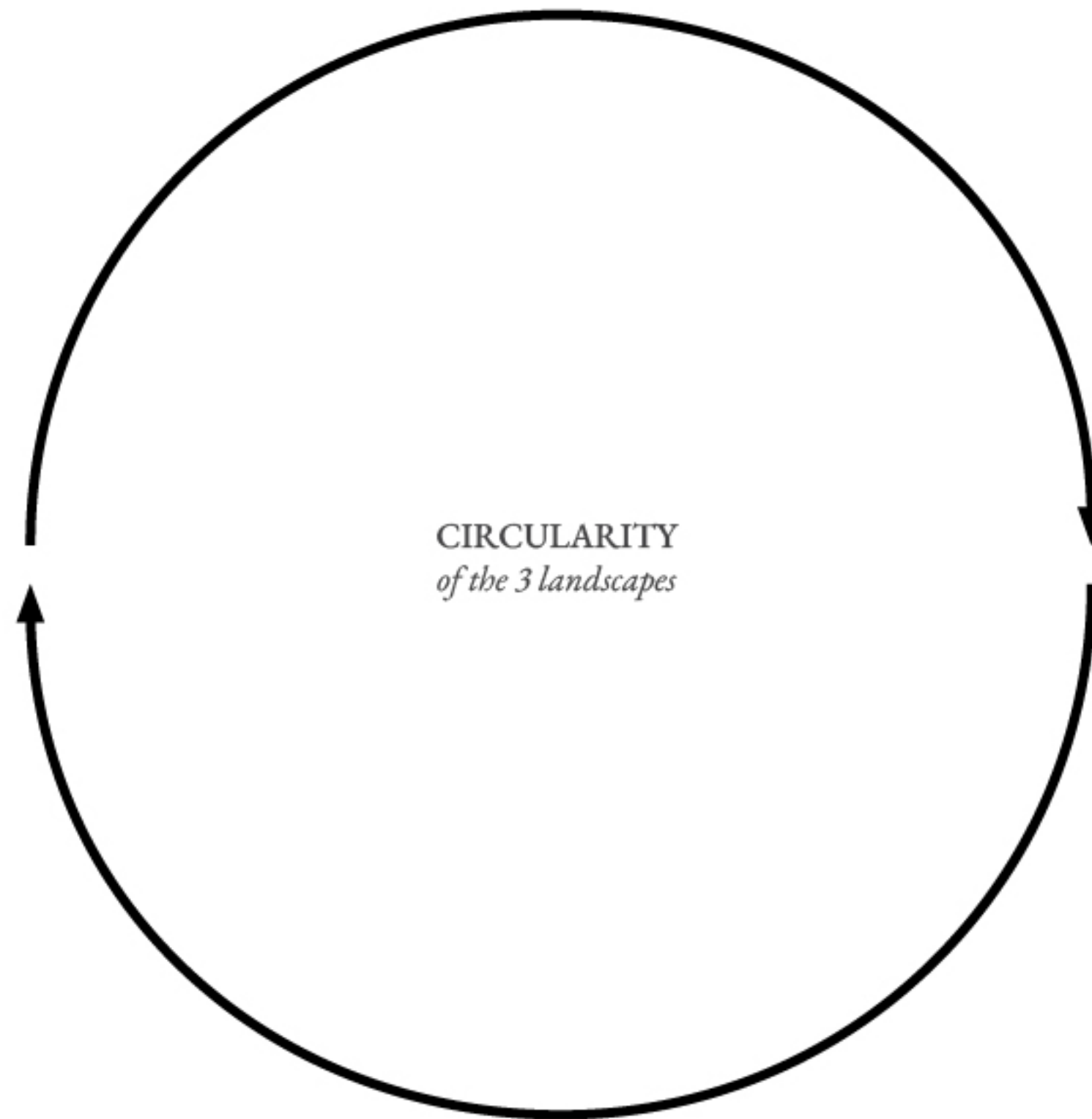
*Cyperus
glomeratus*

*Tertiary corridor
existing*

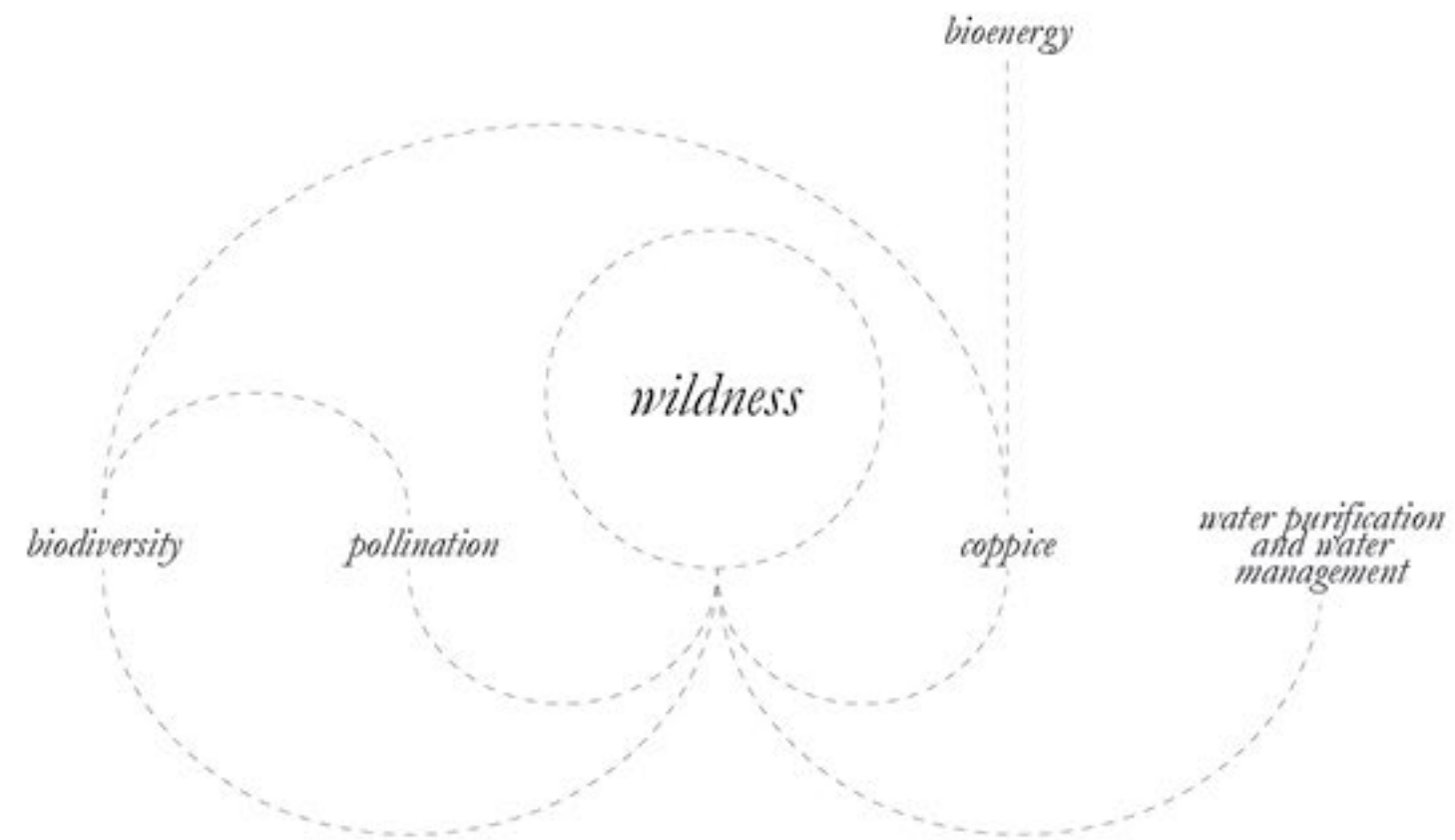


*Tertiary corridor
alternative future for 2030*

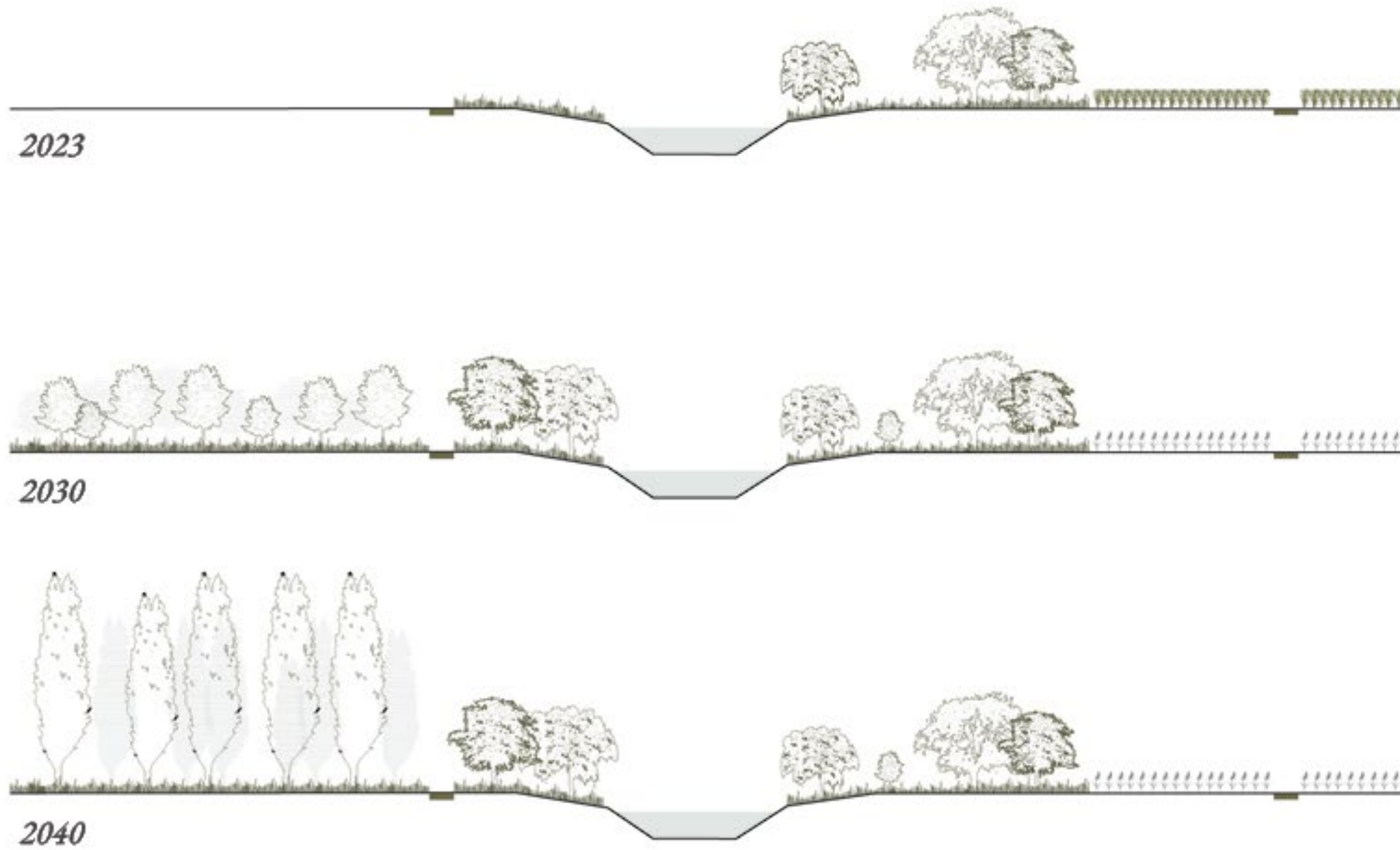




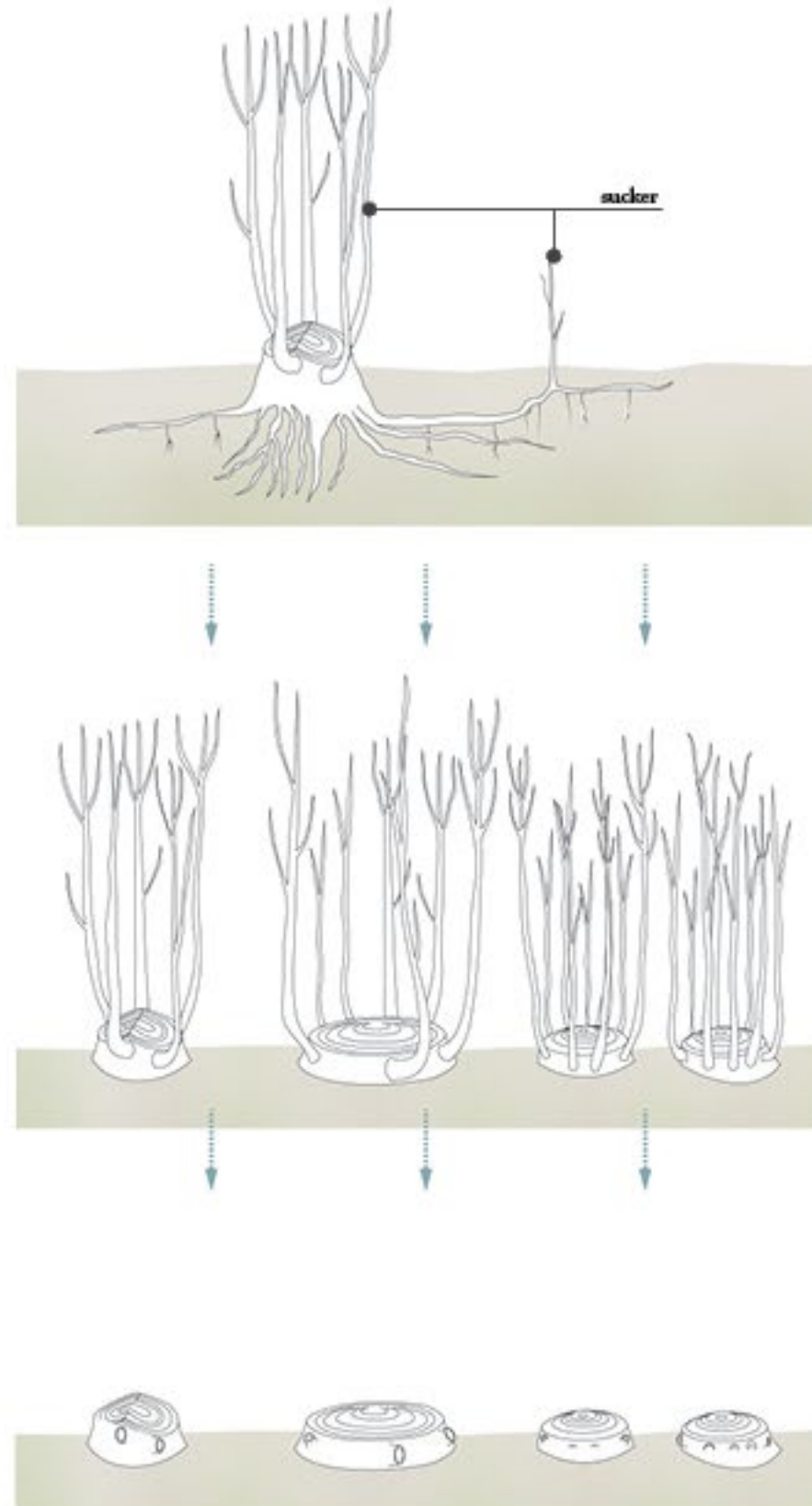
Landscape 1. Wilderness



Landscape 1. Wilderness

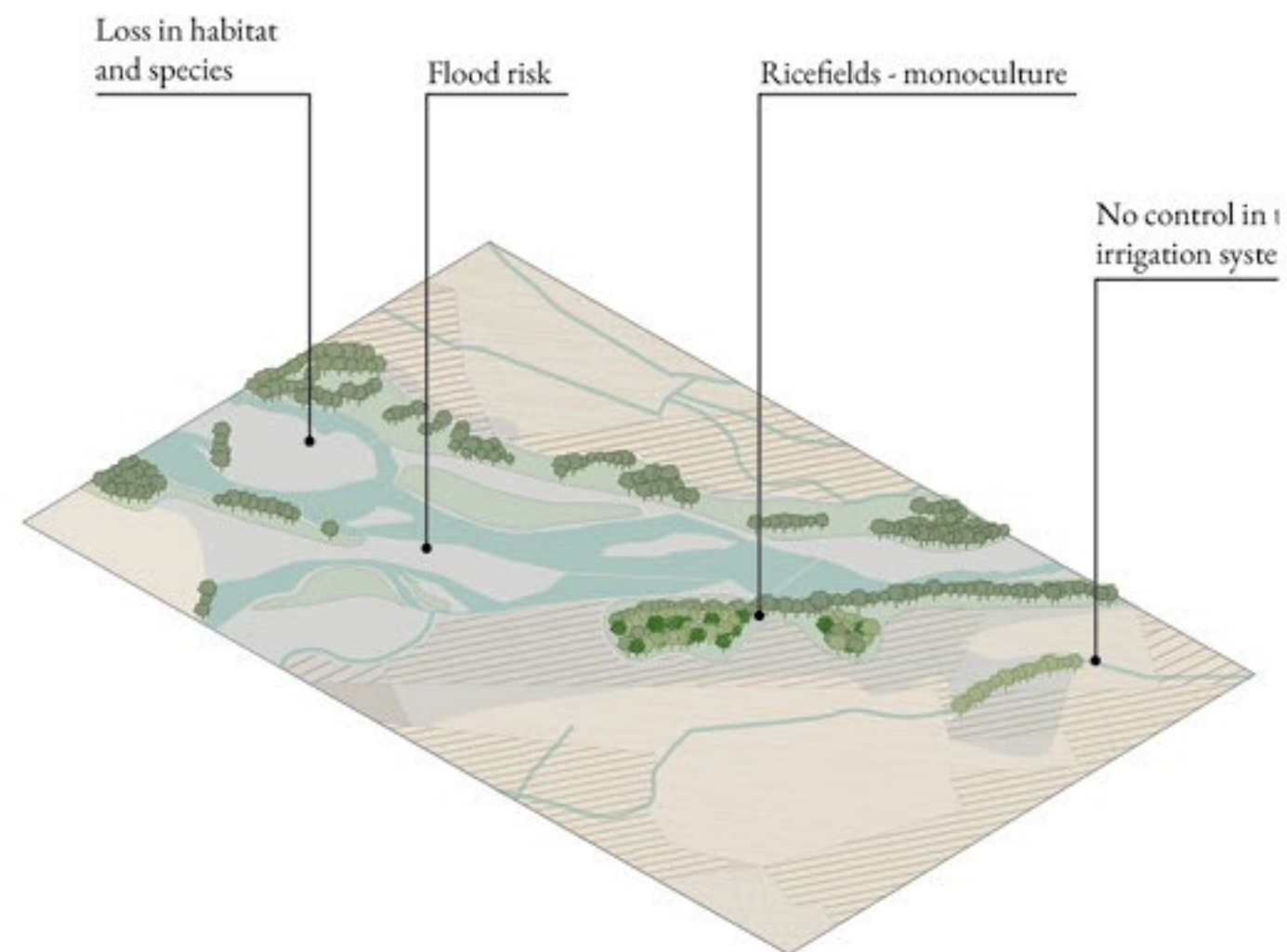


Landscape 1. Wilderness
coppice

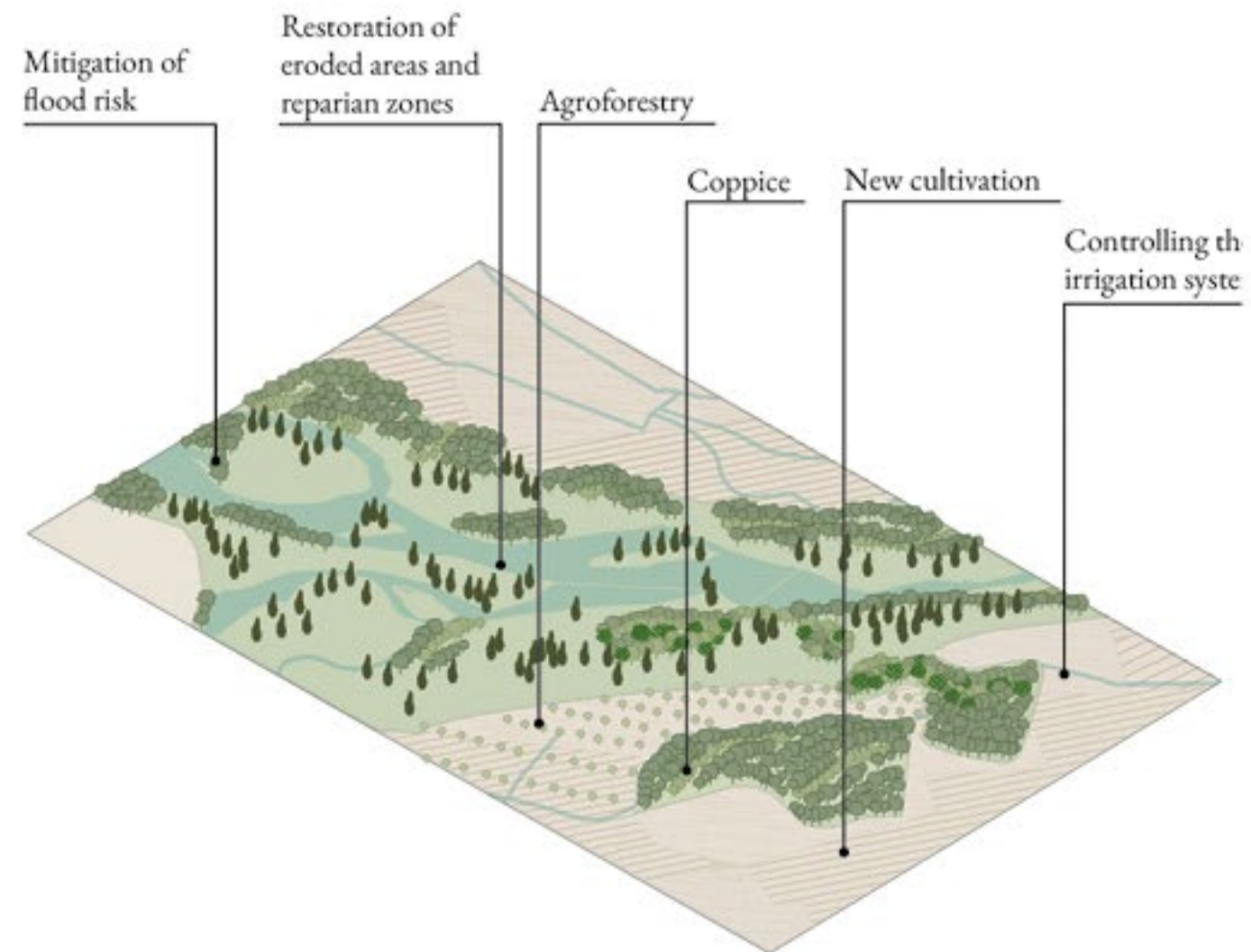


The rebirth of the resurgence belt

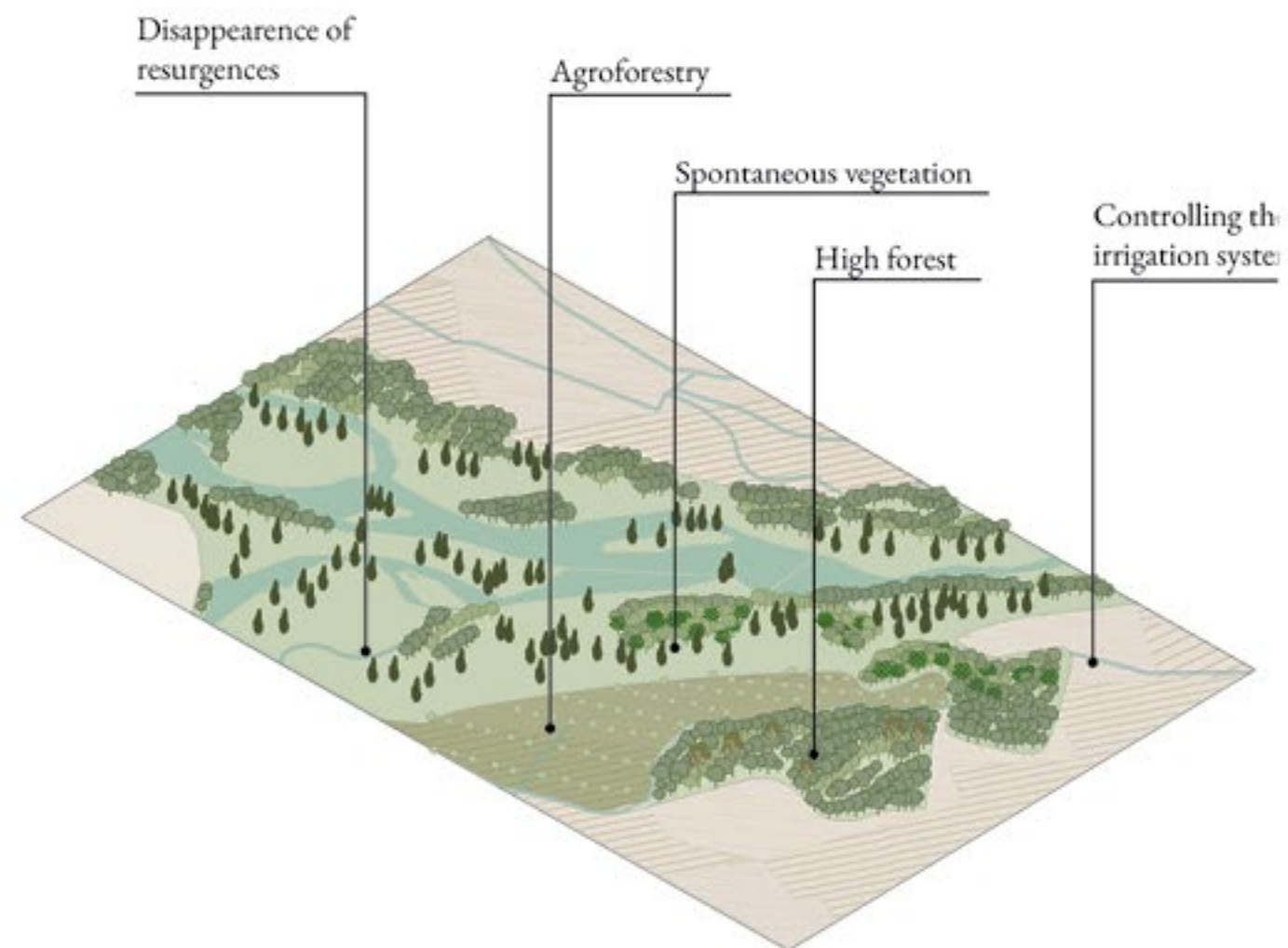
Wilderness
2023



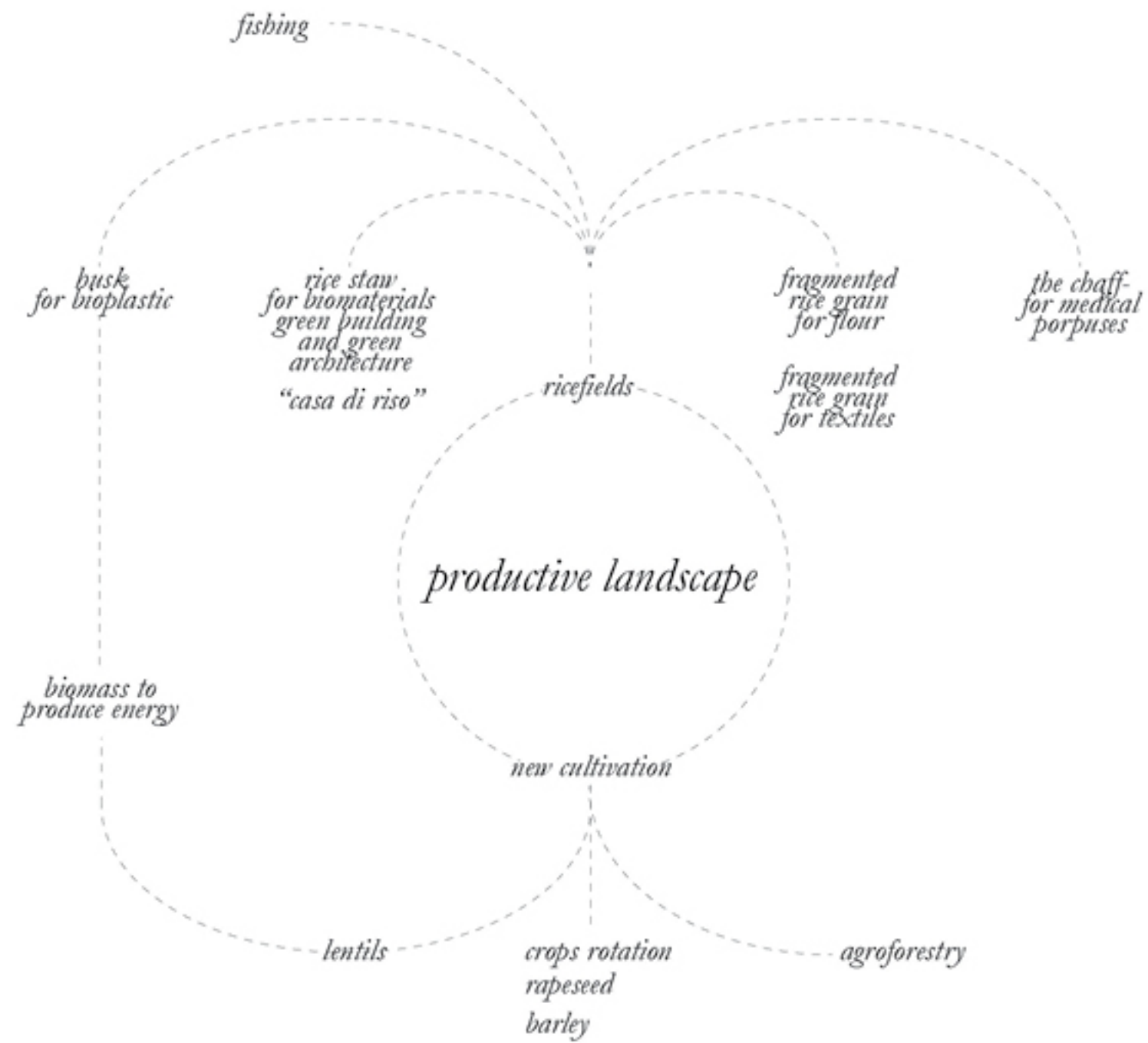
Wilderness
2030



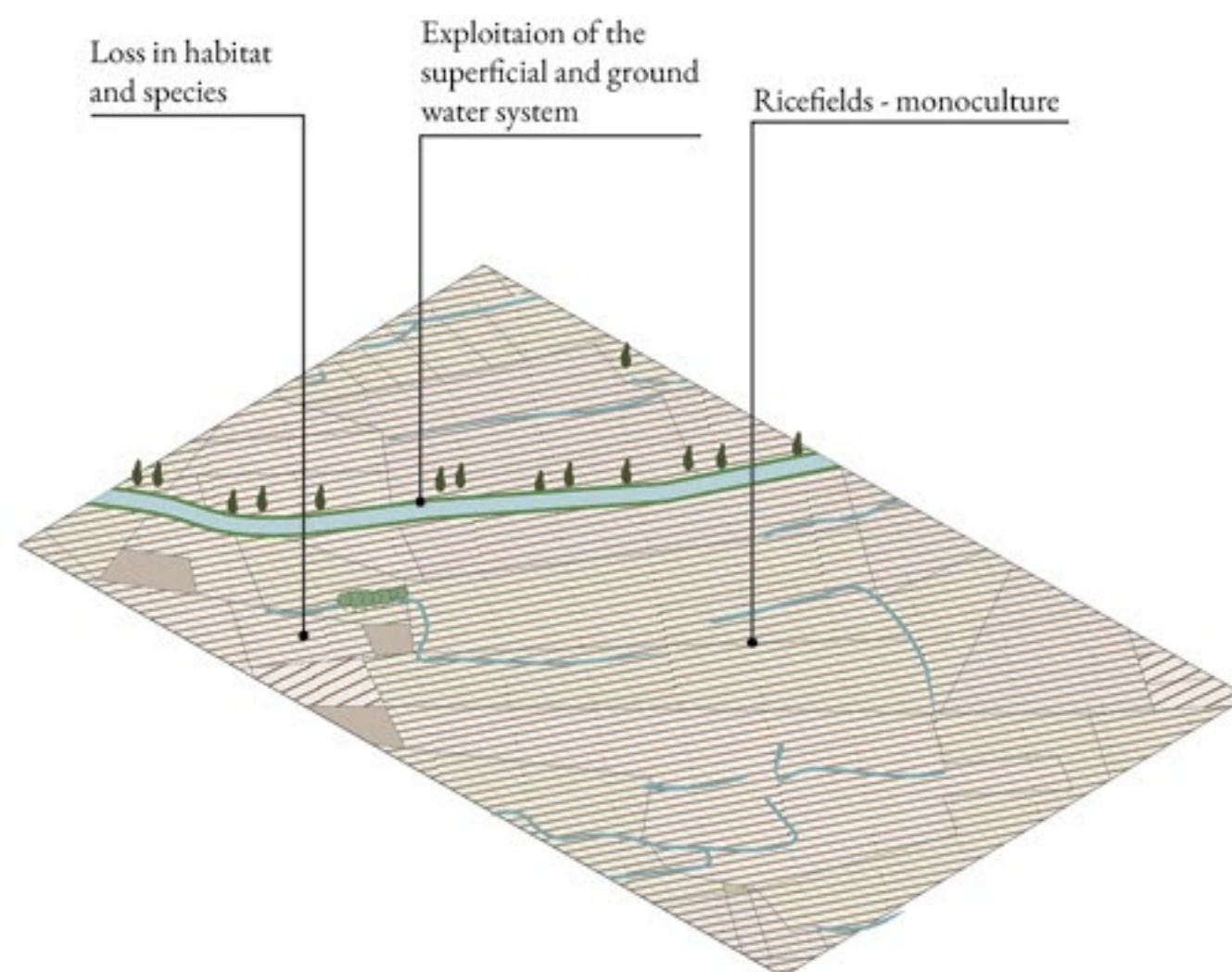
Wilderness
2040



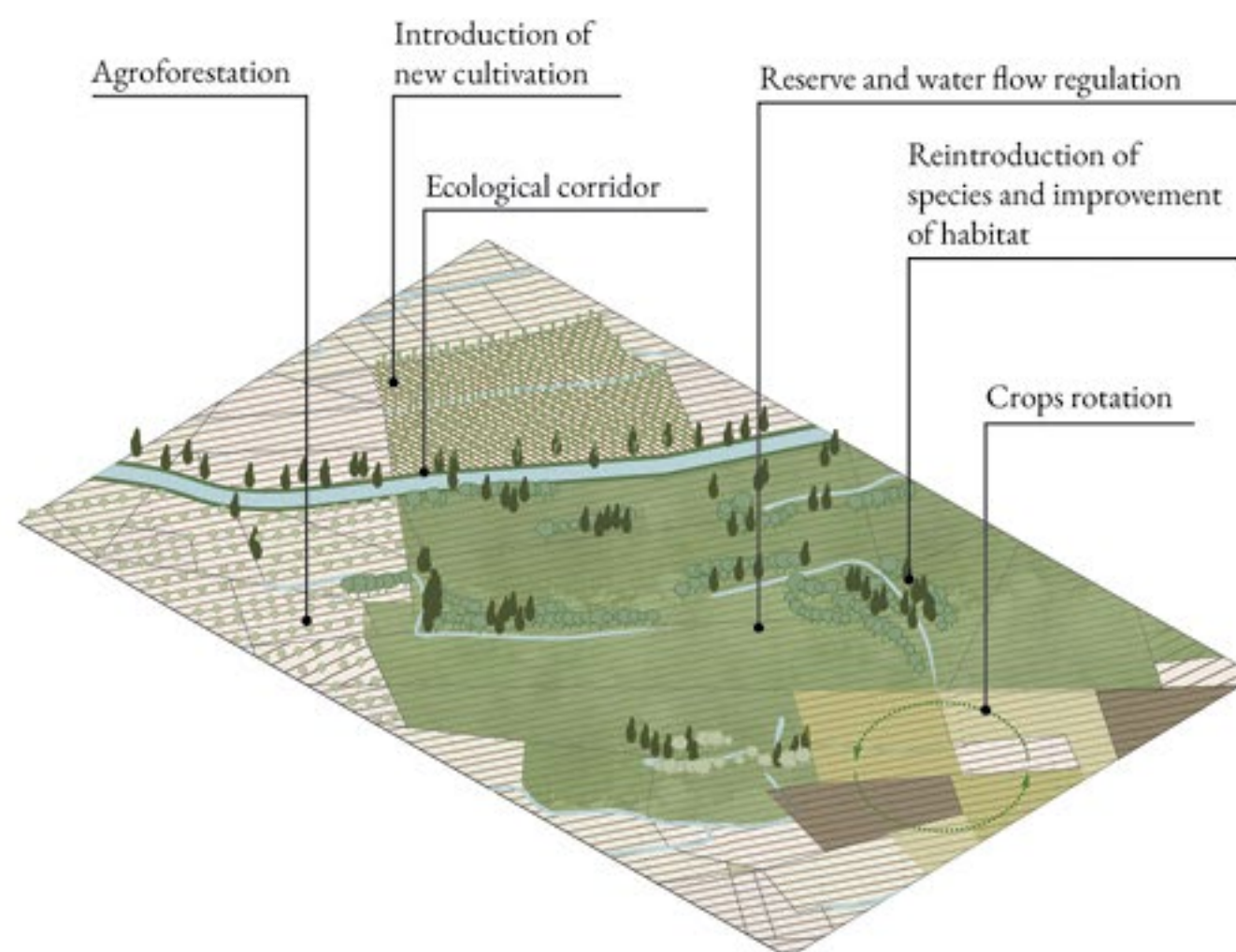
Landscape 2. Productive landscape



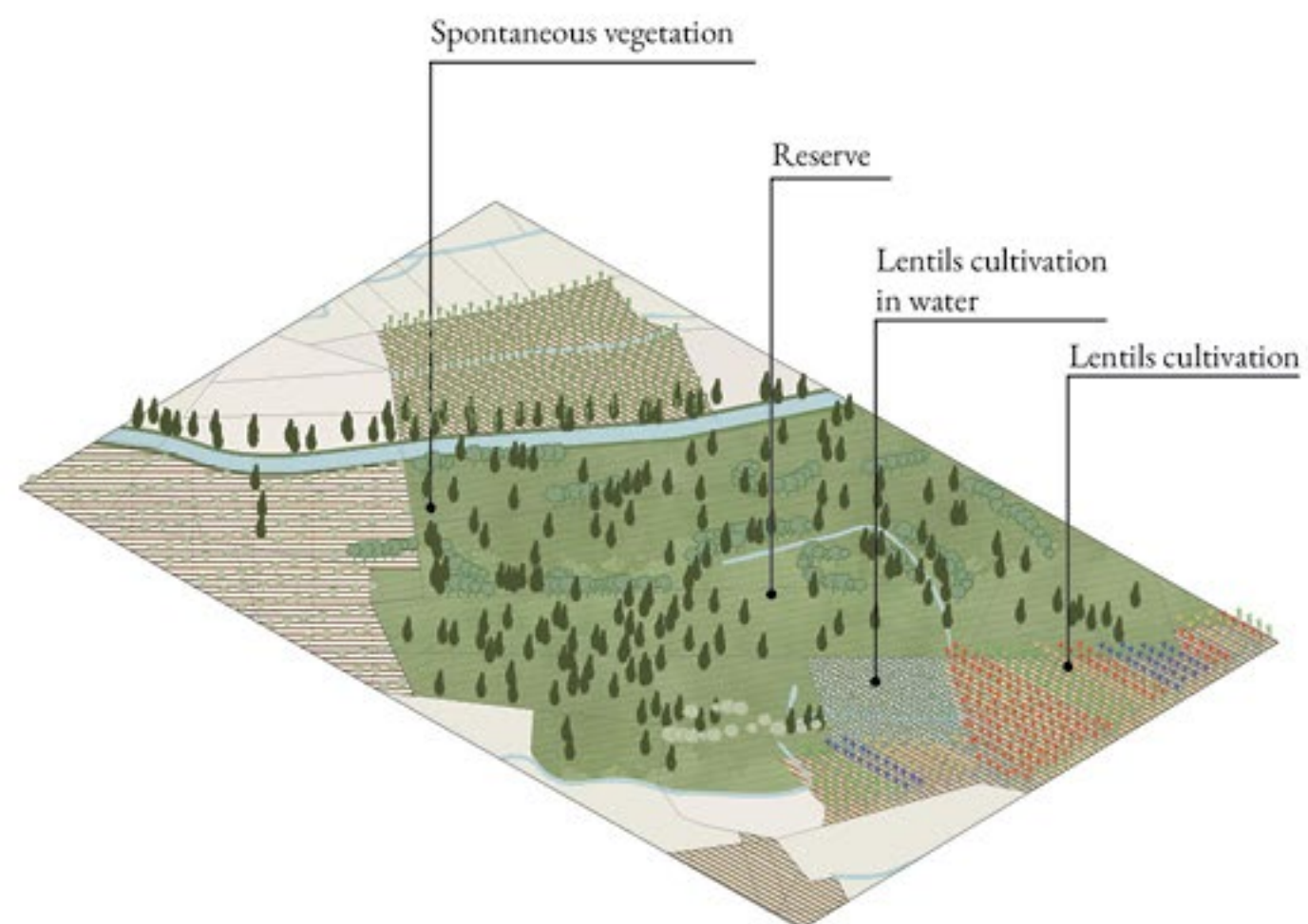
Productive landscape
2023



Productive landscape
2030



Productive landscape
2023



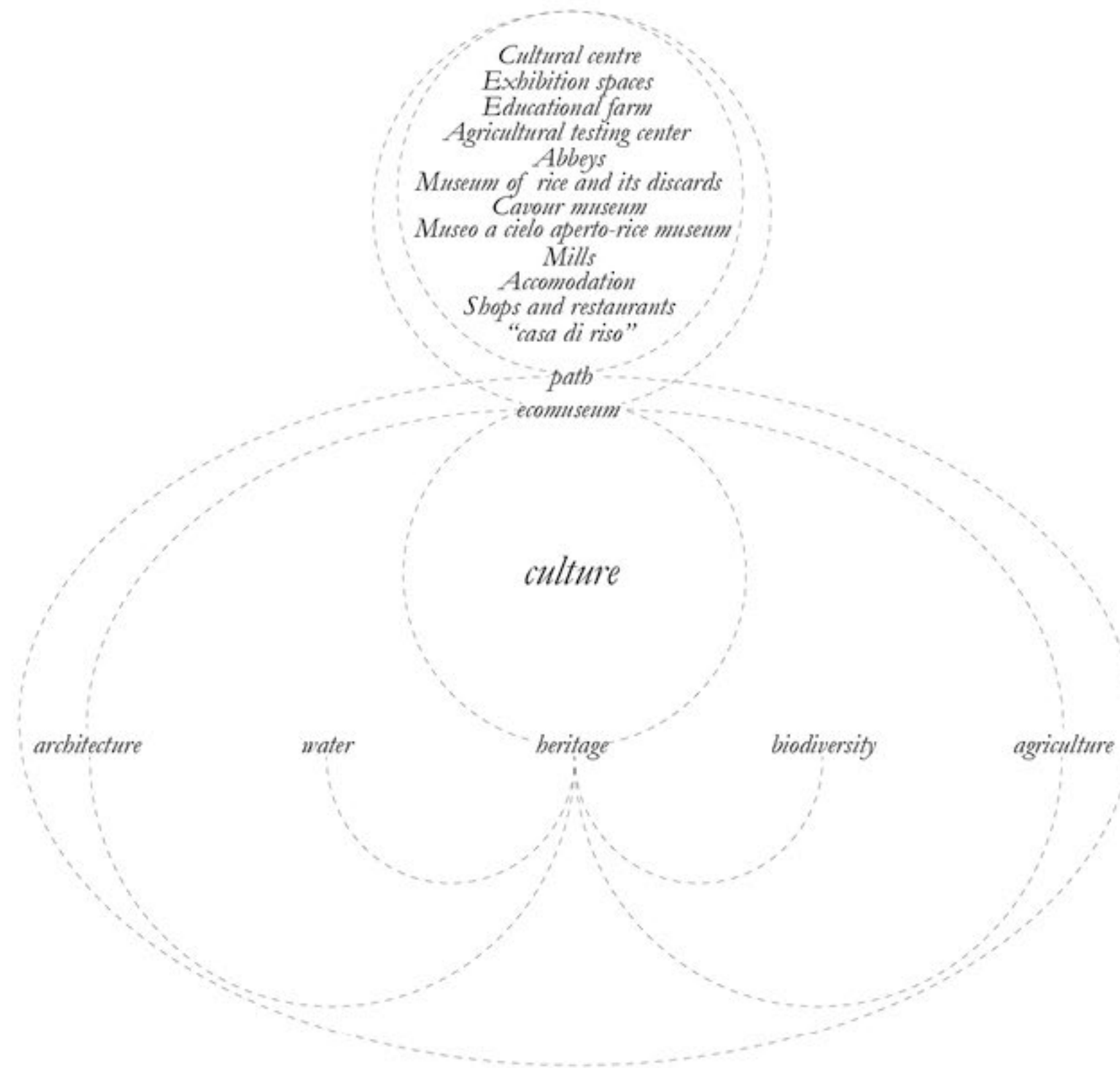
*Productive landscape
lentils alternative future for 2040*



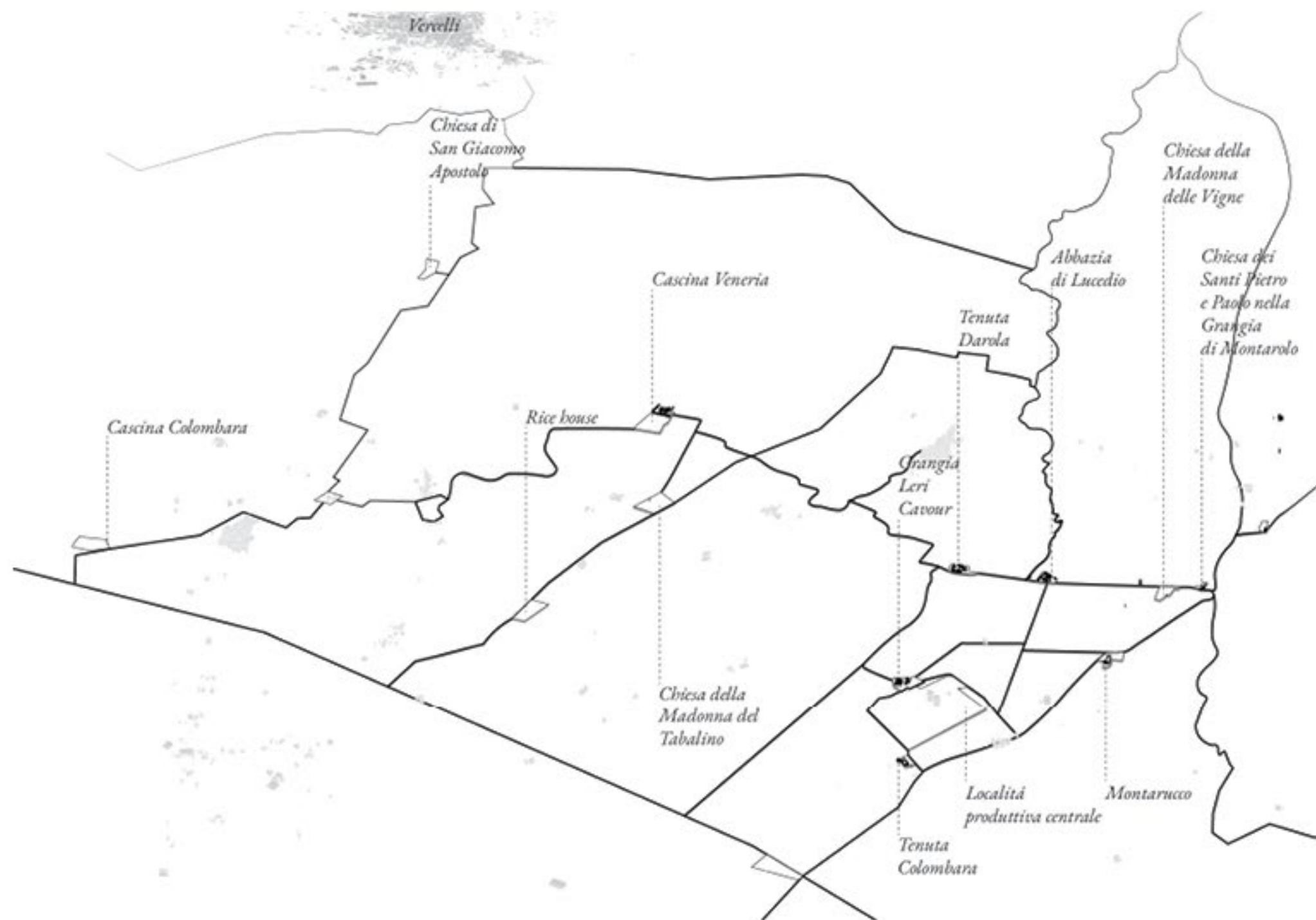
*Productive landscape
ricefields alternative future for 2040*



Landscape 3. Culture



Culture
route for the alternative future



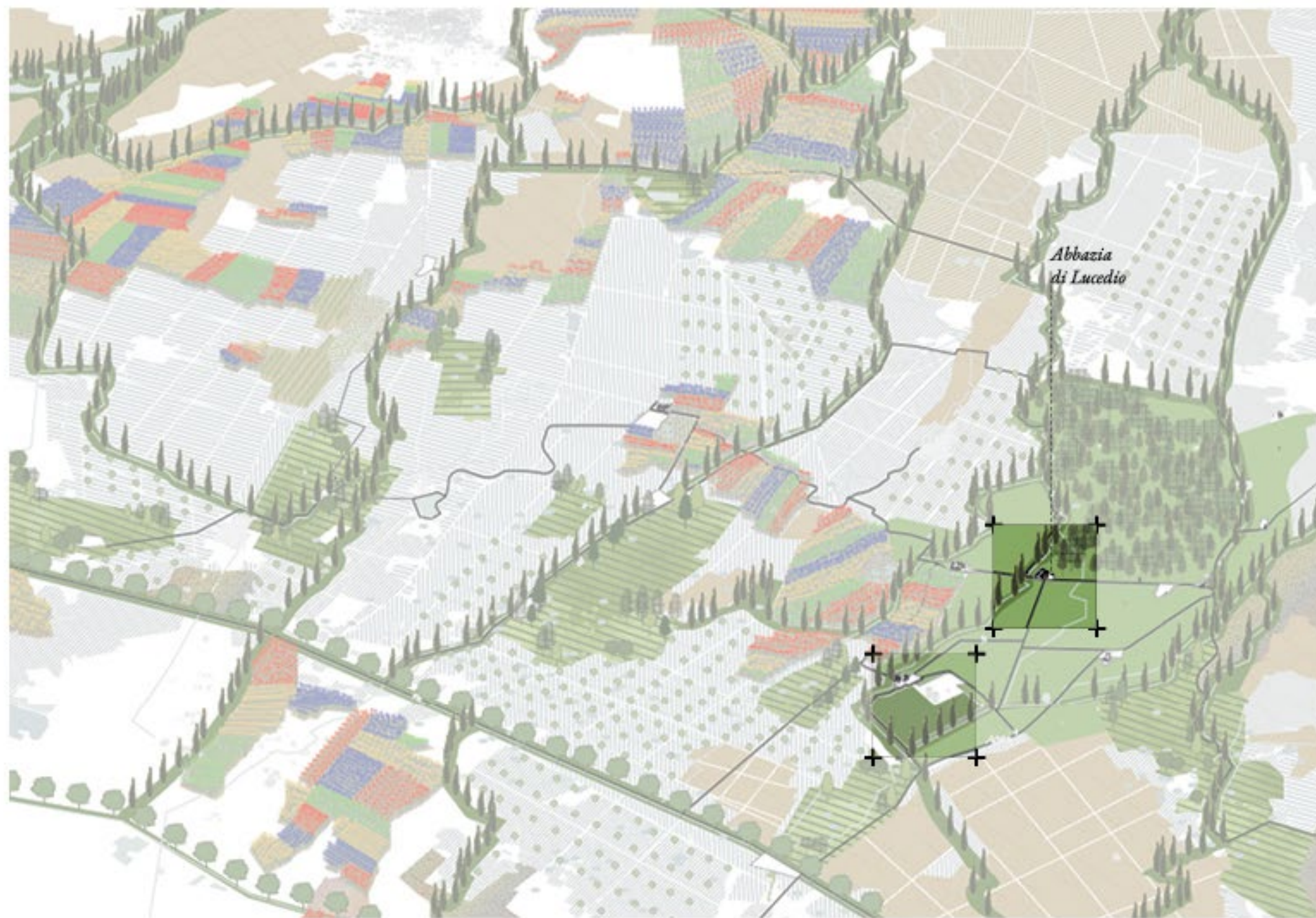
*Culture and wilderness
route for the alternative future*



*Culture, wilderness and agriculture
route for the alternative future*



*Culture, wilderness and agriculture
elements - Abbazia di Lucedio*



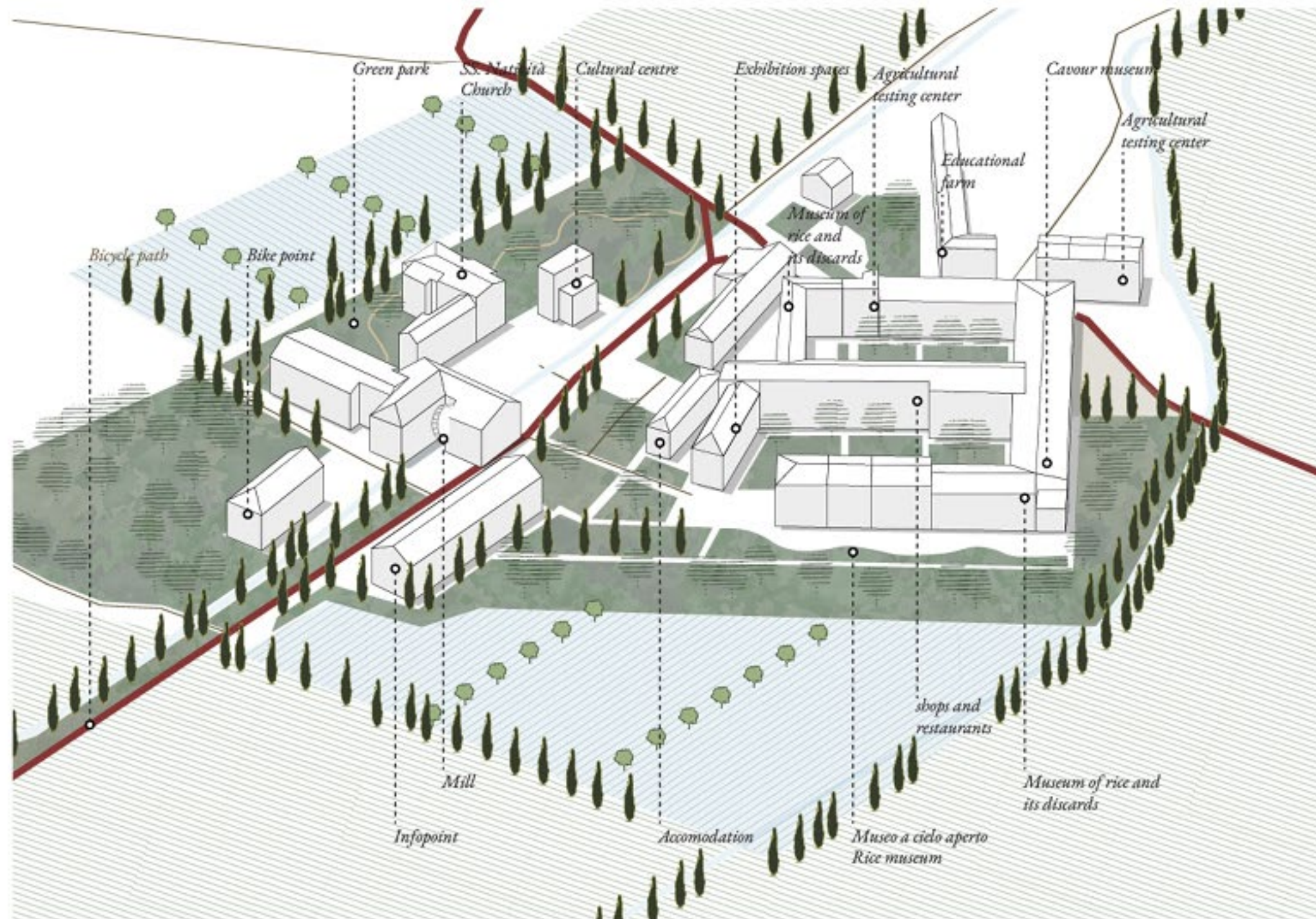
Abbazia di Lucedio



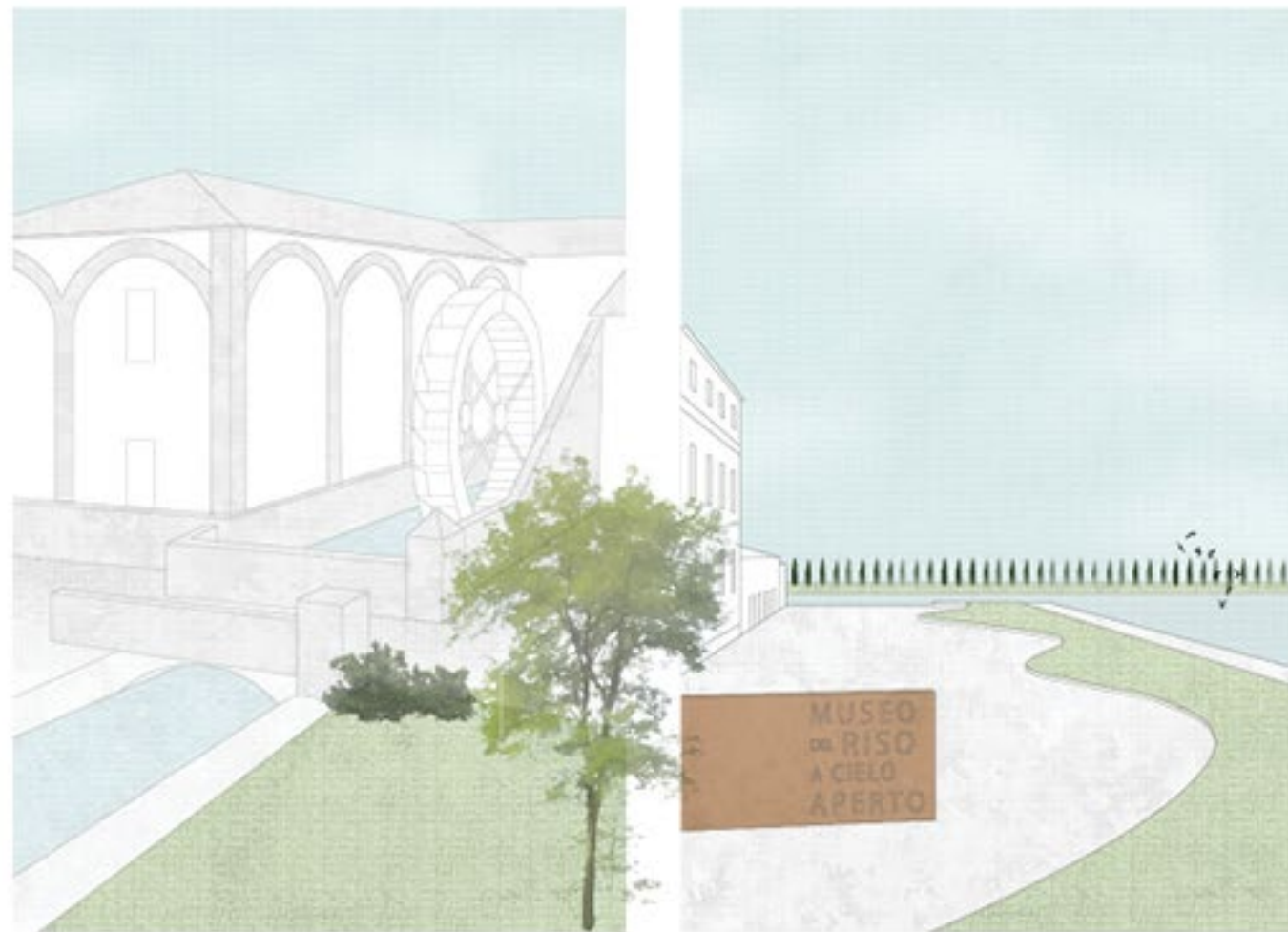
Culture, wilderness and agriculture
elements - Grangia Leri Cavour



Grangia Leri Cavour



Grangia Leri Cavour



Galileo Ferraris - the green factory



Galileo Ferraris - the green factory







Thank you!