



Funded by  
the European Union



# CARDIMED

CLIMATE ADAPTATION AND RESILIENCE  
DEMONSTRATED IN THE MEDITERRANEAN  
REGION

## AquaSPICE Info-day Event

Materializing circular water use, fostering awareness in resource efficiency, and delivering innovative solutions for a Water-Smart Society.

Simos Malamis, Project Coordinator  
National Technical University of Athens

*2<sup>nd</sup> July 2024, Chania, Greece*





EUROPEAN UNION



# EU MISSIONS

ADAPTATION TO CLIMATE CHANGE



WE ARE HERE

September  
2023

February  
2028



# Project Vision & Pillars



**Pilar 1**  
Digital  
Technologies  
for Climate  
Adaptation



**Pilar 2**  
Socio-economic  
Resilience



**Pilar 3**  
Water-Energy-  
Food-Ecosystems  
Nexus



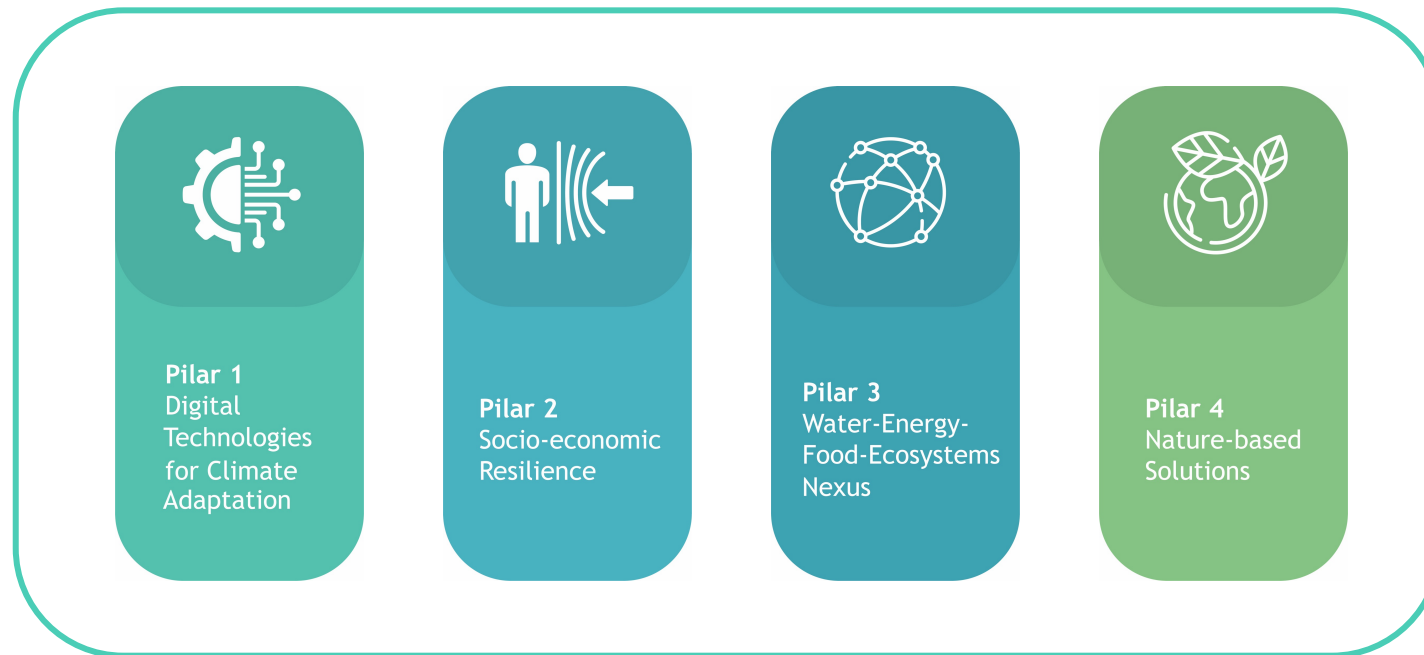
**Pilar 4**  
Nature-based  
Solutions

**VISION:** To enable **systemic transformation for regional climate resilience** in the Mediterranean, by unifying and **mainstreaming NBS** and other engineered infrastructure.

# Project Vision & Pillars

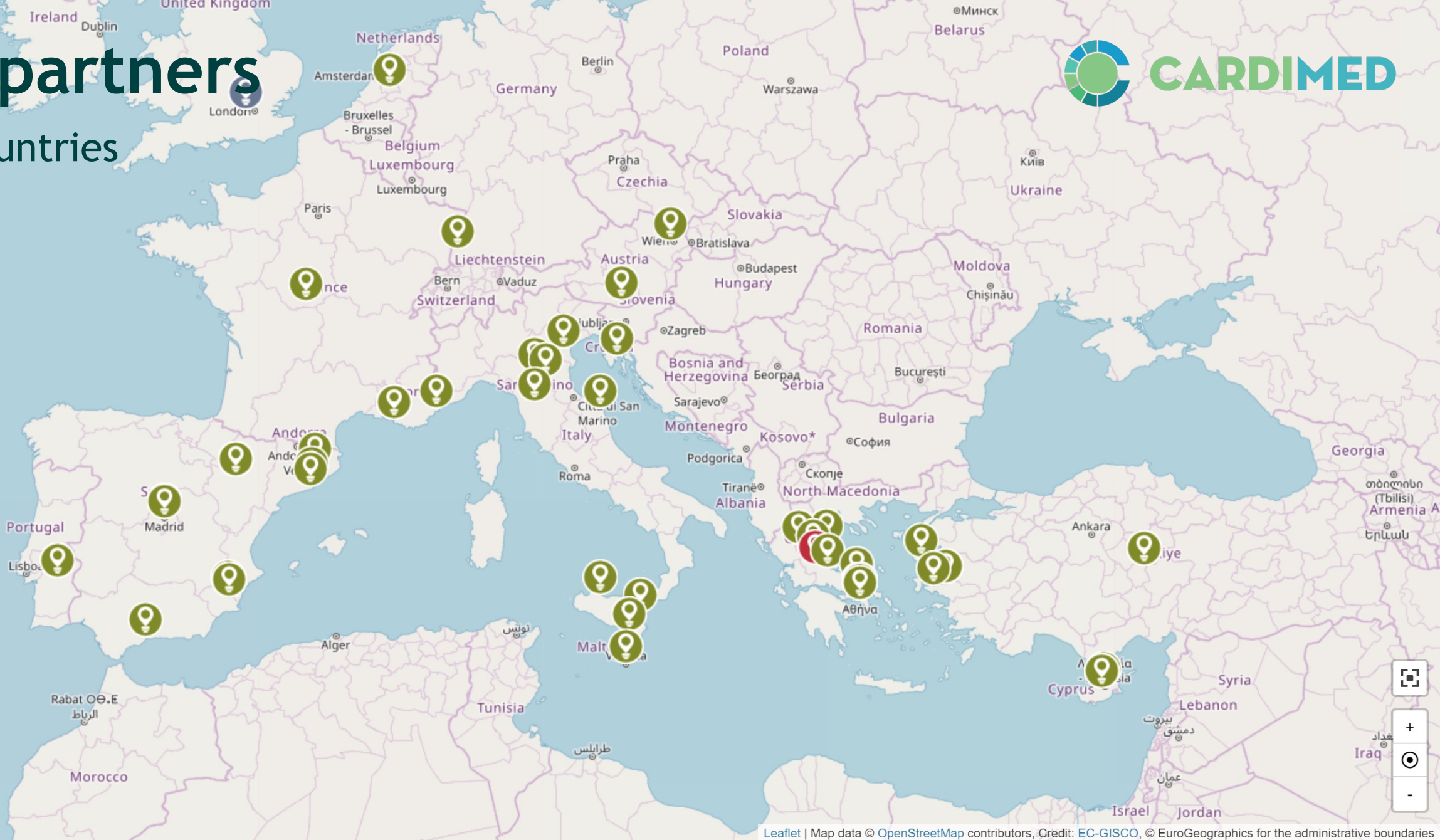


Our ambition is *not* the development and application of *each* pillar but **to holistically connect these solutions at a systems level!**



# 51 partners

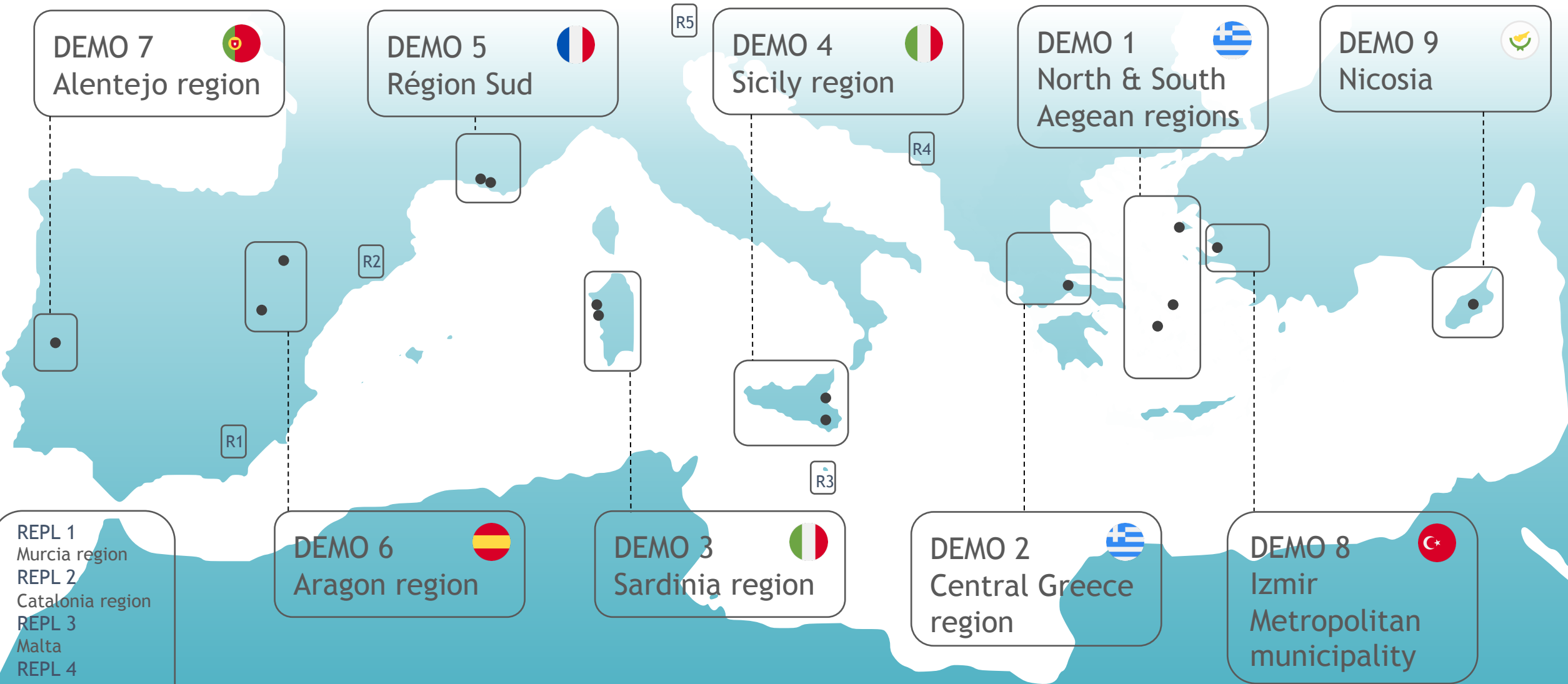
## 14 countries



Leaflet | Map data © OpenStreetMap contributors, Credit: EC-GISCO, © EuroGeographics for the administrative boundaries



# Demonstrators & replication sites



# Demonstrators & replication sites



SEL NTUA  
Sanitary  
Engineering  
Laboratory



MedINA



## Valorisation of non-conventional water loops on Aegean Islands - Greece

### Solutions

- Constructed wetlands
- Circular agroforestry
- Water valorisation
- Subsurface water harvesting
- Bioswale
- Traditional stone weirs
- River flow management

- DEMO 1
- DEMO 2
- DEMO 3
- DEMO 4
- DEMO 5
- DEMO 6
- DEMO 7
- DEMO 8
- DEMO 9

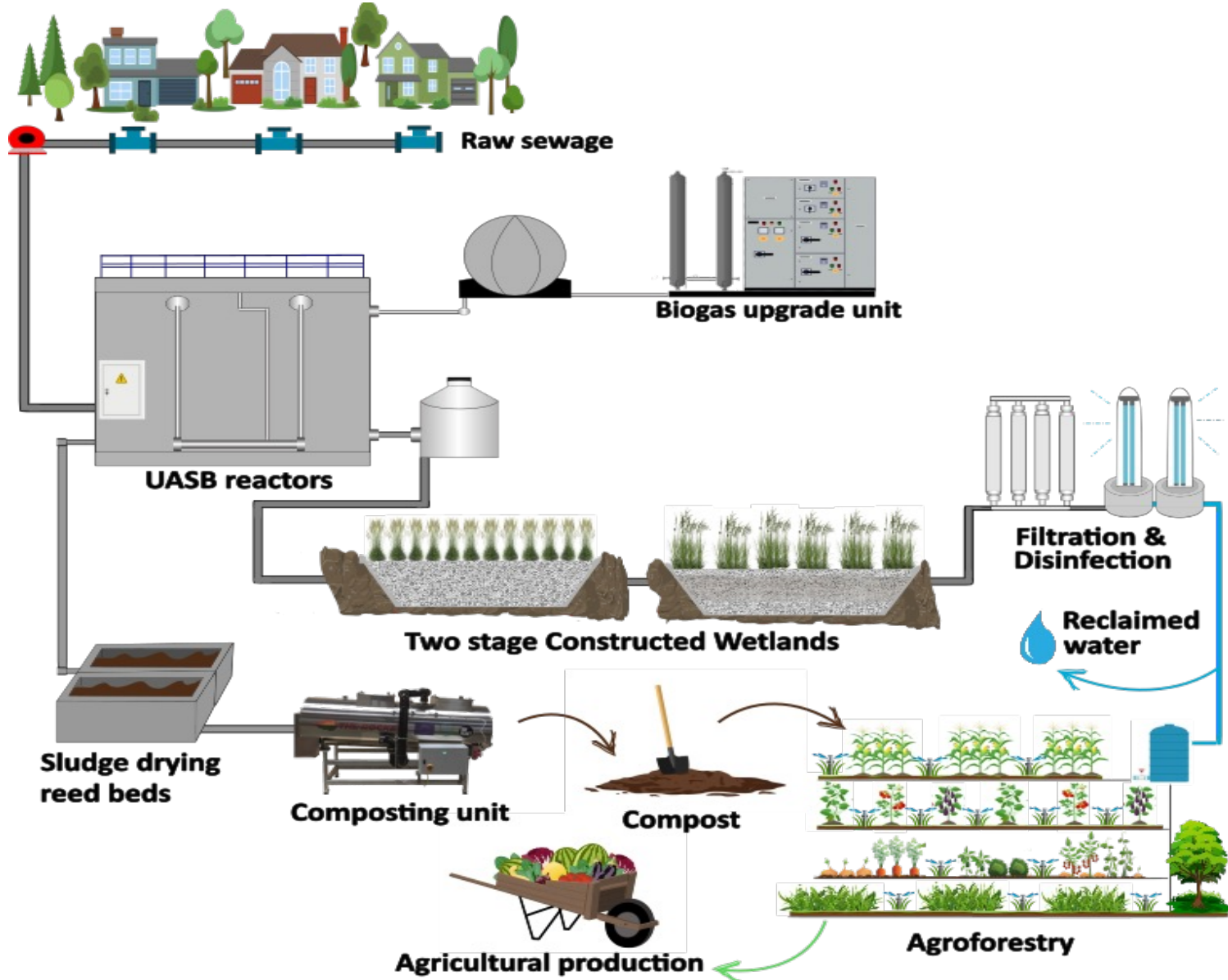
Lesvos island

Mykonos island

Sifnos island



# DEMO 1 – Decentralized Wastewater Management, Lesvos Island



**Scope**

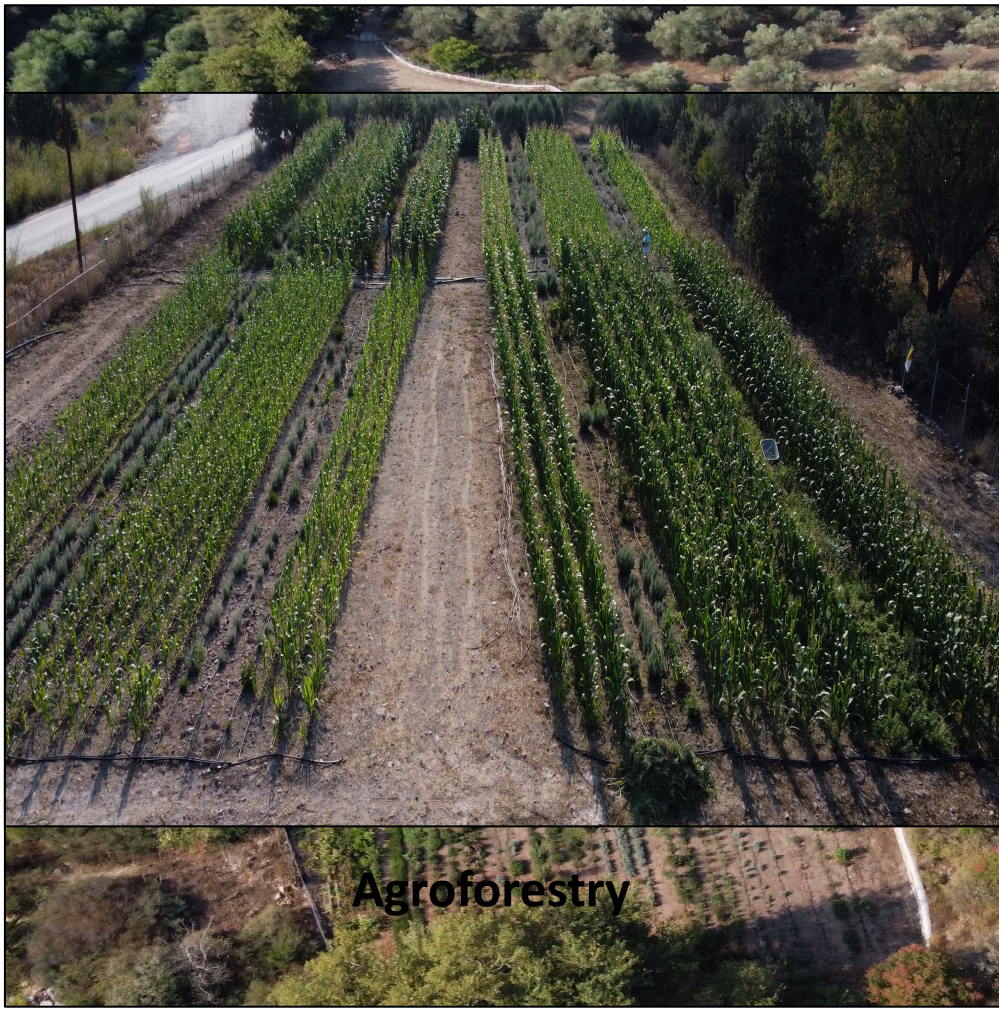
- Valorisation of municipal wastewater
- Energy production,
- Diversified agricultural production
- Nutrients recycling

**NBS addressed**

- Unsaturated CWs
- Saturated CWs
- Electroconductive CWs
- Sludge Drying Reed Beds
- Agroforestry



# DEMO 1 - Decentralized Wastewater Management, Lesvos Island



Agroforestry

Agroforestry

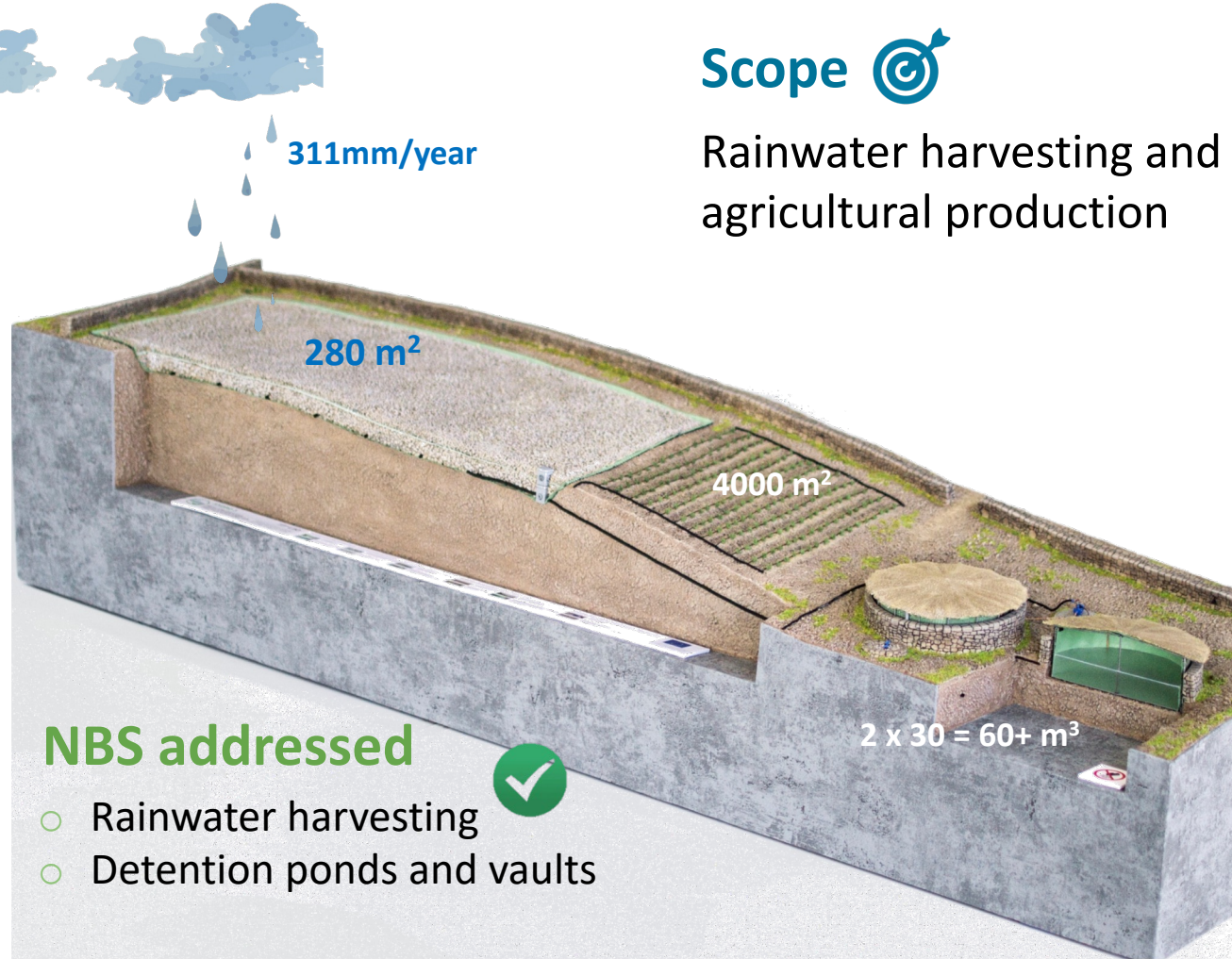


# DEMO 1 - Mykonos Island


## Subsurface rainwater harvesting system

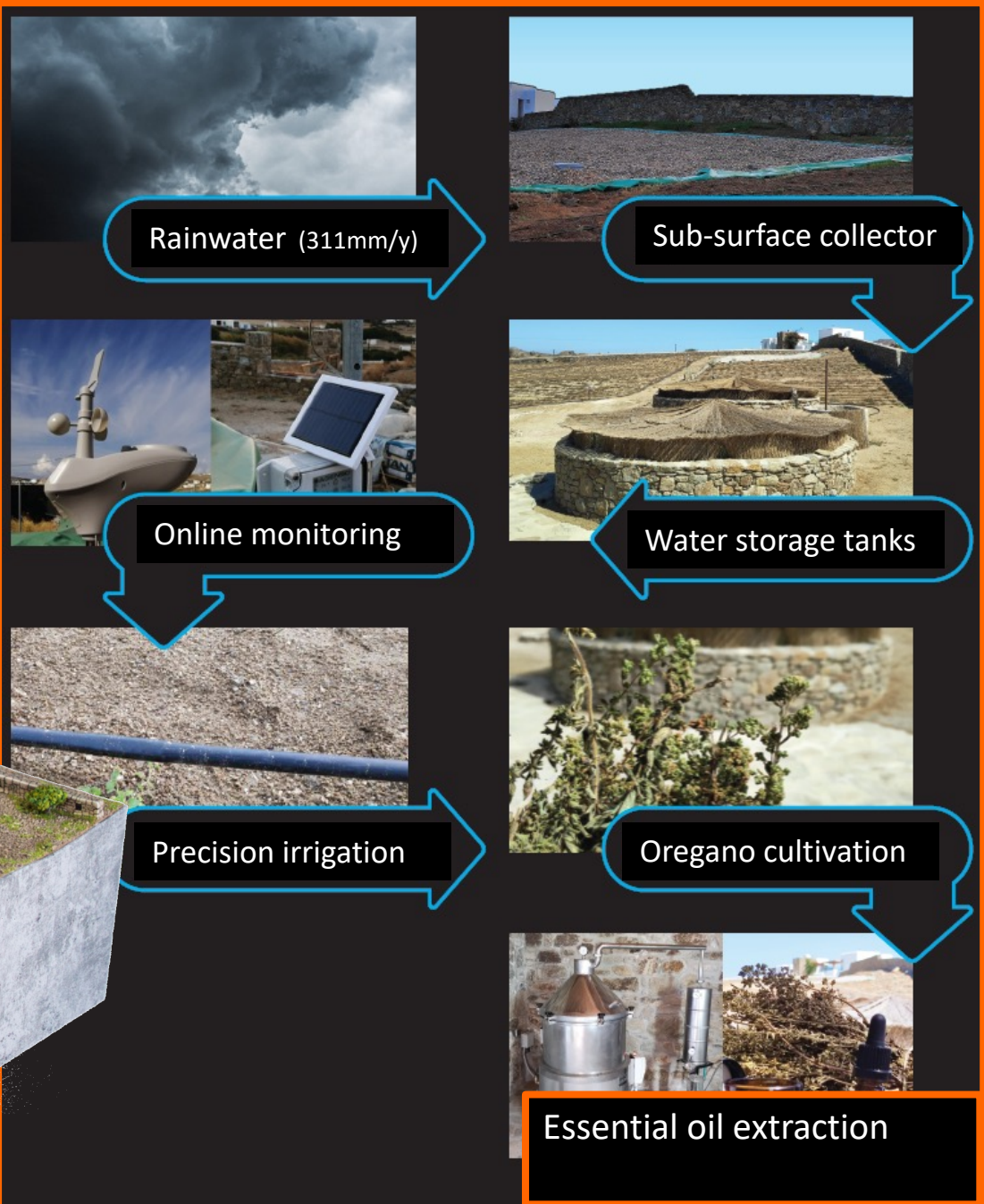
### Scope

Rainwater harvesting and agricultural production



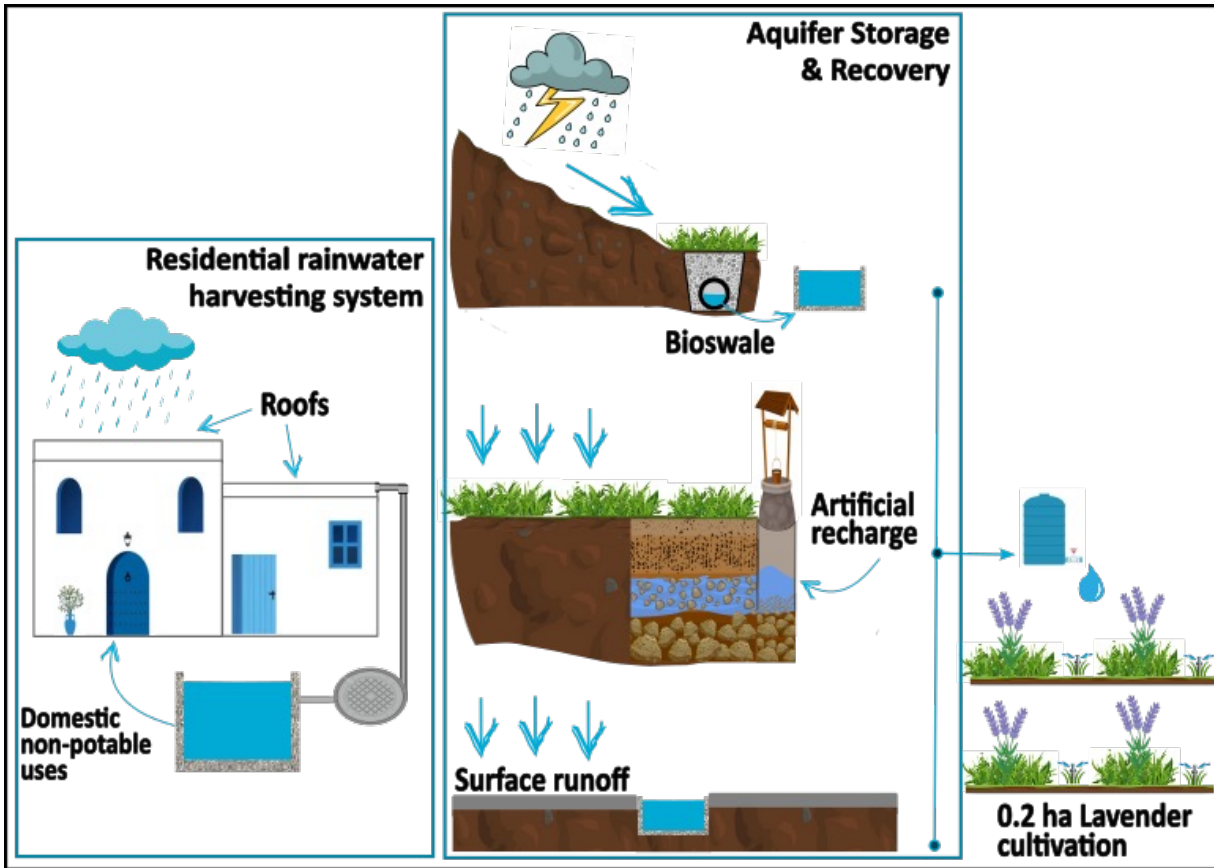
### NBS addressed

- Rainwater harvesting 
- Detention ponds and vaults





# DEMO 1 - Residential Water Management, Mykonos island



## Scope



Rainwater harvesting, aquifer storage, storm water management & agricultural production

## NBS addressed



- Rainwater harvesting
- Bioswale
- Detention vaults and tanks





# DEMO 1 - River Water Management Sifnos island



Stone weirs

## Scope

Flood protection, aquifer enrichment, secure water supply and irrigation, improve biodiversity

## NBS addressed

- Stone-built weirs in ephemeral streams



# Demonstrators & replication sites



## Industrial symbiosis through smart water management - Central Greece

DEMO 1

DEMO 2

DEMO 3

DEMO 4

DEMO 5

DEMO 6

DEMO 7

DEMO 8

DEMO 9

Oinofita

### Solutions

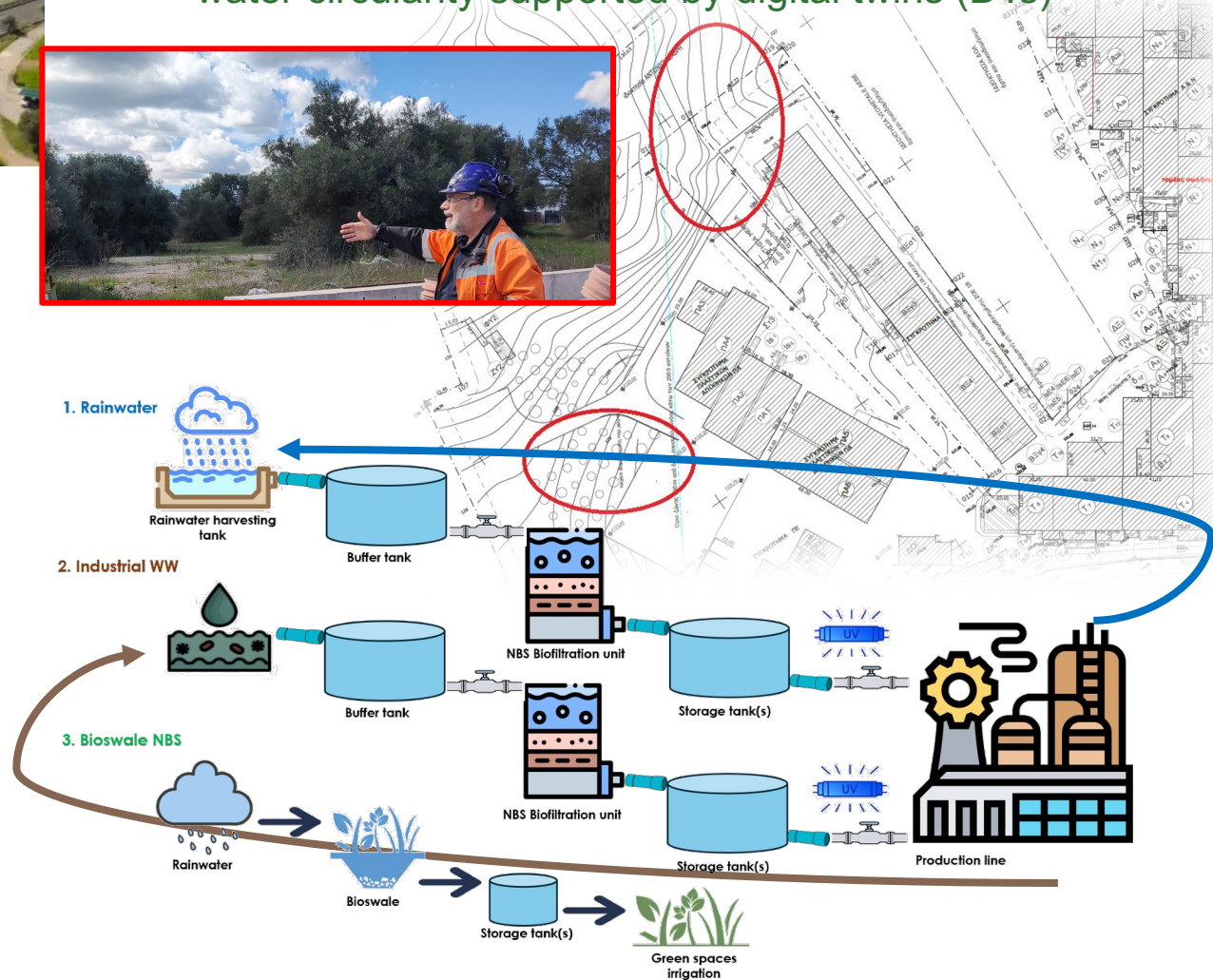
- Bioswale
- Rainwater harvesting for industrial use
- Digital twin
- Demand-Driven Industrial Water Symbiosis System



# DEMO 2 Industrial symbiosis through smart water management in Central Greece



Introduction of NBS in industrial DEMO level improving water circularity supported by digital twins (DTs)





# Demonstrators & replication sites



UNIVERSITÀ  
POLITECNICA  
DELLE MARCHE



ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA



## Decarbonization of agricultural practices, Italy



CREAF



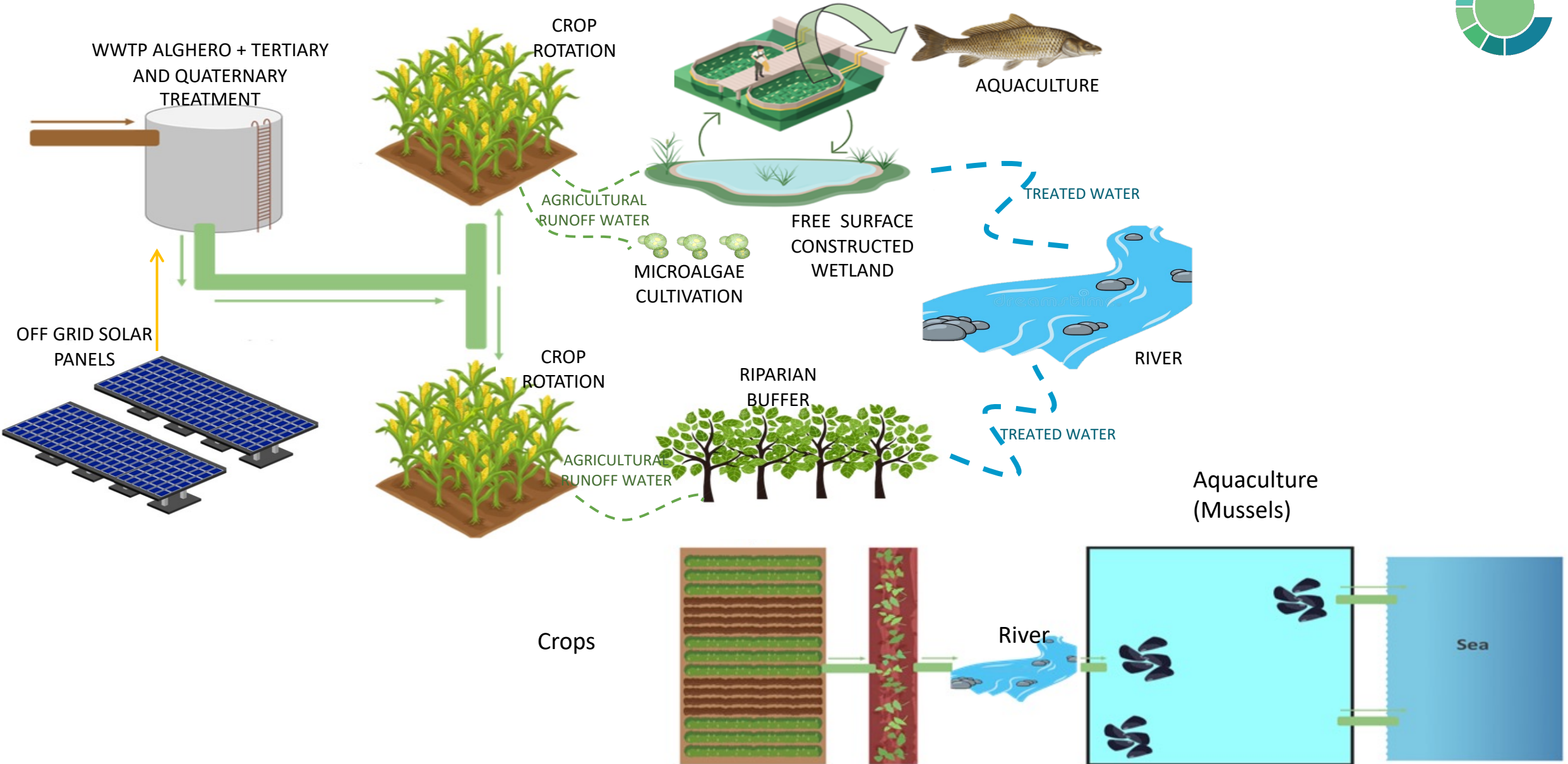
Comune di  
**Alghero**

**Alghero** &  
**Calich Lagoon**  
**Sardinia Island**

### Solutions

- Agricultural runoff treatment
- Buffer strip
- Constructed wetland
- Aquaculture
- Rotational crops
- Precision irrigation
- PV panels

# DEMO 3 - Alghero Municipality & Calich Lagoon, Sardinia Island



# Demonstrators & replication sites



Università  
di Catania



Regione Siciliana  
Dipartimento Regionale Tecnico



Comune di  
Catania



svimed.  
centro euromediterraneo  
per lo sviluppo sostenibile onlus

Raingardens (SuDS)  
and living walls, Italy

Catania  
&  
Ferla  
Sicily Island

## Solutions

- Raingarden & permeable green surfaces
- Flood prevention
- Green wall & facade
- Grey water treatment & reuse

DEMO 1  
DEMO 2  
DEMO 3  
DEMO 4  
DEMO 5  
DEMO 6  
DEMO 7  
DEMO 8  
DEMO 9



# DEMO 4 - Rain garden (SuDS) - Catania Municipality, Sicily



- **Demo scope:** Improve the infiltration of stormwater and contribute to the flood peak reduction and delay retrofitting Tondo Gioeni, a roundabout at the entrance of Catania city centre, which is suffering pluvial flooding
- **NBS addressed:** Rain garden
- Minimum 4400 m<sup>2</sup> intervention area infrastructure by bioretention cell
- Flooding reduction, reducing of 90% the runoff volume post urbanization



*Pluvial flooding in the city centre of Catania*

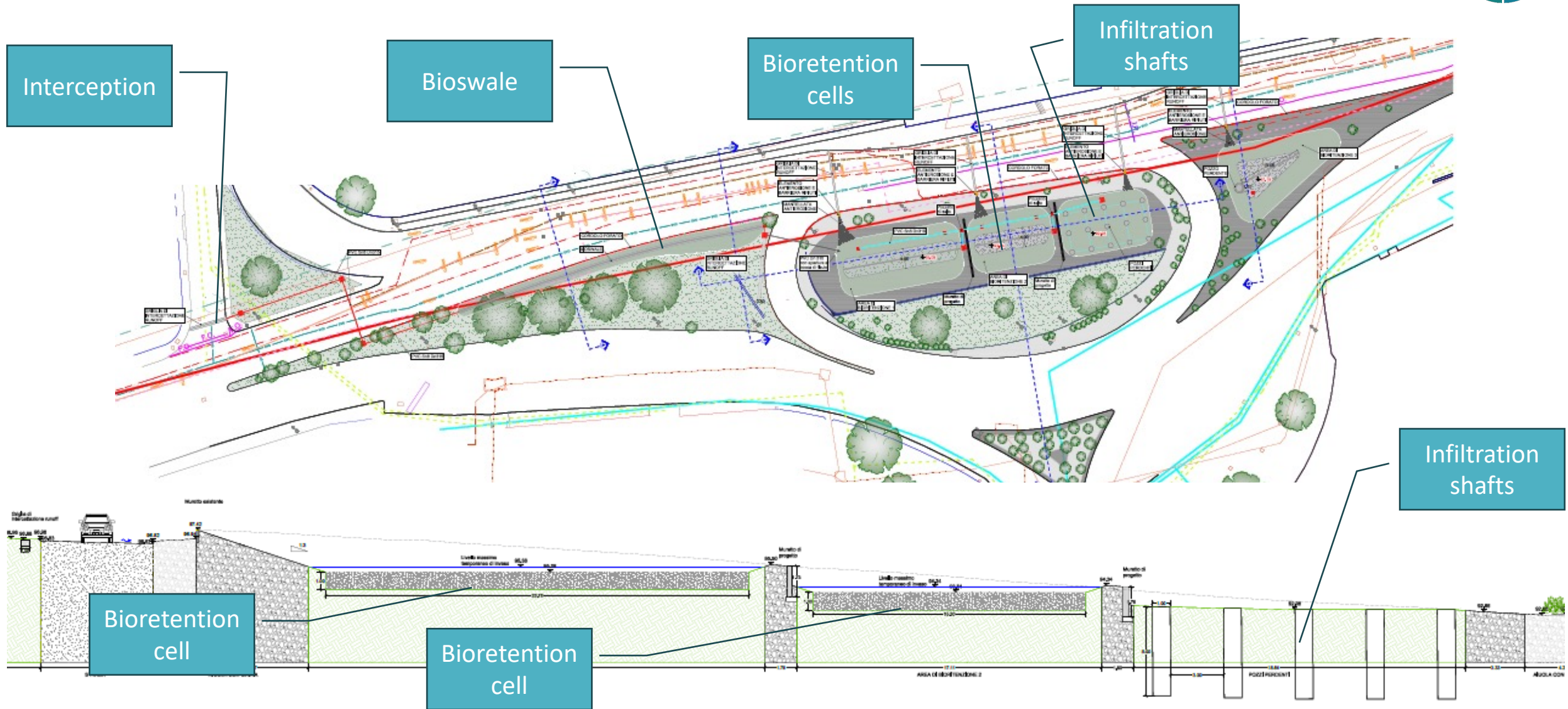


*Tondo Gioeni*



*Landscape view*

# DEMO 4 - Rain garden (SuDS) - Catania Municipality, Sicily





# DEMO 4 - Green Wall - Ferla, Sicily



- **Demo scope:** Treat the greywater from the washbasins of the school, reusing the treated greywater for toilet flushing from the primary School of Ferla
- **NBS addressed:** living wall
- **30 m<sup>2</sup> green wall**



*Disconnection*



*Separated pipes*



*Reuse*



*Green wall at the primary school of Ferla*

# Demonstrators & replication sites

Micro-forests and unsealed soils,  
France



- DEMO 1
- DEMO 2
- DEMO 3
- DEMO 4
- DEMO 5**
- DEMO 6
- DEMO 7
- DEMO 8
- DEMO 9

St. Jerome  
&  
St. Charles  
Marseille

## Solutions

- Urban unsealing
- Micro-forests & pocket parks
- Flood protection
- Green roofs
- Vegetated pergolas
- Reduce heat island effect
- Biodiversity improvement



# Demo 5 - Micro-forests and unsealed soils, Alpes-Côte d'Azur

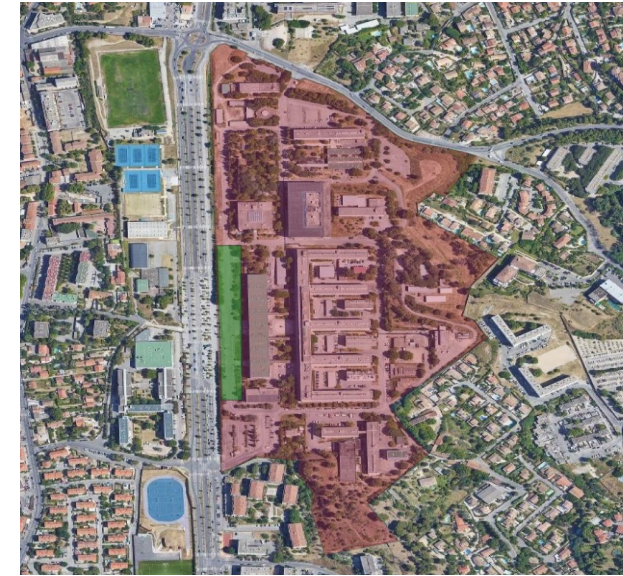


## Saint-Jérôme:

- Peri-urban environment,
- 19.4 ha / unsealing 0.6 ha
- 4,500 students

## Saint-Charles

- Highly densified urban area
- 2ha / unsealing 0.4 ha
- 6,000 students



## Challenges

- High temperature and intense drought
- Increase of the flood event frequencies
- Overload of the sewer system

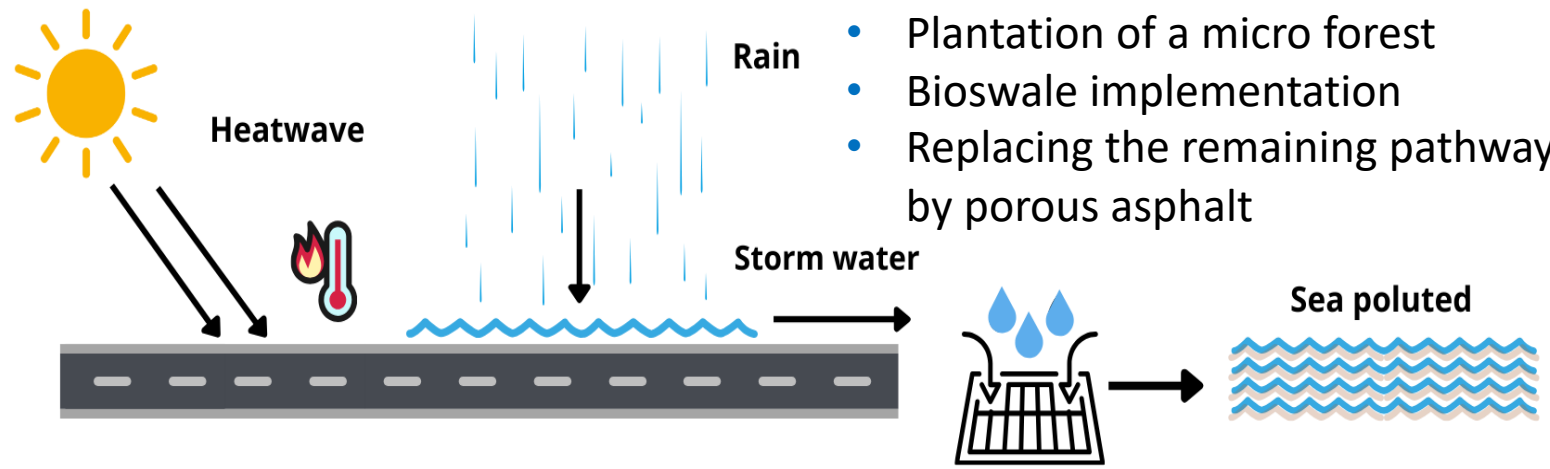
KPI	Target
Soil unsealing	10,000 m <sup>2</sup>
Trees and shrubs planted	300
Rain & storm water infiltrated or retained	1,500 m <sup>3</sup> /year



# Demo 5 - Micro-forests and unsealed soils, Alpes-Côte d'Azur



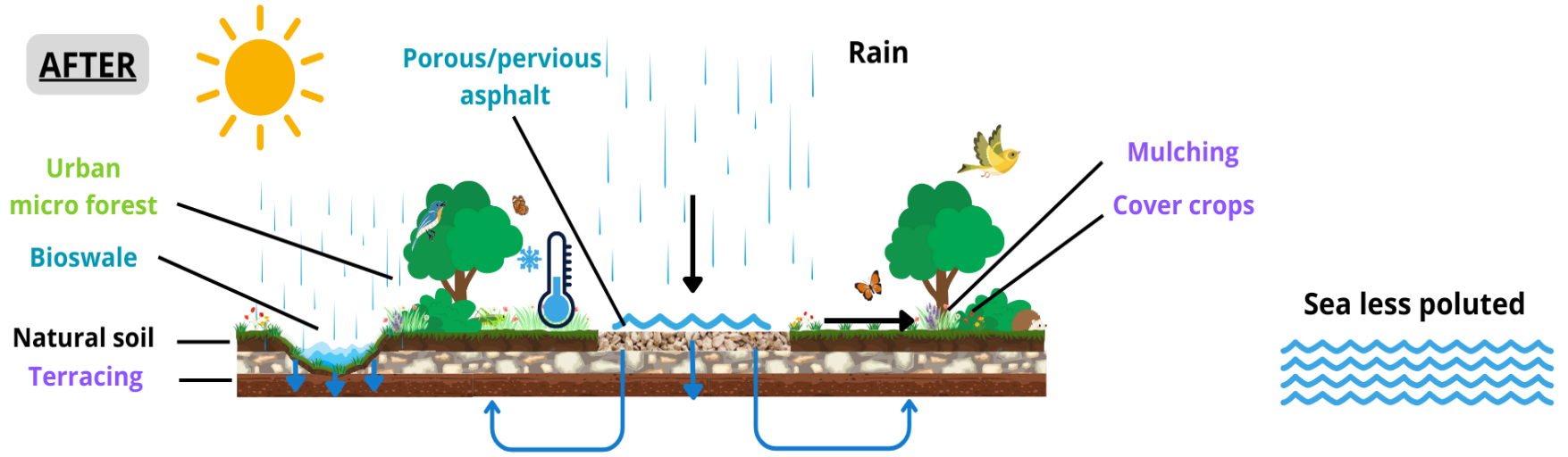
**BEFORE**



## Solutions:

- Unsealing the waterproof asphalt
- Plantation of a micro forest
- Bioswale implementation
- Replacing the remaining pathways by porous asphalt

**AFTER**



# Demonstrators & replication sites



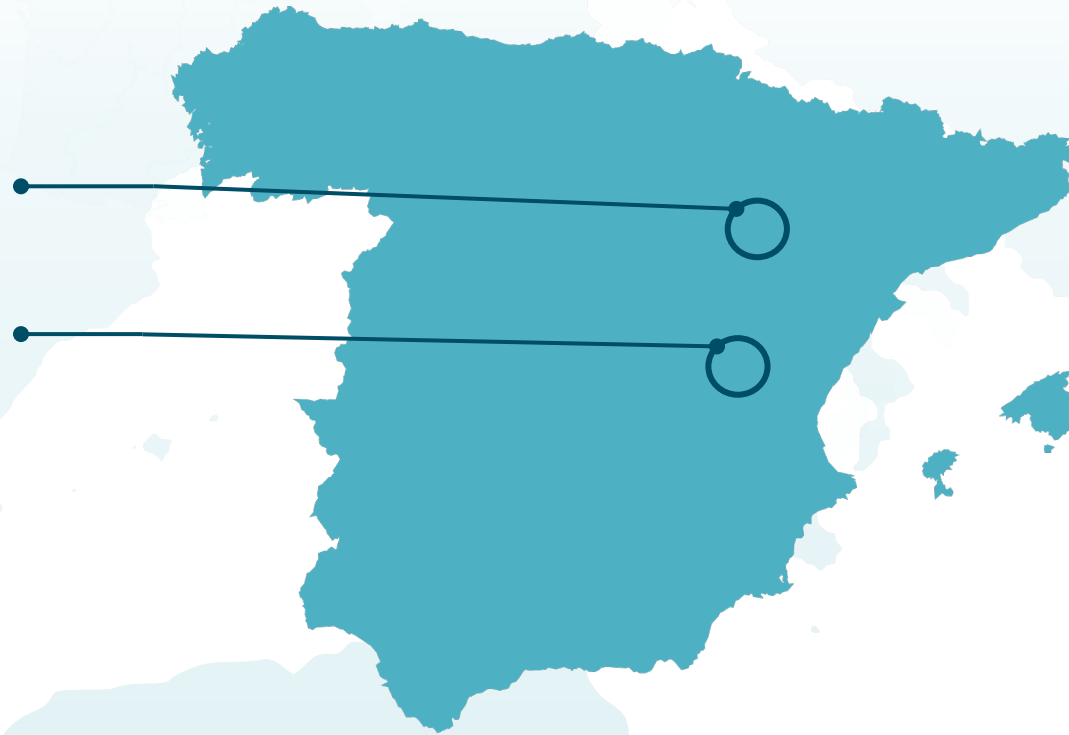
## Forest management and heatwave resilience, Spain



- DEMO 1
- DEMO 2
- DEMO 3
- DEMO 4
- DEMO 5
- DEMO 6**
- DEMO 7
- DEMO 8
- DEMO 9

Zaragoza

Teruel forest



### Solutions

- School gardens
- Urban greening
- Vertical gardens
- Invasive species forest management (mistletoe)
- Commercial mistletoe use
- Local bird species



# Demo 6 - Forest management & heatwave resilience, Aragon



- **Scope:** Develop NBS for climate resilience in both urban and natural areas.

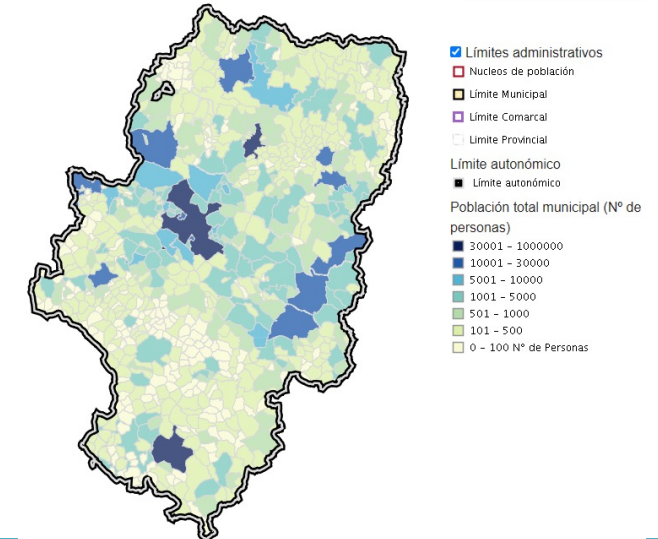
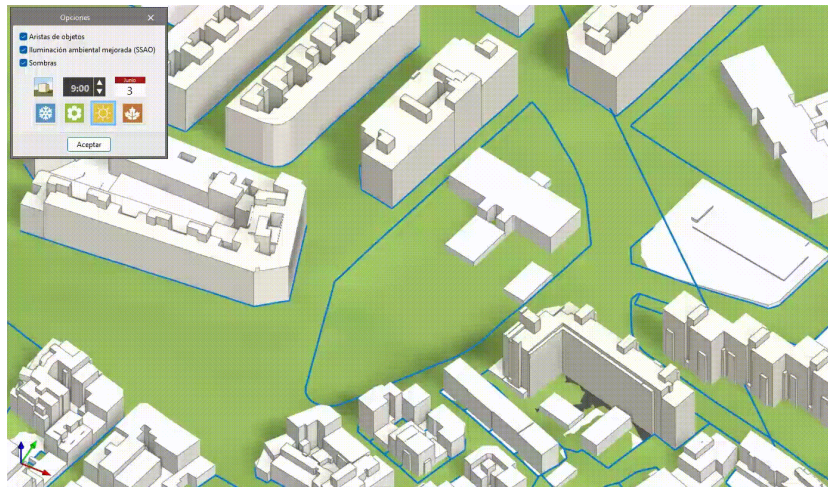
## Natural Environment

Sustainable forest management, especially control and monitoring for **mistletoe**



## Urban Environment

NBS will be implemented in **public schools**, to adapt them to heat-wave episodes



# Demonstrators & replication sites



## Cultural Landscape restoration, Portugal

- DEMO 1
- DEMO 2
- DEMO 3
- DEMO 4
- DEMO 5
- DEMO 6
- DEMO 7**
- DEMO 8
- DEMO 9

**Alentejo  
water  
streams**



## Solutions

- Riparian buffer
- Water stream restoration
- Habitat restoration
- Invasive species control
- Riverbank engineering
- Local bird species



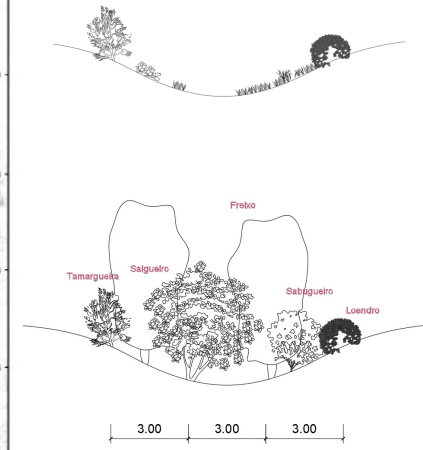
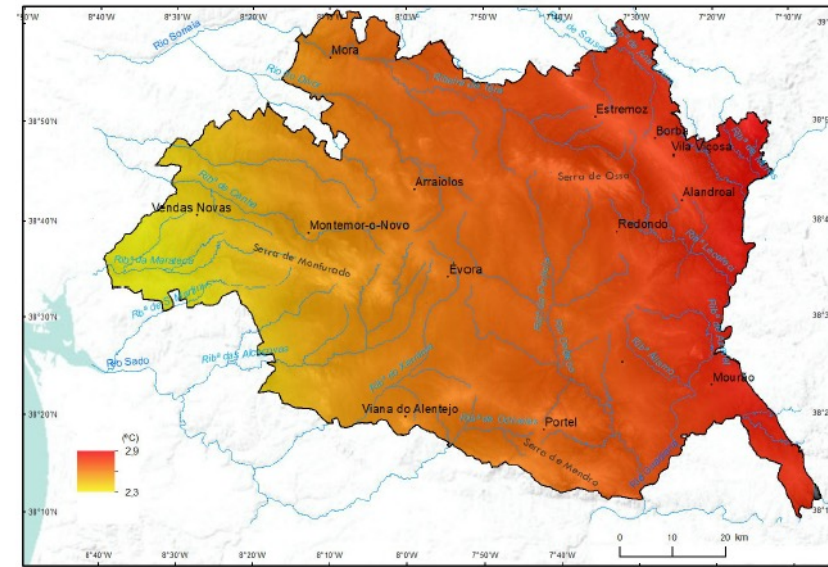


# Demo 7 - Cultural Landscape Restoration, Alentejo



- **Scope:** Ecological restoration of riversides vegetation at a regional level - Ecological restoration of cultural landscape “*dehesas*”
- **Challenges**
  - Heat waves and intense drought
  - Precipitation decline
  - Loss in biodiversity
- **NBS:**
  - ✓ Restore riparian habitats and degraded “*dehesas*”, through plantations and control of Invasive alien species.
  - ✓ Support biodiversity, providing nutrition, refuge and nesting for birds, mammals and insects
  - ✓ Reduce harmful impacts to fauna & flora by controlling invasive alien species.
  - ✓ Improve soil quality and land connectivity.

Figura 32. Valor médio das anomalias da temperatura máxima de Verão no Alentejo Central. Período 2041-2071, cenário RCP 8.5



Fonte: CEDRU / IGOT / WECONSULTANTS (2017)



# Demonstrators & replication sites



Indigenous production landscapes - Turkey

Gediz river delta



## Solutions

- Bivalve reef
- Native tree and shrub species
- Regenerative grazing
- Lagoon restoration
- Fisher shacks
- Halophyte garden
- PV panels

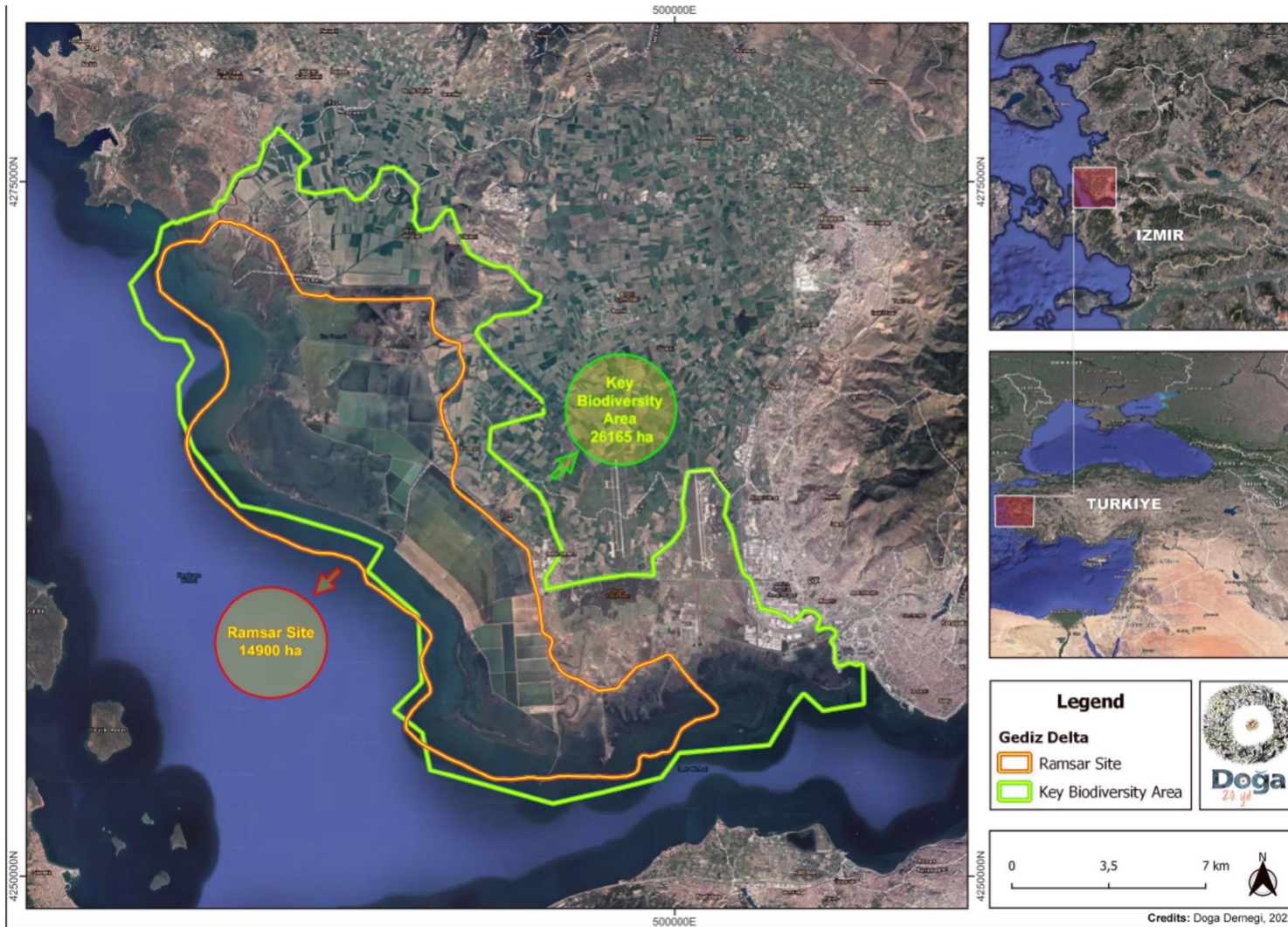
- DEMO 1
- DEMO 2
- DEMO 3
- DEMO 4
- DEMO 5
- DEMO 6
- DEMO 7
- DEMO 8**
- DEMO 9



# Demo 8 - Indigenous production landscapes - Izmir



## Gediz Delta



### Gediz Delta

- Ramsar Site
- Over 300 bird species
- 8 medium and large wild mammals
- >450 plant species
- 10% of greater flamingo's world population

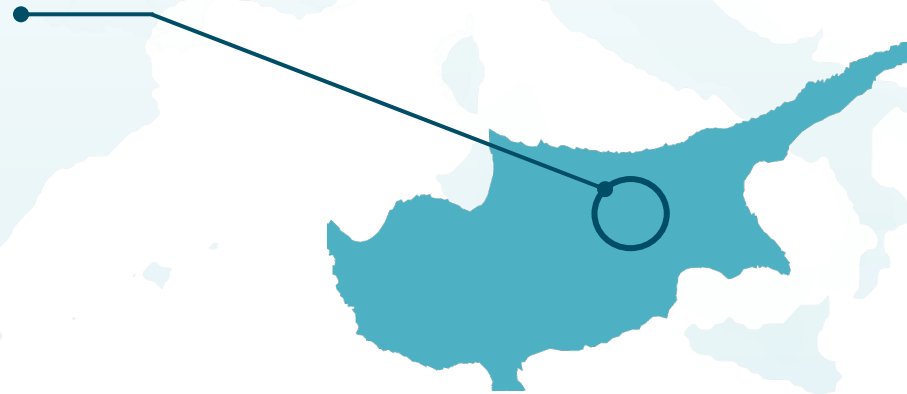
**Scope:** Implement NBS for ecological and shallow water marine environment habitat restoration and creation to deal with long-term climate resilience to sea-level rise, ecological degradation, and salinity intrusion.

# Demonstrators & replication sites



Gardens of the future in the heart of the city, Cyprus

Nicosia



## Solutions

- Hydroponic vertical farming
- Algal pond for groundwater treatment
- Community gardens
- Rainwater harvesting

- DEMO 1
- DEMO 2
- DEMO 3
- DEMO 4
- DEMO 5
- DEMO 6
- DEMO 7
- DEMO 8
- DEMO 9

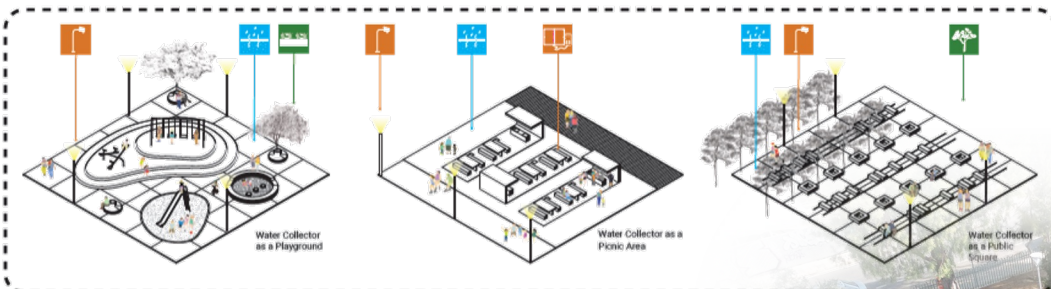
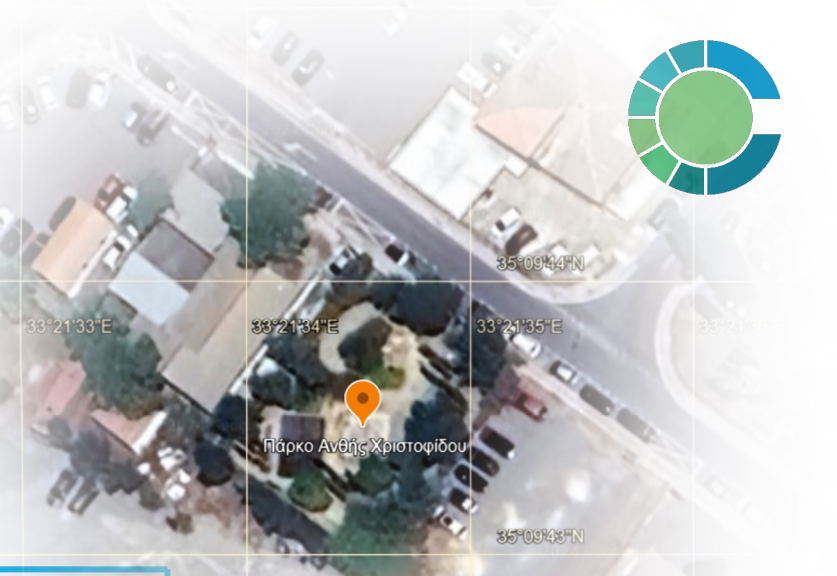


# Demo 9 - Nicosia

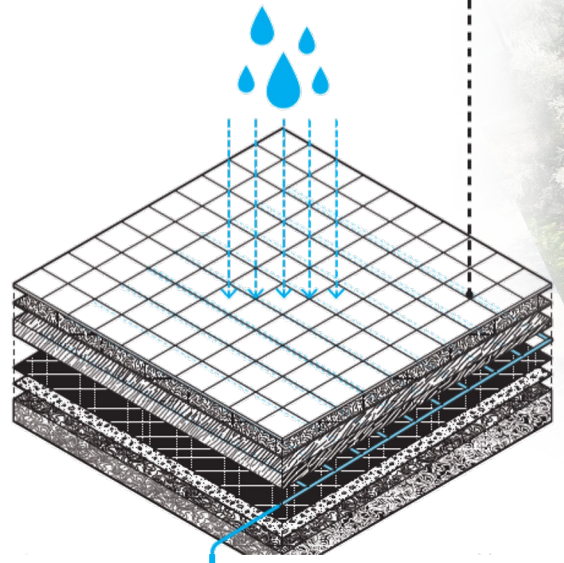


**Scope:** Water management, greening & food production by NBS in an urban context

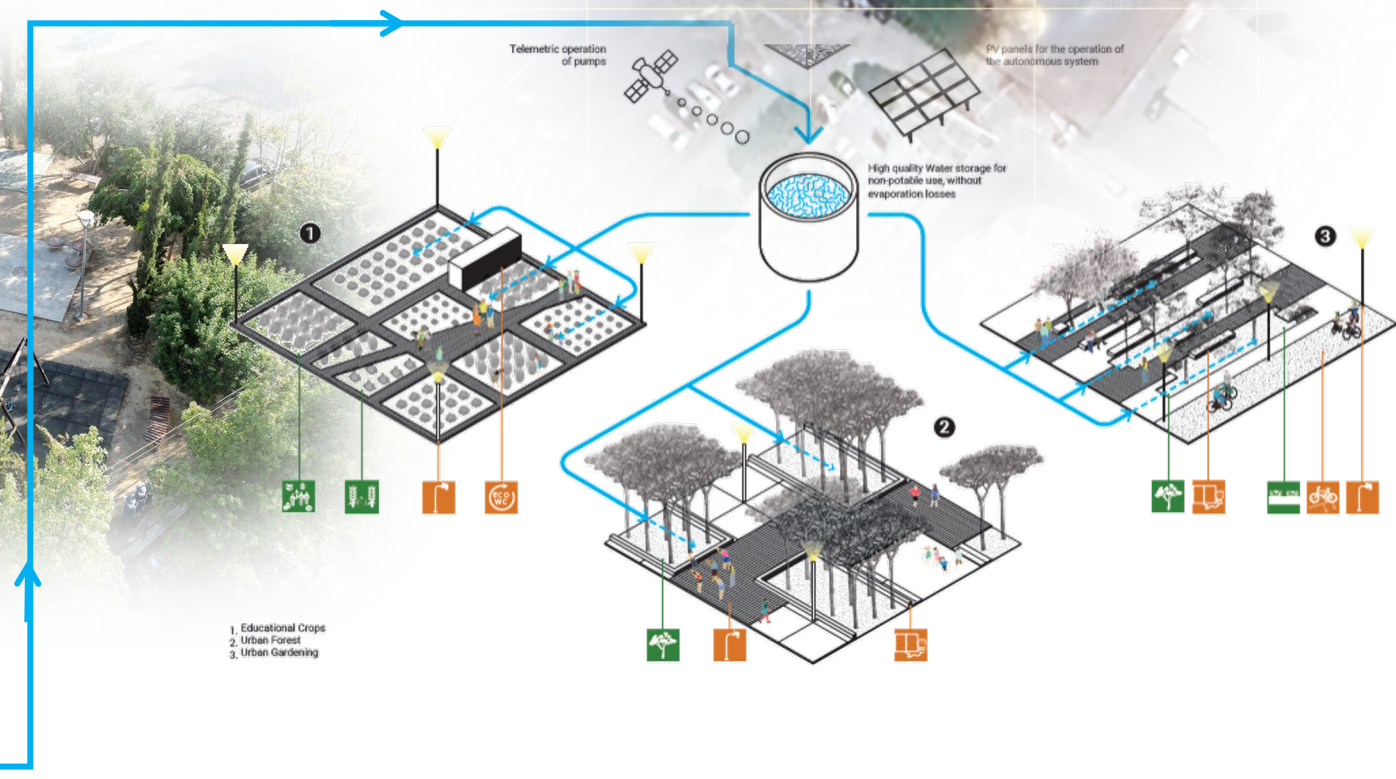
- Vertical Greening Systems; Rainwater harvesting
- Urban Greening; Food & Biomass Production by Hydroponics
- Groundwater treatment by biodesalination (algae)



- Green**
- Crops for educational purposes
- Urban Crops
- Urban Forest
- Urban Gardening
- Energy**
- Autonomous lighting
- Eco WC
- Bike Lines
- Smart urban furniture



- Rain Water (collected)
- Gravel (0.4m)
- Geotextile
- Gravel (Drainage 2cm)
- Perforated Drainage Pipe
- Geomembrane
- Sand
- Natural soil



# Beyond the project



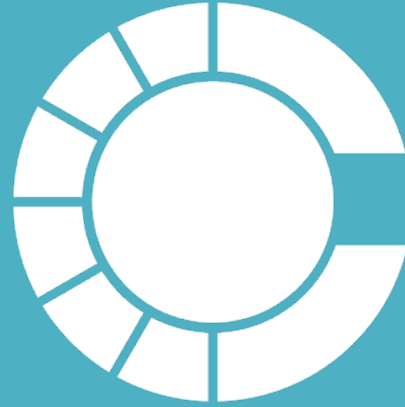
Participating regions/municipalities/communities will establish the

## CARDIMED Resilience Alliance

- partnership will share knowledge and experience;
- drive further up-take and introduce new cases;
- coordination with the Mission on Adaptation to Climate Change.

CARDIMED Resilience Alliance expects to have **28 regions** and **70 communities** in the network by 2030, create **8000 jobs** in the NBS sector, and mobilize over **450 M€** in climate investment.





# CARDIMED

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DEMONSTRATED IN THE MEDITERRANEAN REGION

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