

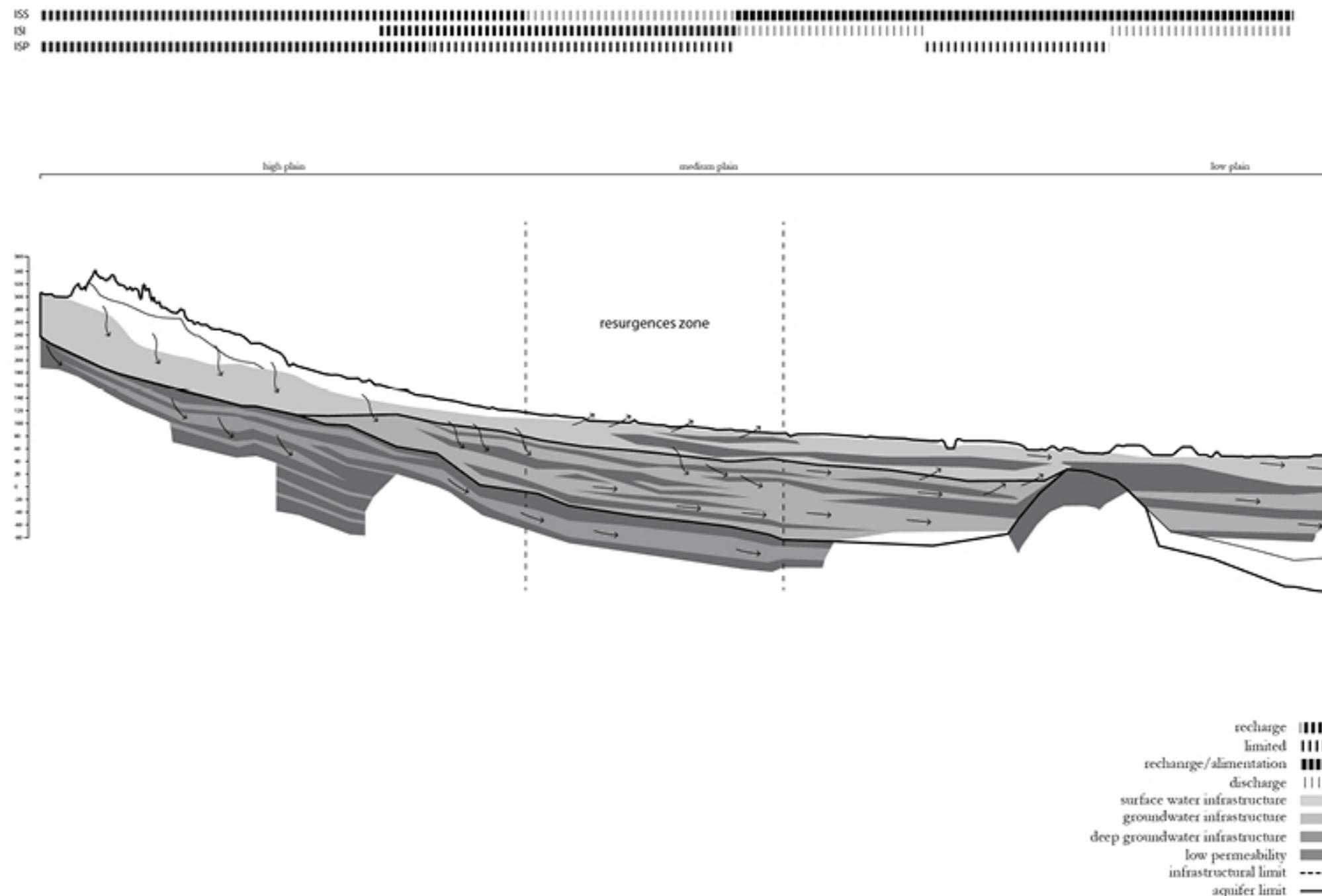


*The rebirth of the resurgence belt:
the floodplain as a complex human-water system*

The Po Valley



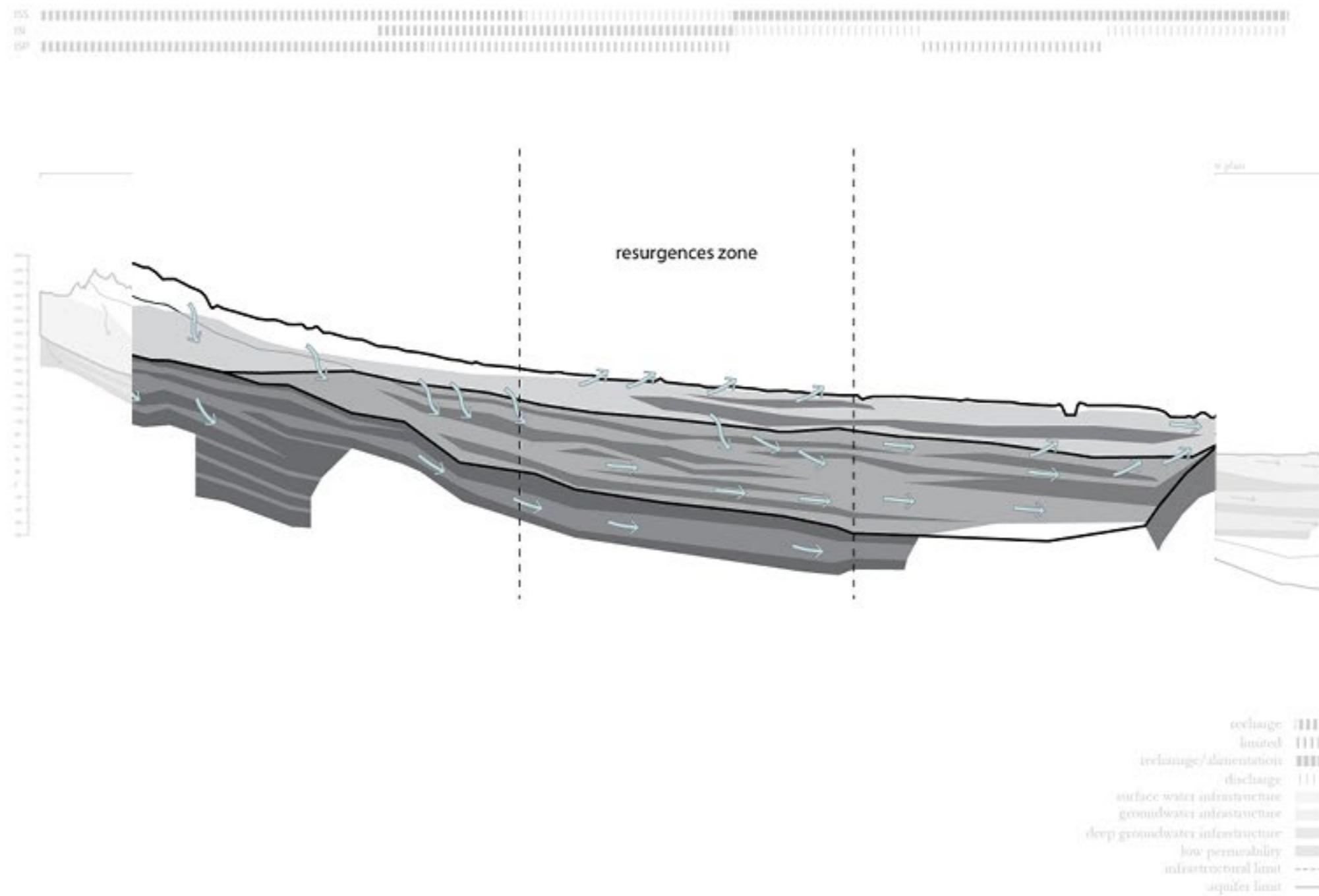
Formation of resurgences



Source: Progetto di accompagnamento e 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

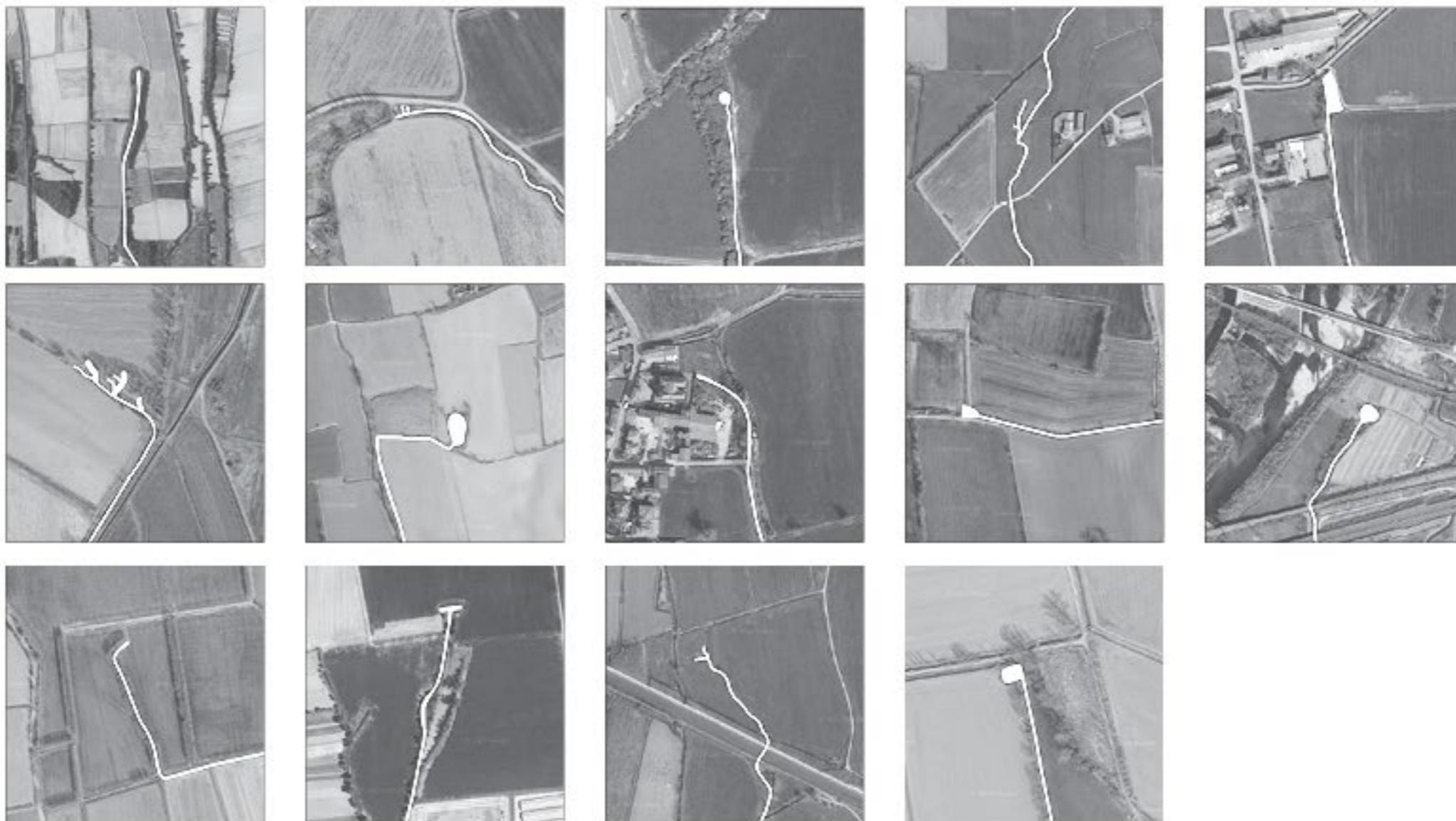
A resurgence



The anatomy of a resurgence



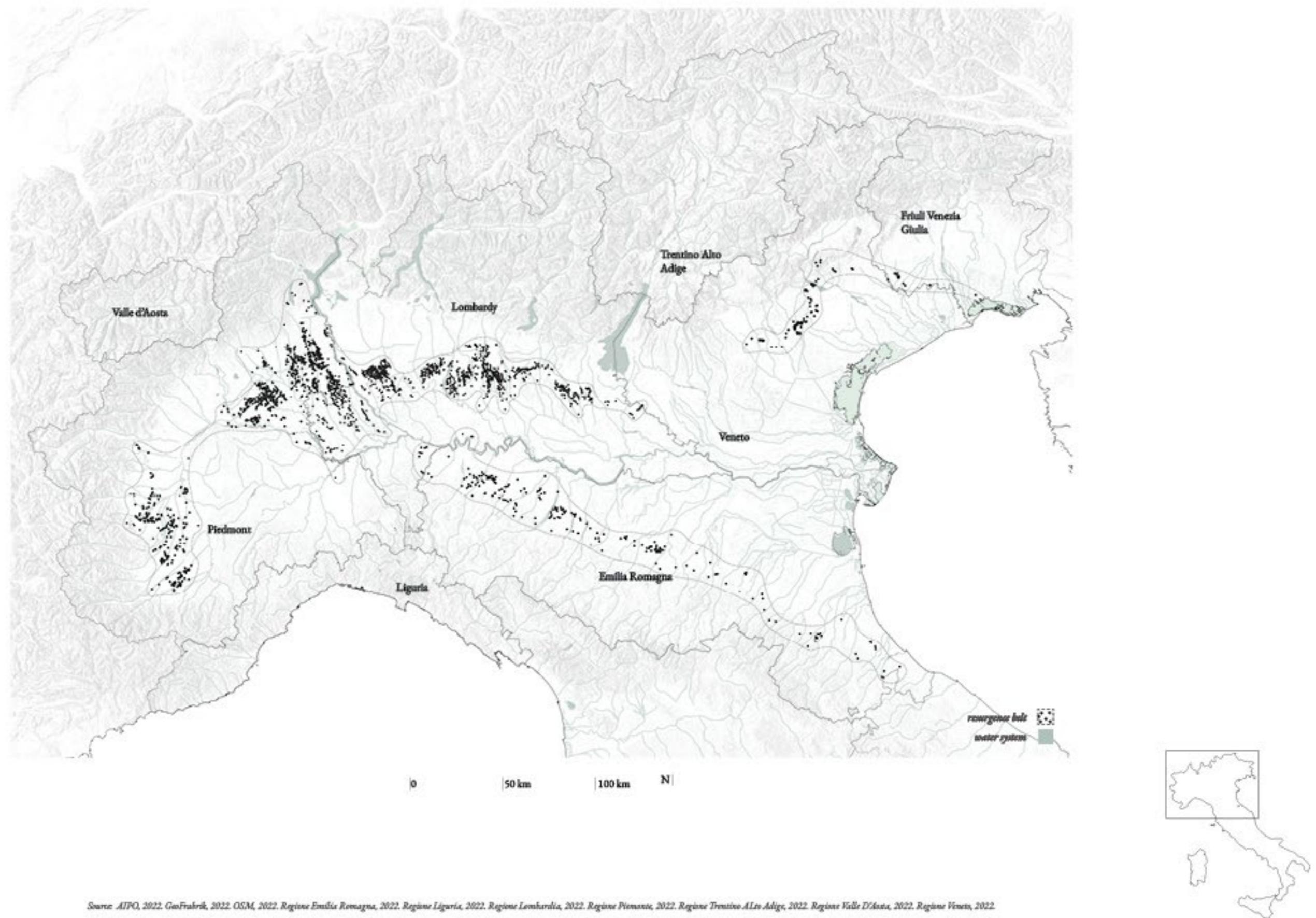
The shapes of resurgences



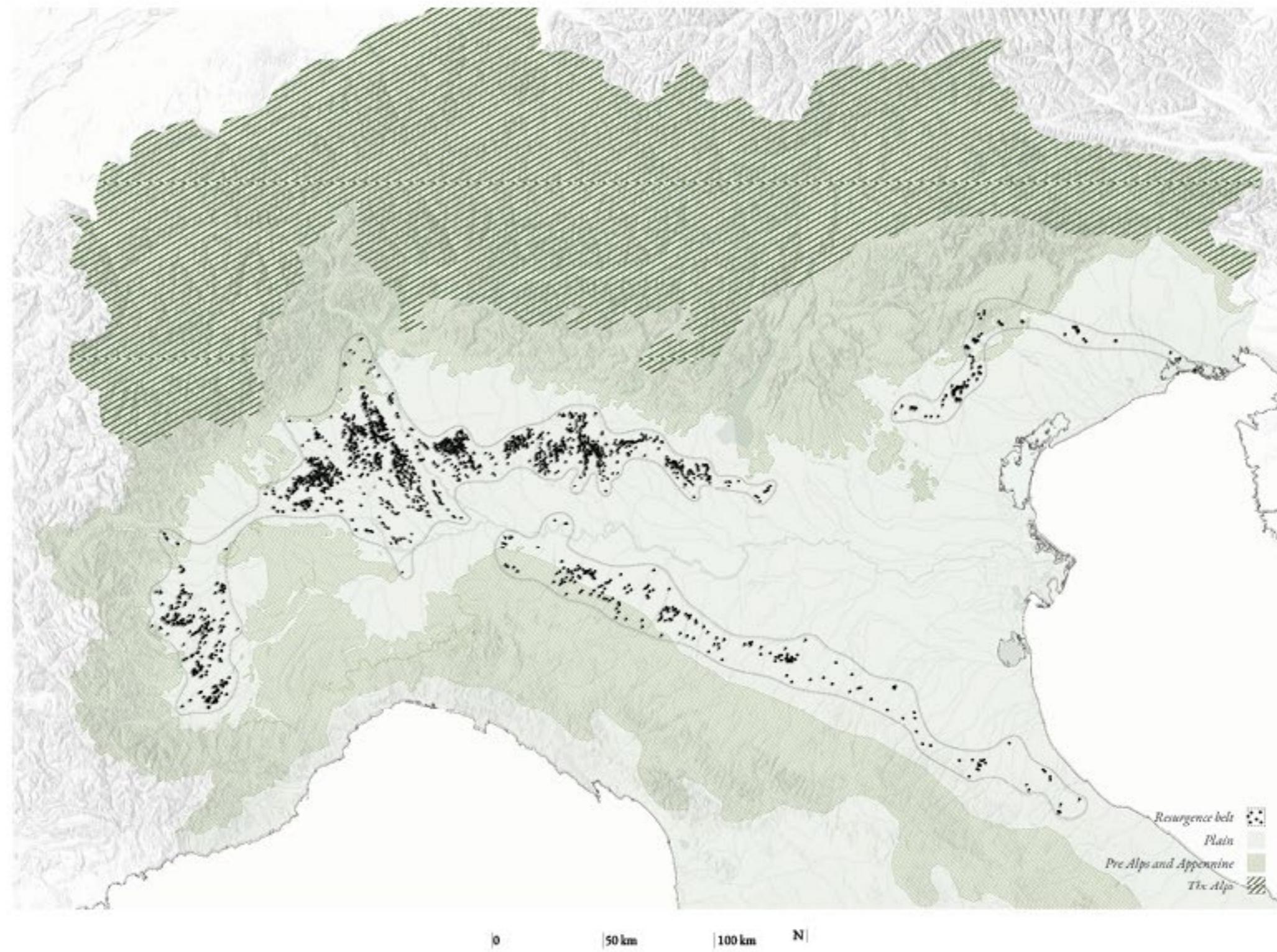
Source: Google Earth, 2022. Regione Emilia Romagna, 2022. Regione Liguria, 2022. Regione Lombardia, 2022. Regione Piemonte, 2022. Regione Trentino Alto Adige, 2022. Regione Valle D'Aosta, 2022. Regione Veneto, 2022.

The rebirth of the resurgence belt

Regions crossed by resurgences



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 rebirth of the resurgence belt



The landscapes of resurgences



The rebirth of the resurgence belt

The landscapes of resurgences



Source: Riserva San Massimo. Source <http://riservasanmassimo.net/il-ciclo-dell'acqua/>

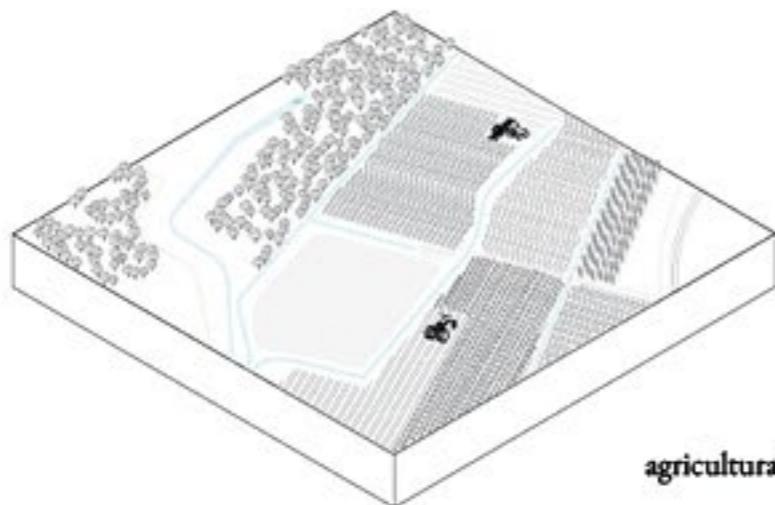
The rebirth of the resurgence belt

The landscapes of resurgences



The rebirth of the resurgence belt

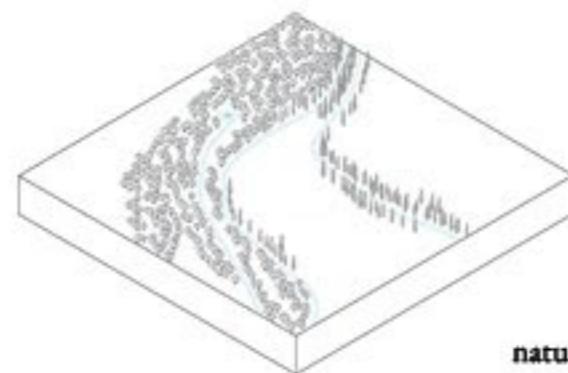
Resurgences as main irrigation sources



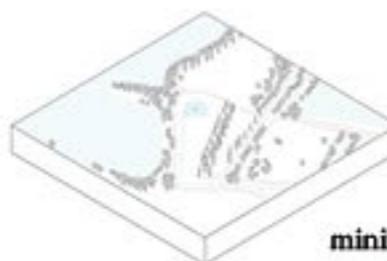
agricultural area: 82,5 %



industrial area: 4 %



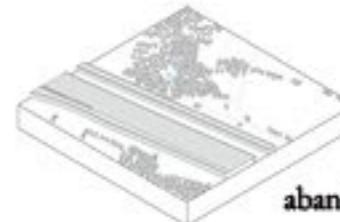
natural area: 4,4 %



mining area



urban area: 8 %



abandoned area

Source: Google Earth, 2022

The rebirth of the resurgence belt

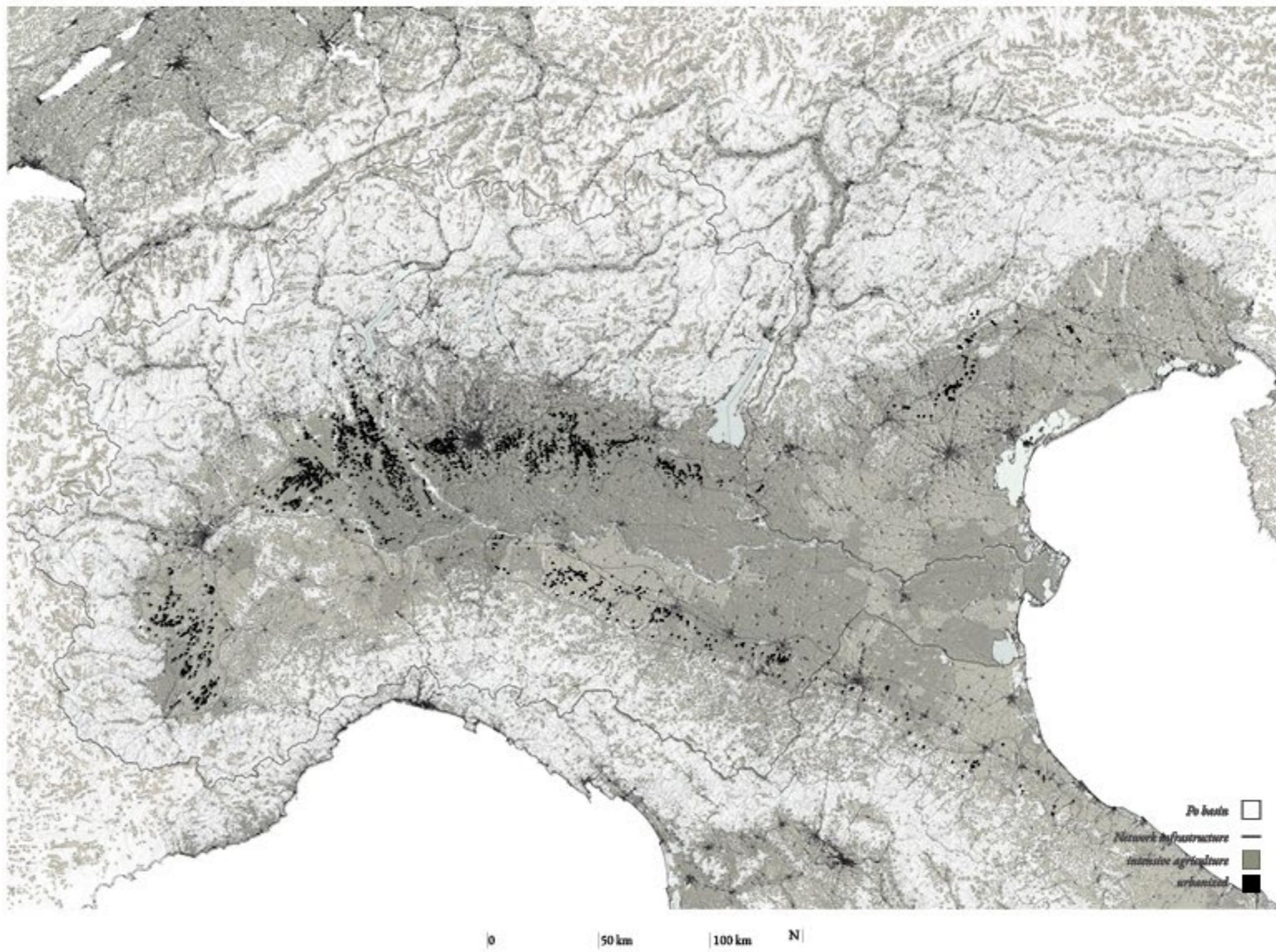
Garden of Europe and Christianity



SOURCE: Pertengo, Santuario della Madonna d'Orsha. SOURCE: Finestre sull'Arte. (2022)

The rebirth of the resurgence belt

Urbanization phenomena

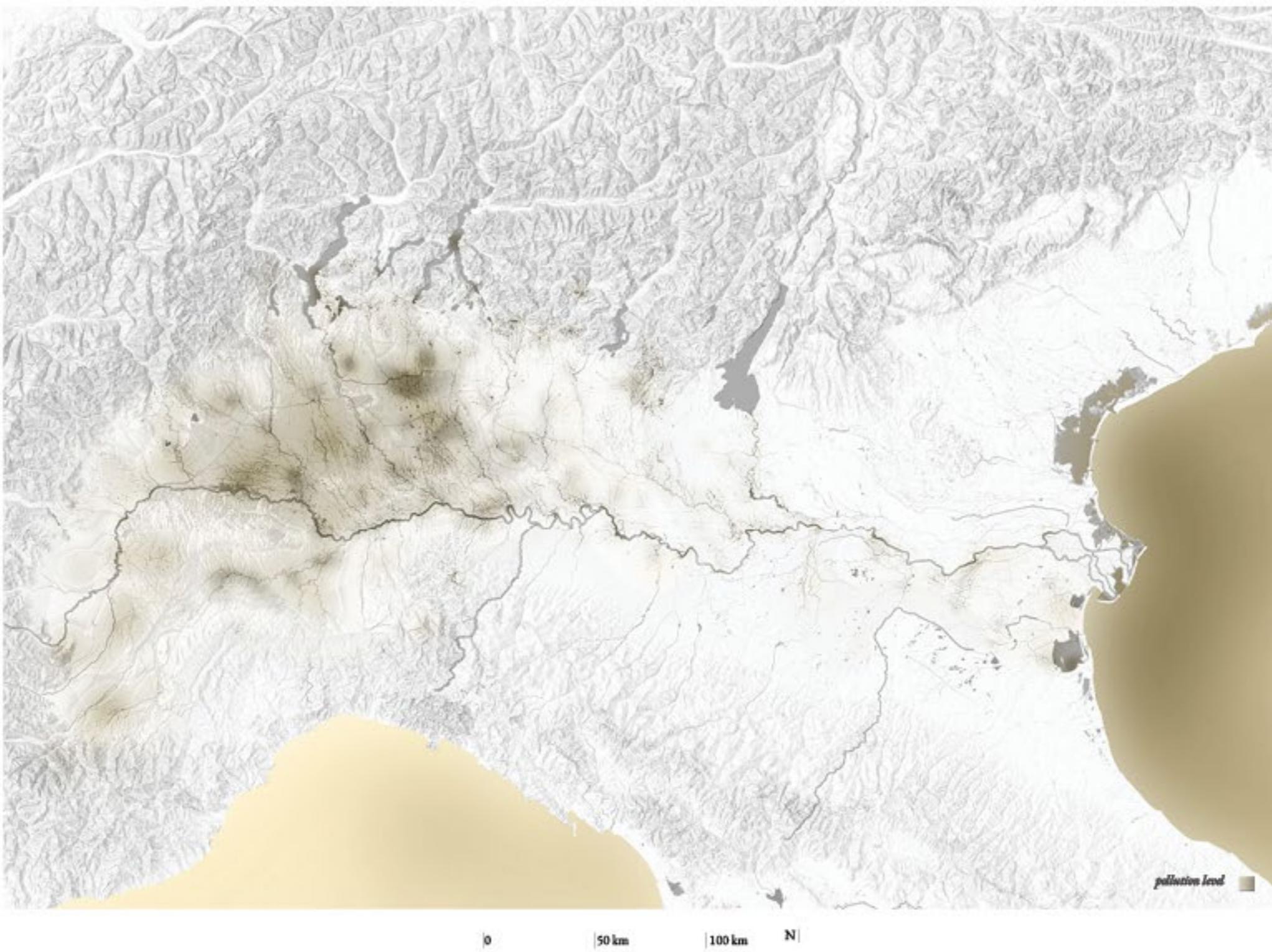


Source: AIPO, 2022. GeoFuturaE, 2022. OSM, 2022.

The rebirth of the resurgence belt



Pollution levels

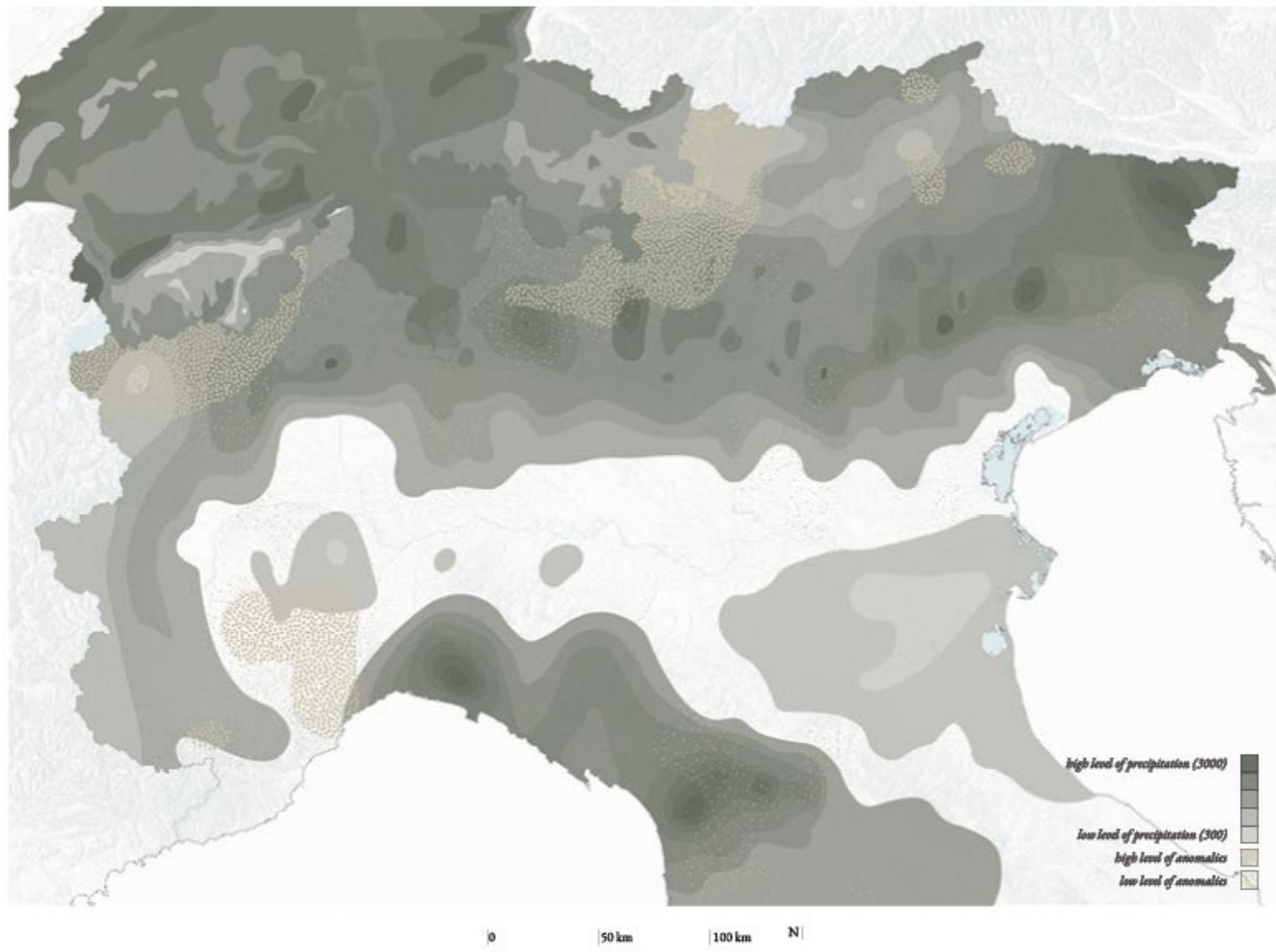


Sources: Elevation/World_Hillshade, 2022. OpenStreetMap, 2022. AIPO, 2022. Copernicus Marine Service, 2022.

The rebirth of the resurgence belt



The precipitation tragedy

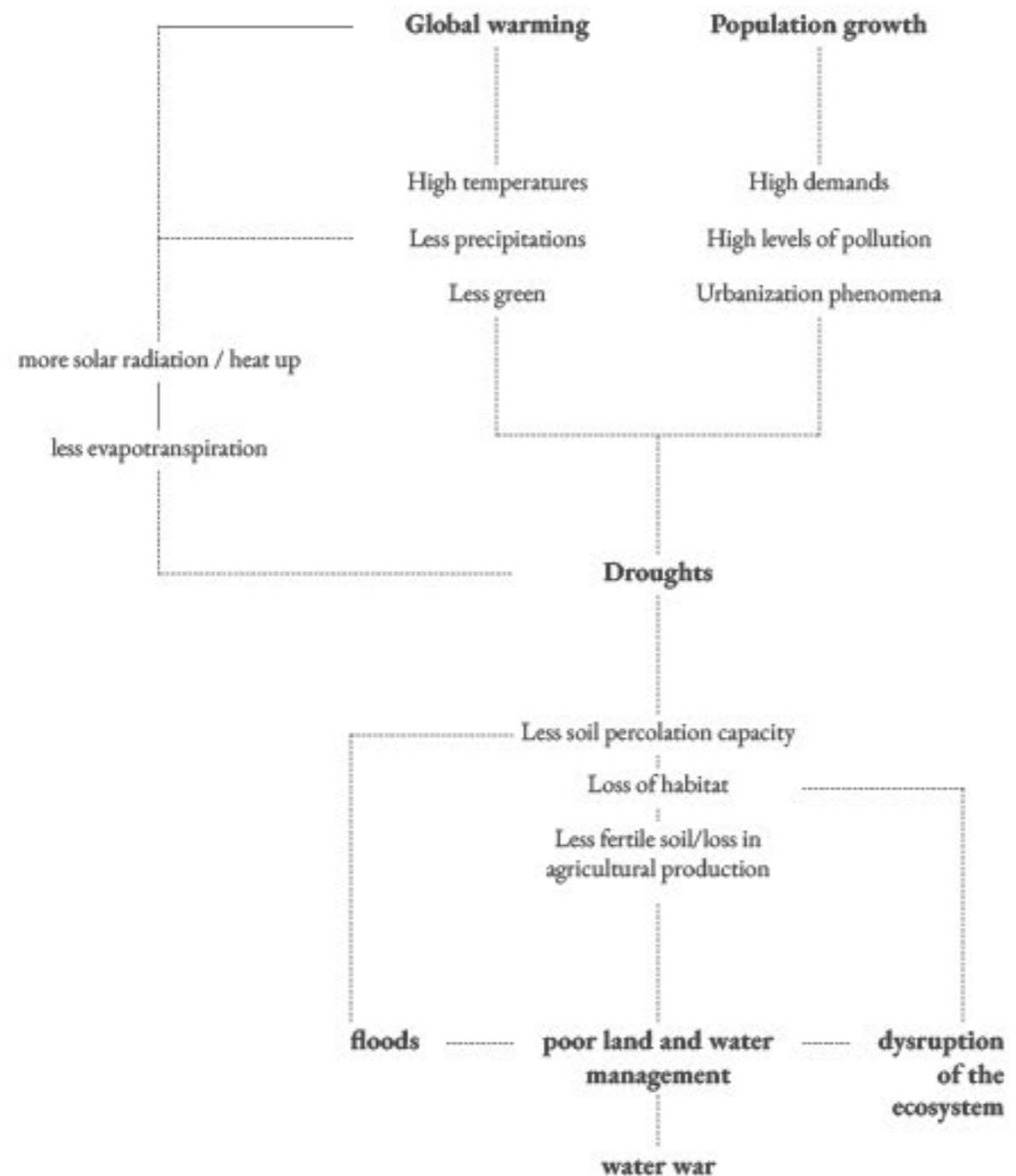


Source: Copernicus, 2022

The rebirth of the resurgence belt



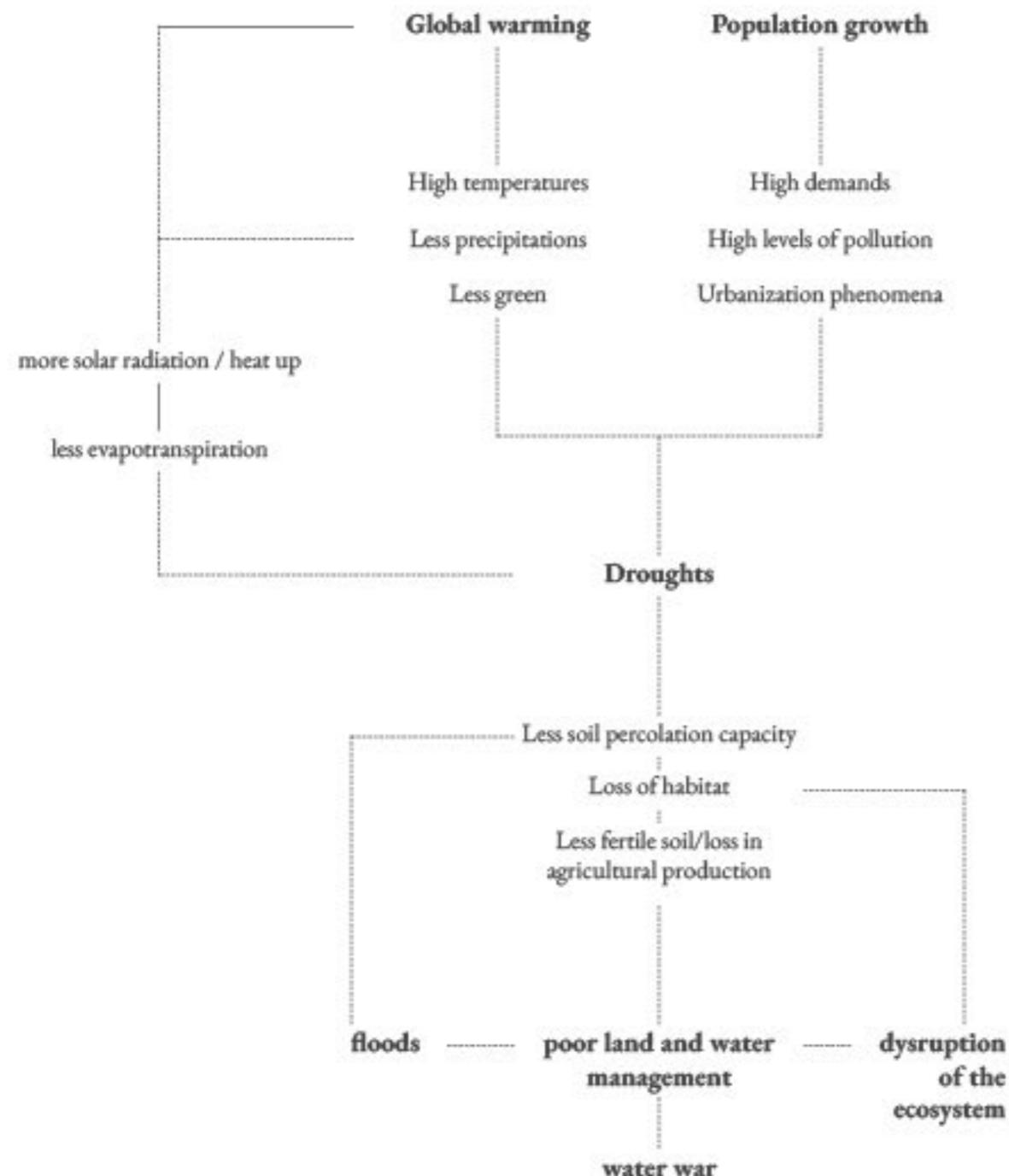
The vicious cycle of a system in crisis



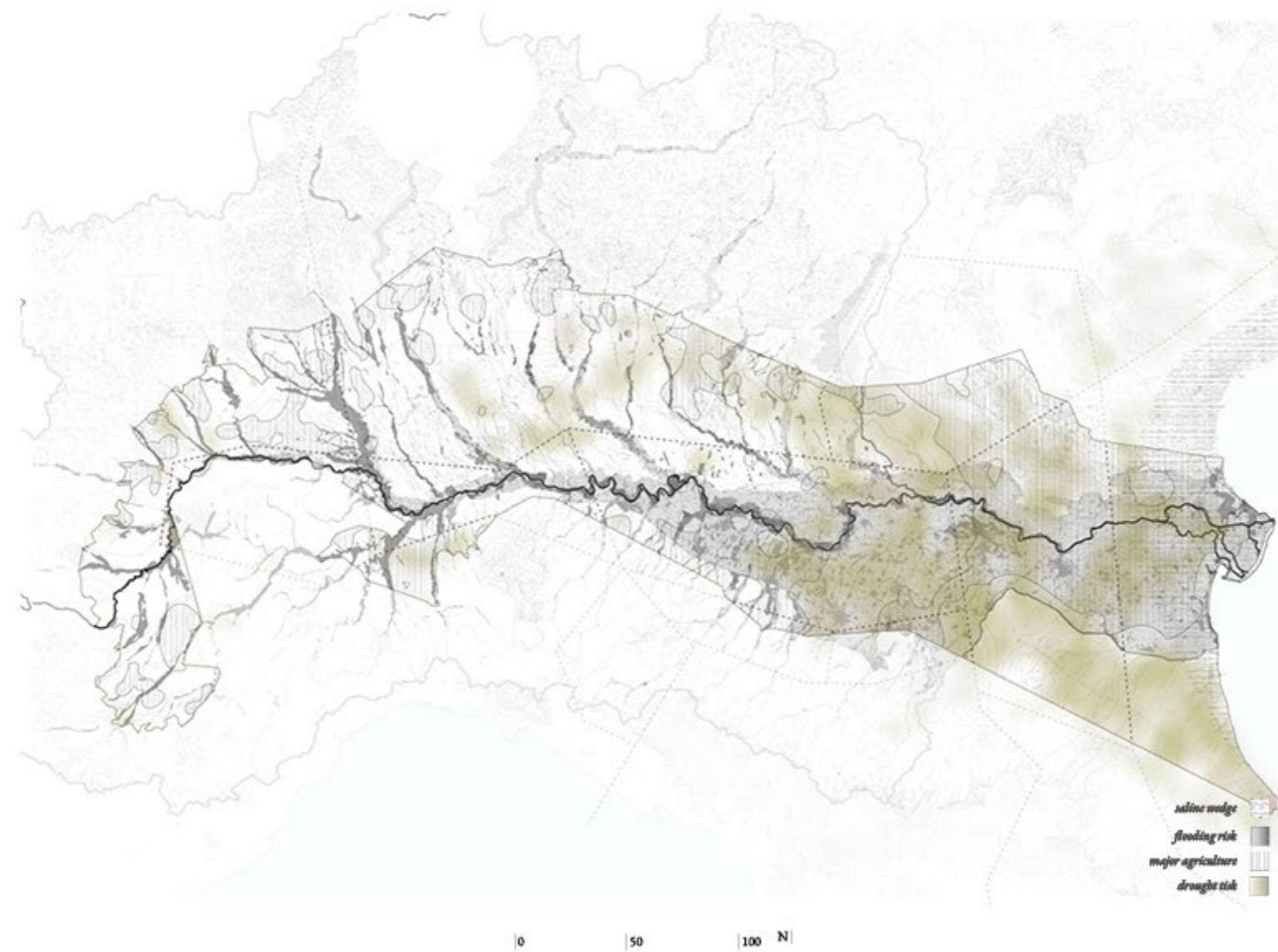
Source: image produced by the author

The rebirth of the resurgence belt

The vicious cycle of a system in crisis



Hydrological risks



Source: Natura 2000, 2022. ADERPO, 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



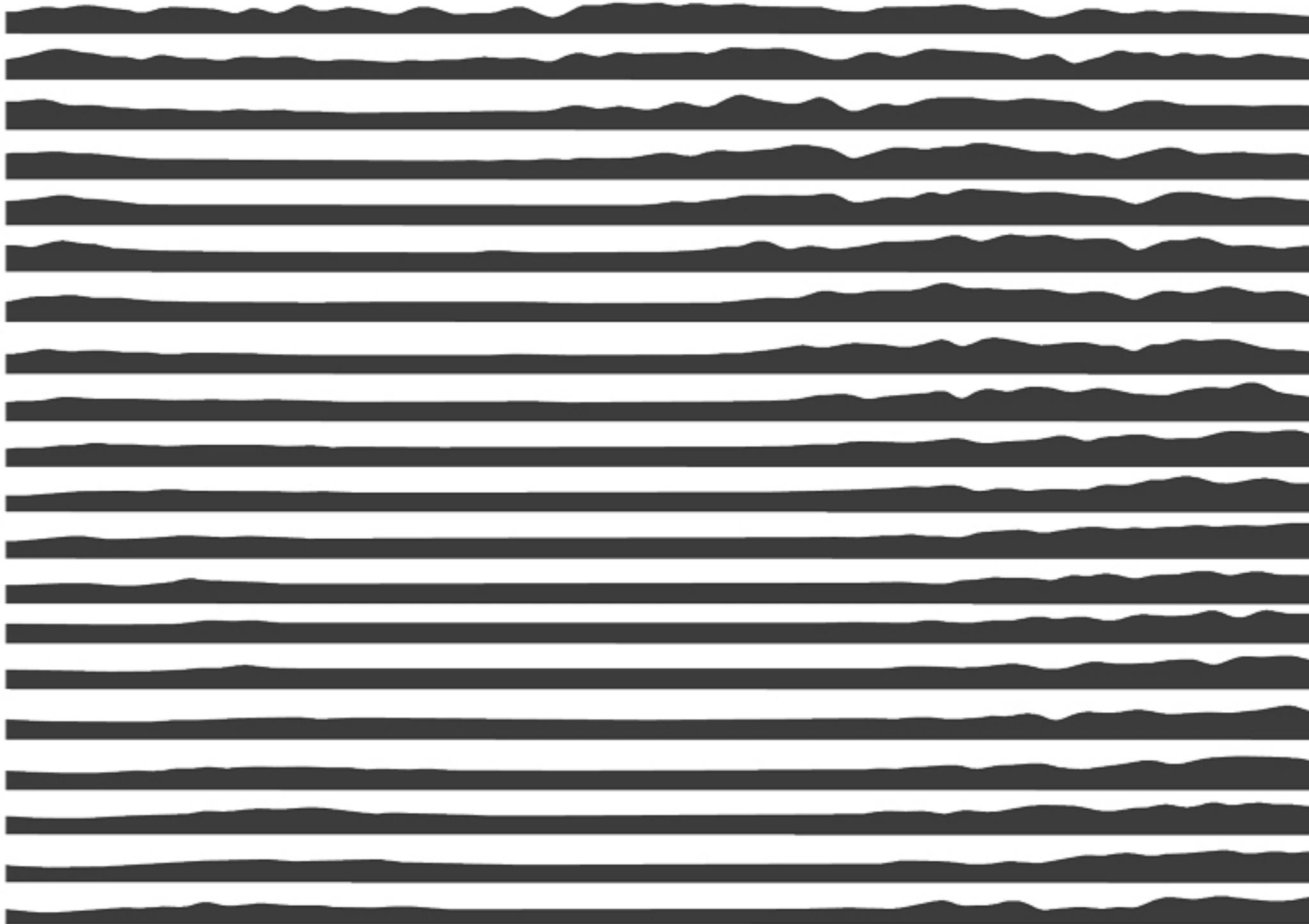
2023



Source: Google Earth, 2023.

The rebirth of the resurgence belt

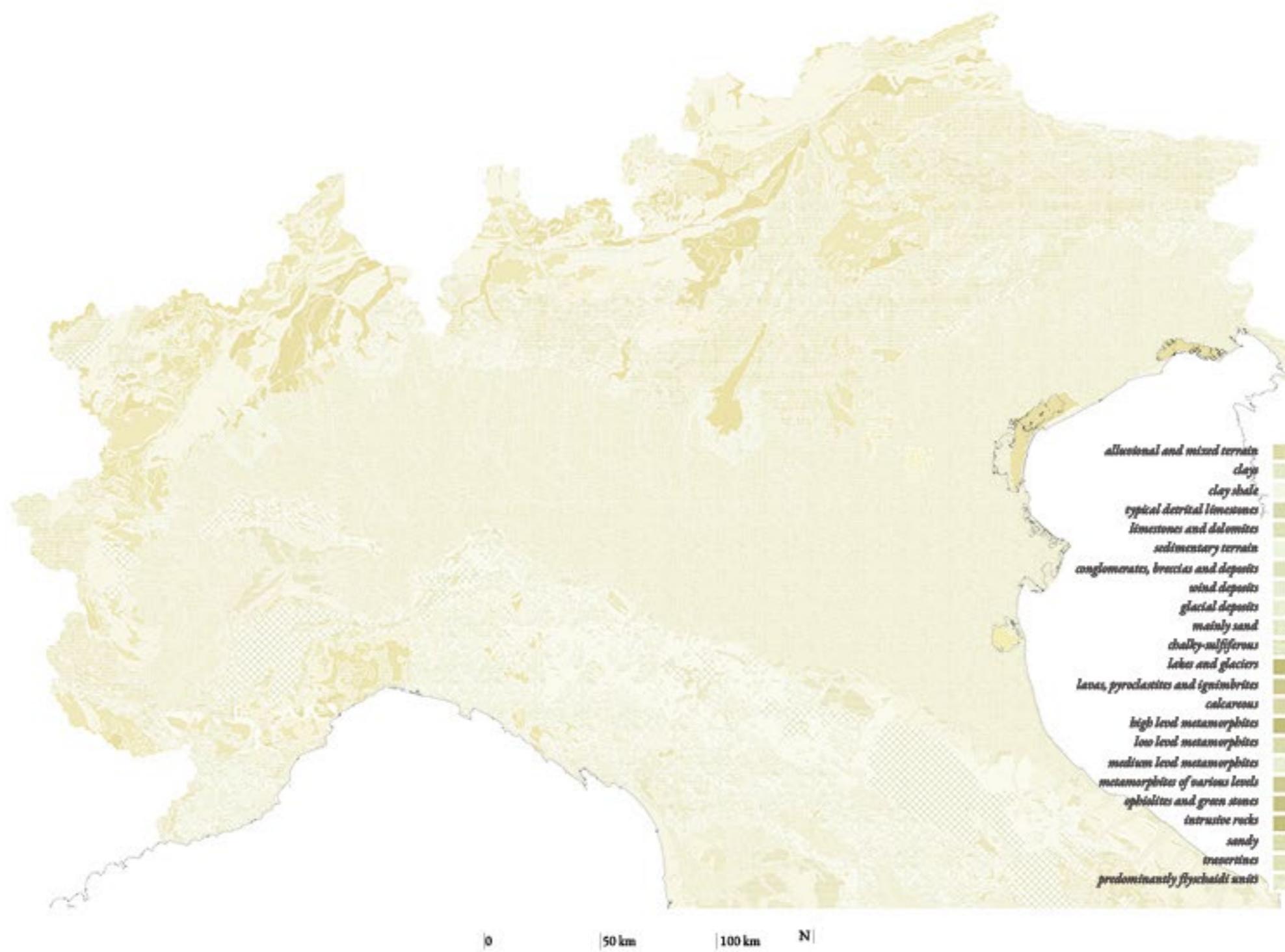
Topography



Source: AIPQ, 2022. LiDAR, 2022.

The rebirth of the resurgence belt

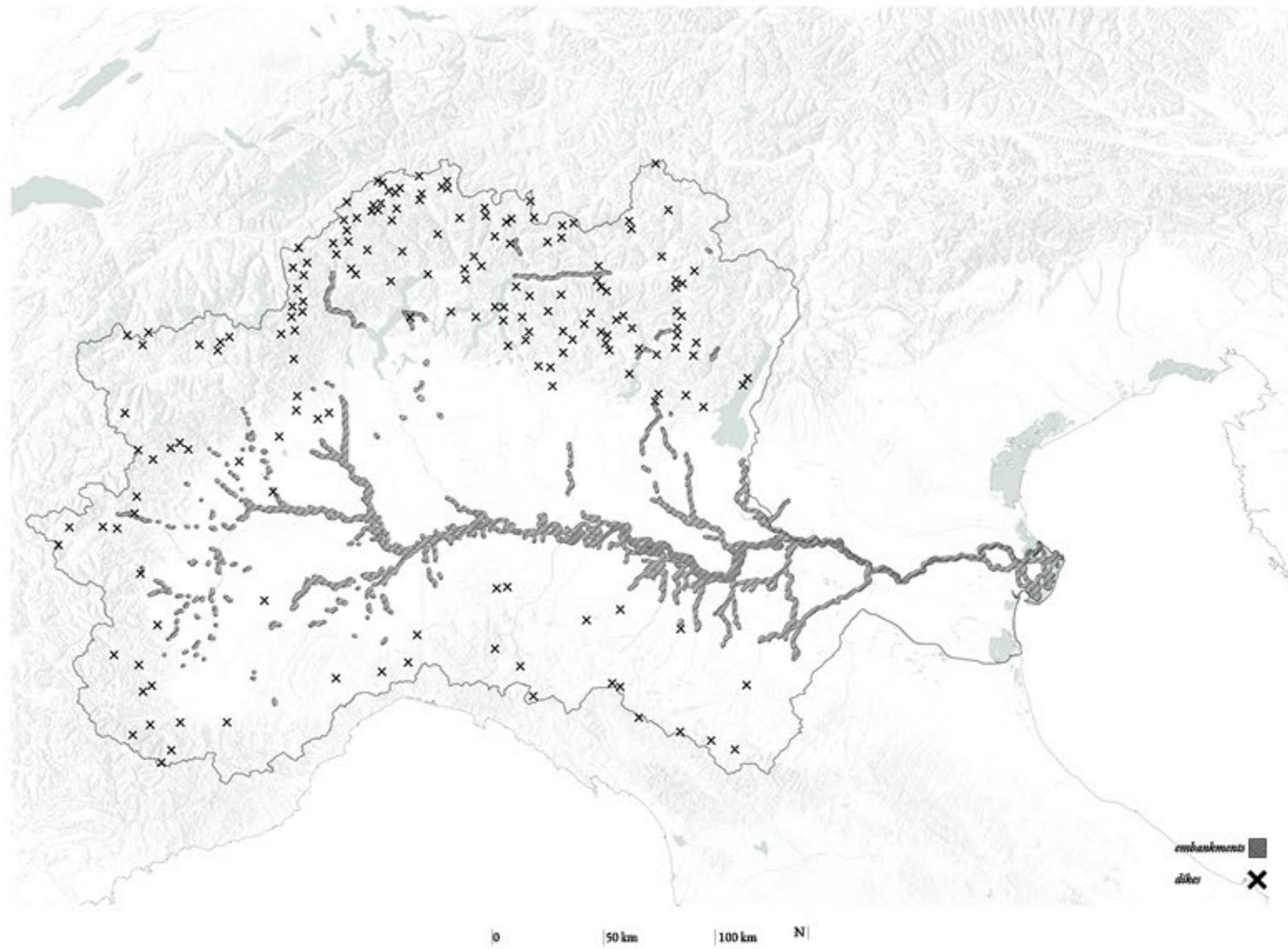
Geology map



Source: AIPO, 2022. 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.



Water management



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

The rebirth of the resurgence belt



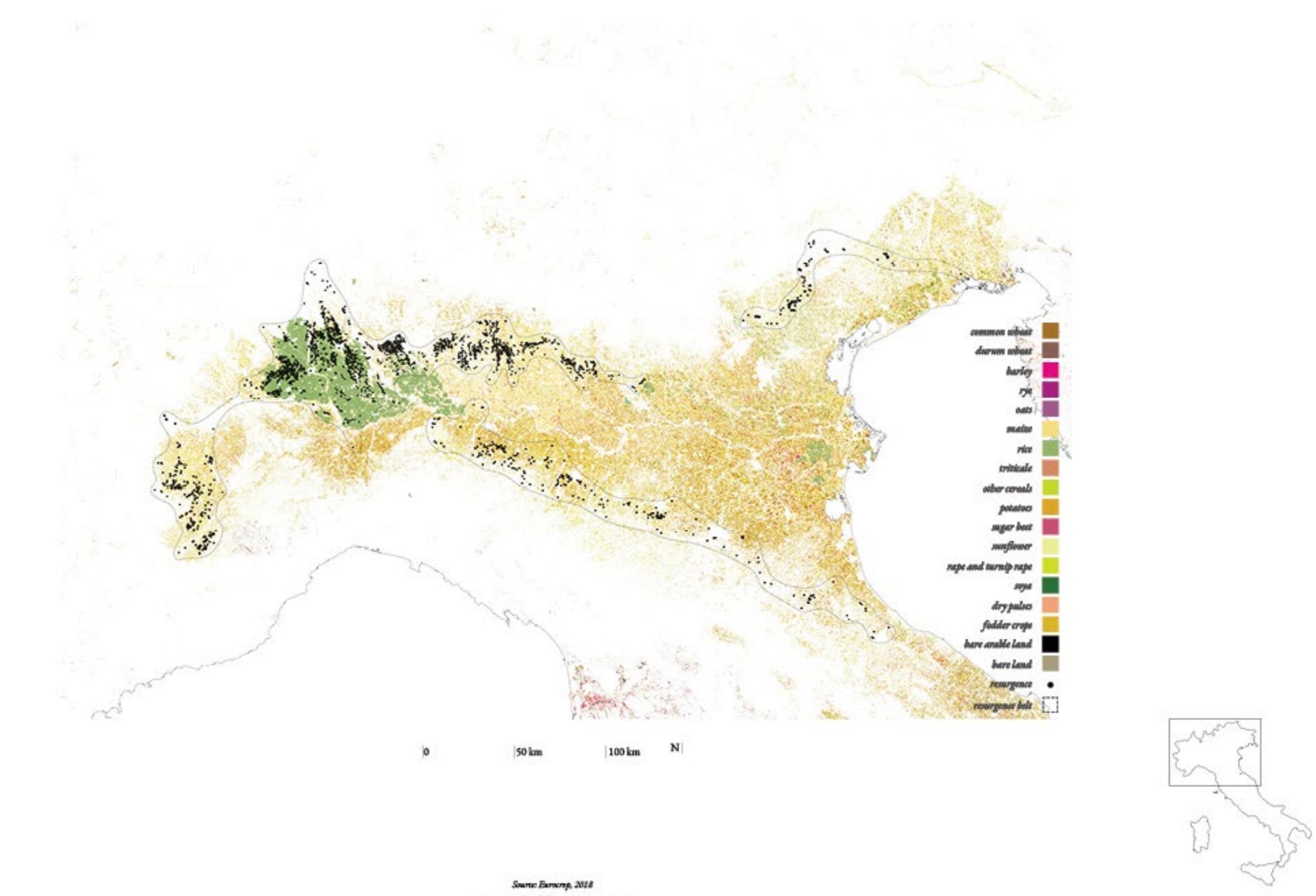




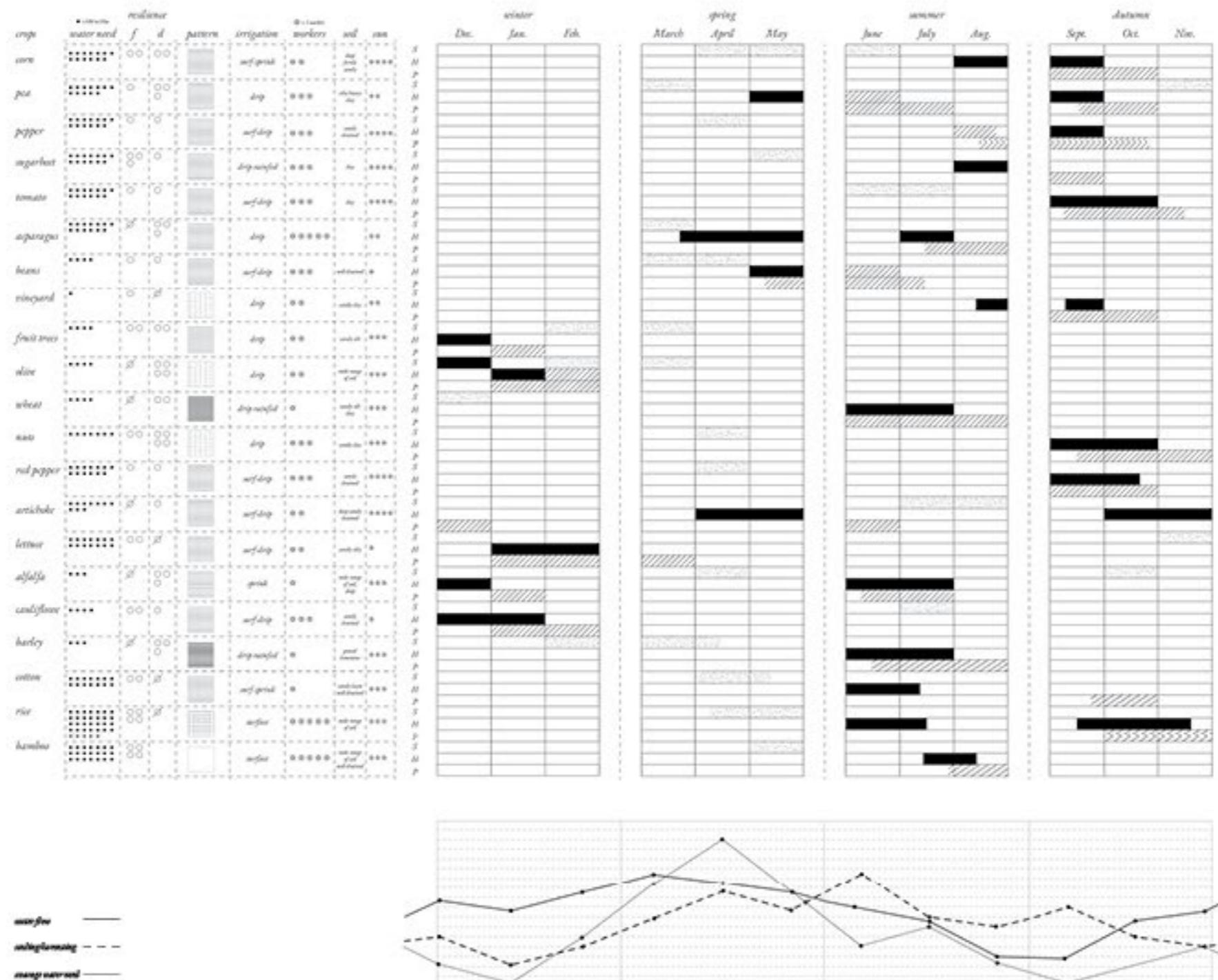
*...within 20 years we will see the drying up of most of the existing
resurgences*

What if the resurgence belt disappears?

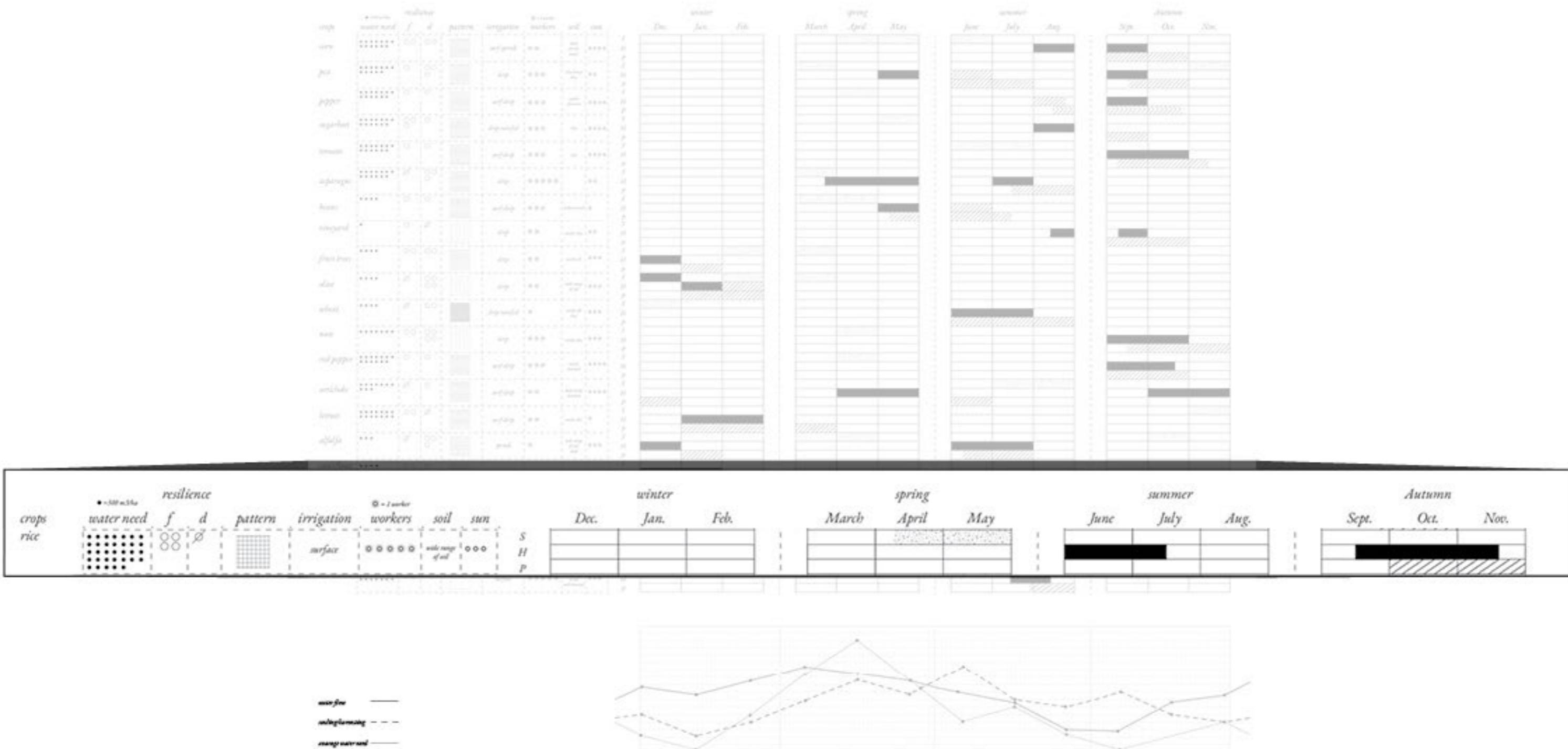
The crops of the Po Valley



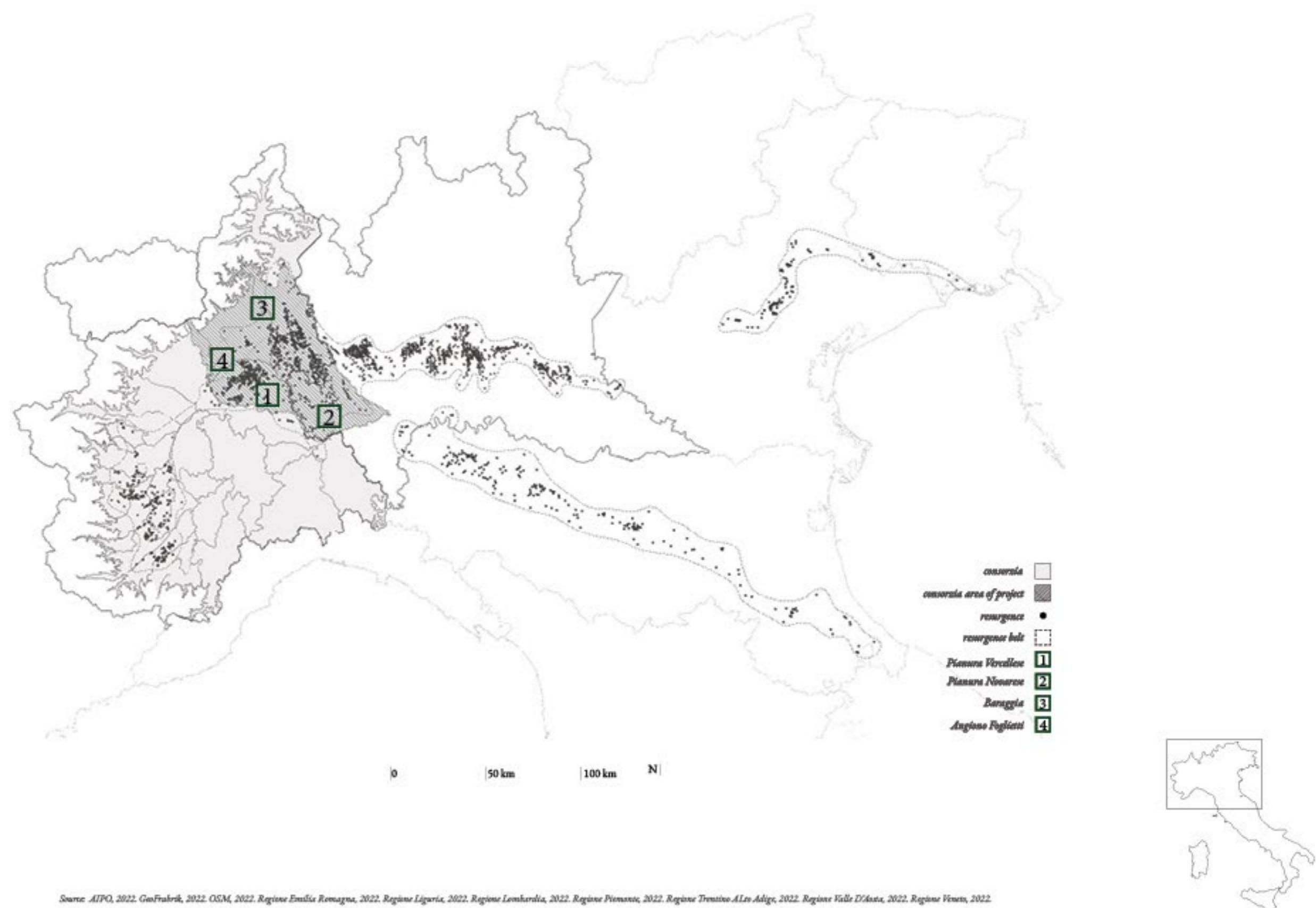
The crops of the Po Valley



The crops of the Po Valley



Zoning - area of study



The origin of rice



The history of rice in North Italy - Vercelli



I-II century AD

First land reclamation (military)

From the first and 2nd century AD vast uncultivated areas were donated to the military to reclaim the land and make it productive; most of these interventions were concentrated for some centuries only in the areas located along the main communication routes or near major urban centres, hence so the marshes and woodlands still dominated a good part of the Vercelli area. In the beginning of the first millennium woods, marshes, forests, thickets and barnacks dominated the territory.

XII century AD

Abbazia di Lucedio (monks)

In the beginning of the XII century AD the Cistercian monks of the Abbey of Lucedio thanks to the recovery of areas marshy areas and subsequent construction of channels for water management created the conditions for the introduction XV century rice-growing activity.

XV century AD

Primordial irrigation system

The system of natural streams and fountains was revolutionized thanks to the fifteenth-century creation of secondary canals such as the Canale del Rotto and the Naviglio d'Irea which, taking the necessary water from the Dora Baltea, a tributary of the Po, allowed the start of a primordial irrigation system in the Vercelli area based on canals and the first cultivation of this cereal, without however allowing it to establish itself as a reference crop. Lediani monks, being owners of two thirds of the work, were able to exploit the water from the canal for the irrigation of the first ricefields, used initially for medical purpose.

Job opportunities

The introduction of this new crop offered new job opportunities especially among the inhabitants of mountainous or poor areas who saw working in the rice field as a real turning point. Their influx into these places was further favored in the second half of the sixteenth century with the abolition of serfdom, at the behest of the Savoyard duke Emanuel Filiberto and thanks to which the peasants, freed from the condition of dependence and exploitation in which they found themselves, were able to move around in complete freedom.

XVII - XVIII century AD

Wars, French and Spanish domination

The XVI/V century was a historical period marked by wars, plagues and French and Spanish domination. In the XVIII century the Vercelli area was affected by the War of Spanish Succession that ended in 1714, after 13 years of European conflicts, it profoundly marked the countryside.

1864

Cavour canal

With the nineteenth-century creation of Cavour canal, designed to divert the waters of the Po in order to remedy the problem of summer drought beyond the Sesia river in the Lomellina and lower Novara areas, complex unirrigation works were started which led to a growth in the irrigation network and a consequent increase in rice paddy area.

XX century AD

World War I

During the First World War there had been a significant increase in the rice-growing area due to a growing demand for this cereal, which occupied 40% of the agricultural landscape Vercelli, once the war was over the rice sector suffered a profound crisis due to importation of rice from Asia. The Fascism tried to support the national rice production establishing in 1931 the Fondo Nazionale Riso and with which undertaken programs for example research on new rice varieties, supports financial aid to rice growers and setting the price at a national level.

1960

World War II and the agricultural mechanization

In the period following the Second War, new ones were cultivated worldwide varieties such as Carnaroli, Vialone nano, il Baldo and the S. Andrea; The agricultural mechanization and the introduction of chemical herbicides meant that the laborers until then present in rice field like the one represented by figure of the rice weeder would disappear in the early 60s. From this moment on, the agricultural technologies and techniques became increasingly innovative that the work in the rice fields became simpler and quicker.

The rebirth of the resurgence belt

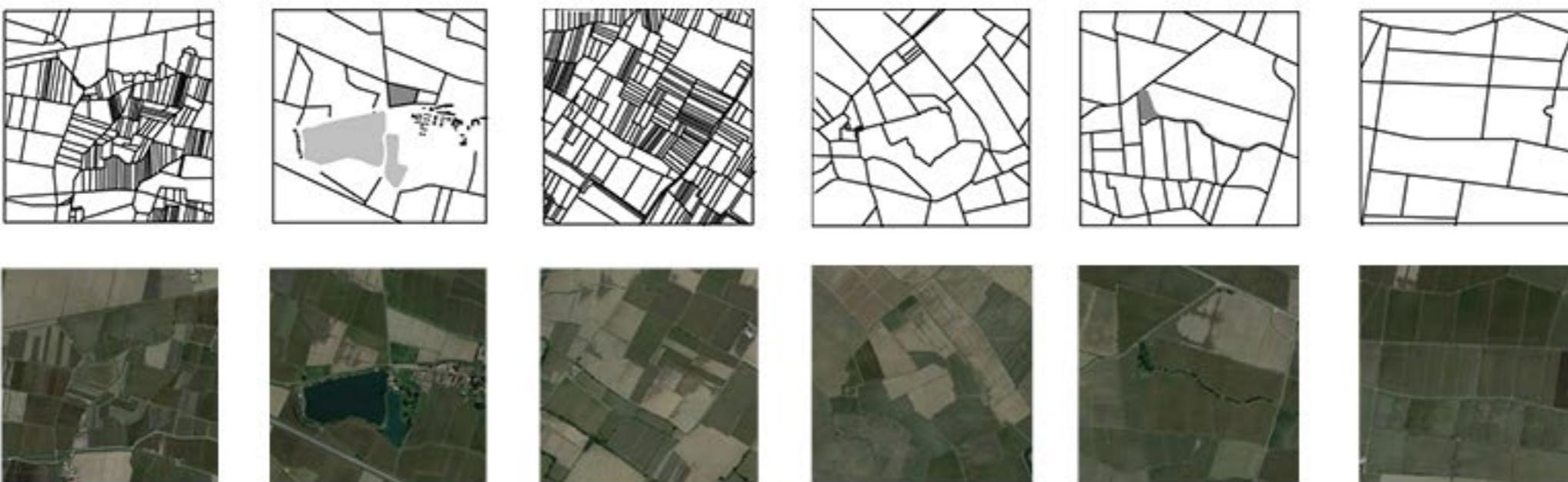


Comparing parcellation



1960

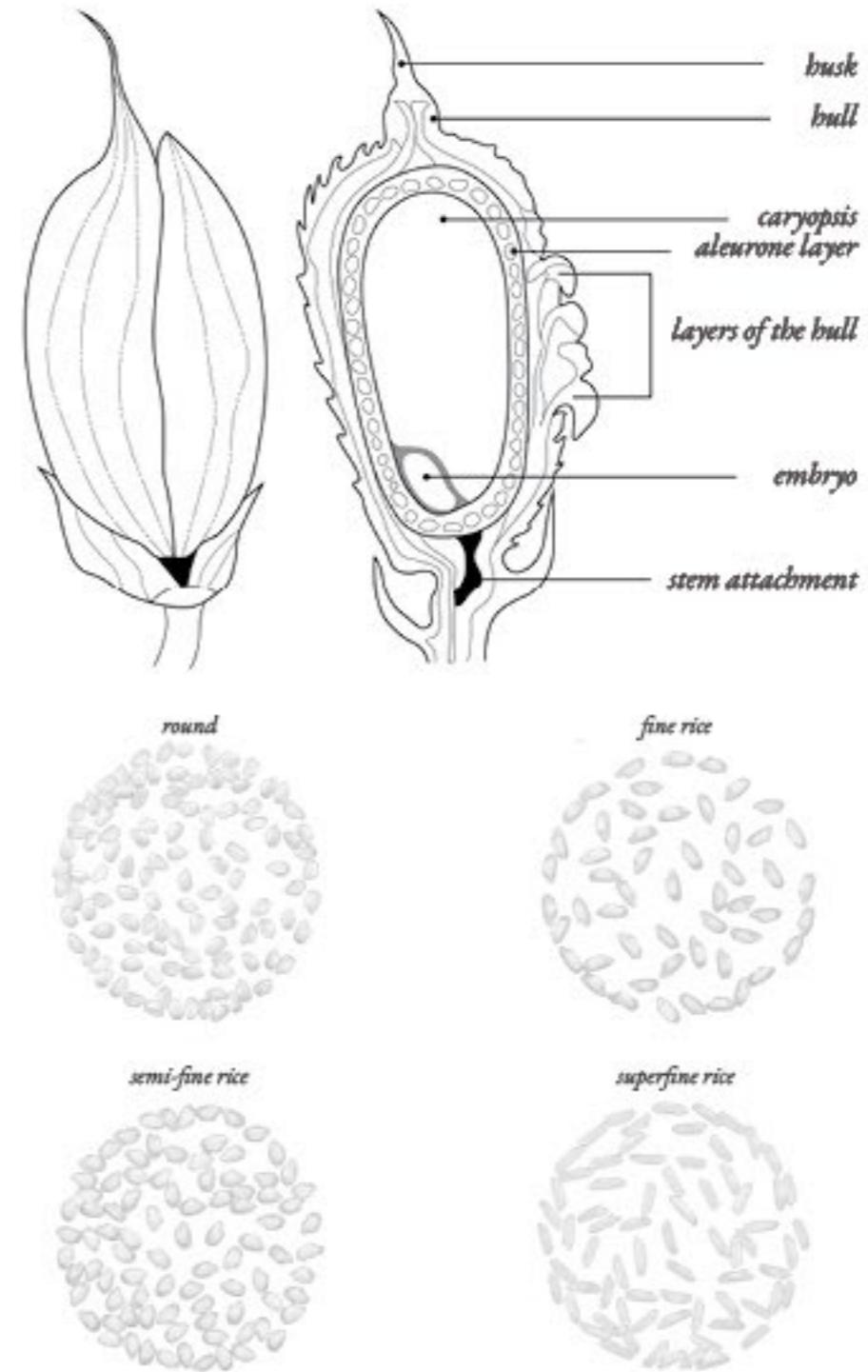
2023



Source: Google Earth, 2022

The rebirth of the resurgence belt

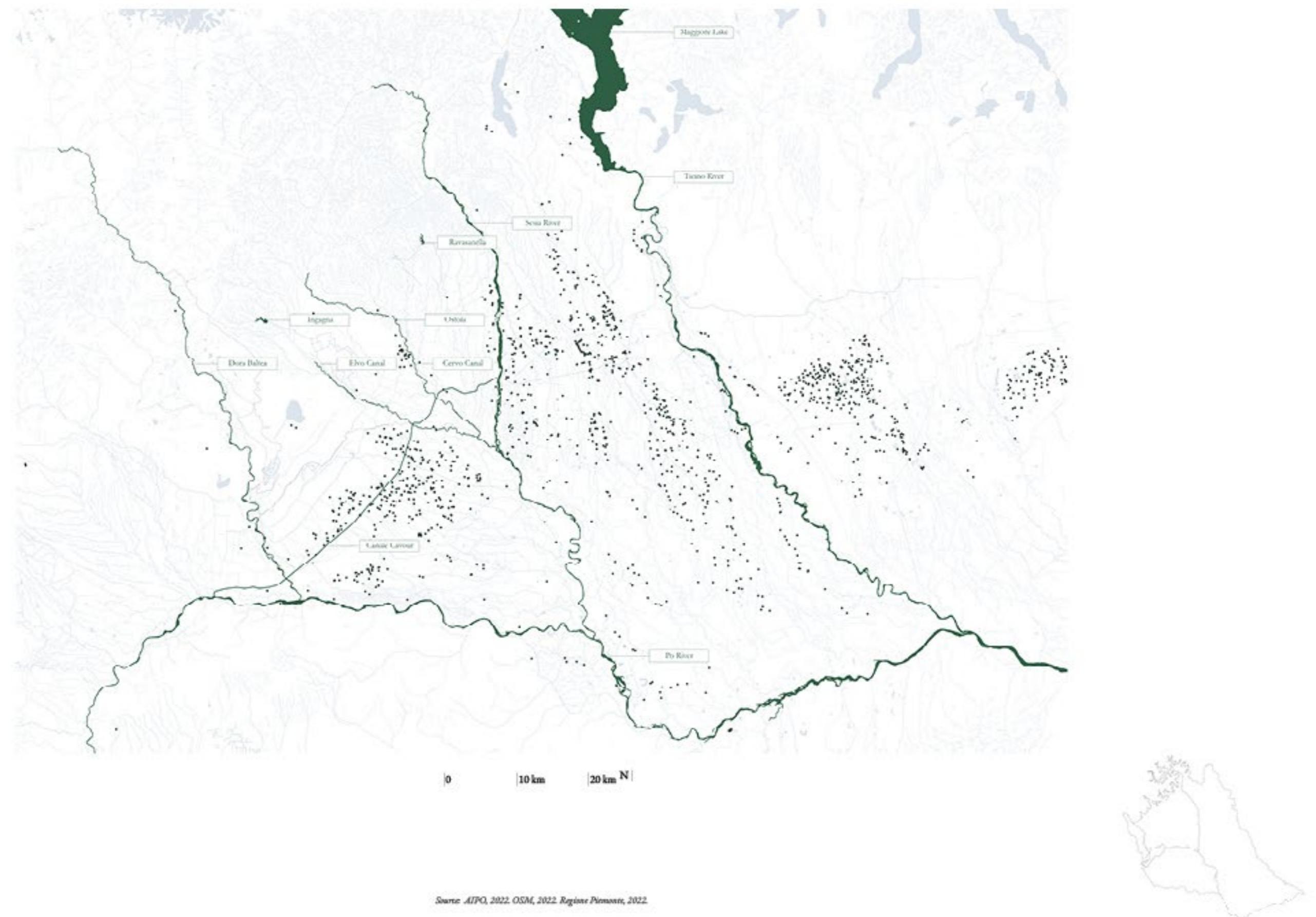
Anatomy of rice



Source: images made by the author

The rebirth of the resurgence belt

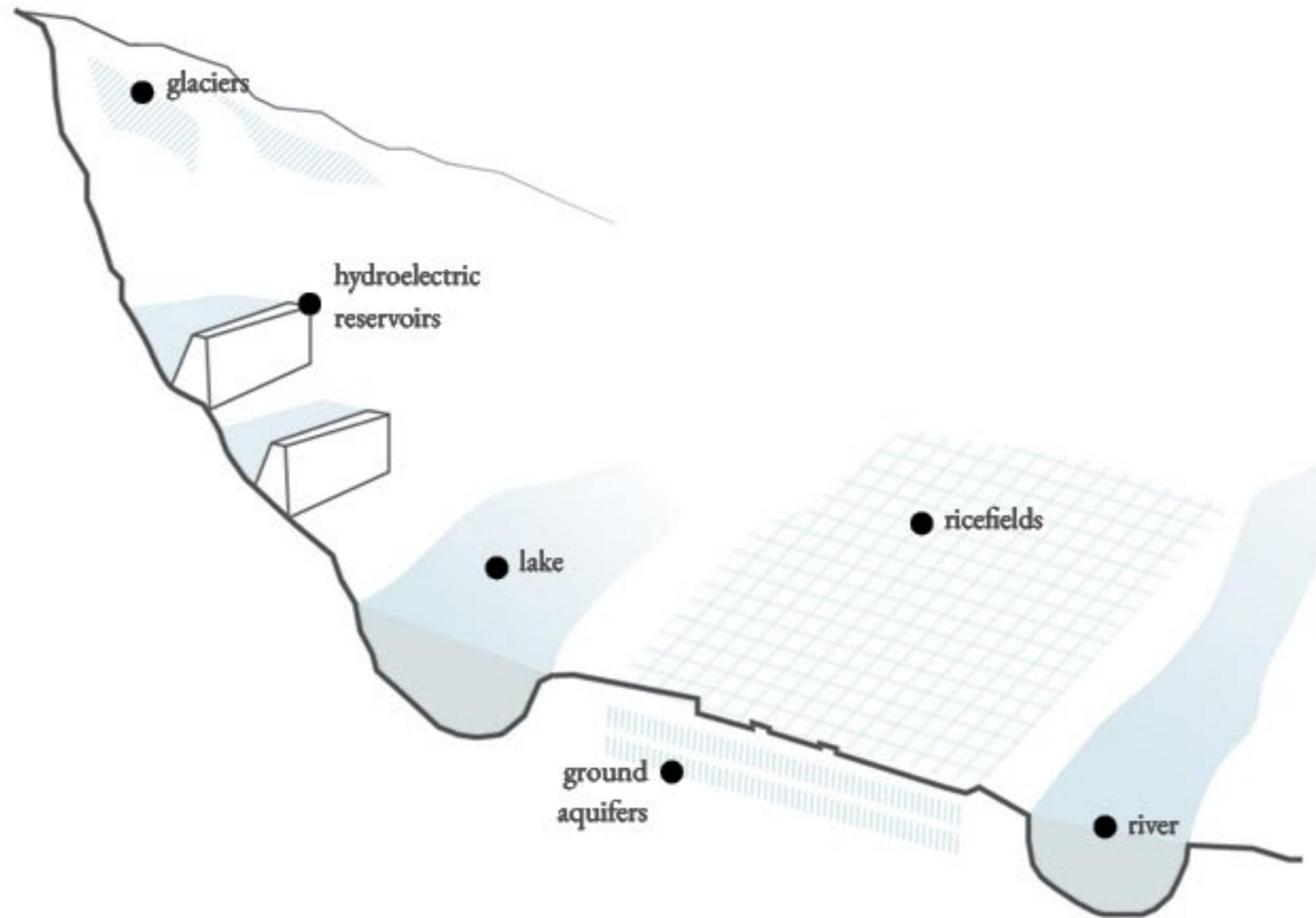
Area of study - main water sources



Source: AIPO, 2022. OSM, 2022. Regione Piemonte, 2022.

The rebirth of the resurgence belt

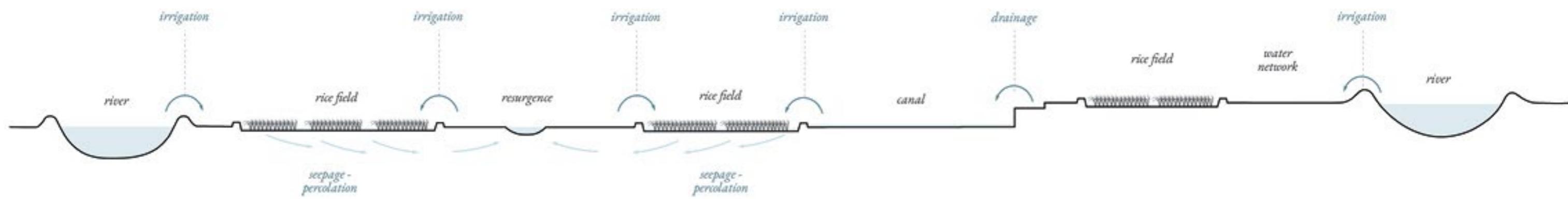
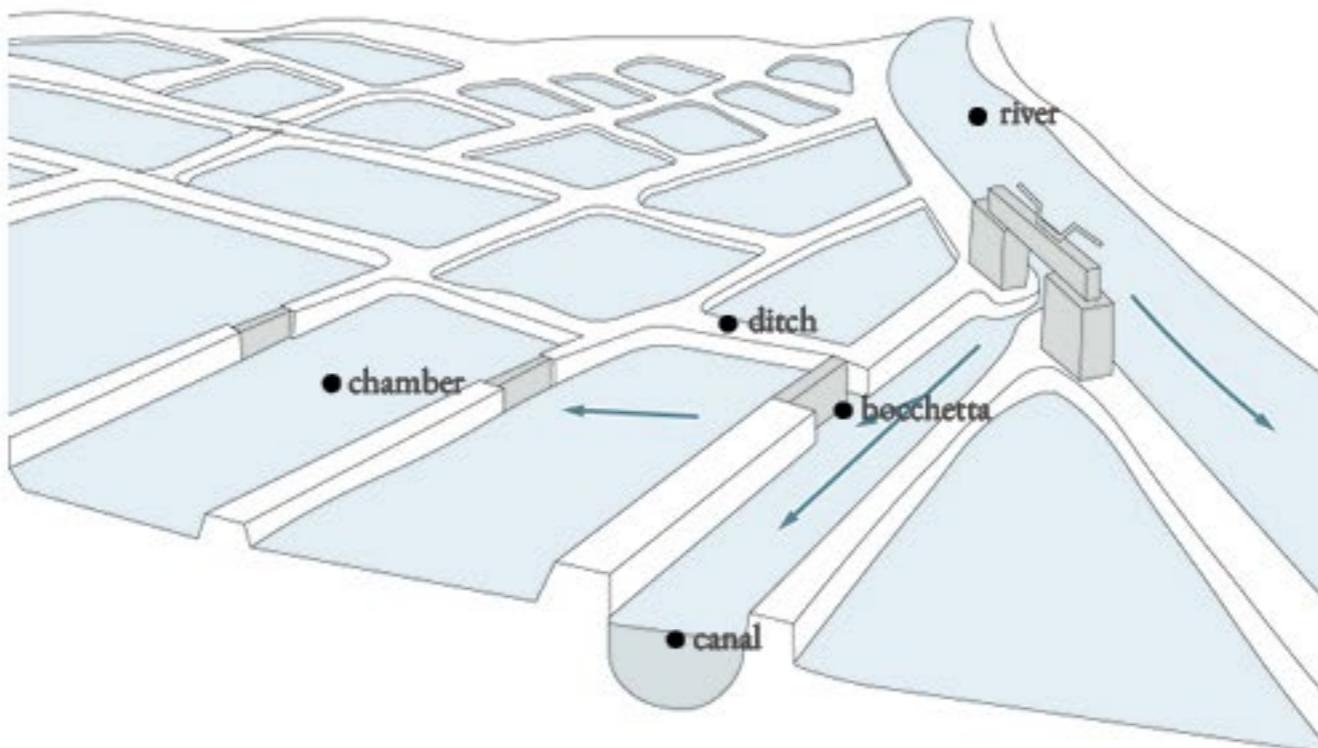
What is the role of ricefields in the natural water management regulation?



Source: image made by the author

The rebirth of the resurgence belt

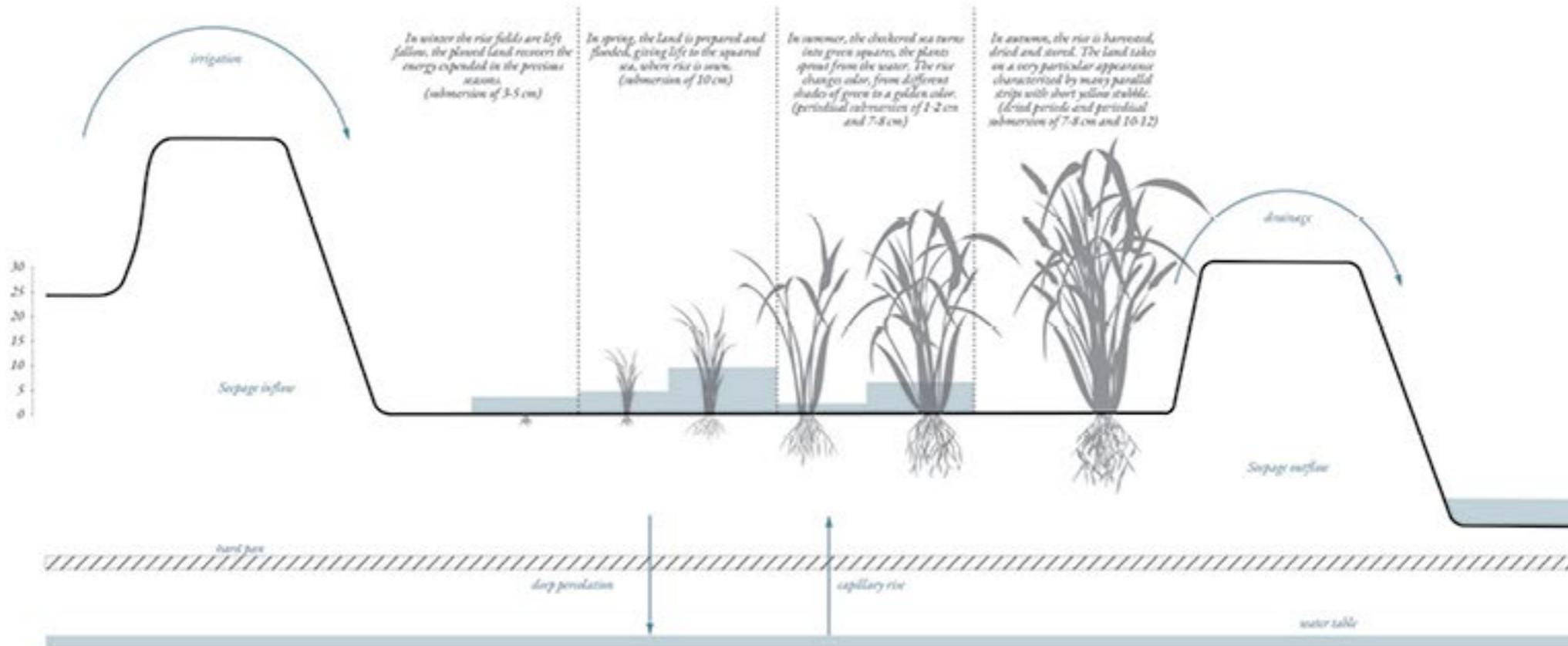
What is the role of ricefields in the natural water management regulation?



Source: image made by the author

The rebirth of the resurgence belt

Submersion of ricefields

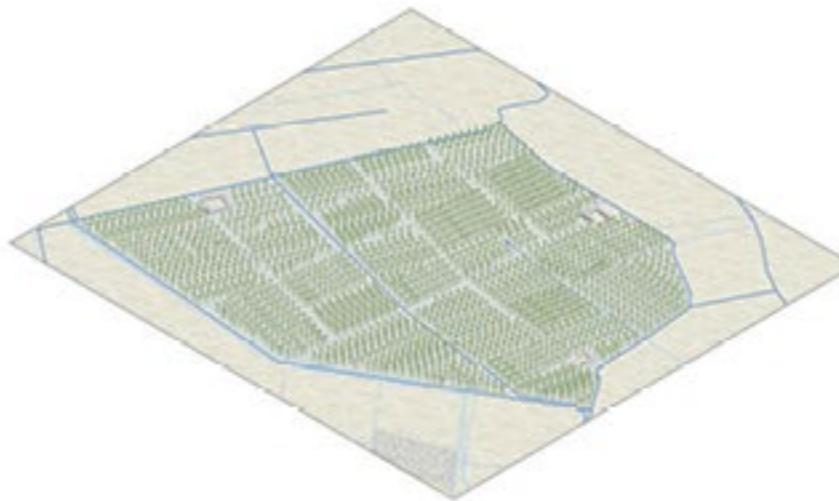


Seasonality of ricefields

Submerged | winter



Submerged | summer



Submerged | spring

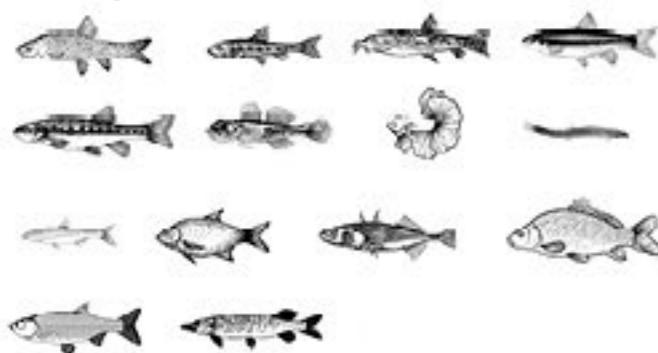


Submerged | autumn





Fishes 60+ species



Birds 95+ species



Mammals 50+ species



Ambibians, reptiles and insects 20+ species



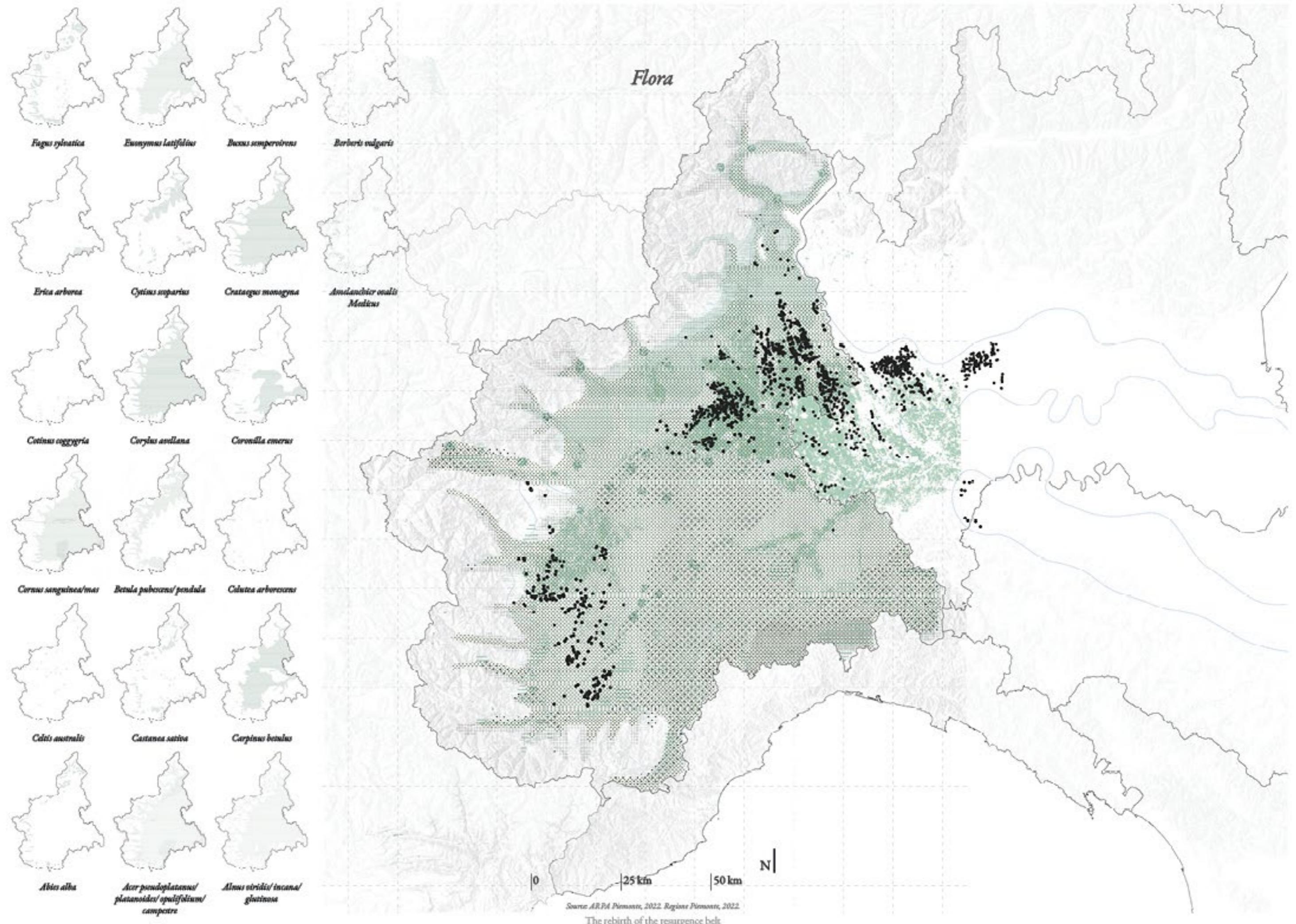
Fauna

Source ARPA Piemonte, 2022. Regione Piemonte, 2022.

The rebirth of the resurgence belt

migration point
ricefields
pollination areas
resurgence belt

0 | 25 km | 50 km | N

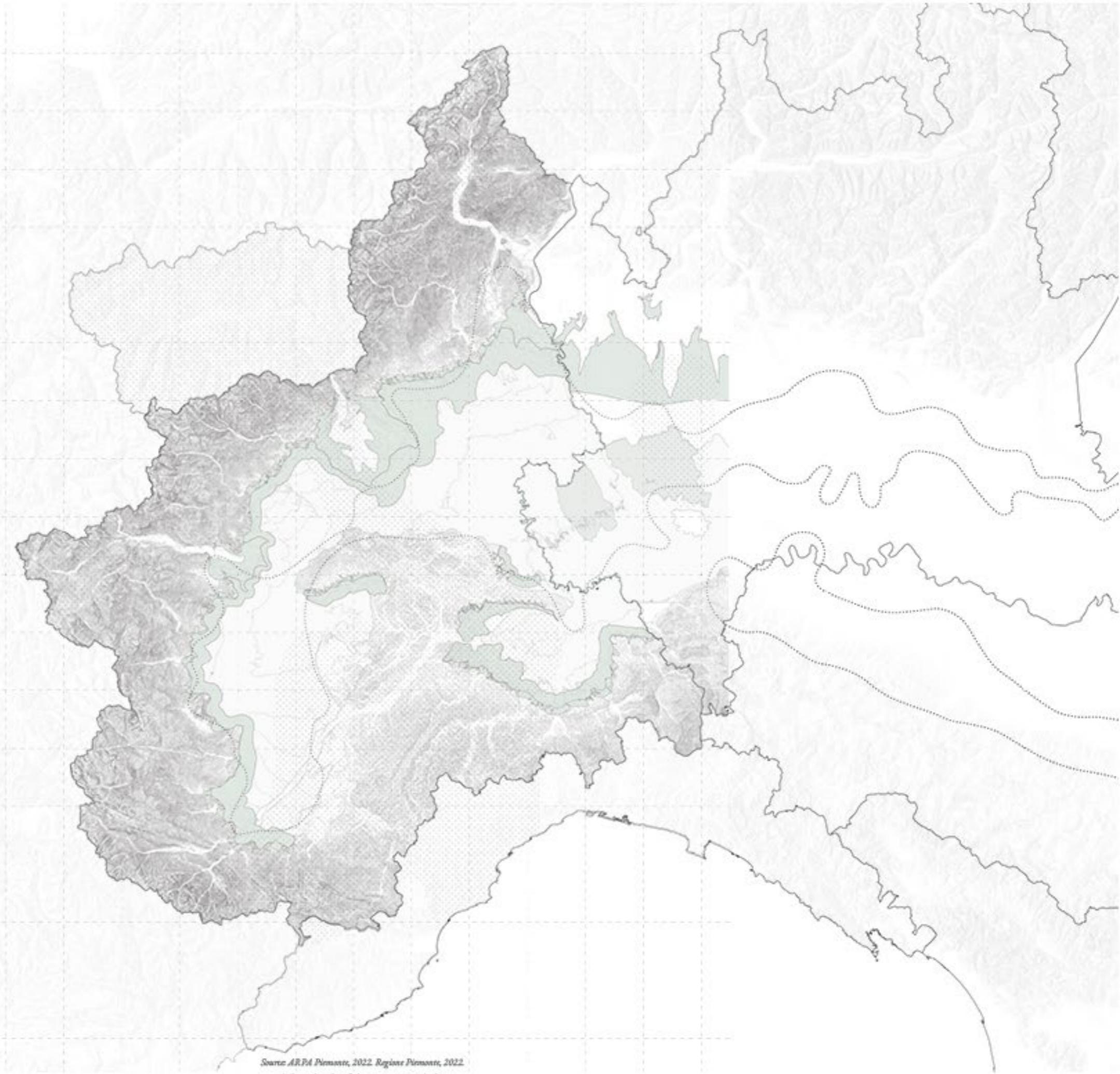


*The natural water
management*

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

0 | 25 km | 50 km

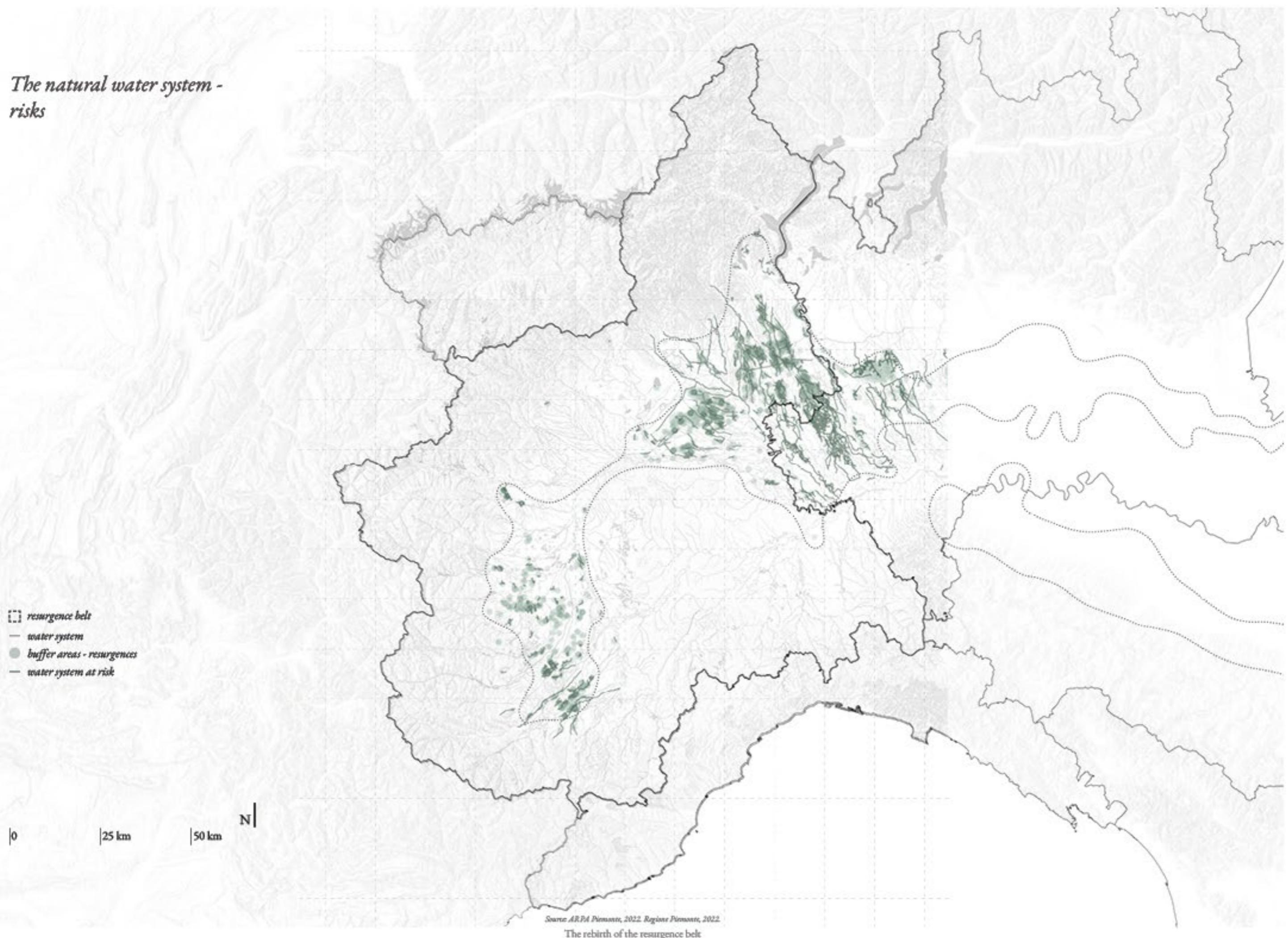
N

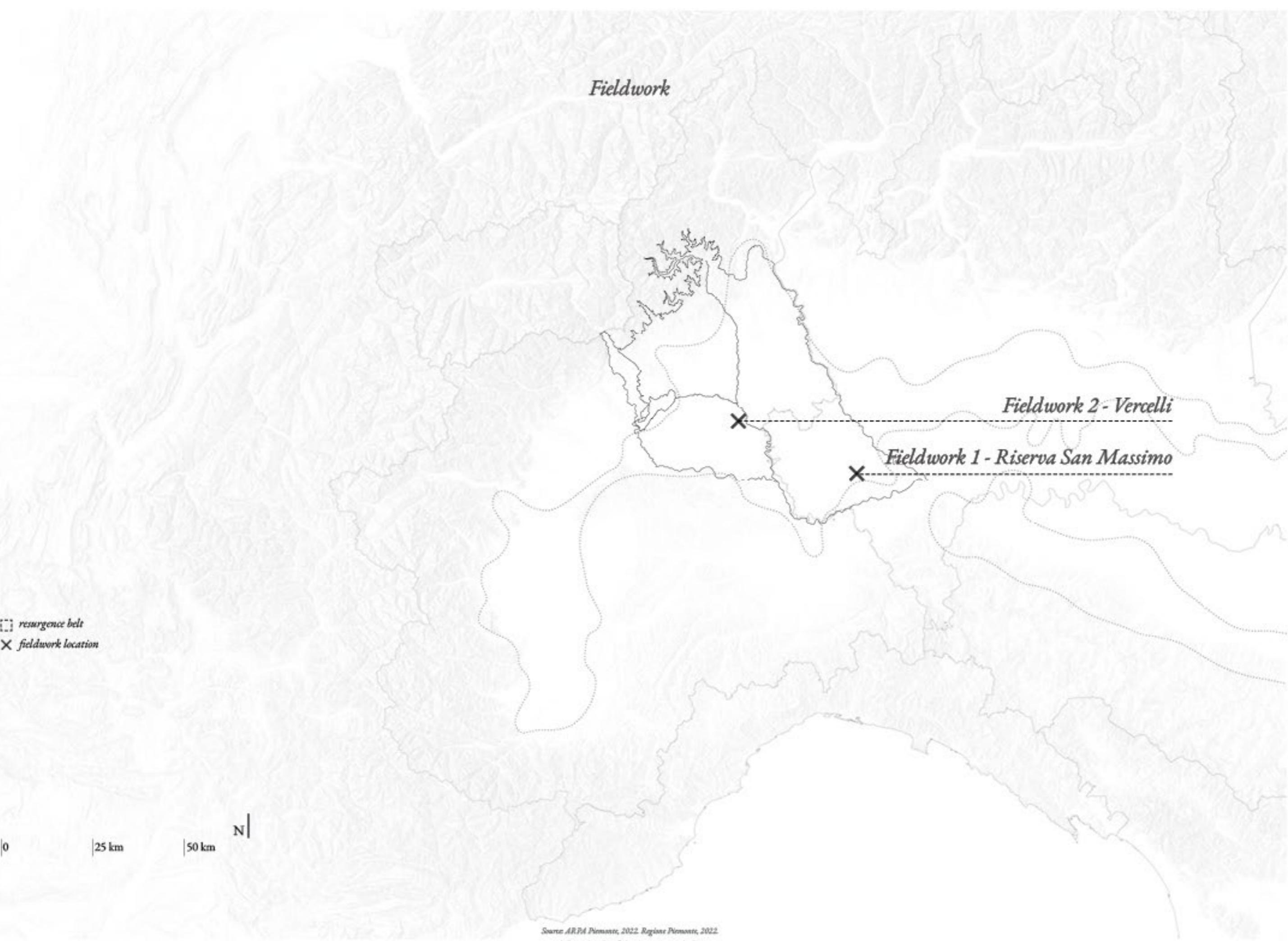


Source ARPA Piemonte, 2022. Regione Piemonte, 2022.

The rebirth of the resurgence belt

*The natural water system -
risks*





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



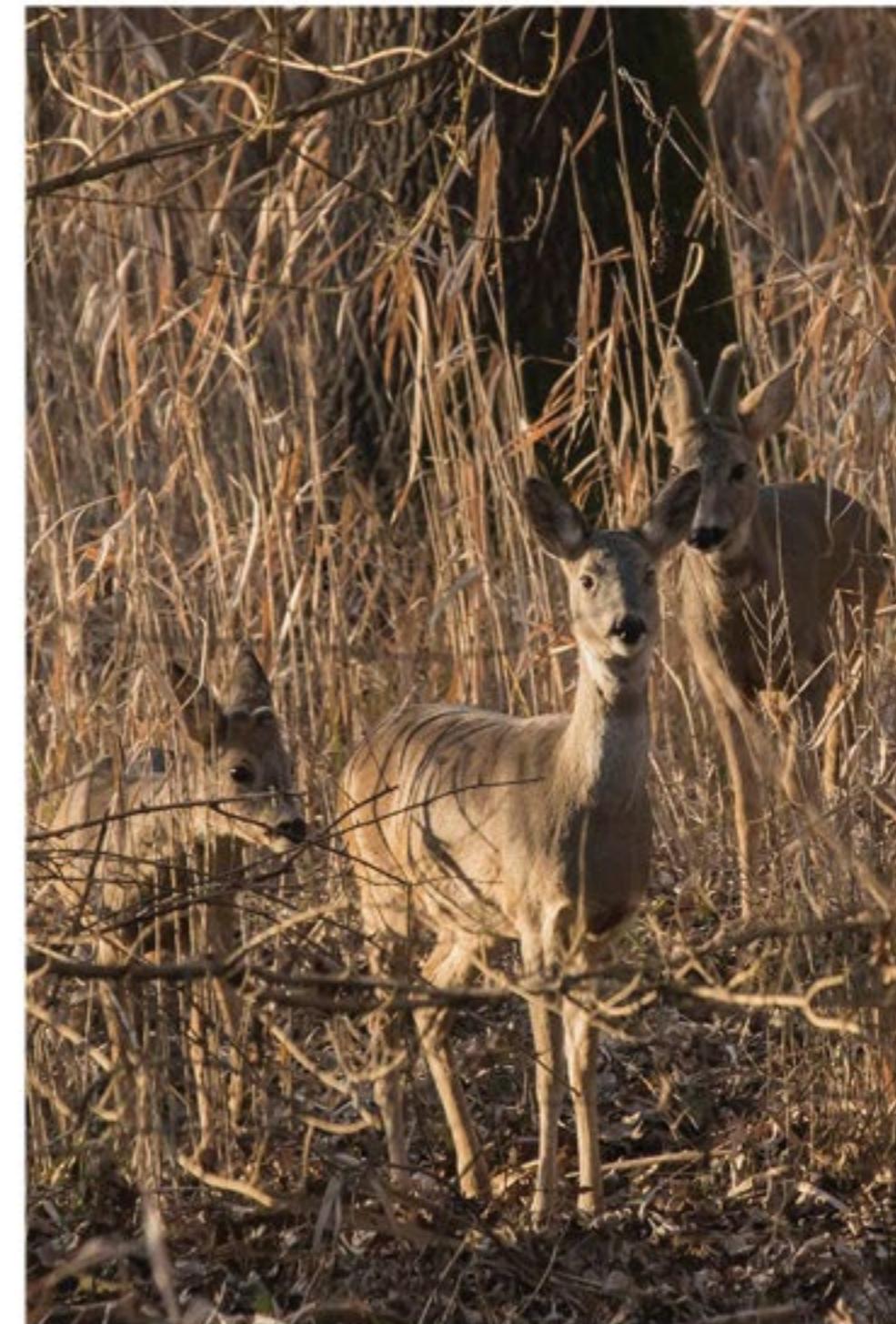
Fieldwork 1 - Riserva San Massimo



The rebirth of the resurgence belt



Fieldwork 1 - Riserva San Massimo



Fieldwork 2 - Vercelli



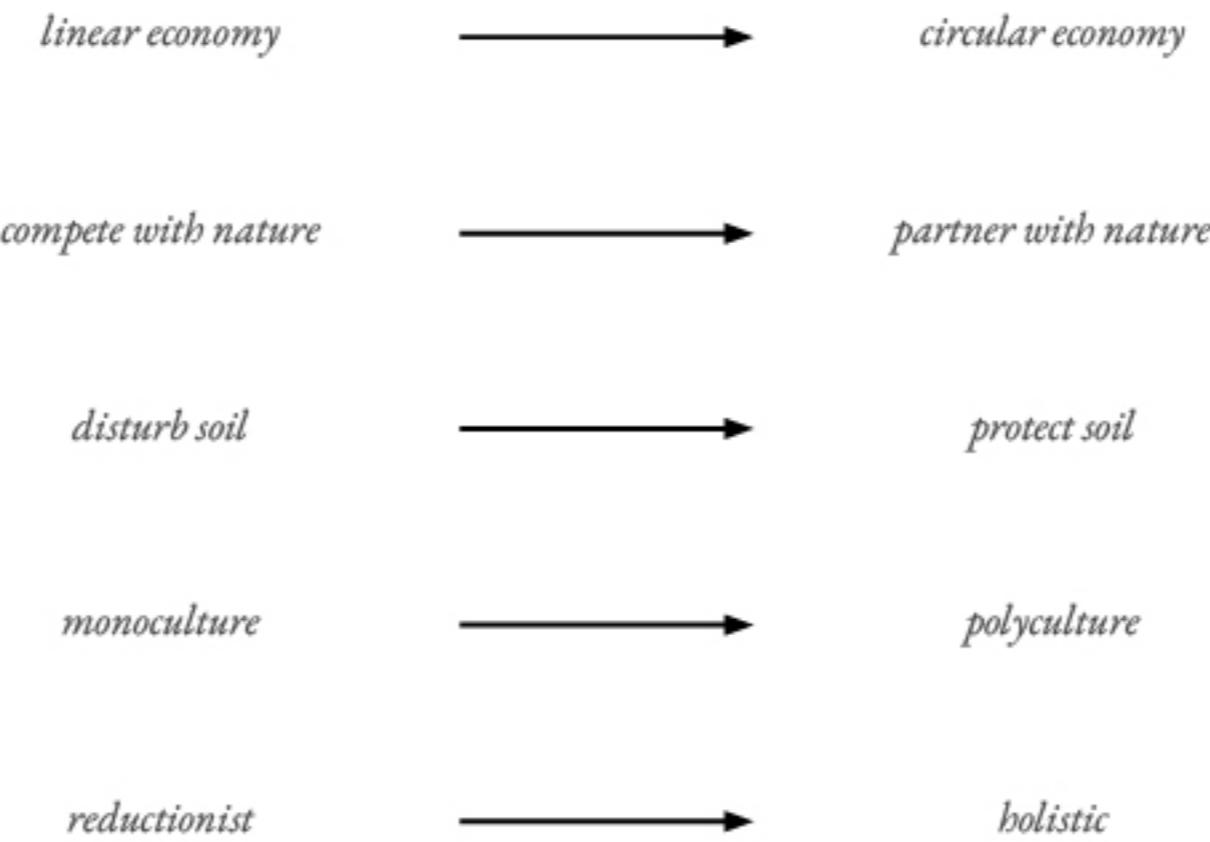
The rebirth of the resurgence belt



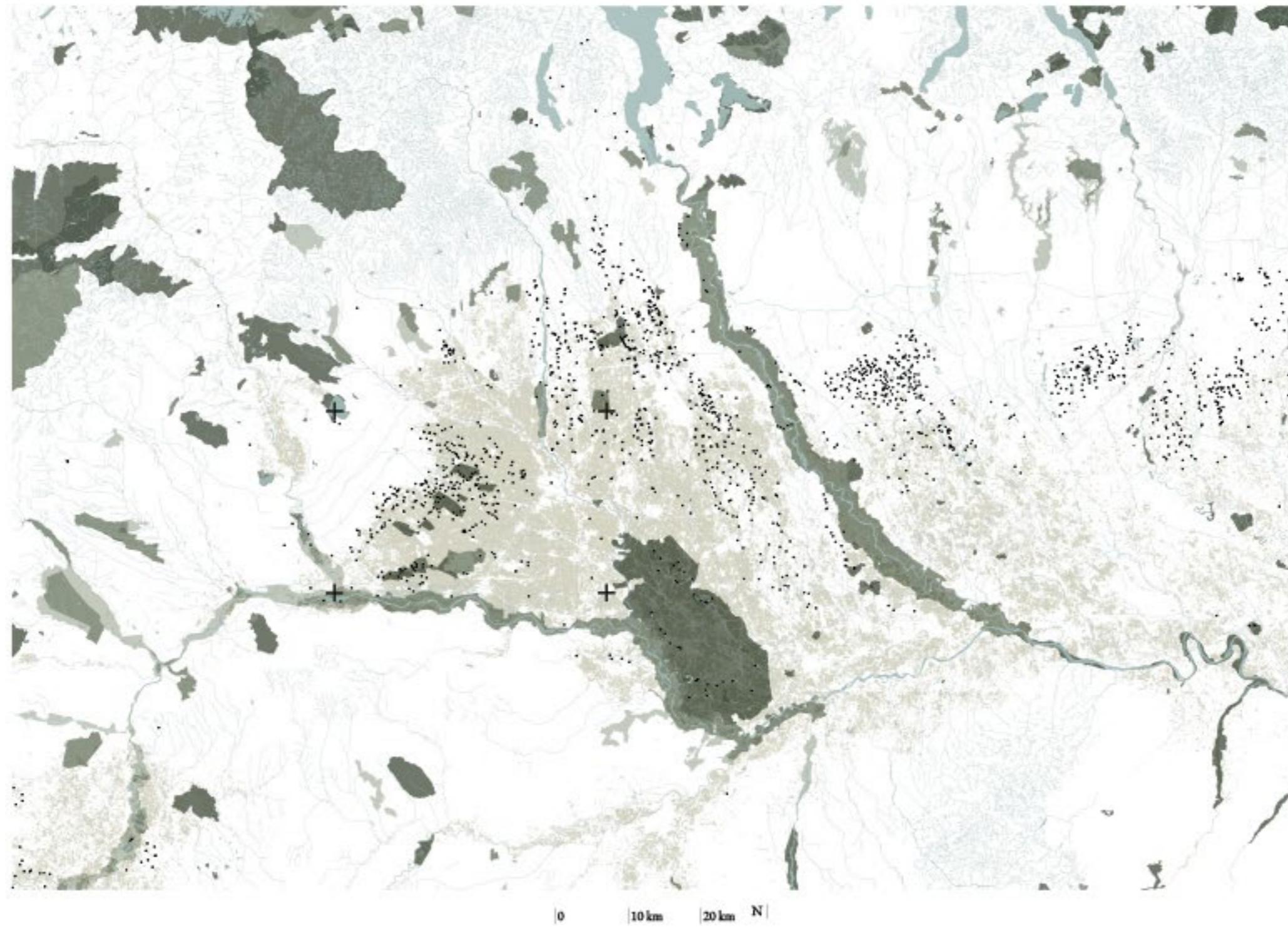
Fieldwork 2 - Vercelli



Shifting the paradigm



Current situation of (un-)existing green infrastructure



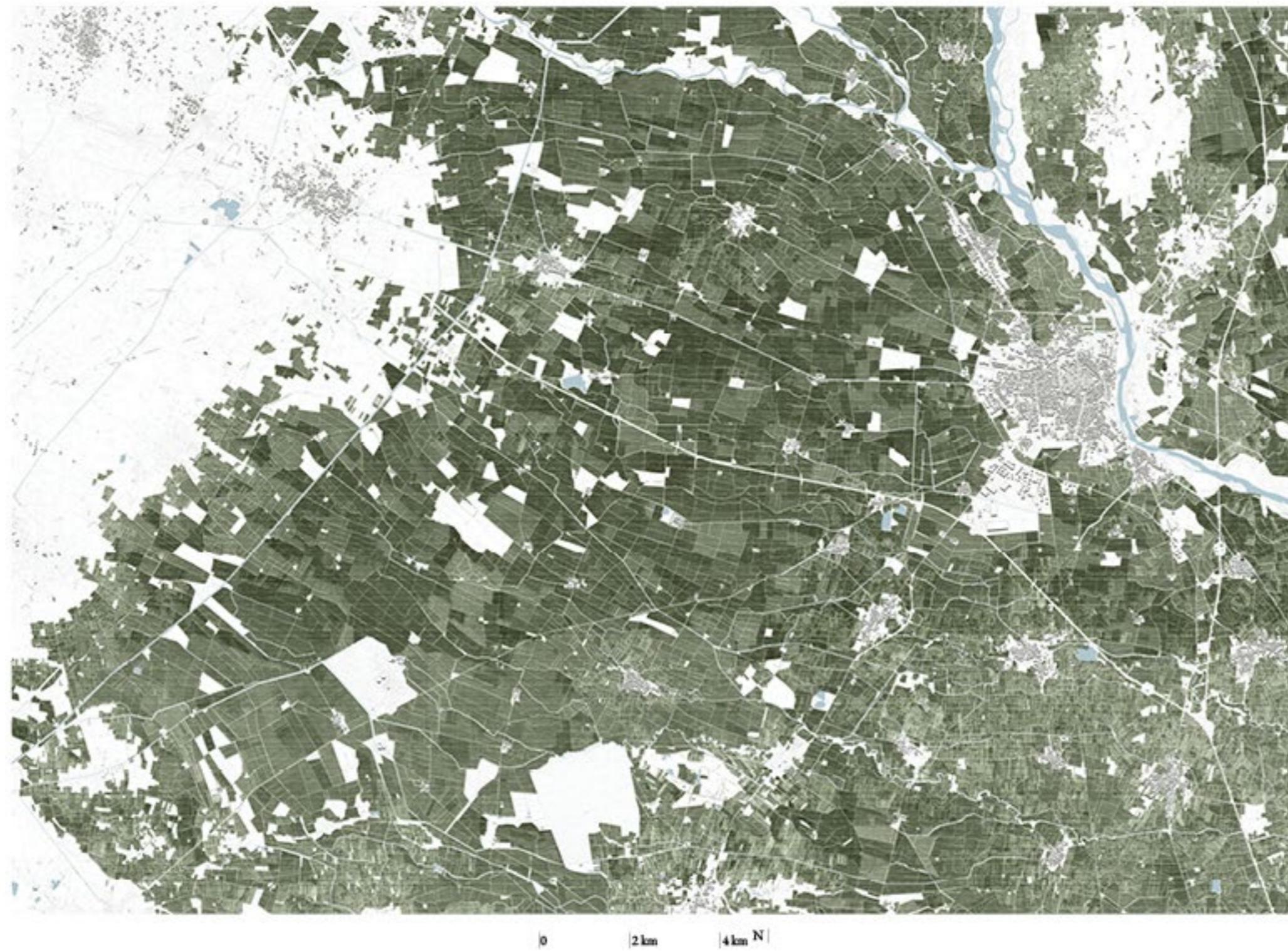
Source: *Natura 2000*, 2022. ARPA Lombardia, 2022. ARPA Piemonte, 2022. Regione Lombardia, 2022. Regione Piemonte, 2022.

The rebirth of the resurgence belt

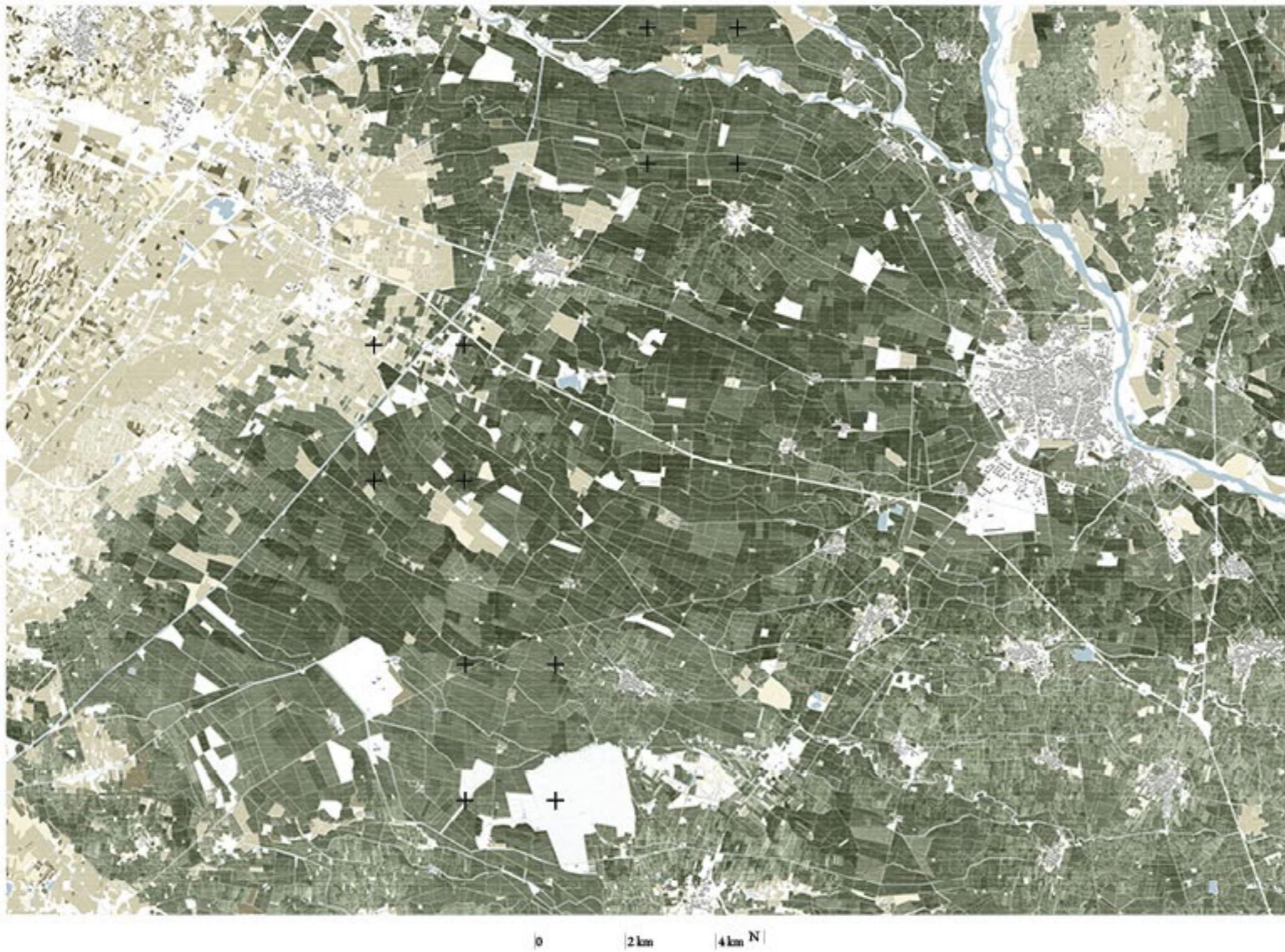
Current situation of (un-)existing green infrastructure in Vercelli



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

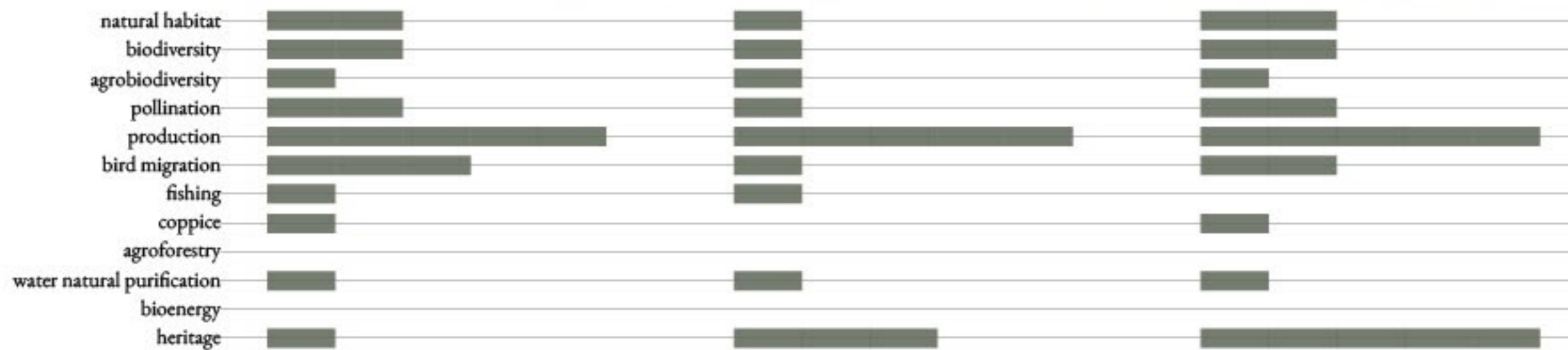
1. Wilderness



2. Productive landscape



3. Culture



Soil - impermeable layer



Soil typology. Source: Regions Piemonte, 2022.

The rebirth of the resurgence belt

Soil - semipermeable layer



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

The rebirth of the resurgence belt

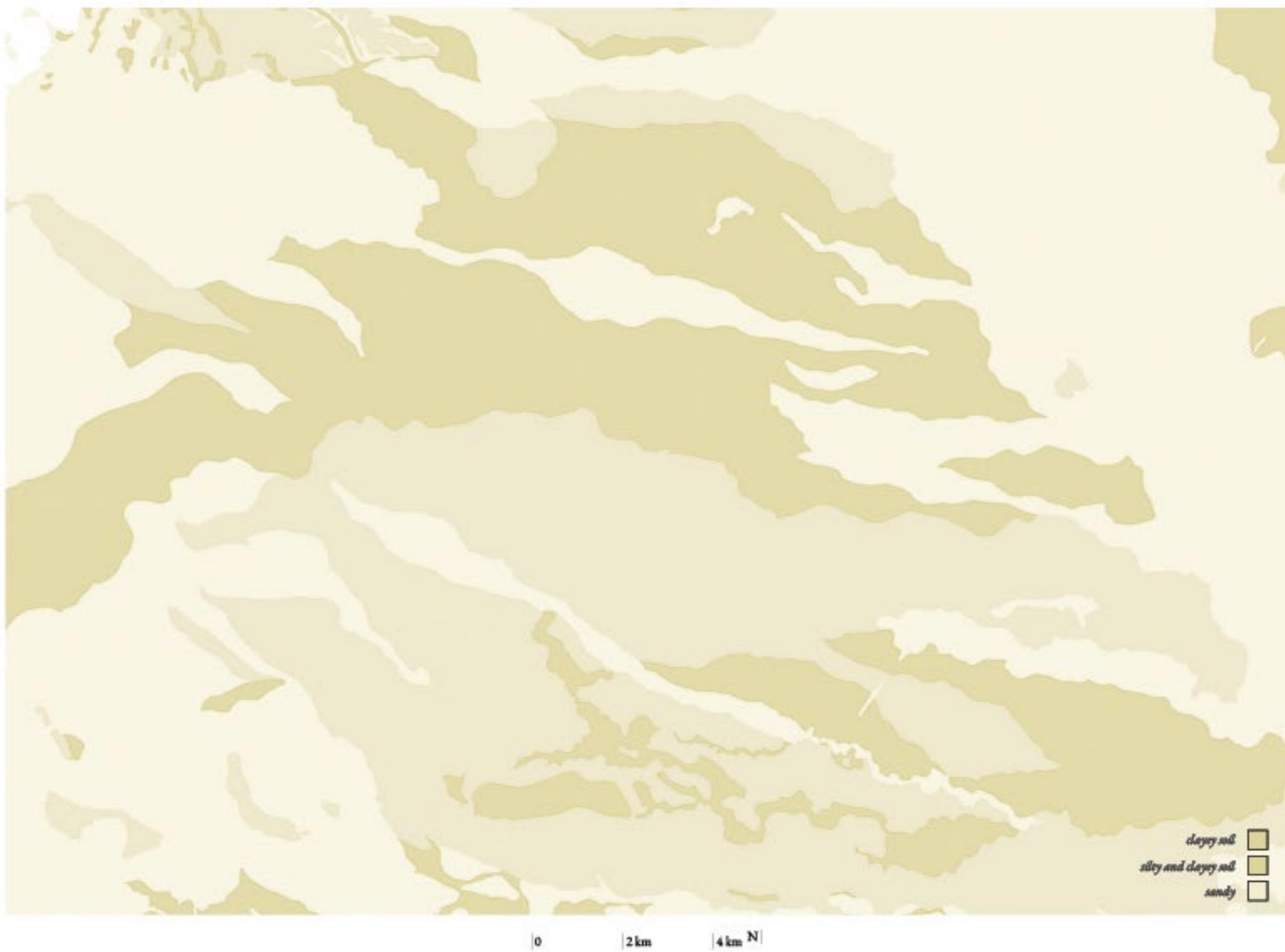
Soil - permeable layer



Soil typology. Source: Regions Piemonte, 2022.

The rebirth of the resurgence belt

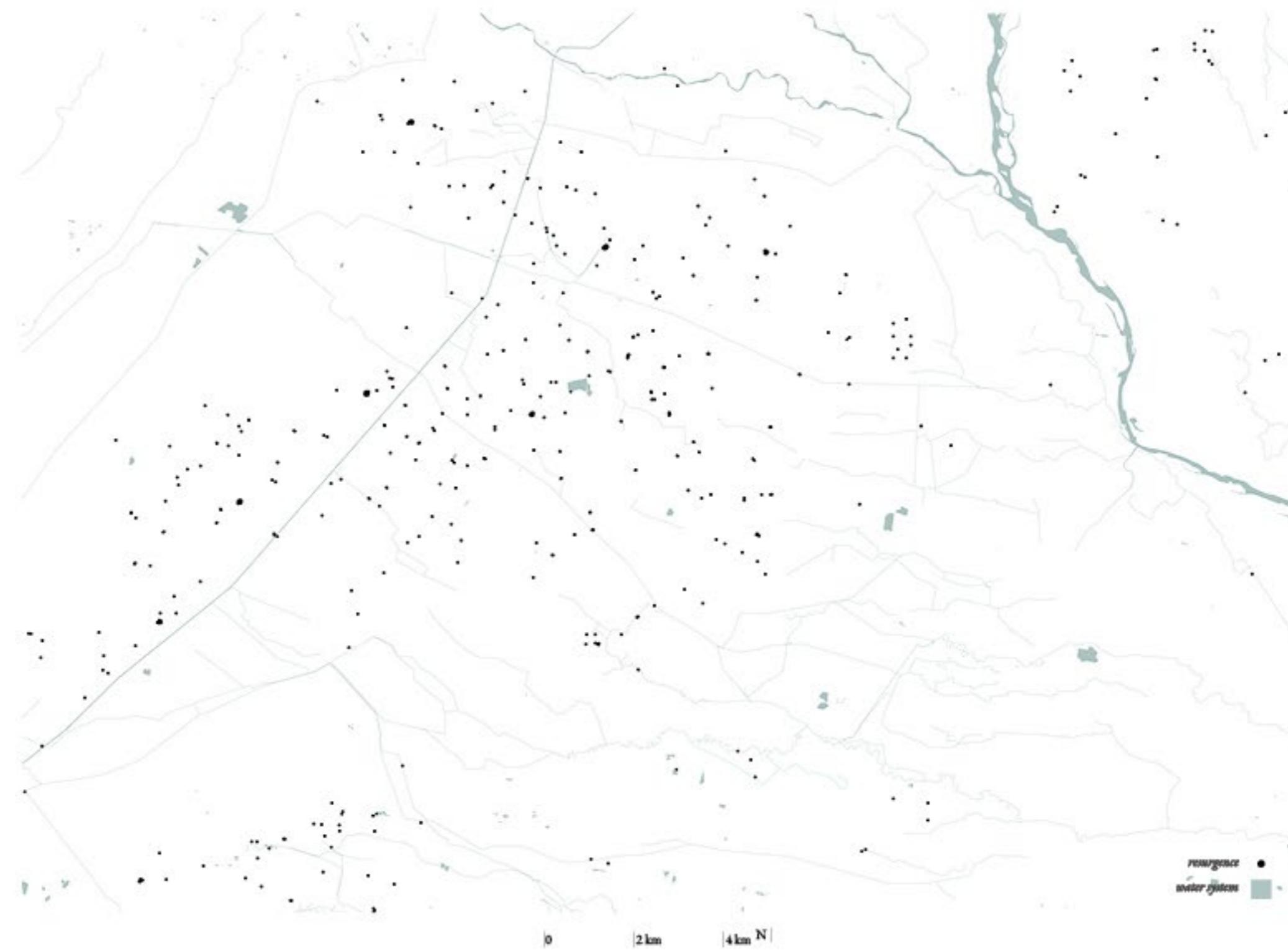
Soil



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

The rebirth of the resurgence belt

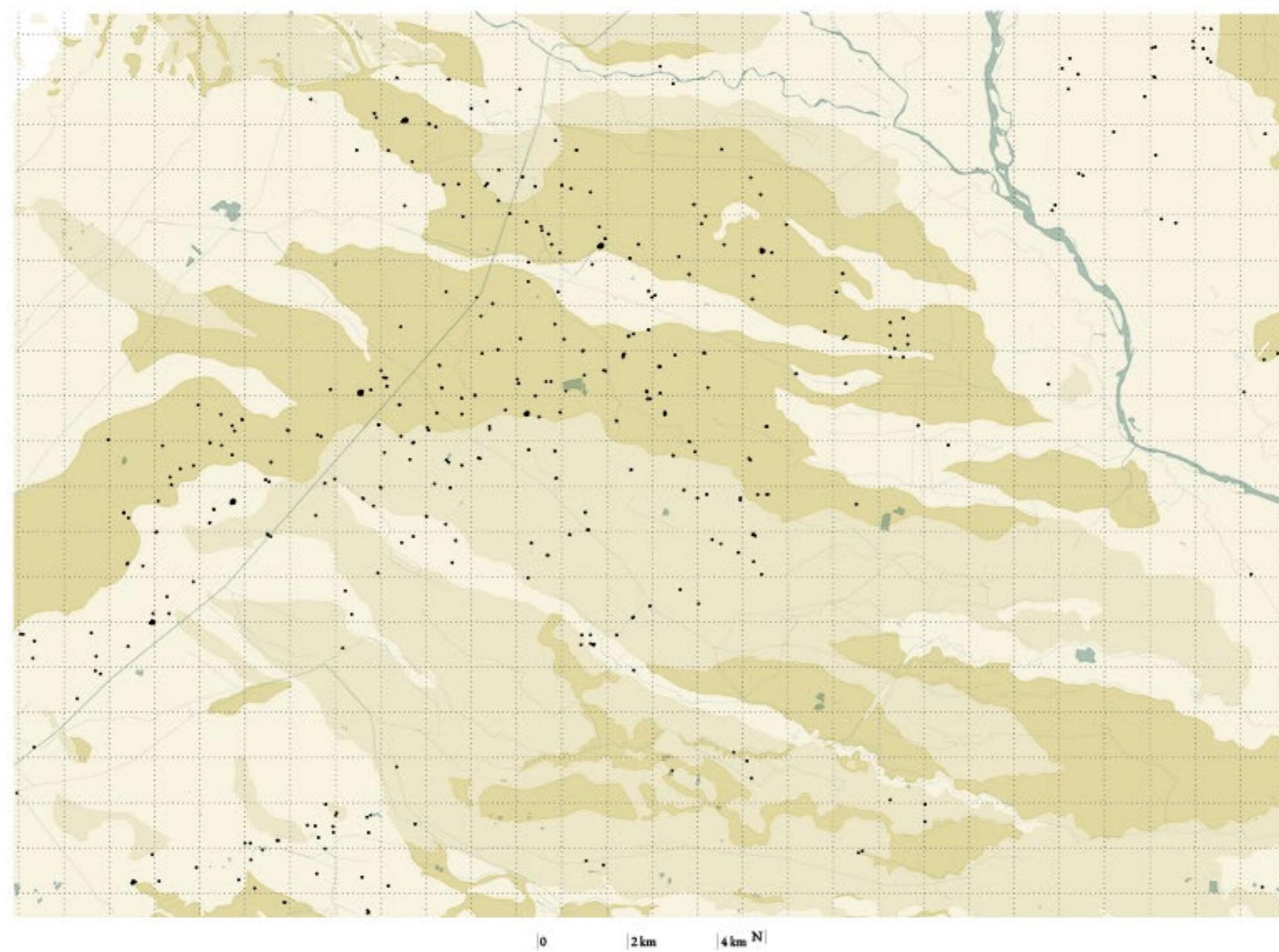
Water elements - current situation



Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

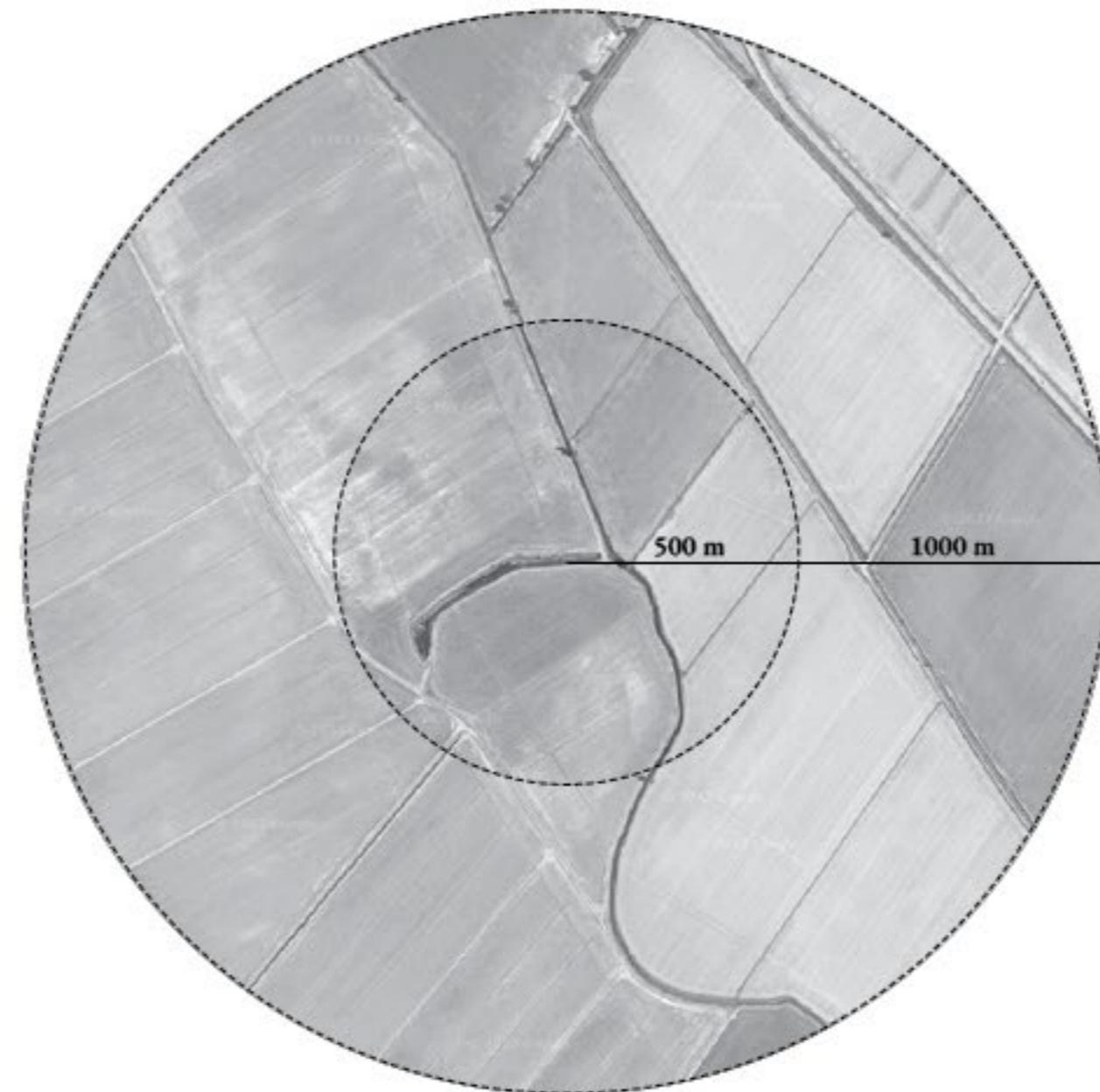
Soil and water system



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

The rebirth of the resurgence belt

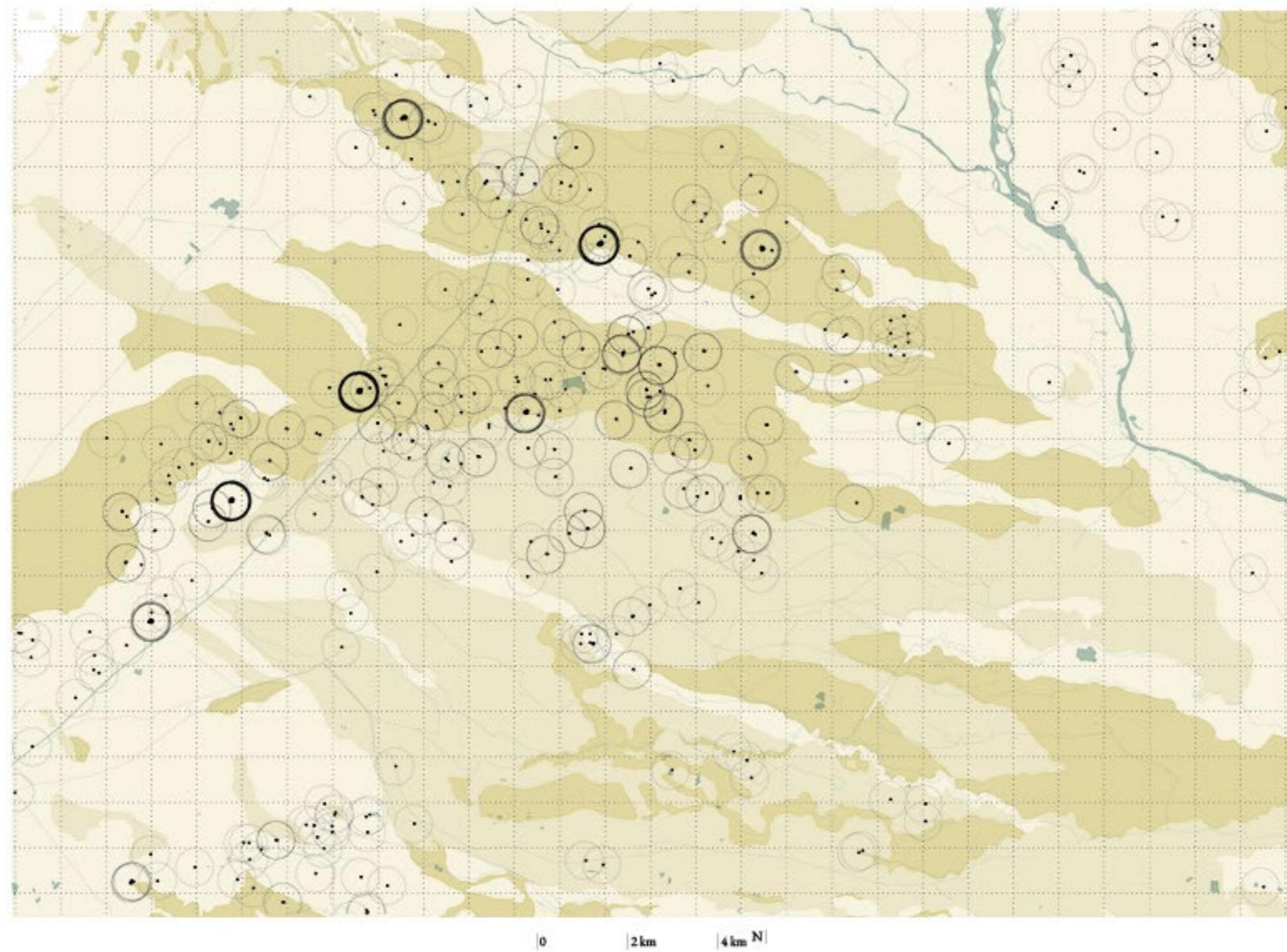
Buffer areas of resurgences



Source: Google Earth, 2022.

The rebirth of the resurgence belt

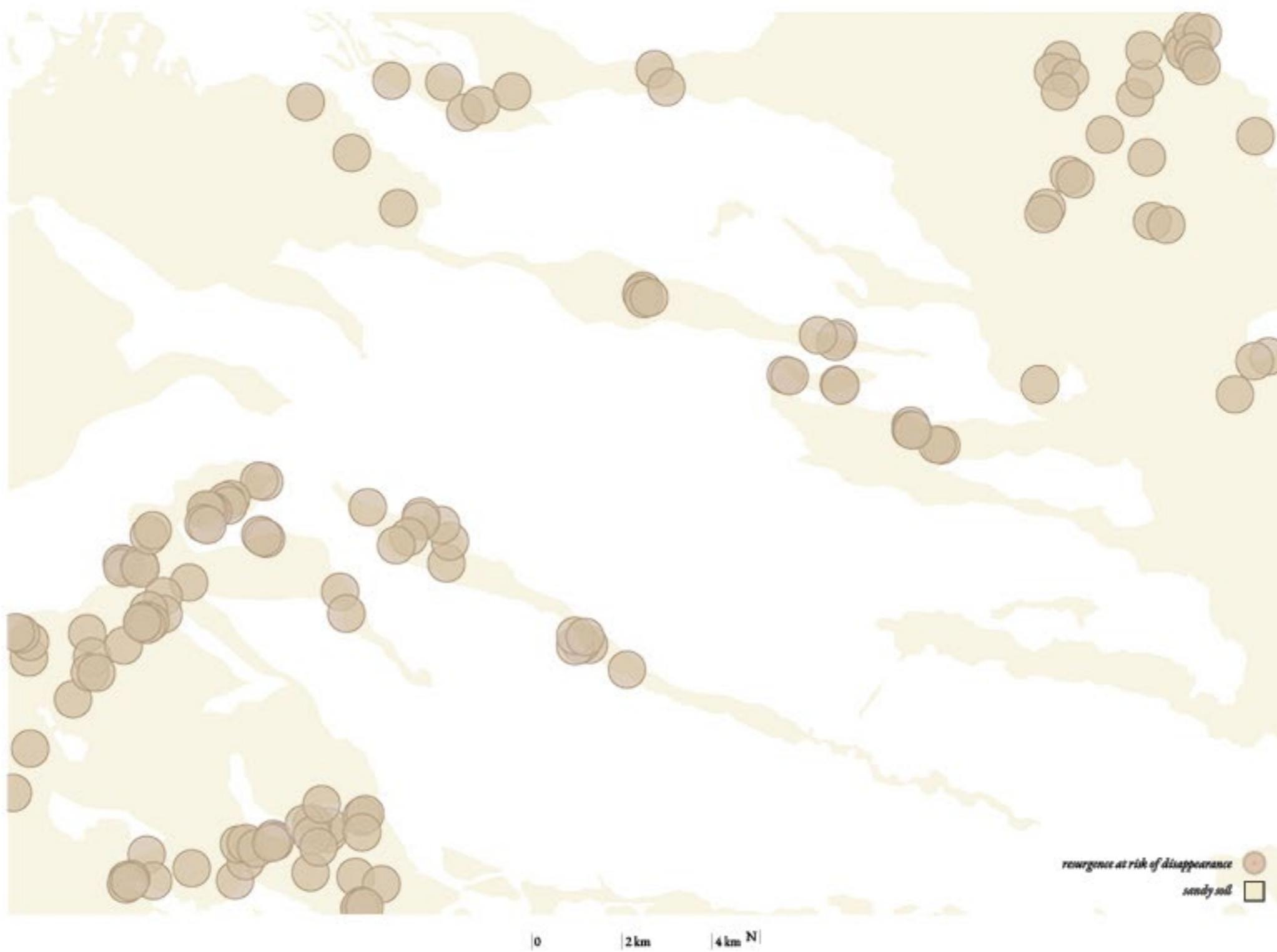
Soil and water system and buffer areas



Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

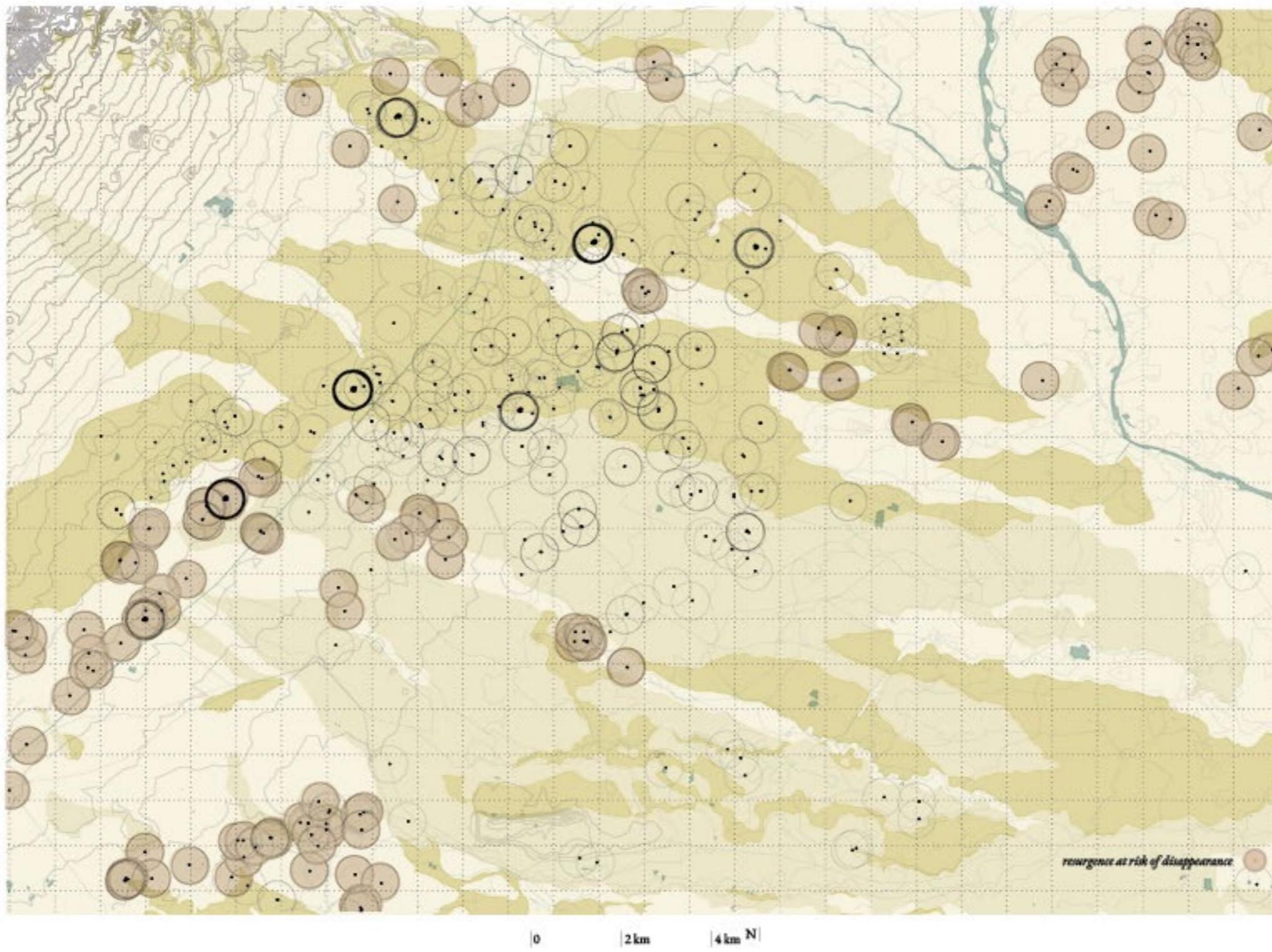
Resurgences at risk of disappearing



Soil typology. Source: Regions Piemonte, 2022.

The rebirth of the resurgence belt

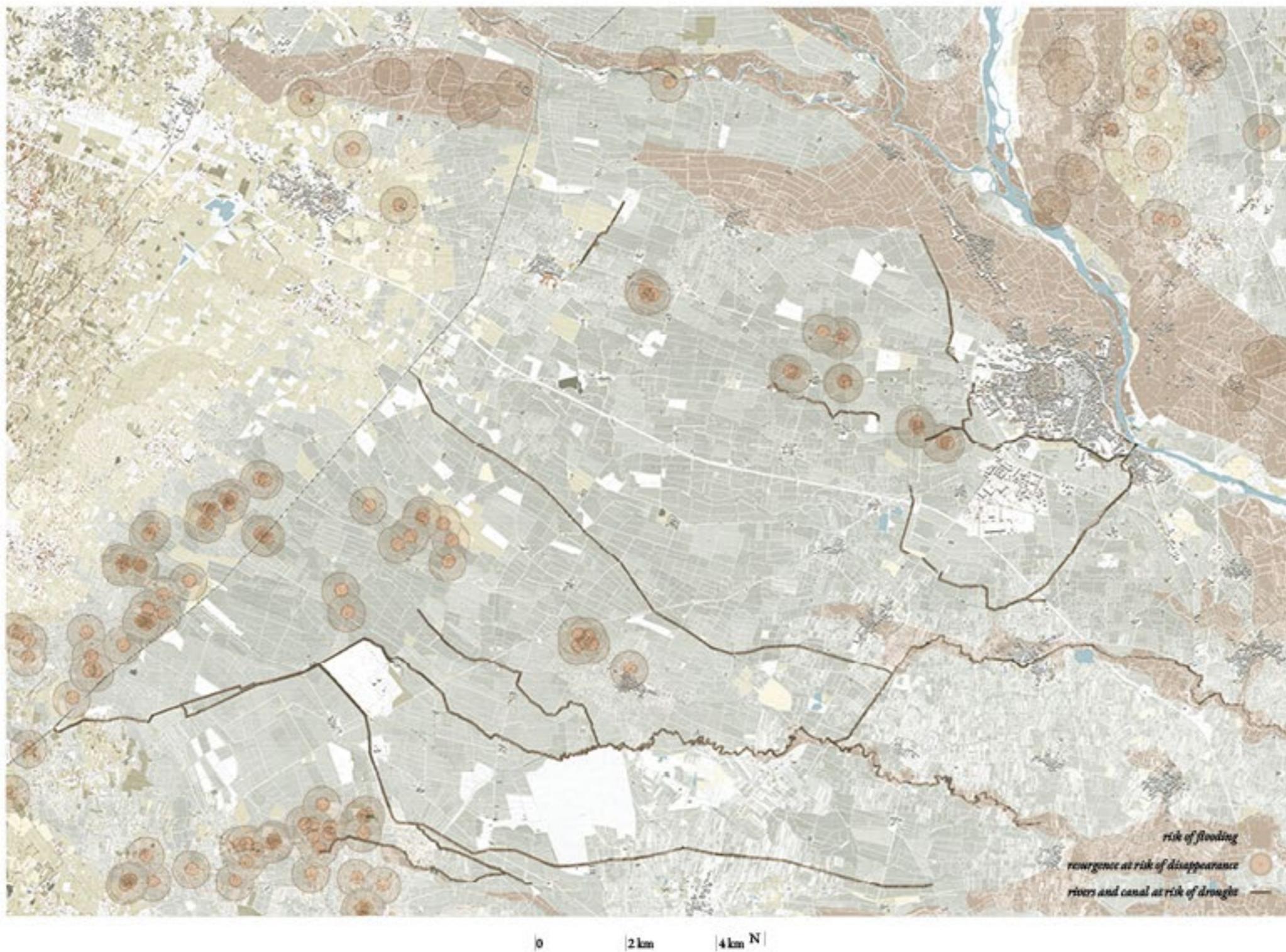
Soil and water system and buffer areas



Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

Current situation of possible hydrological risks



Source: Regione Piemonte, 2022.

The rebirth of the resurgence belt

Polyculture
alternative future for 2030



*The 3 landscapes of 2030
alternative future*

1. Wilderness



2. Productive landscape

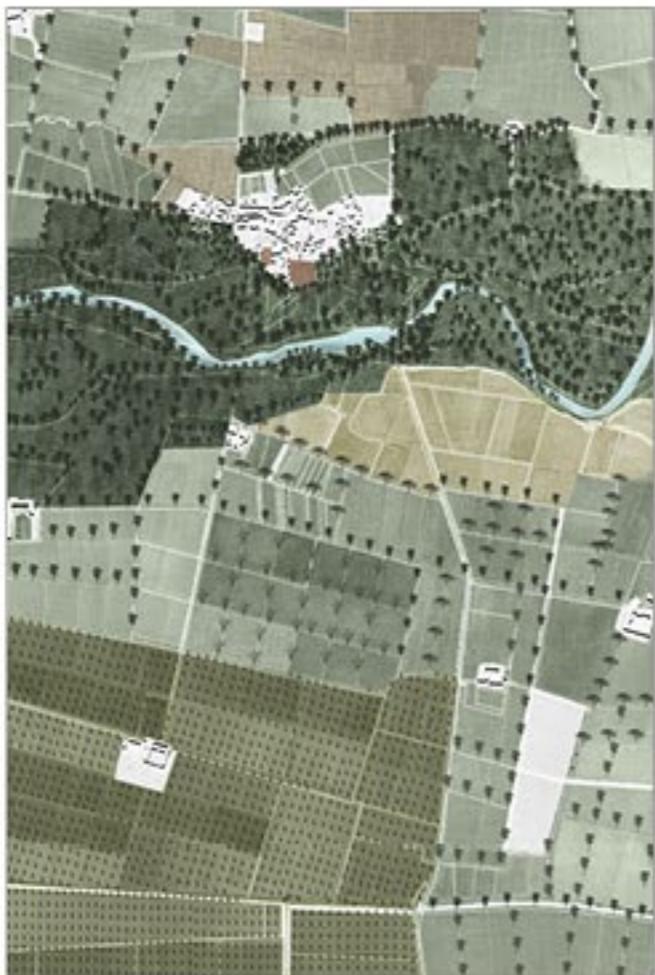


3. Culture



*The 3 landscapes of 2030
alternative future*

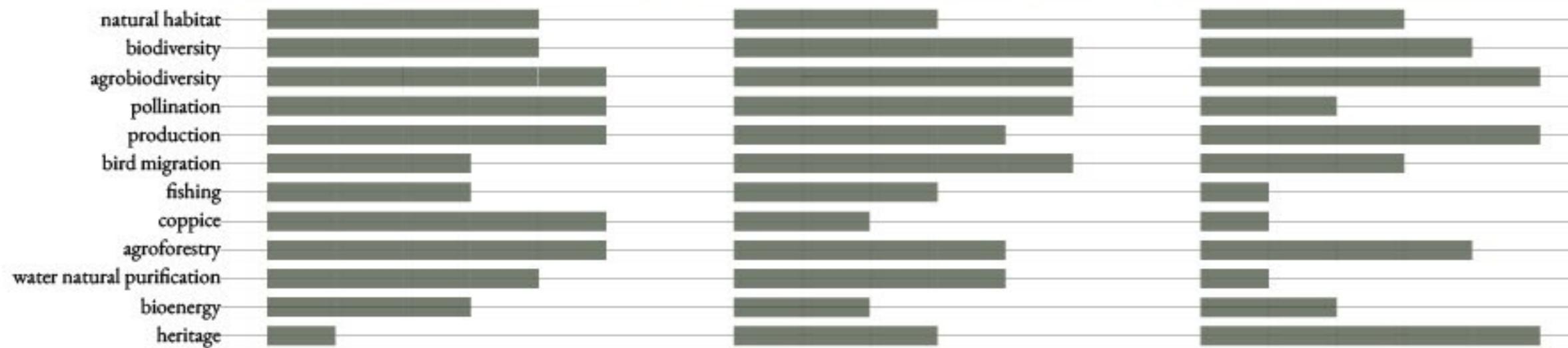
1. Wilderness



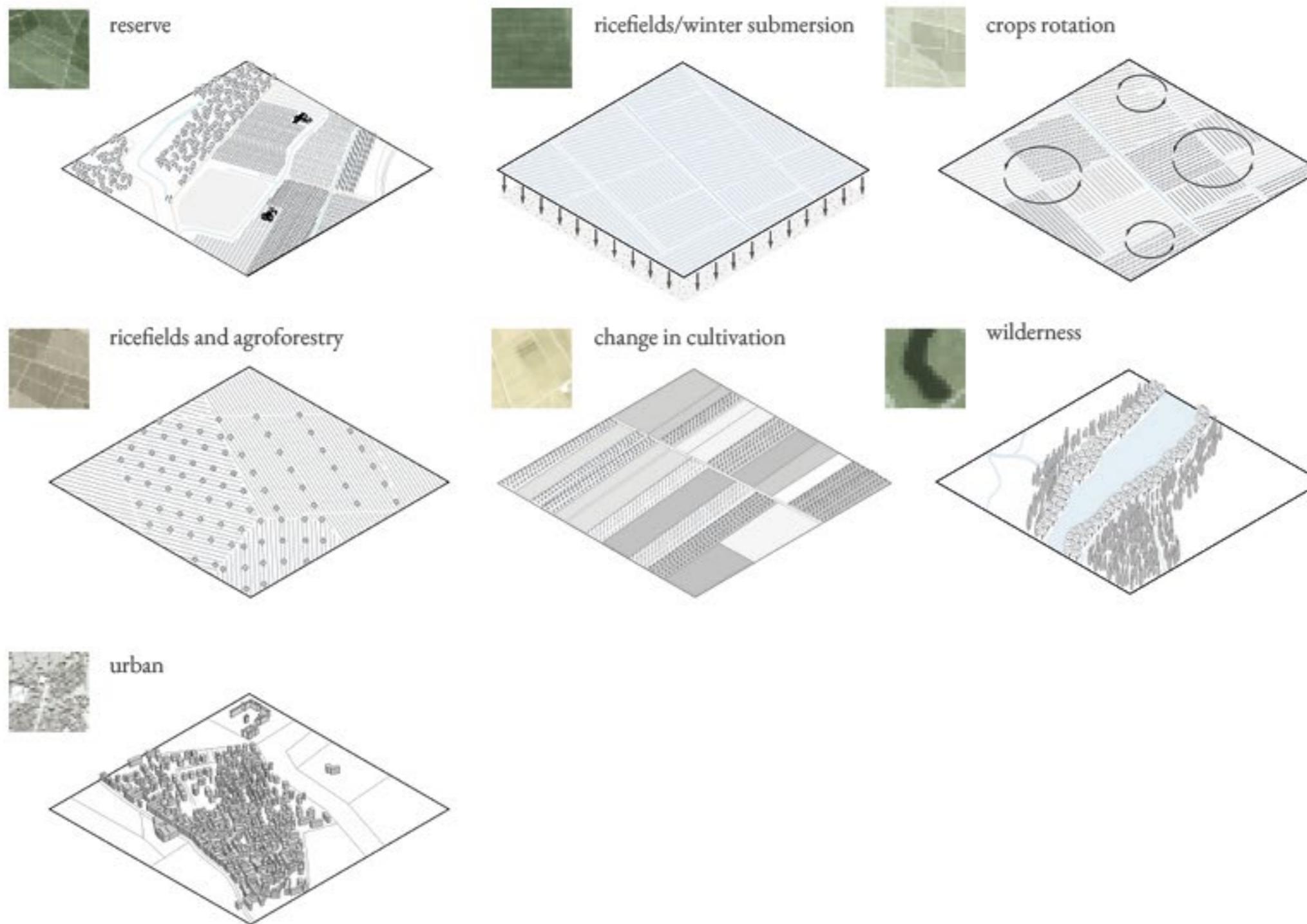
2. Productive landscape



3. Culture



Actions
alternative future for 2030



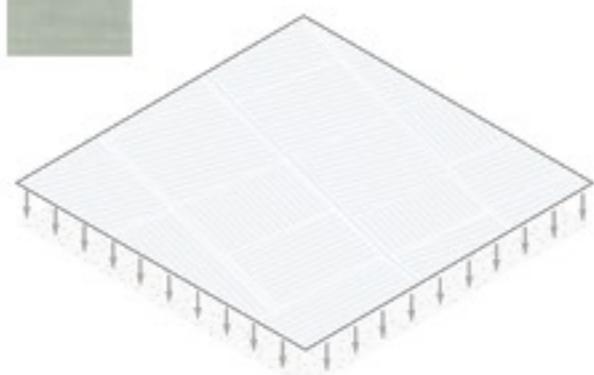
Actions
alternative future for 2030



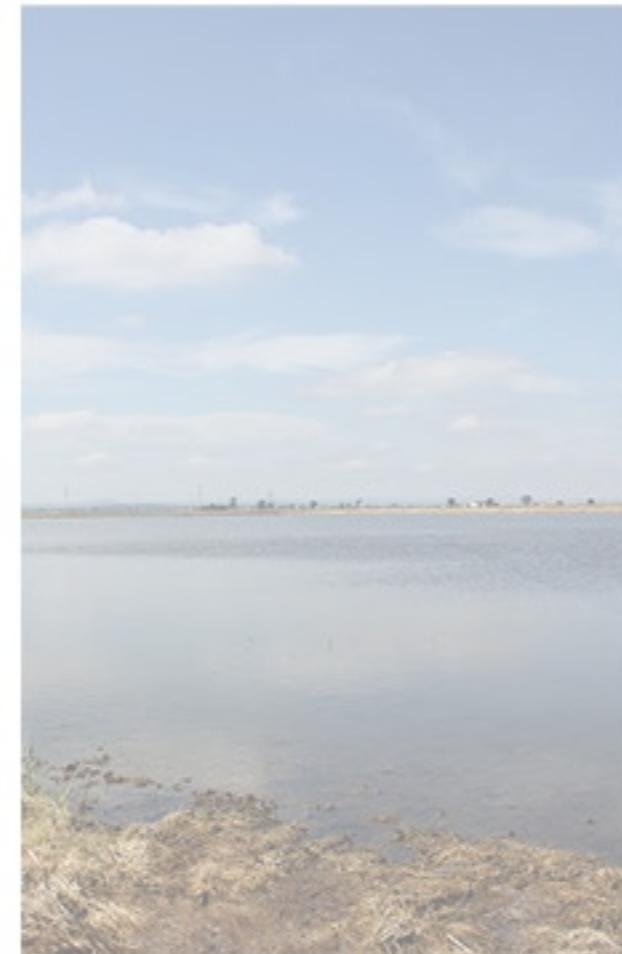
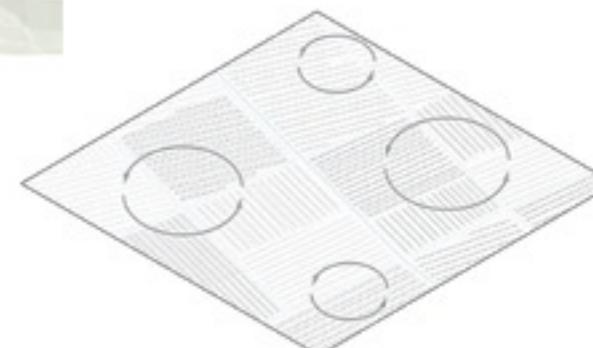
reserve



ricefields/winter submersion



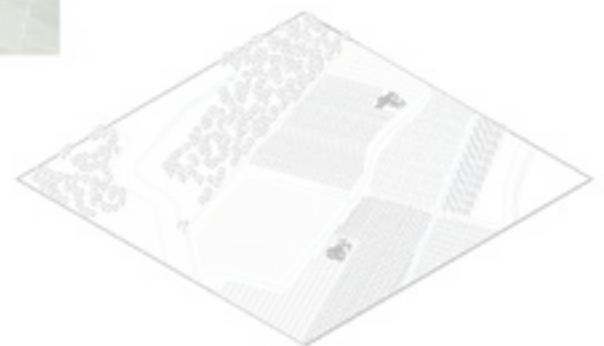
crops rotation



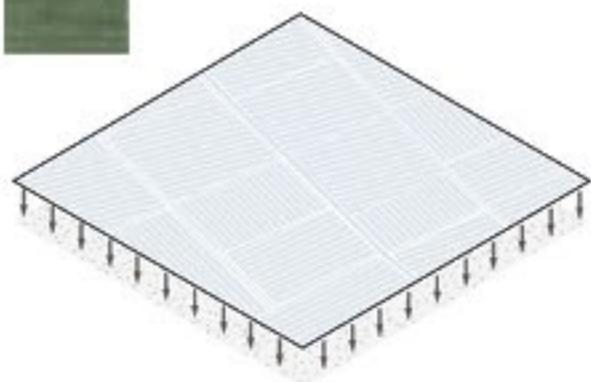
Actions
alternative future for 2030



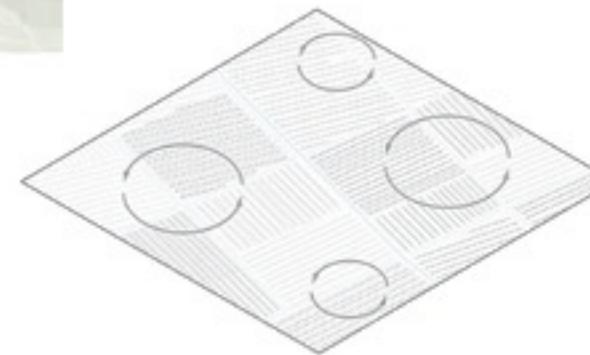
reserve



ricefields/winter submersion



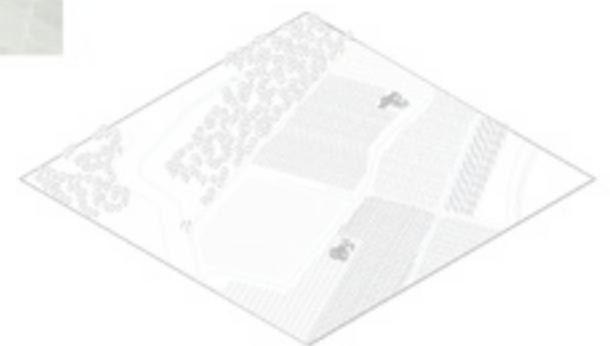
crops rotation



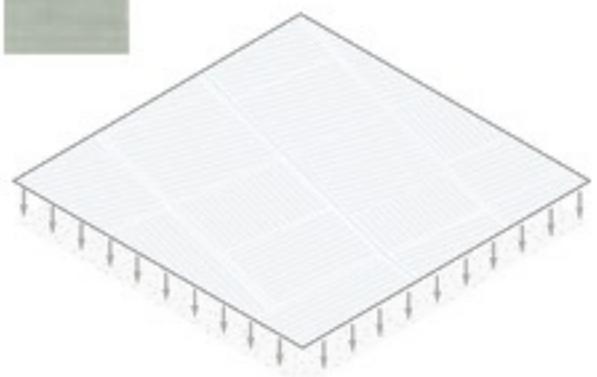
Actions
alternative future for 2030



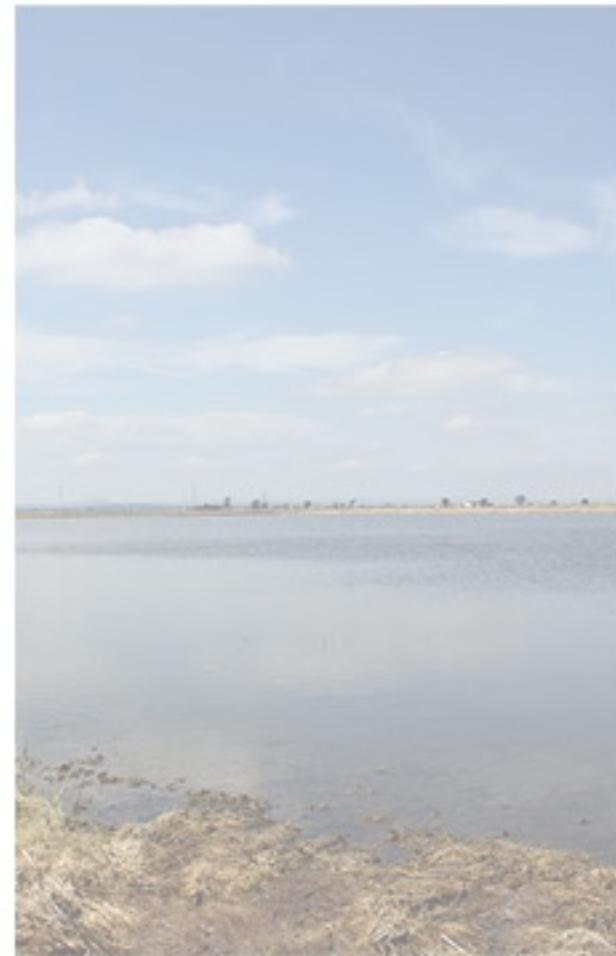
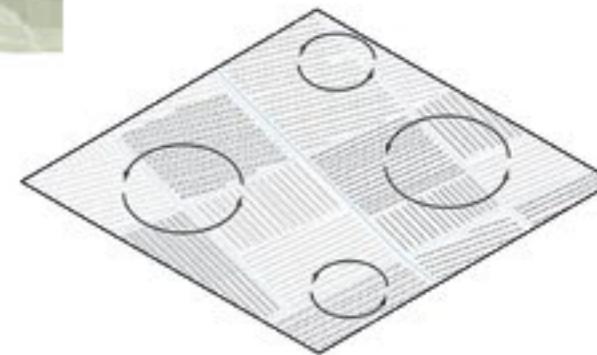
reserve



ricefields/winter submersion



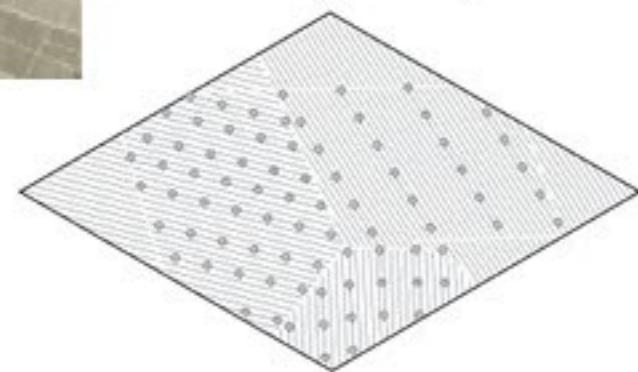
crops rotation



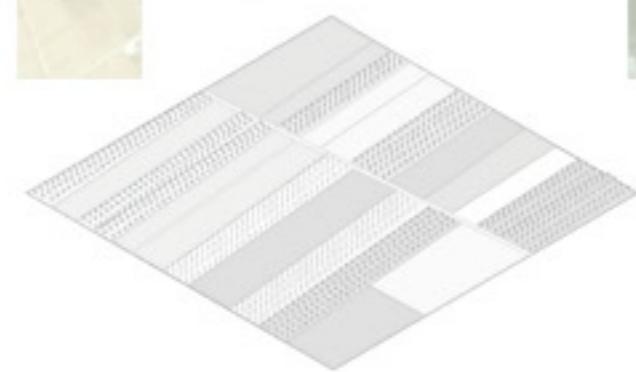
Actions
alternative future for 2030



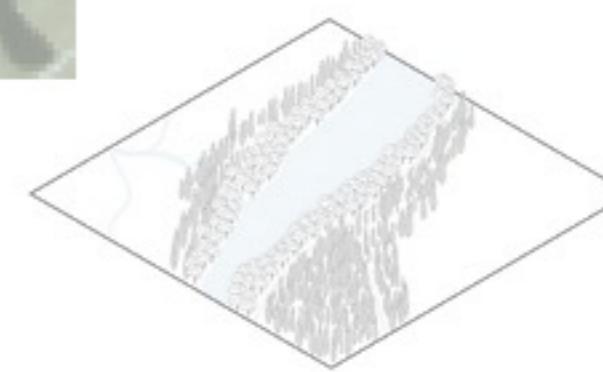
ricefields and agroforestry



change in cultivation



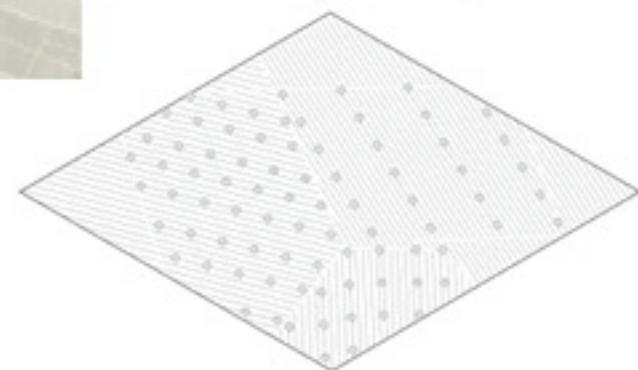
wilderness



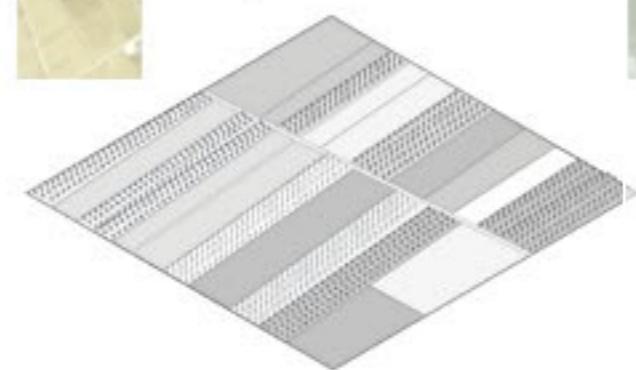
Actions
alternative future for 2030



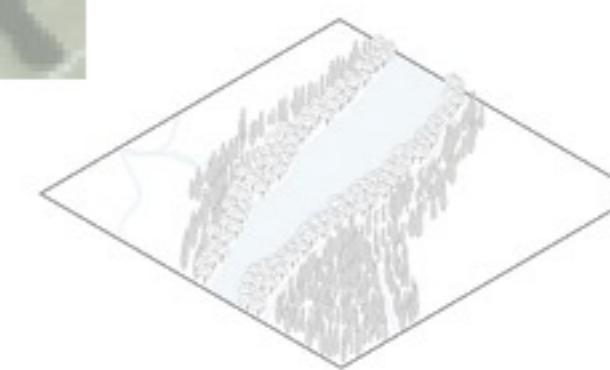
ricefields and agroforestry



change in cultivation



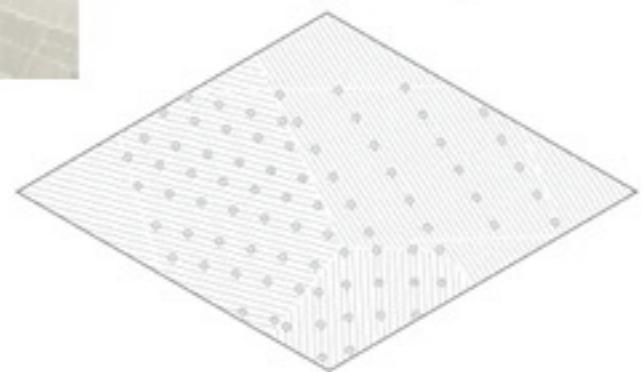
wilderness



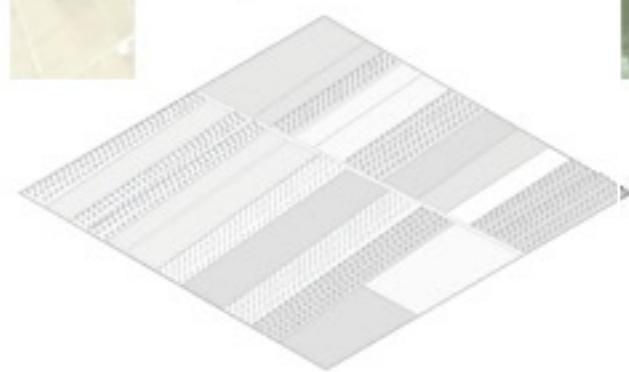
Actions
alternative future for 2030



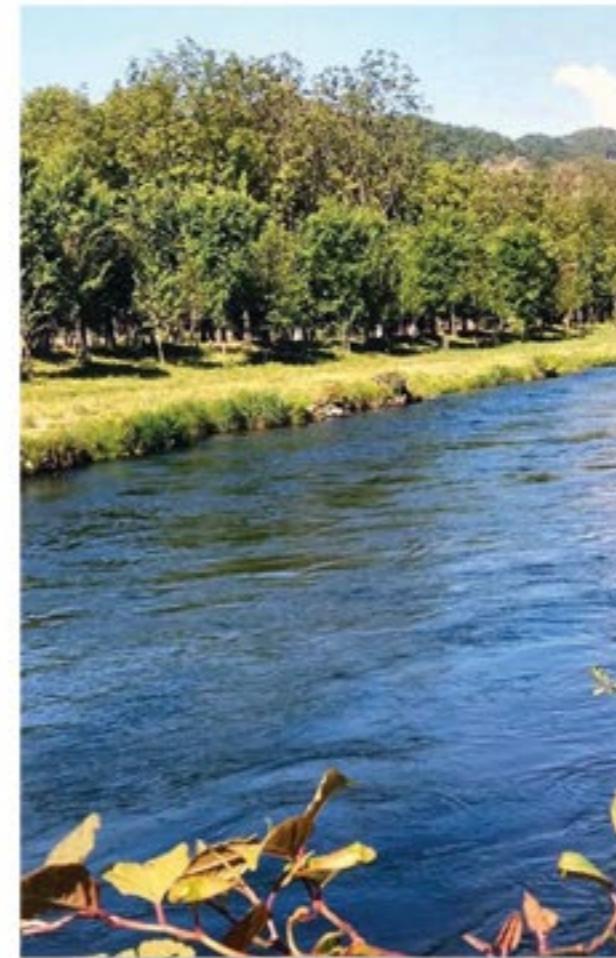
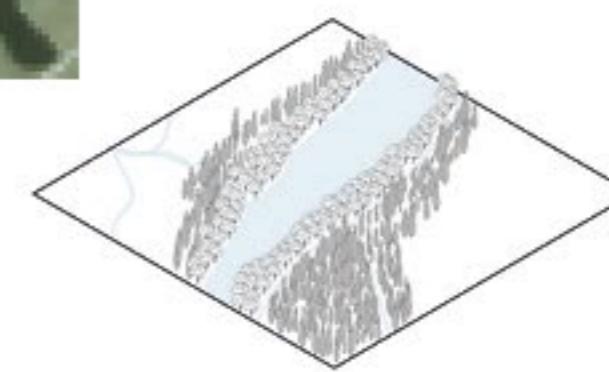
ricefields and agroforestry



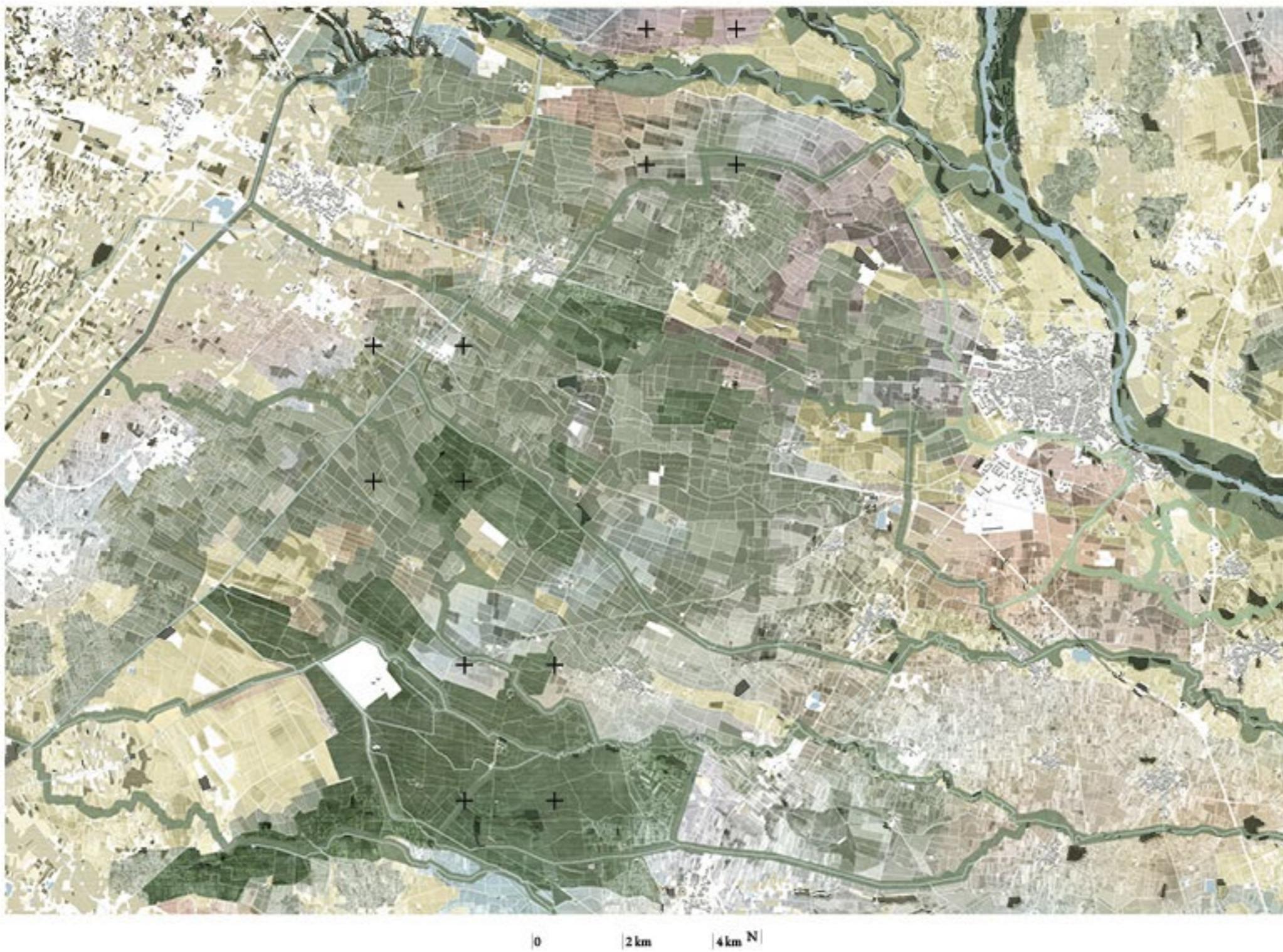
change in cultivation



wilderness



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*

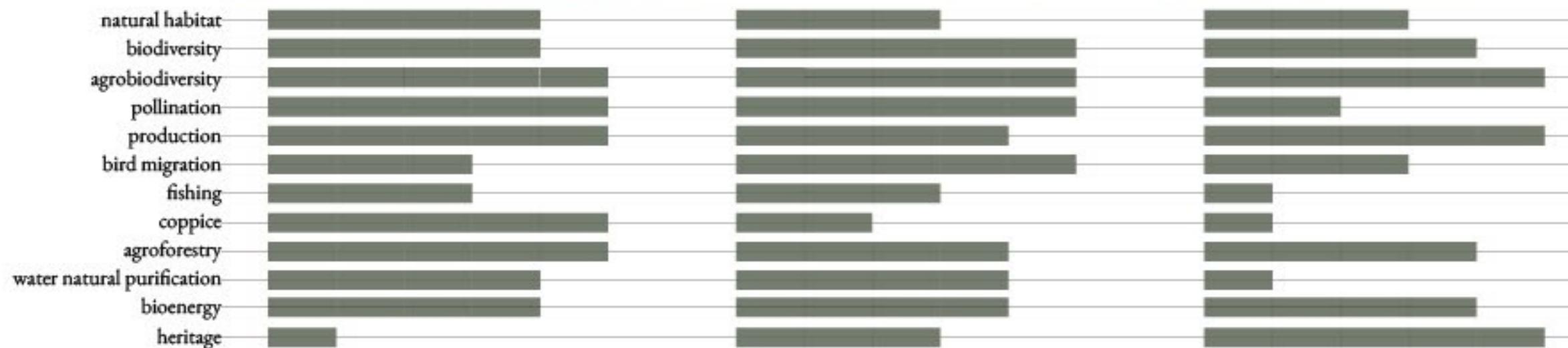
1. Wilderness



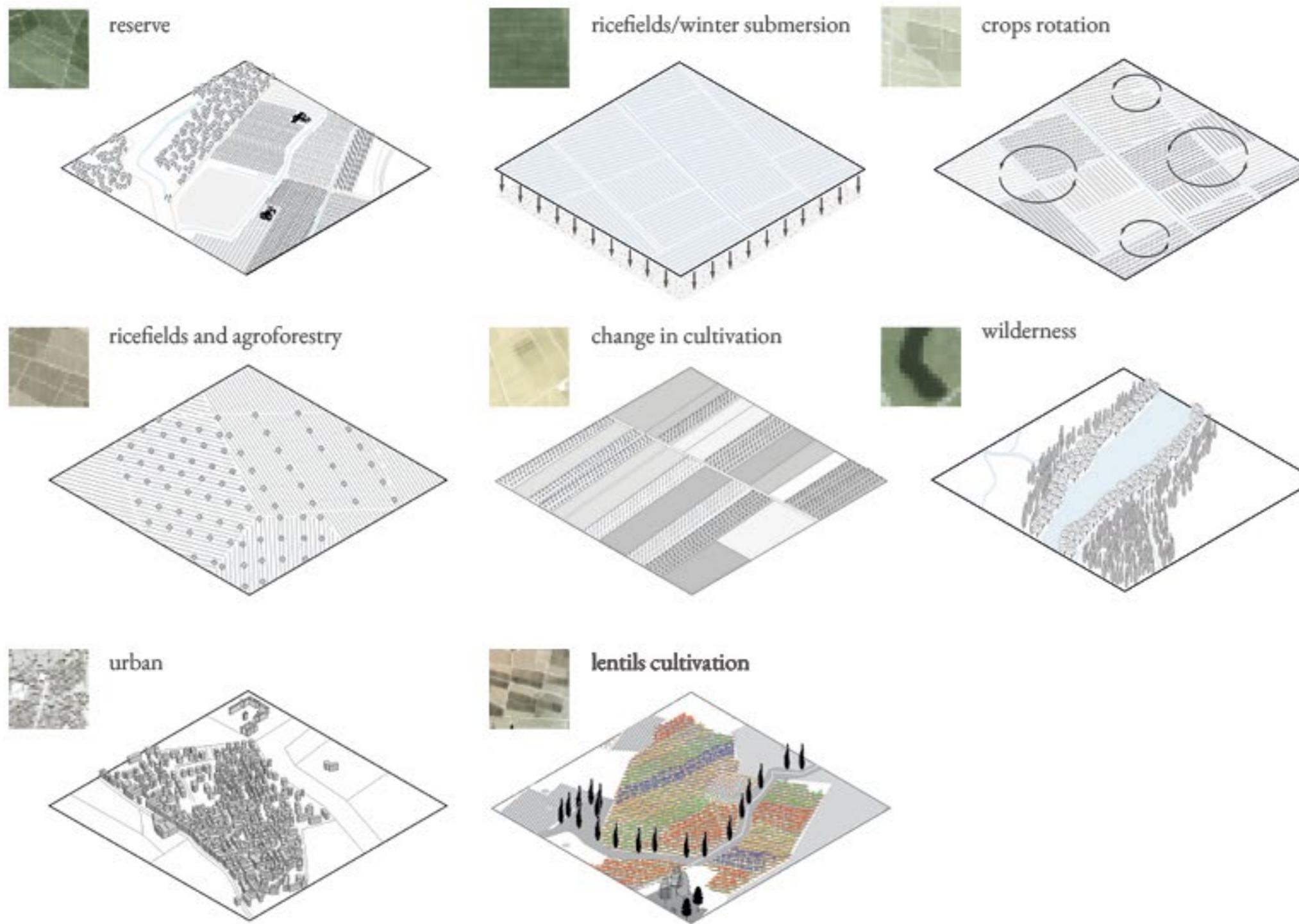
2. Productive landscape



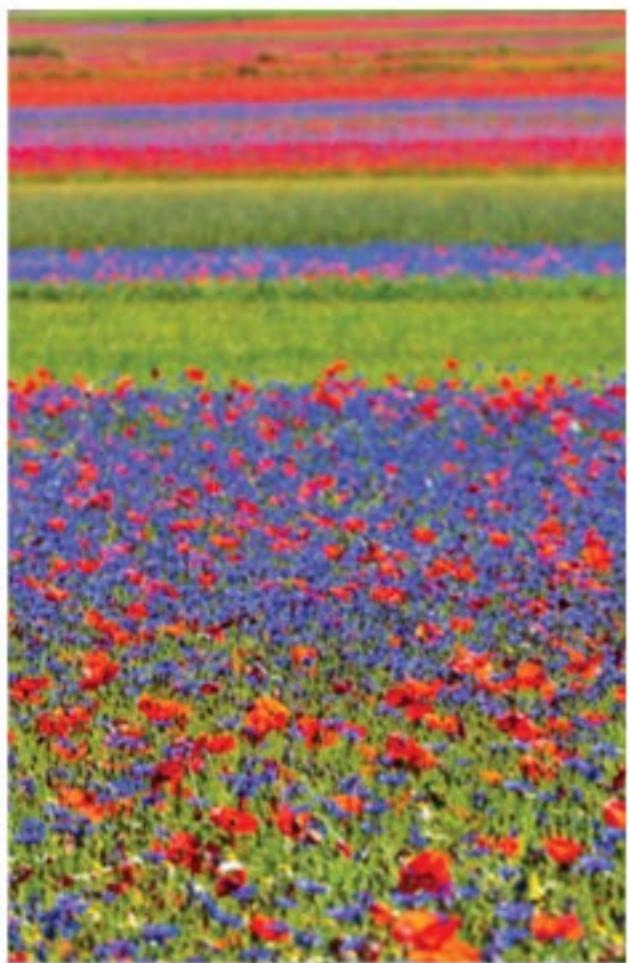
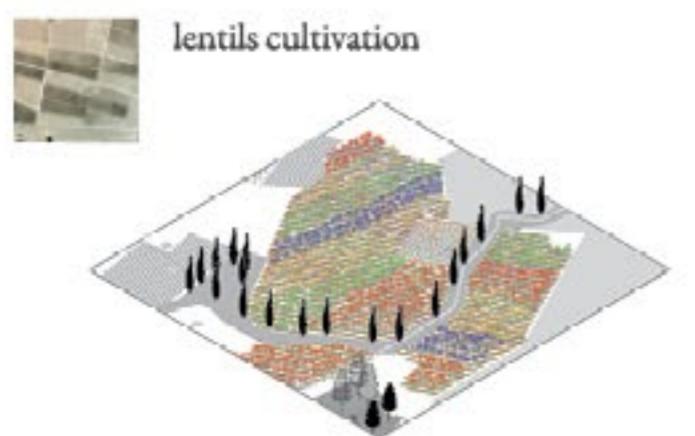
3. Culture



Actions
alternative future for 2040



Actions
alternative future for 2040



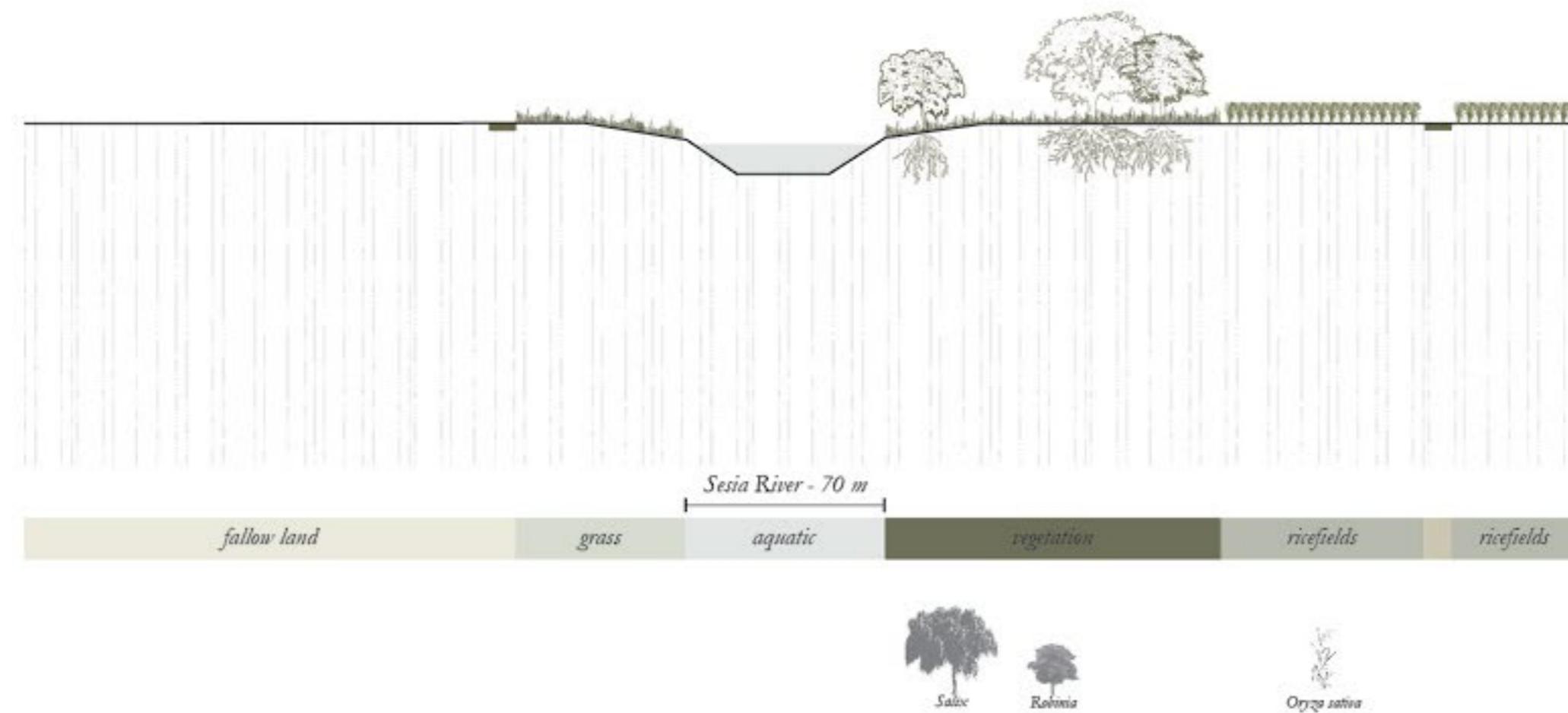
Source: <http://viaggi.corriere.it/titineuri-e-lughi/itards/fioritura-castelli-città-nove-a-sapere/?img=6>

The rebirth of the resurgence belt

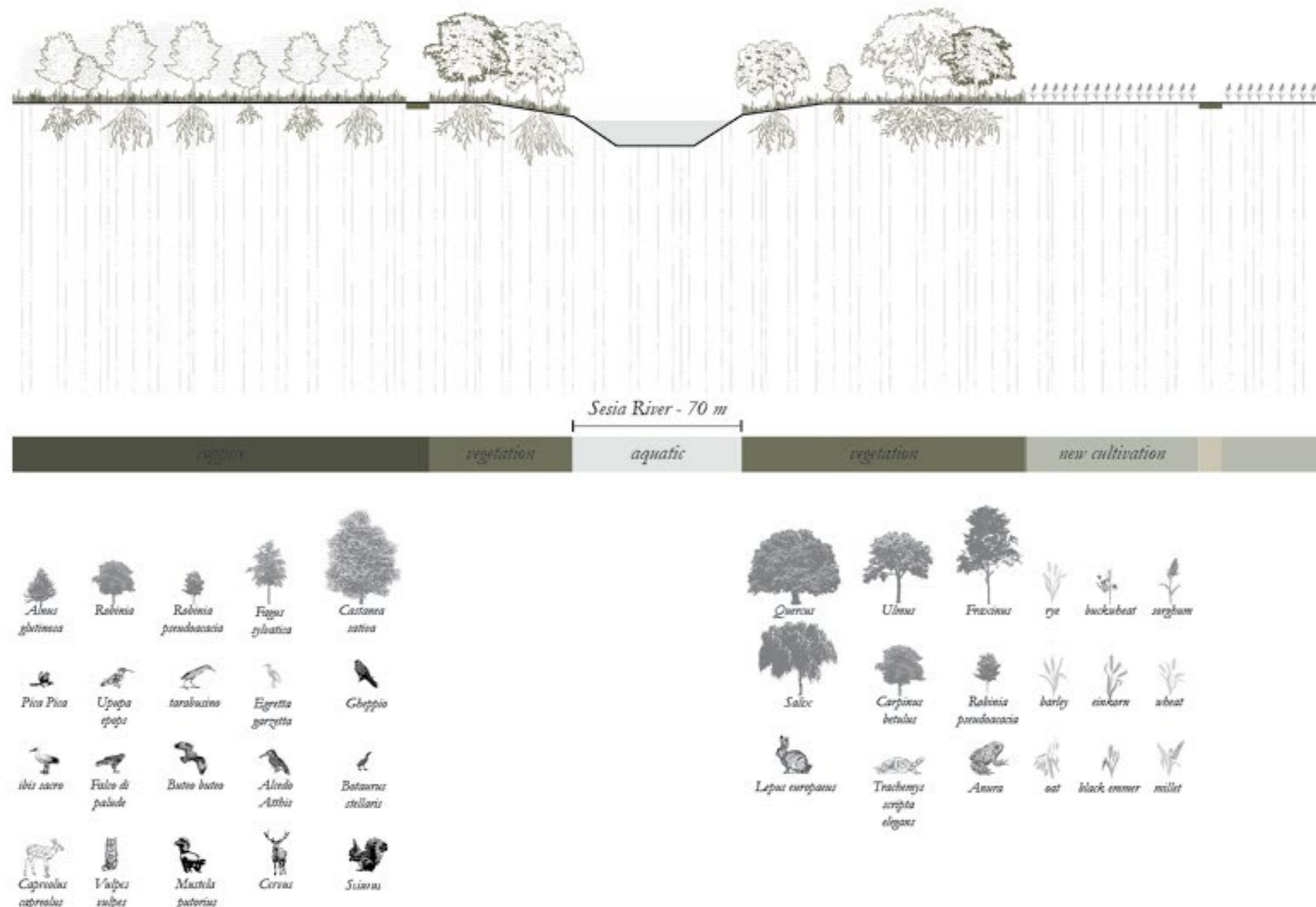
Ecological corridors
alternative future for 2040



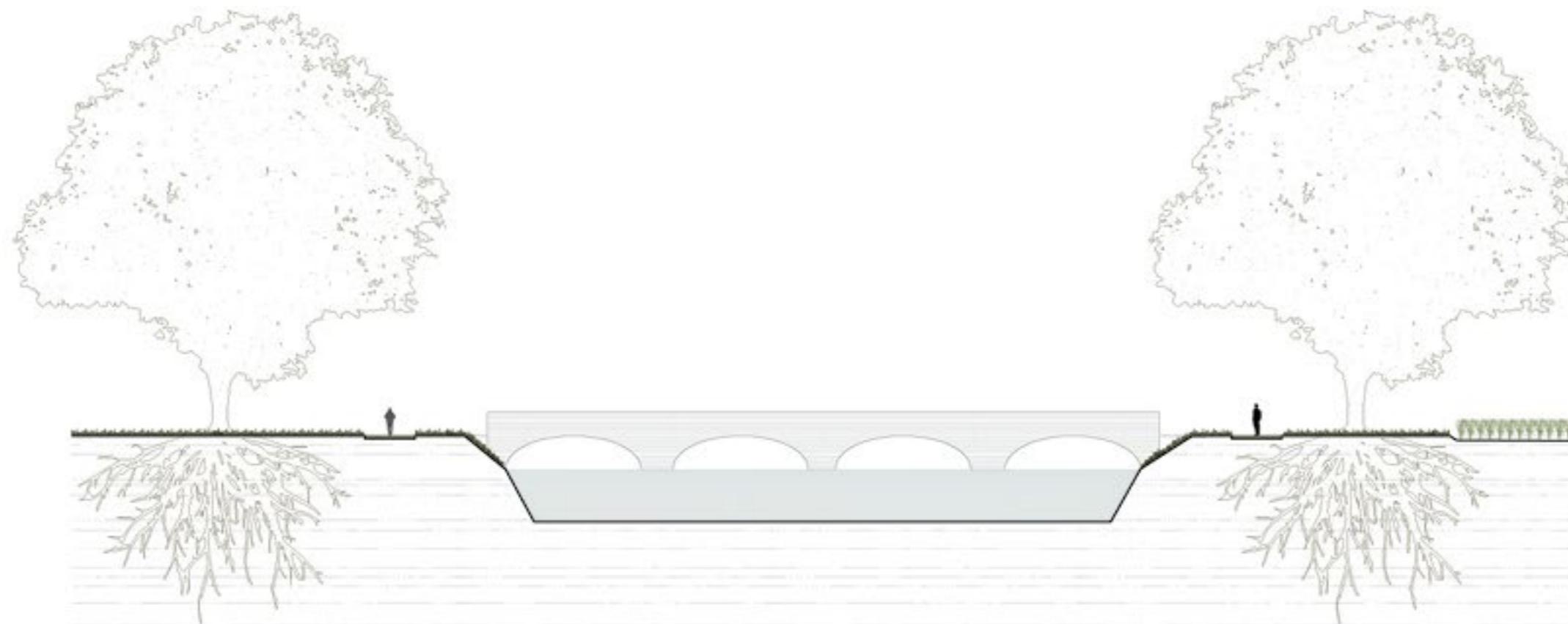
Primary corridor
alternative future for 2030



*Primary corridor
alternative future for 2030*



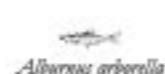
Secondary corridor
Existing



Cavour Canal - 35 m



Quercus Robur



Alburnus arberus



Rattus rattus



Barbus Barbus



Canadair Challenger

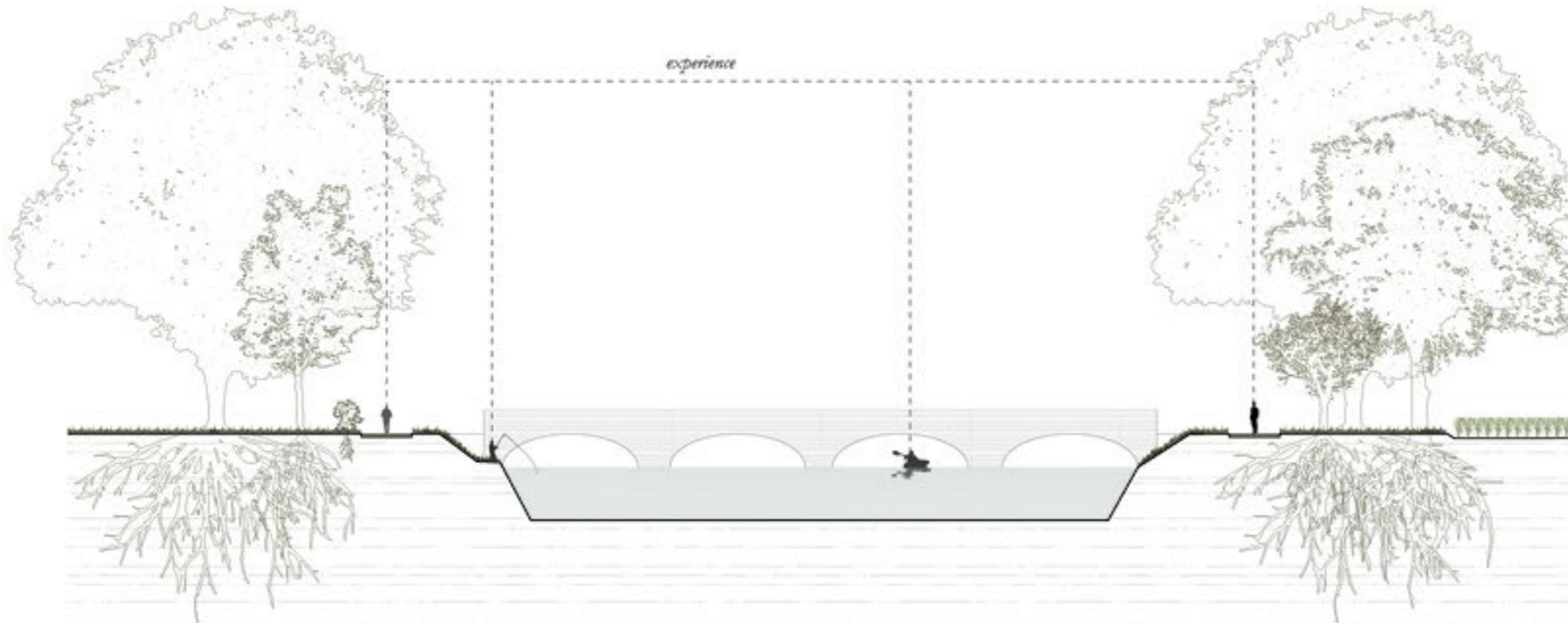


Quintus Robin

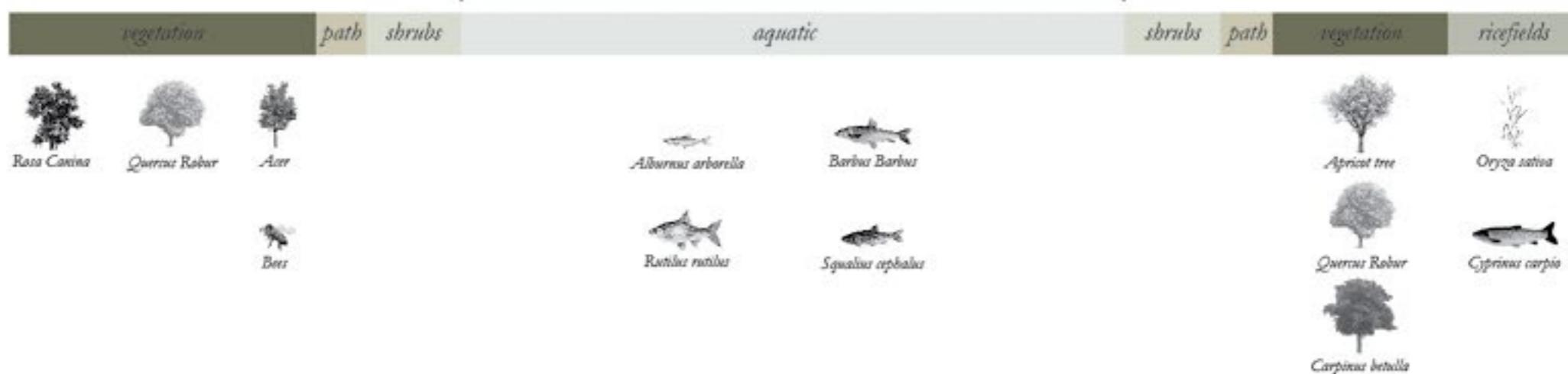


Onyx sativa

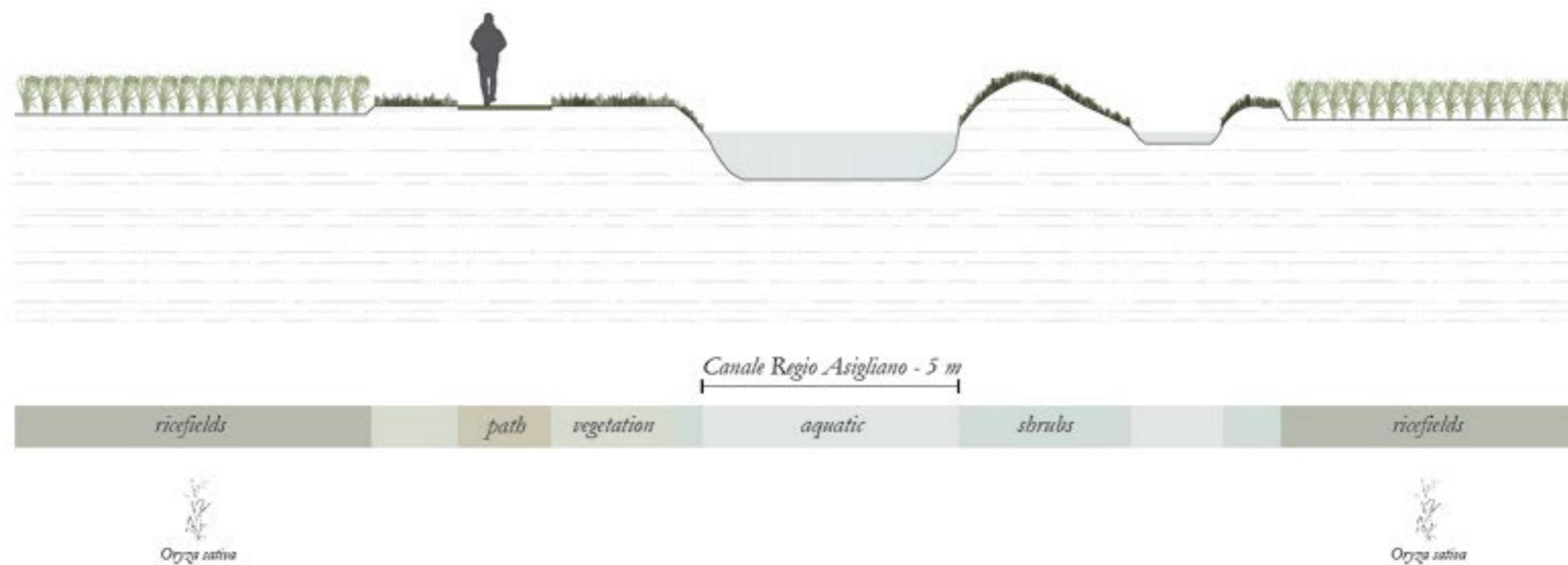
*Secondary corridor
alternative future for 2030*



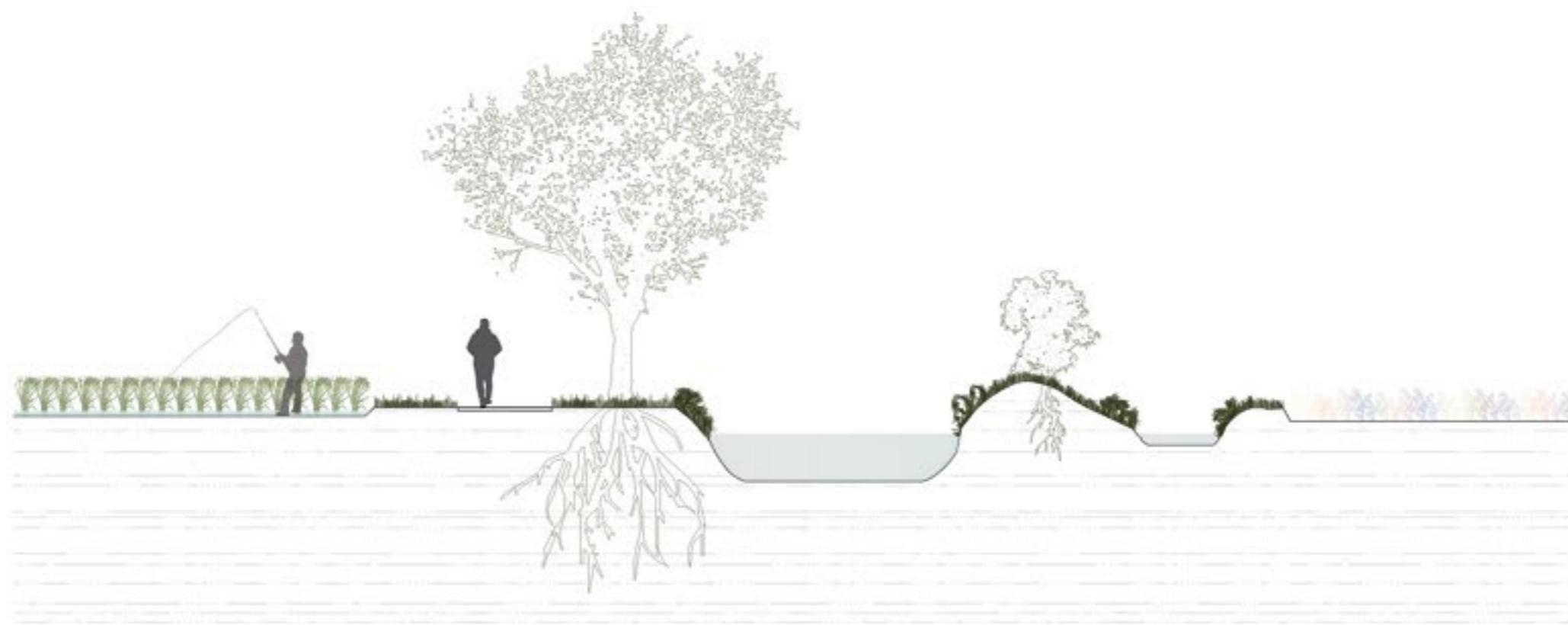
Cavour Canal - 35 m



Secondary corridor
Existing



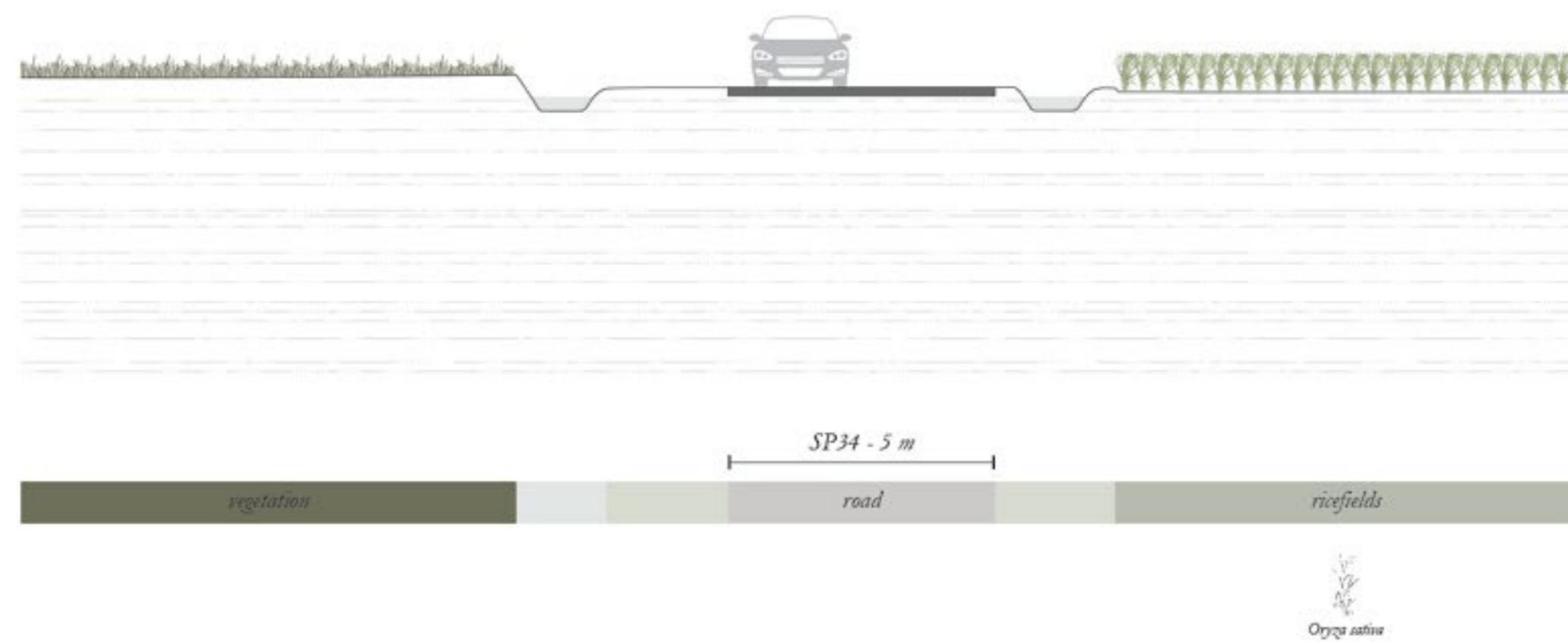
*Secondary corridor
alternative future for 2030*



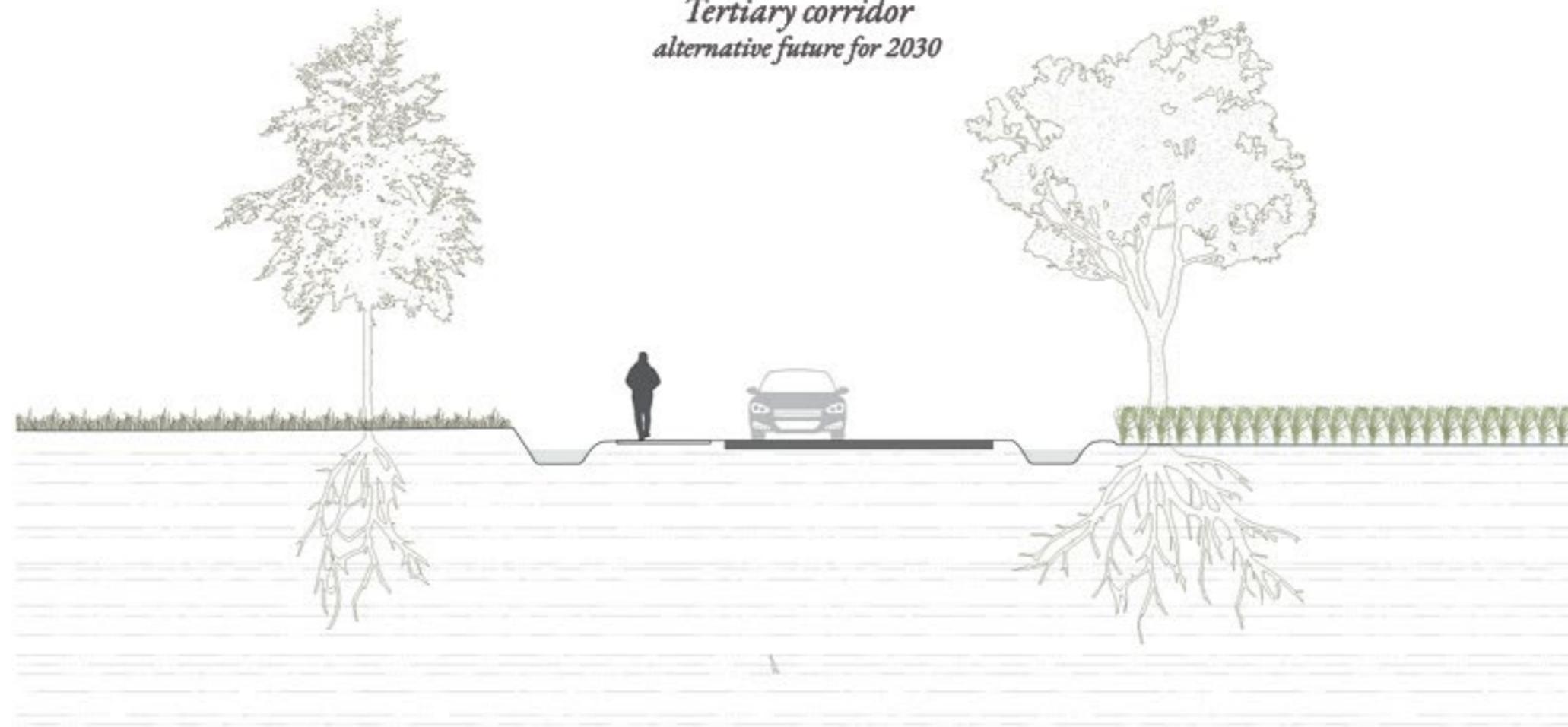
Canale Regio Asigliano - 5 m



Tertiary corridor
existing

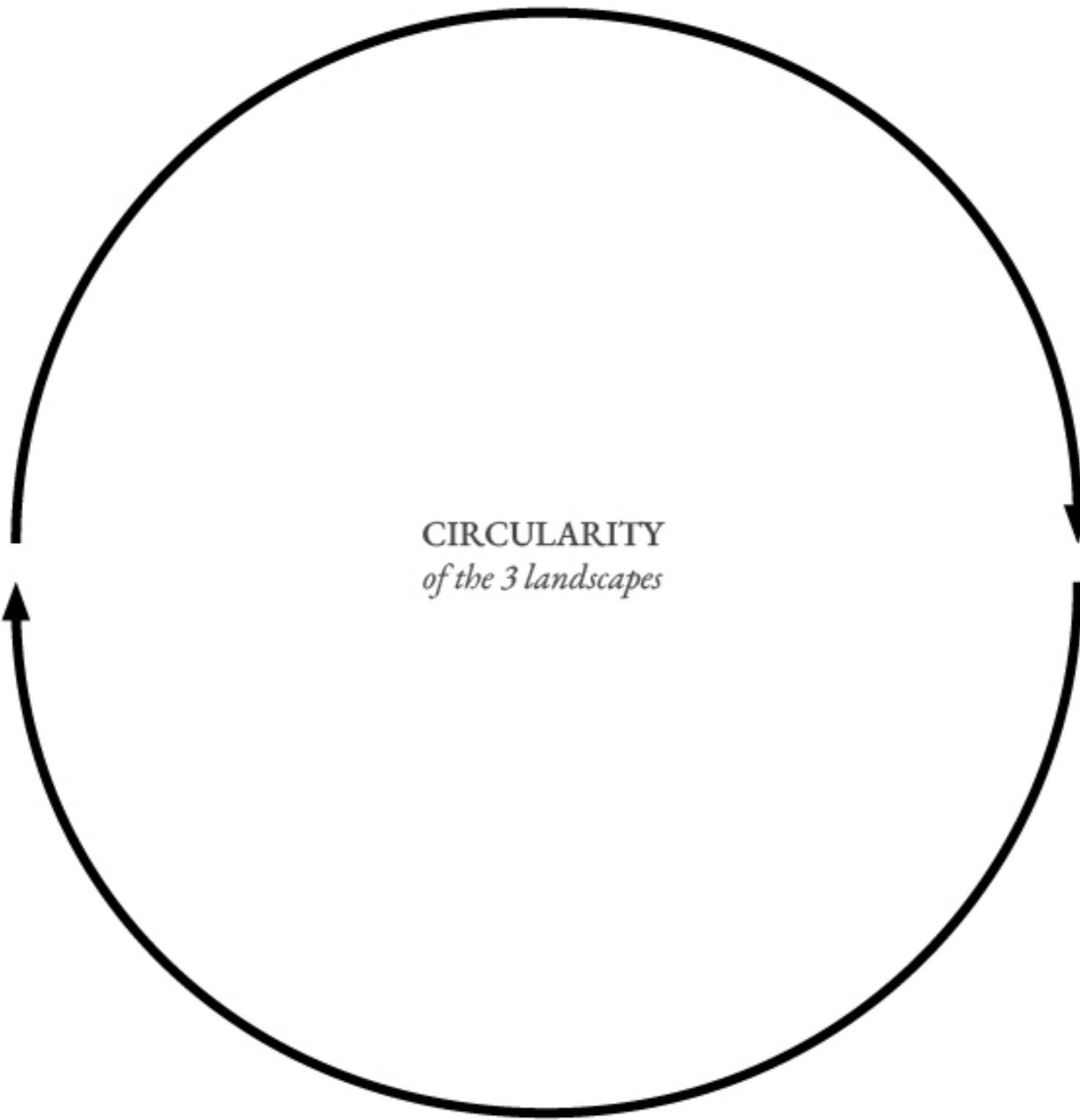


*Tertiary corridor
alternative future for 2030*

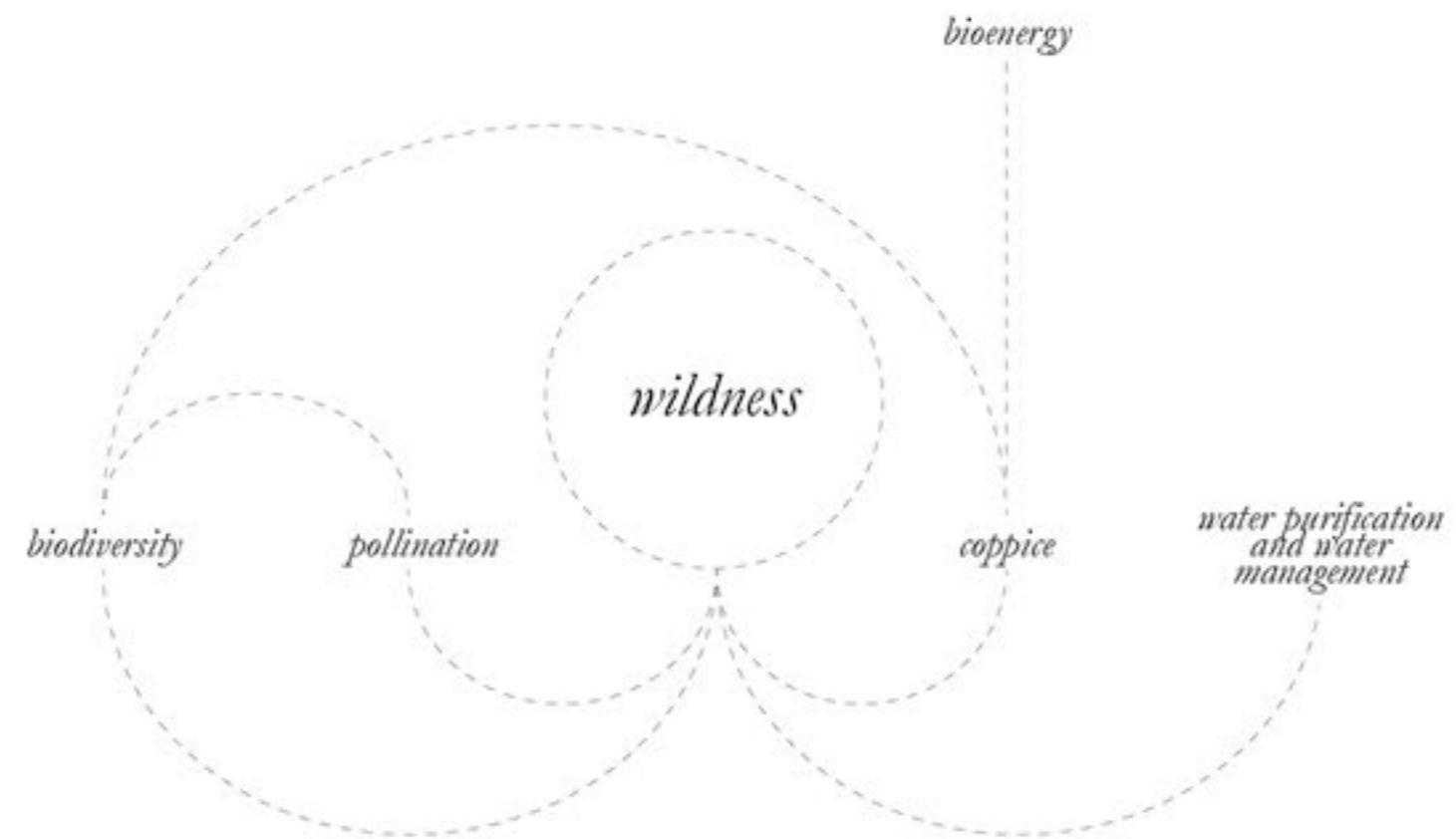


SP34 - 5 m

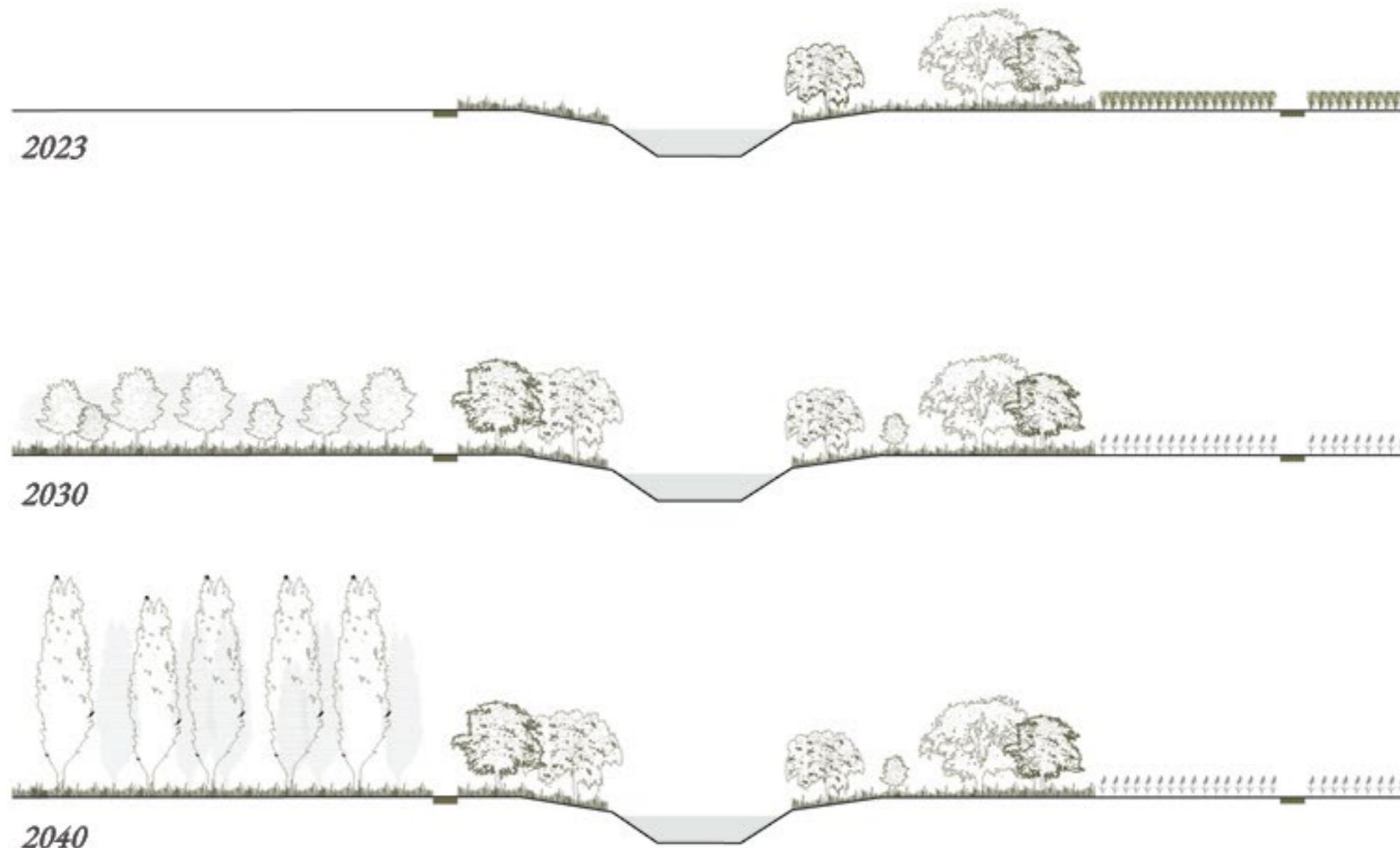




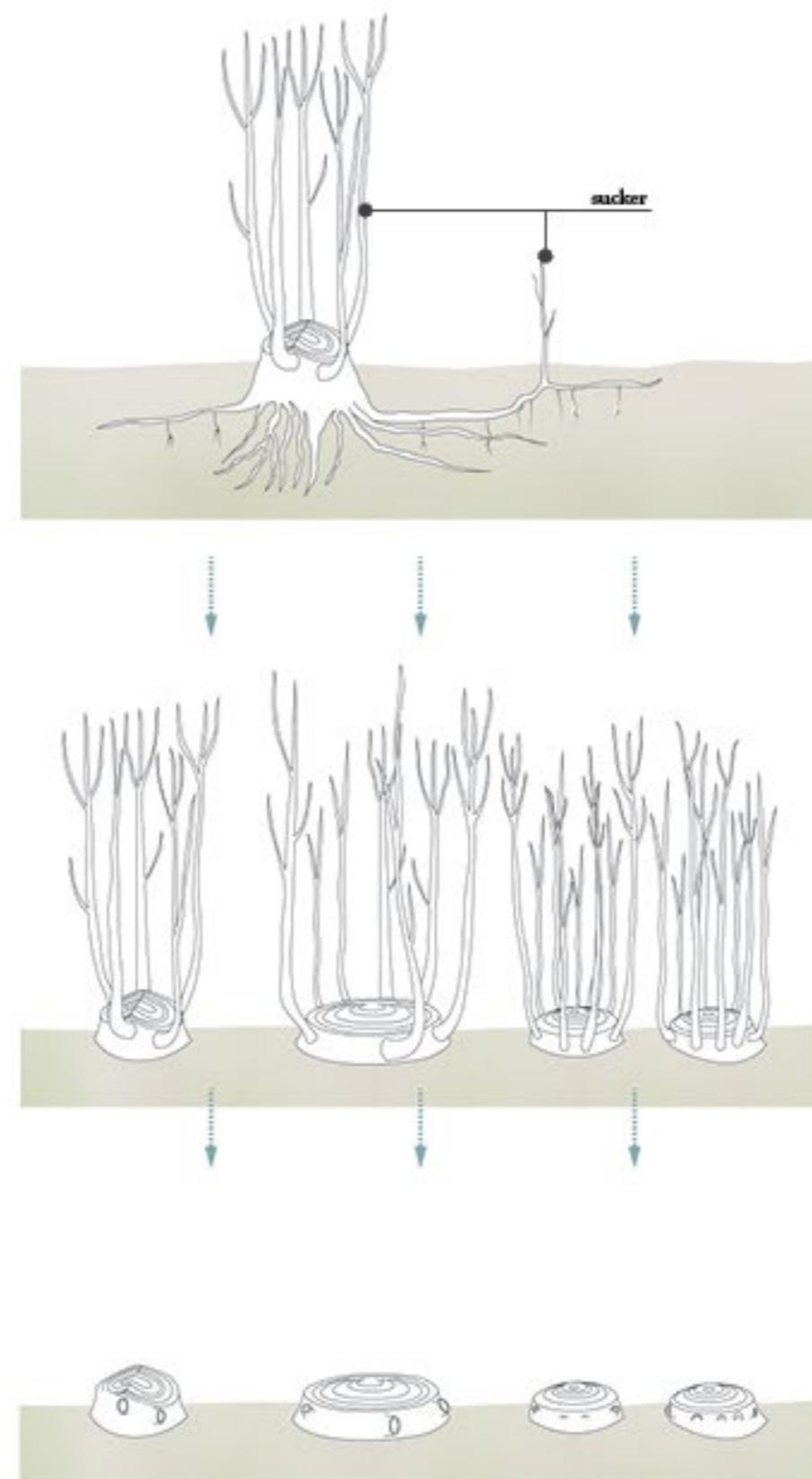
Landscape 1. Wilderness



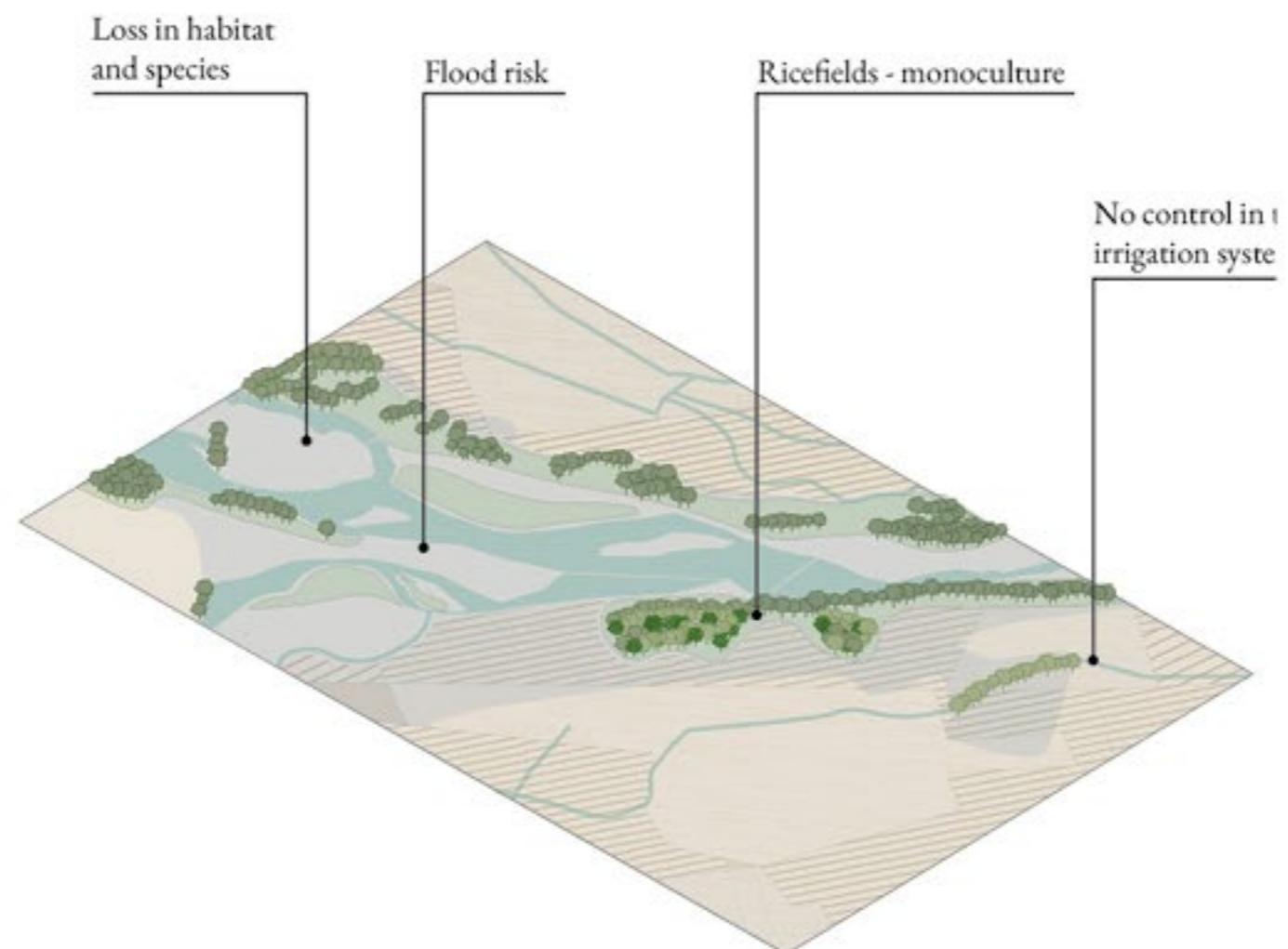
Landscape 1. Wilderness



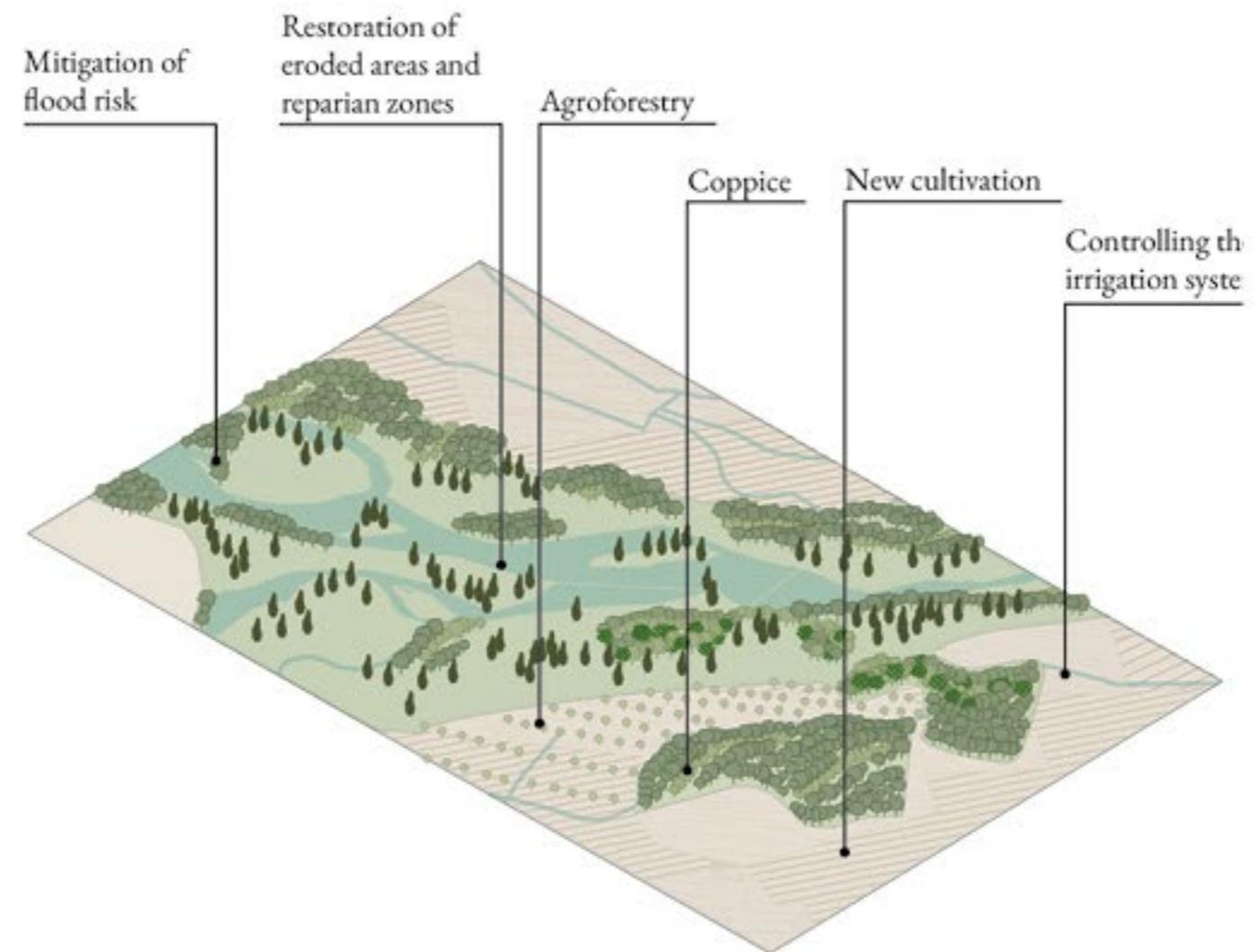
*Landscape 1. Wilderness
coppice*



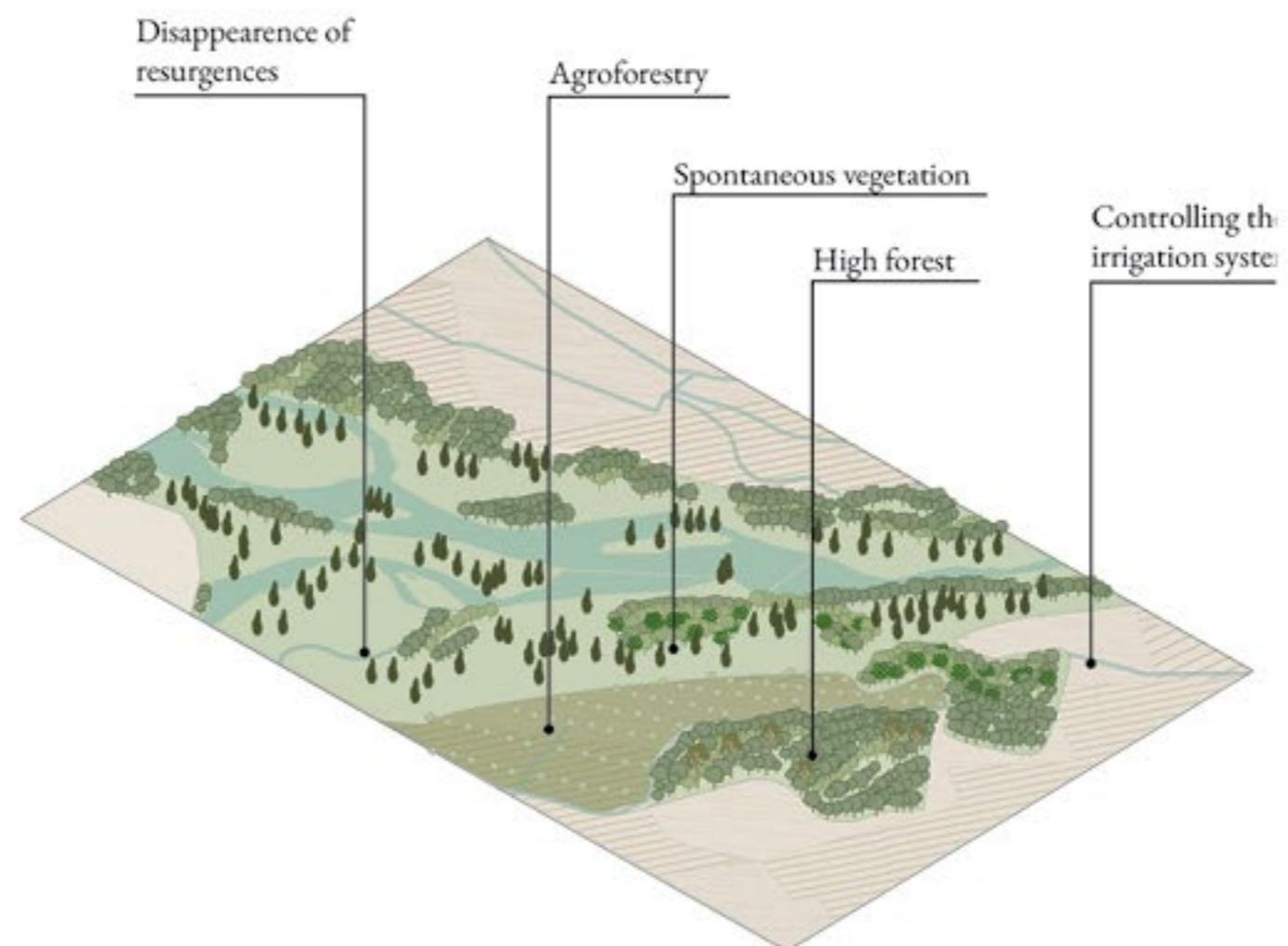
The rebirth of the resurgence belt



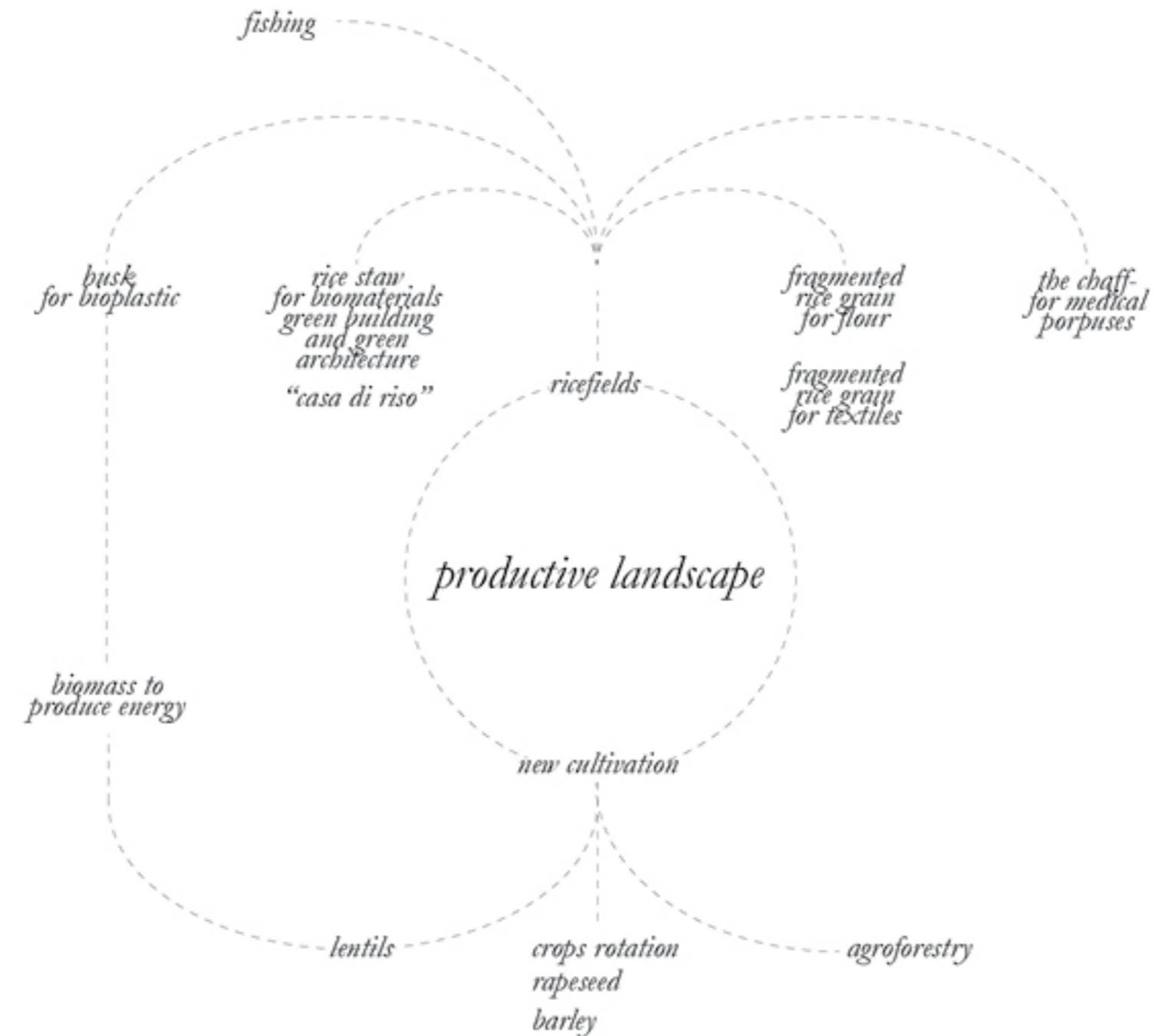
Wilderness
2030



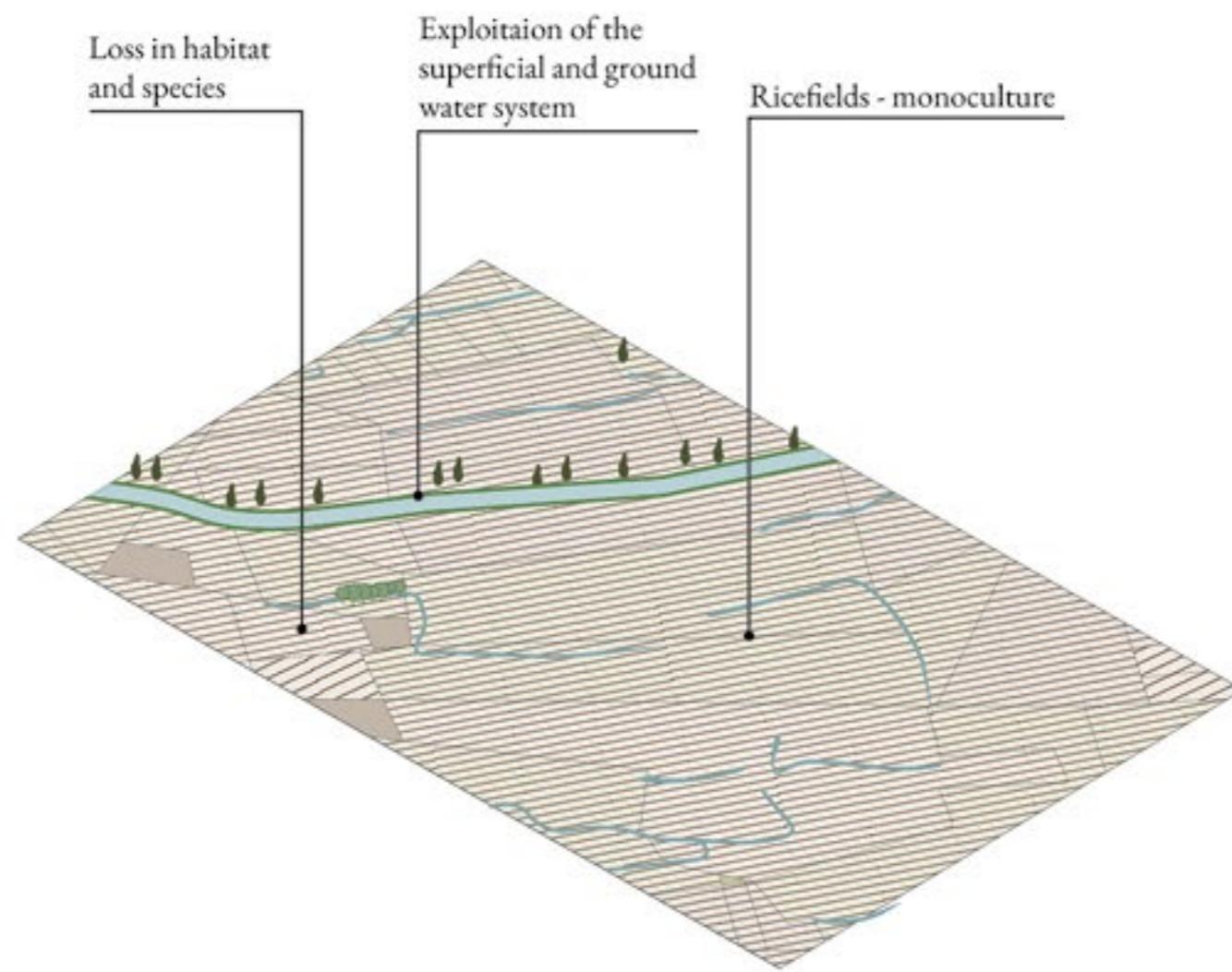
Wilderness
2040



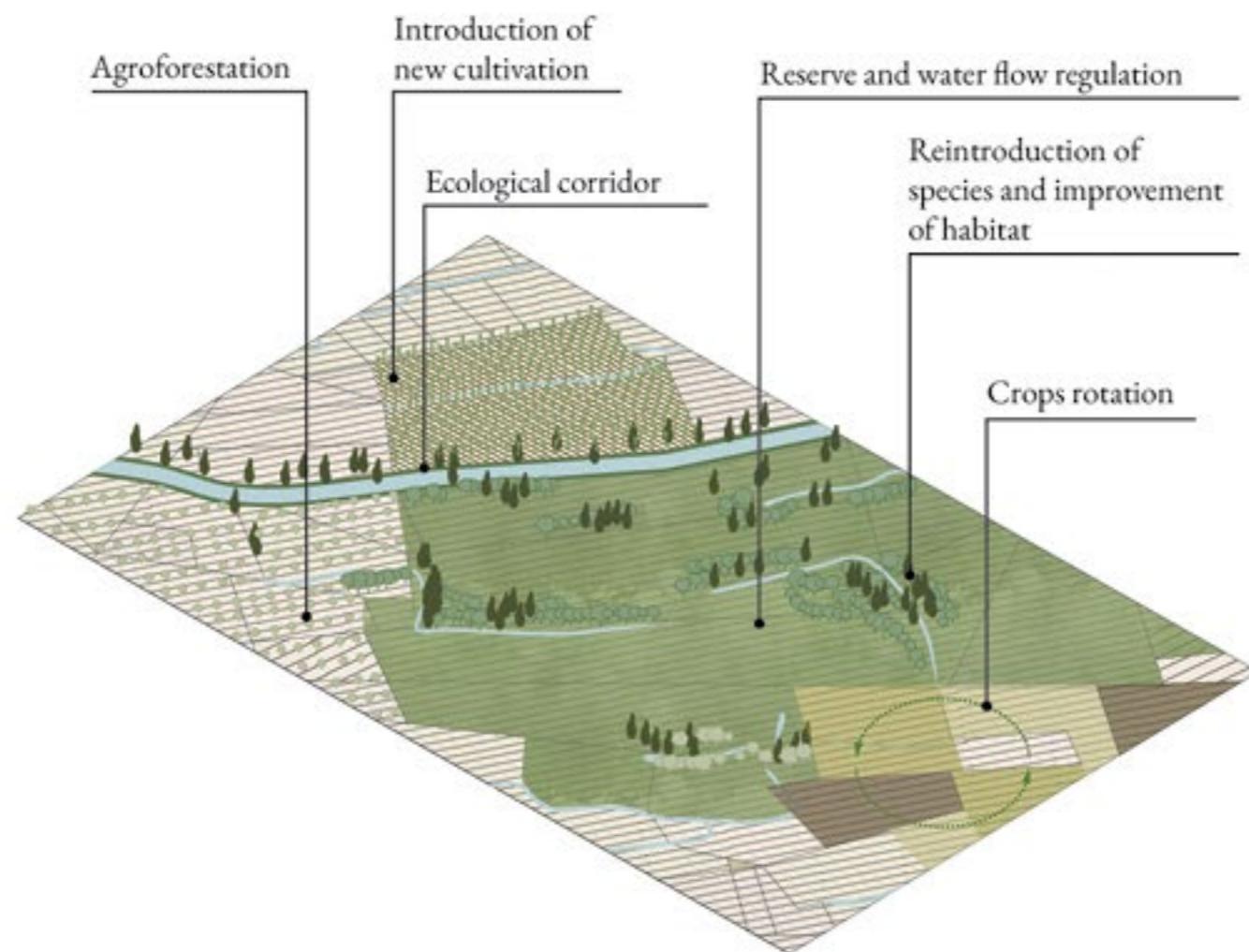
Landscape 2. Productive landscape



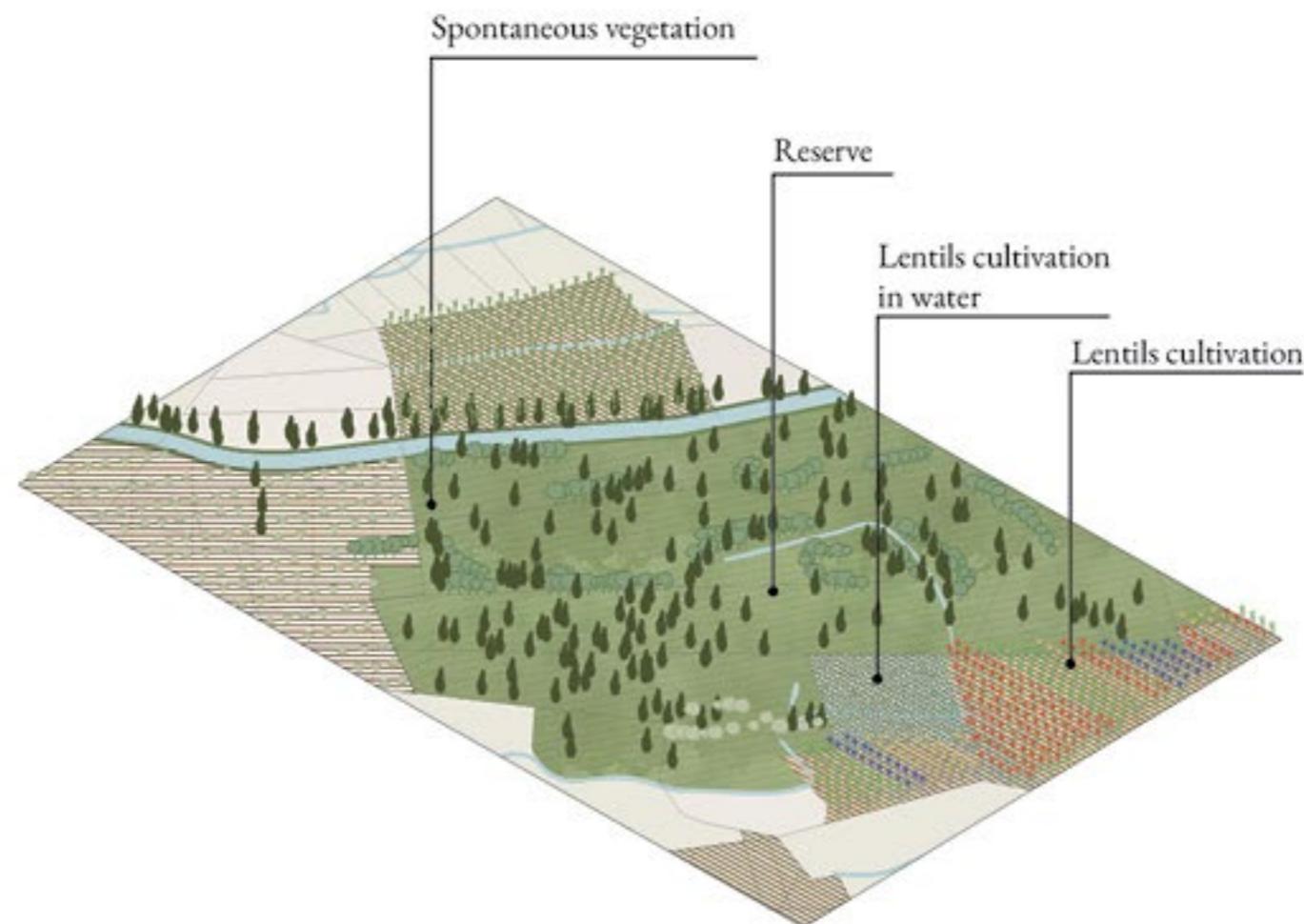
Productive landscape
2023



Productive landscape
2030



Productive landscape
2023



*Productive landscape
lentils alternative future for 2040*

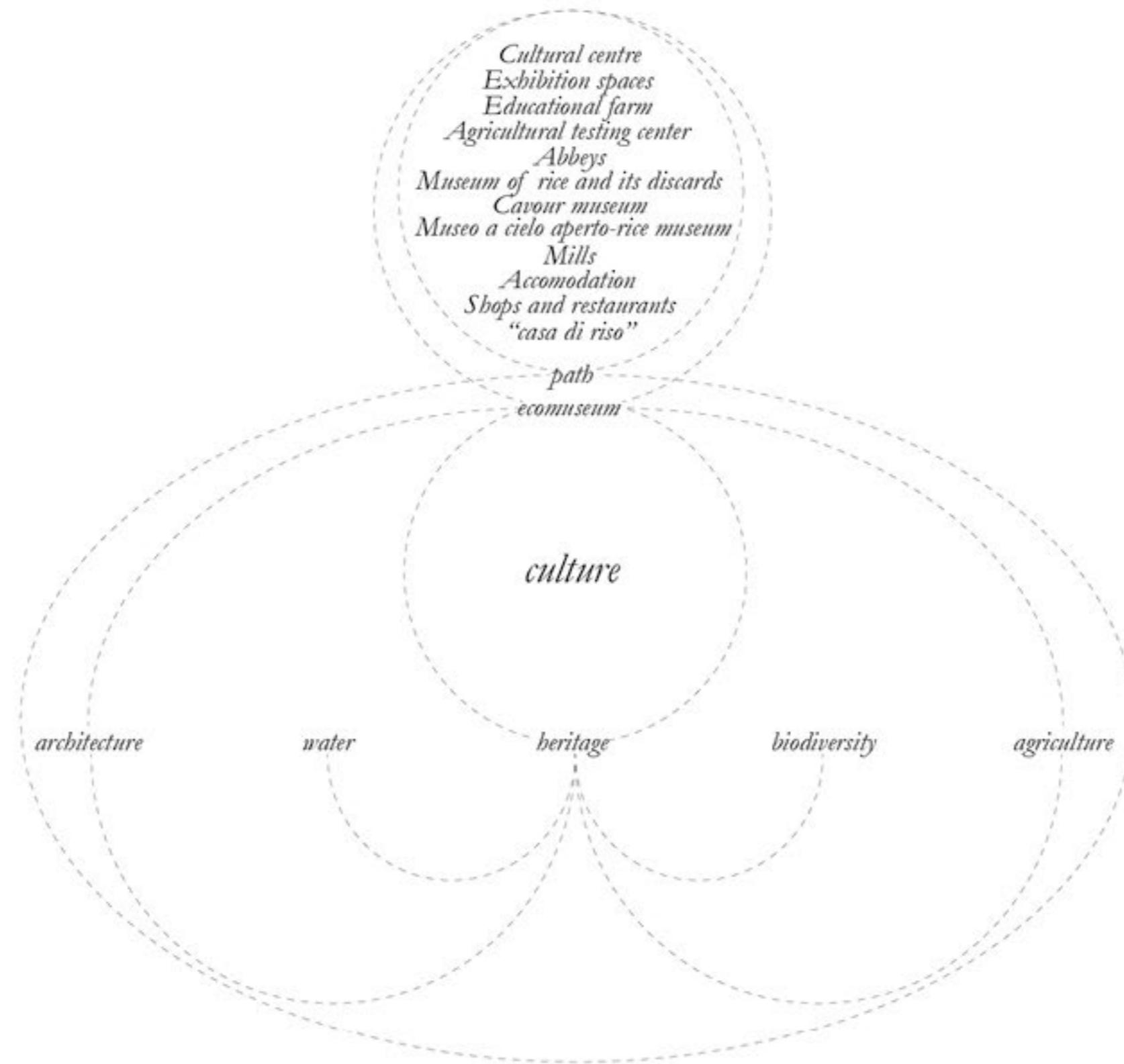


*Productive landscape
ricefields alternative future for 2040*

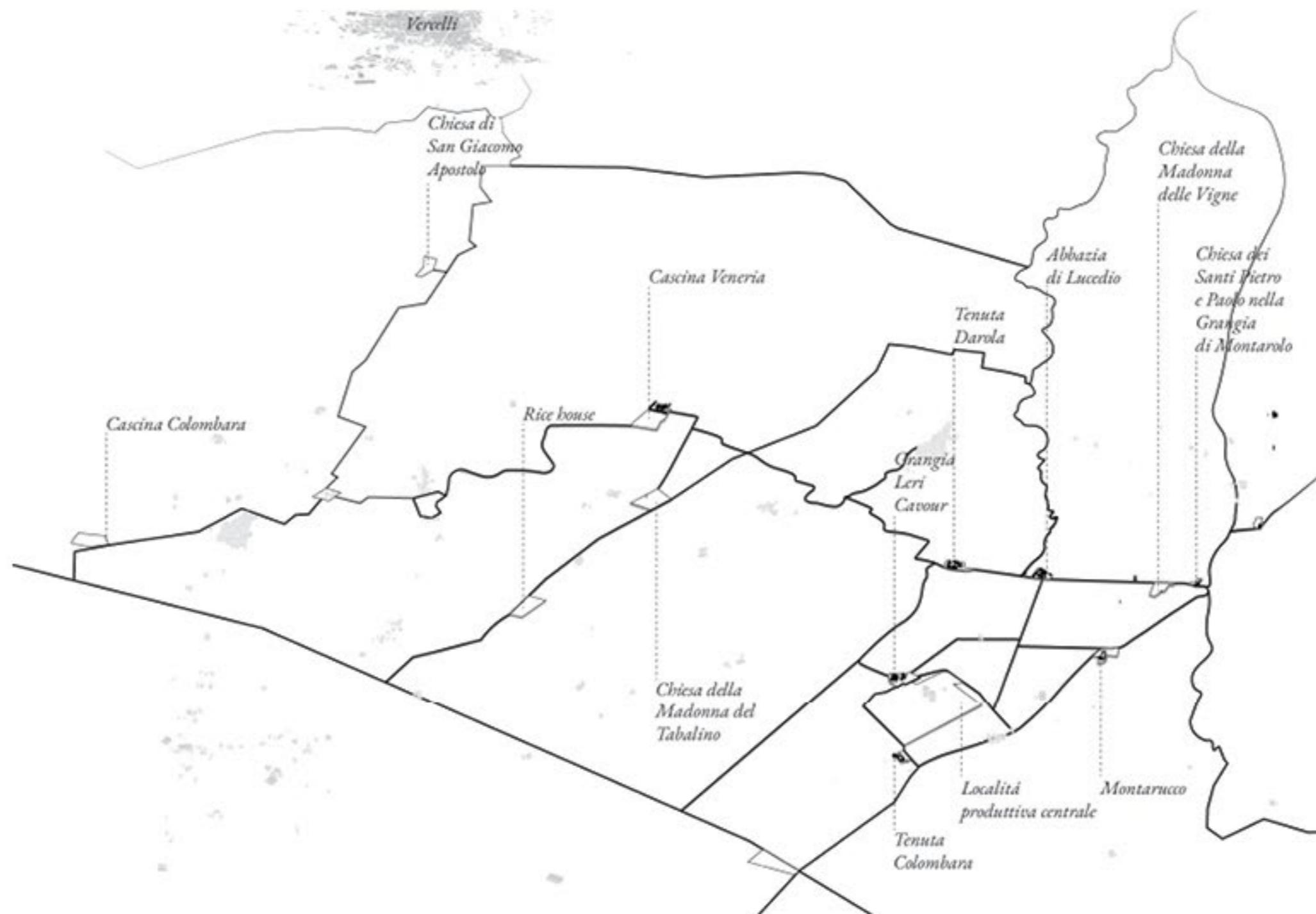


The rebirth of the resurgence belt

Landscape 3. Culture



Culture
route for the alternative future



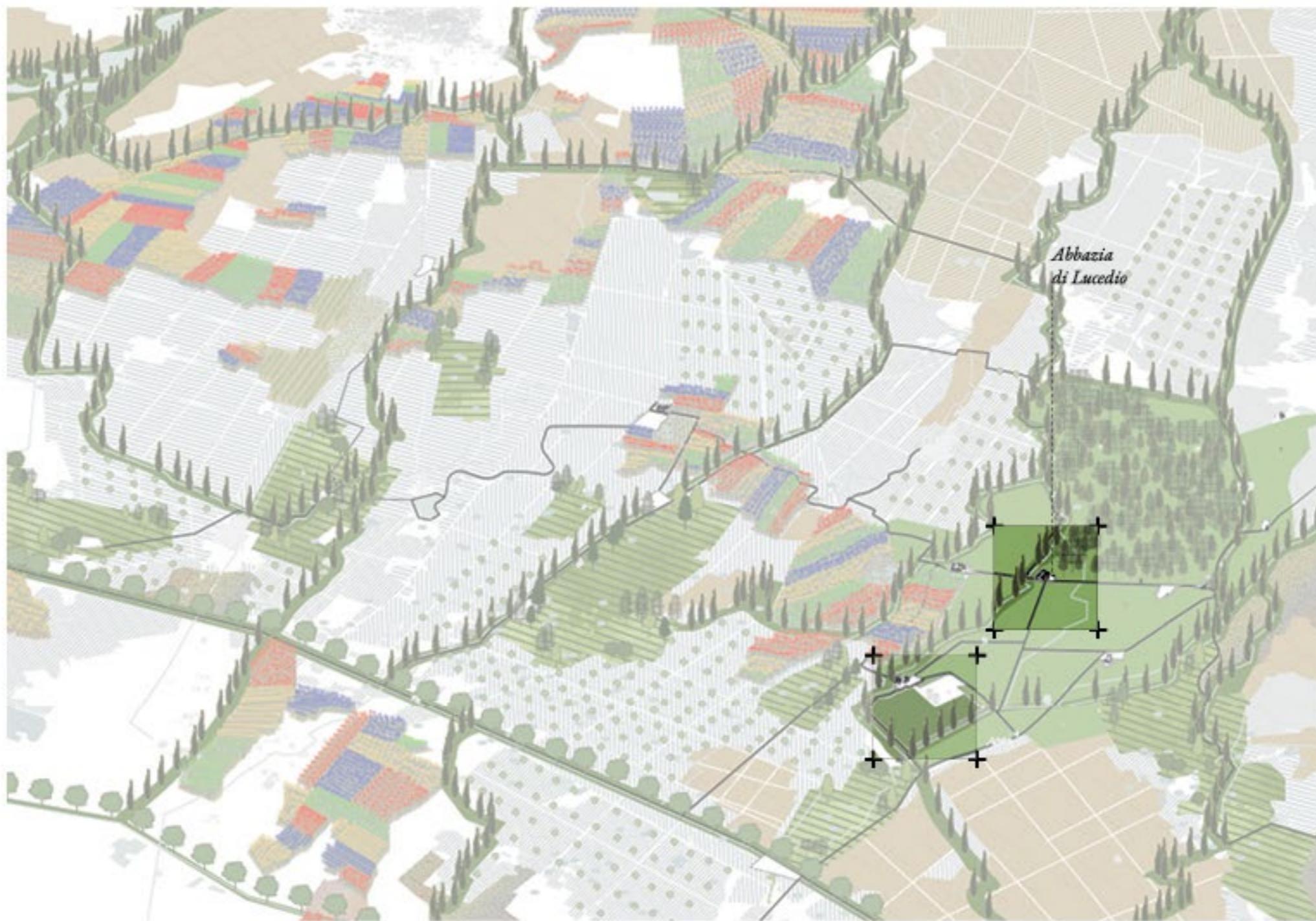
*Culture and wilderness
route for the alternative future*



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



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



Abbazia di Lucedio

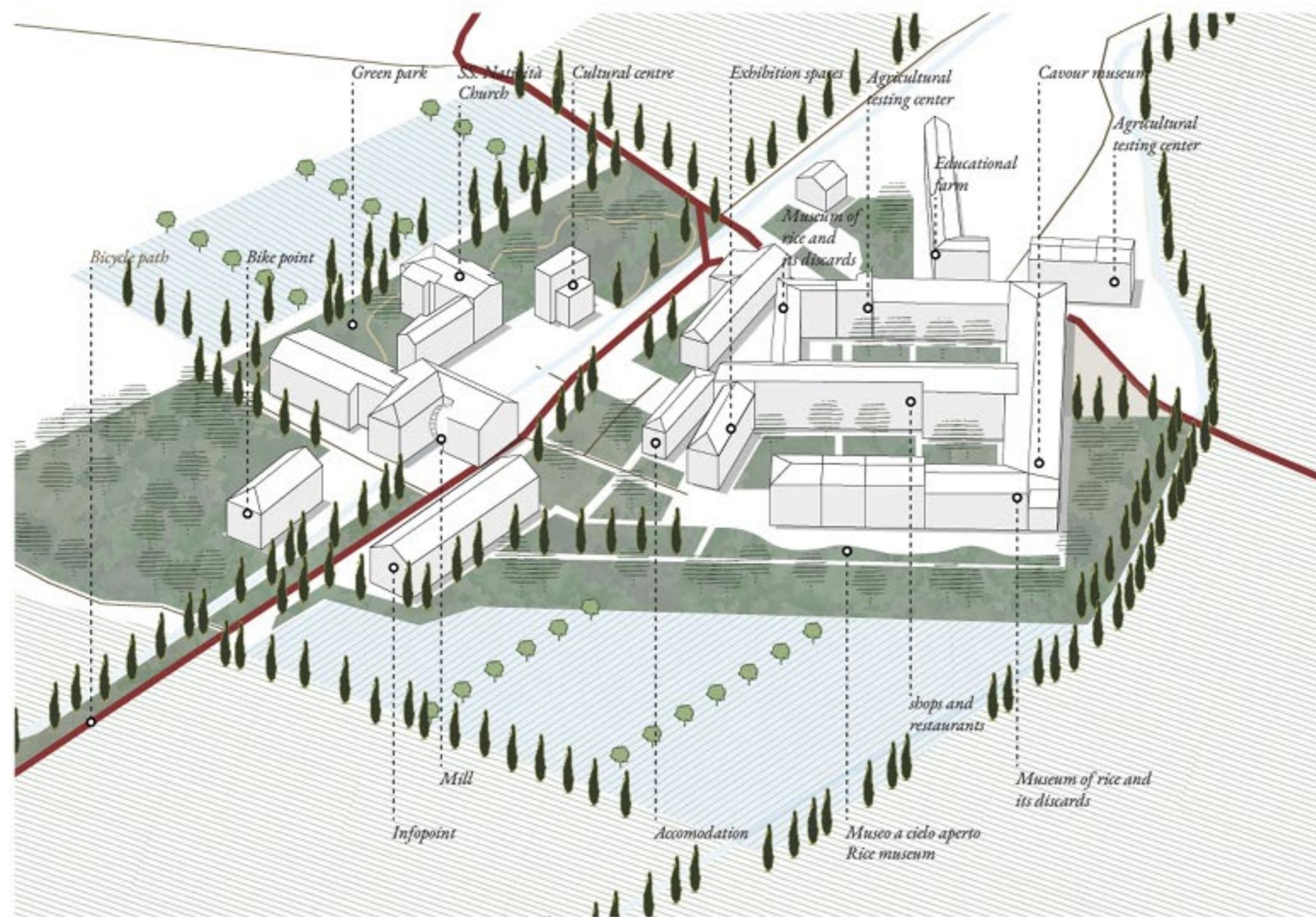


The rebirth of the resurgence belt

*Culture, wilderness and agriculture
elements - Grangia Leri Cavour*



Grangia Leri Cavour



Grangia Leri Cavour



Galileo Ferraris - the green factory



Galileo Ferraris - the green factory



The rebirth of the resurgence belt



The rebirth of the resurgence belt



Thank you!