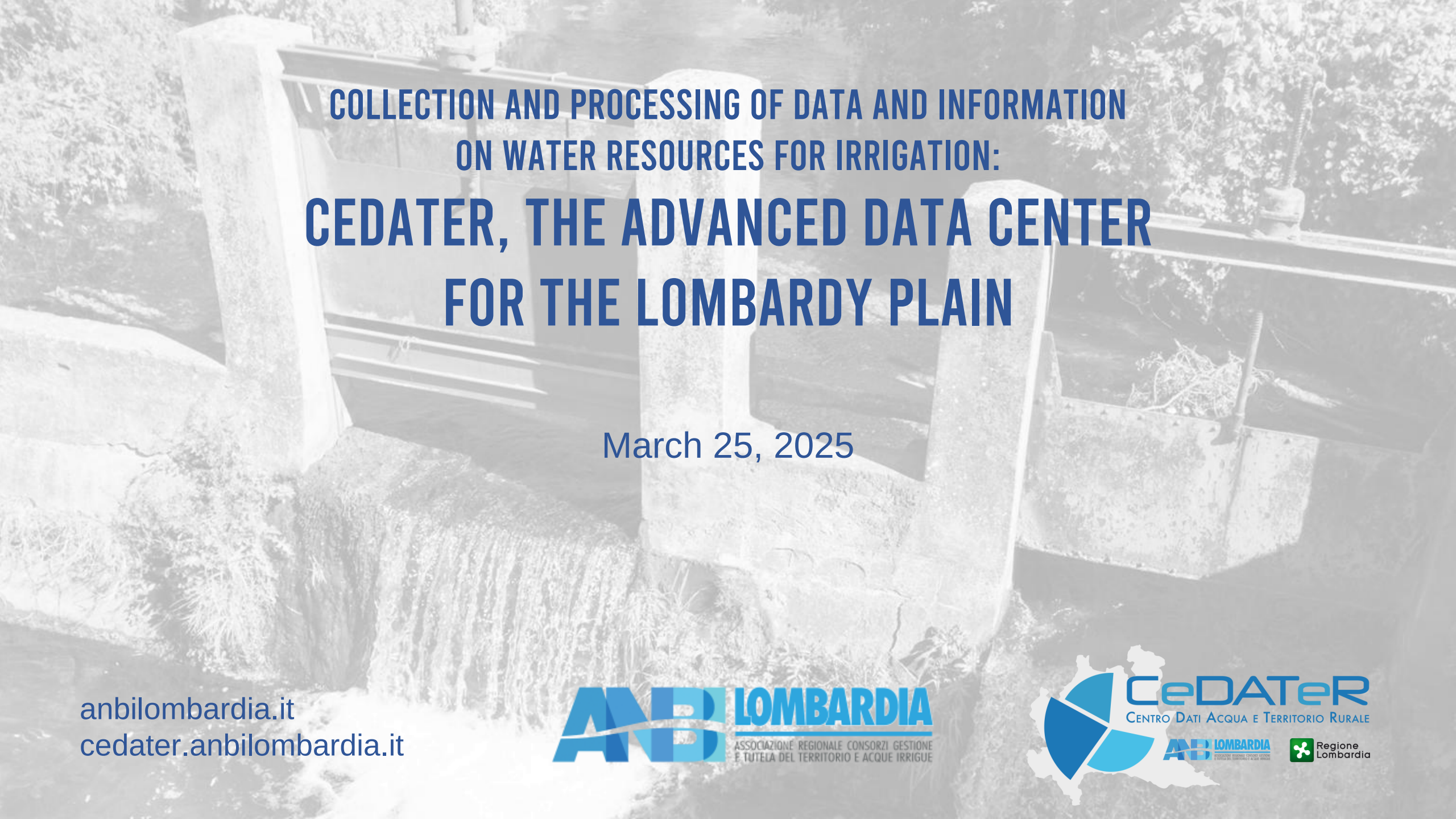

COLLECTION AND PROCESSING OF DATA AND INFORMATION ON WATER RESOURCES FOR IRRIGATION:

CEDATER, THE ADVANCED DATA CENTER FOR THE LOMBARDY PLAIN

March 25, 2025

anbilombardia.it
cedater.anbilombardia.it

ANBI LOMBARDIA
ASSOCIAZIONE REGIONALE CONSORZI GESTIONE E TUTELA DEL TERRITORIO E ACQUE IRRIGUE

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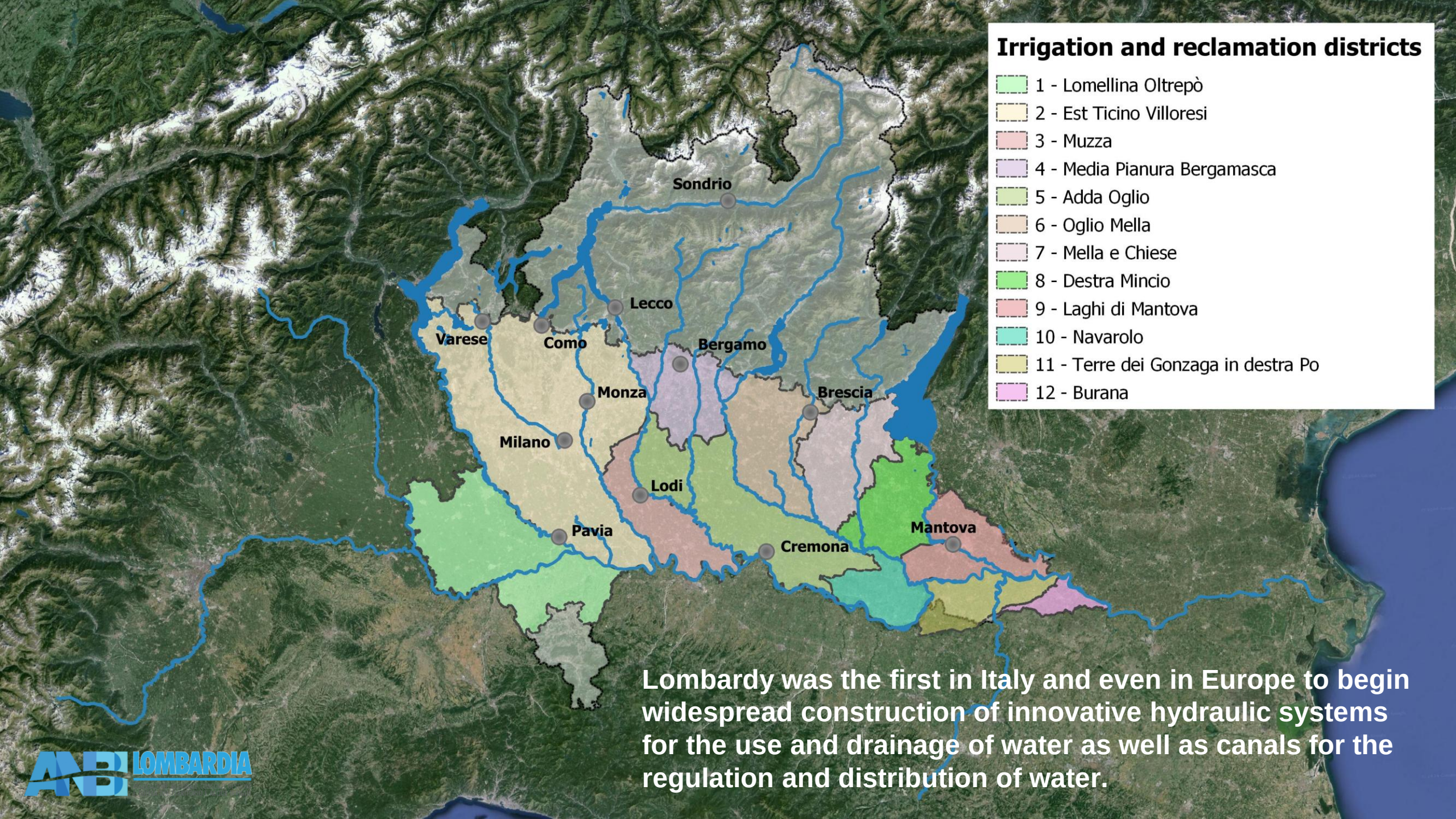
Regione Lombardia



Lombardy was the first in Italy and even in Europe to begin widespread construction of innovative hydraulic systems for the use and drainage of water as well as canals for the regulation and distribution of water.

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…managed by 12 Reclamation and Irrigation Consortiums

01 est sesia consorzio di irrigazione e bonifica
02 Est Ticino Villoresi Consorzio di Bonifica
03 MBL Consorzio Bonifica Muzza Bassa Lodigiana
04 CONSORZIO DI BONIFICA DELLA MEDIA PIANURA BERGAMASCA
05 Consorzio di bonifica Dugali Naviglio Adda Serio
06 CONSORZIO DI BONIFICA OGLIO MELLA
07 CONSORZIO DI BONIFICA CHIESE
08 Garda Chiese consorzio di bonifica
09 Consorzio di bonifica Territori del Mincio
10 CONSORZIO DI BONIFICA NAVAROLO AGRO CREMONESE MANTOVANO
11 CONSORZIO di BONIFICA TERRE DEI GONZAGA IN DESTRA PO
12 CONSORZIO DELLA BONIFICA BURANA

The Italian term for reclamation, “bonifica” has a double meaning:

LAND RECLAMATION: protecting land from floods and transforming swampland to make it safe and productive;

IRRIGATION: irrigating land which has a scarce supply of water and regulating water when it is in abundance.

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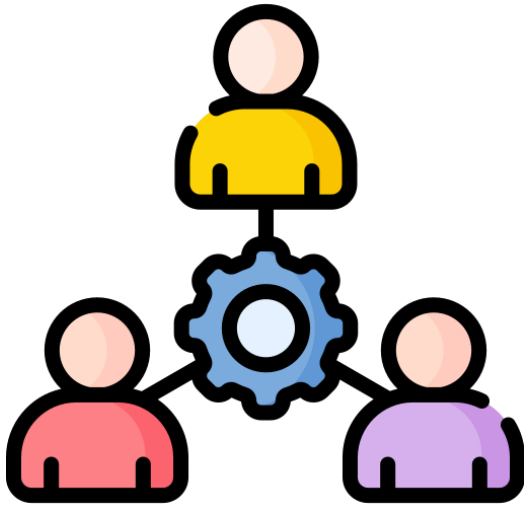
Reclamation and Irrigation Consortiums

- **Public associations**, part of the regional system and governed by a Statute approved by the Lombardy Region
- Their **representatives are democratically elected** by all the consortium members
- Based on a consolidated organizational and professional structure, with the presence of **multiple professional figures including architects, designers, engineers and agronomists**. Each skill is necessary to respond to the multiple tasks managed by the Consortiums.

	Employees
Technical and administrative staff	444
Employees	573
Seasonal employees	277
Totale	**1294**



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The role of Reclamation and irrigation consortiums

Keyword is MULTIFUNCTIONALITY

Irrigation and agriculture	intake structures, pumping station, irrigation and drainage networks
Land reclamation and hydraulic defense	
Green energy production	Hydroelectric and solar energy
Environment, landscape and biodiversity	Springs (flowing wells), wetlands, natural reserves
Tourism, recreation and culture	Cycle/pedestrian paths, architecture and avantgarde machinery and technology, protected areas

Ecosystem Services

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Intake structure & canals

Naviglio di Bereguardo

Diga del Panpeduto (VA)

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Pumping stations

Impianto di sollevamento della Travata (MN)

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Routine maintenance of the irrigation network

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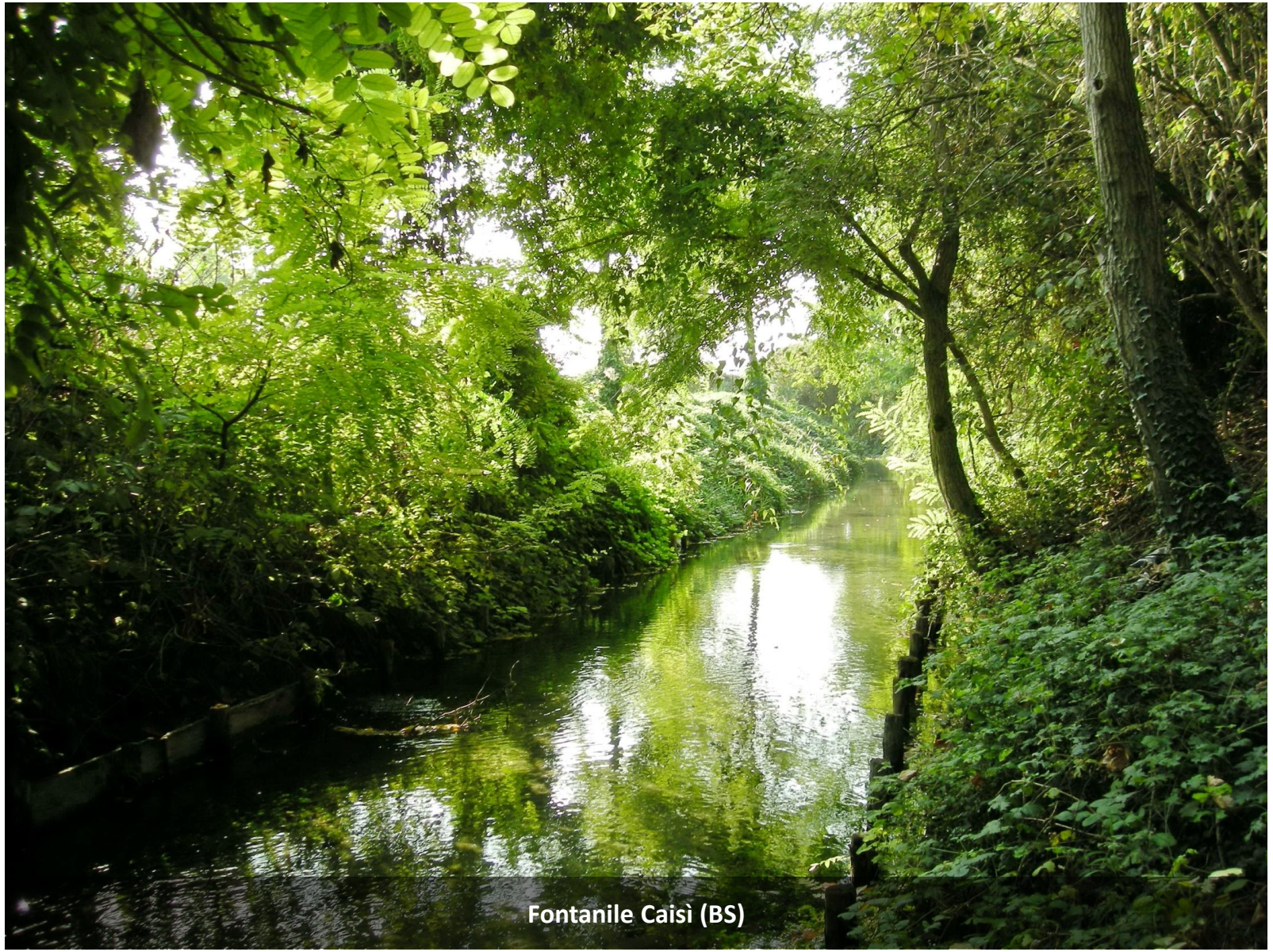
Environment, landscape and biodiversity

Parco del Fontanone (BS)



Fontanile Caisì (BS)

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Green energy production (hydroelectric and solar energy)

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Tourism, recreation and culture

Ciclabile lungo i Navigli

Il Naviglio Grande a Gaggiano (MI)

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Diga di Garlate – Lago di Como

Diga di Sarnico – Lago d'Iseo

Diga del lago d'Idro

Diga della Miorina – Lago Maggiore

Diga di Monzambano – Lago di Garda

Lecco
Varese
Como
Monza
Milano
Lodi
Pavia
Cremona
Mantova
Brescia

ANBI LOMBARDIA

…managed by 5 Regulation Consortiums

A

CONSORZIO DEL TICINO
Ente Pubblico non Economico
ai sensi della legge 70/75

B

Consorzio dell'Adda

C

CONSORZIO
dell' OGLIO

D

CONSORZIO DEL CHIESE
DI BONIFICA
DI SECONDO GRADO

E

CONSORZIO DEL MINCIO
Ente di bonifica di 2° grado e di utilizzazione idrica
46100 MANTOVA

Among the **members of the Regulation Consortiums** there are Reclamation and irrigations consortiums and other private irrigation consortiums.

Regulate the lakes to optimize their level through the **dams management**.

Coordinate the diversions along the regulated rivers in order **to make more efficient the withdrawal of the water**

Diga della Miorina (VA)

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ANBI Lombardia: the Consortium regional Association

Represents the associated Consortium;

Formulates **political and programmatic guidelines** for land reclamation and irrigation activities;

Encourages and promote the **development of initiatives** not only for land reclamation and irrigation but also for environmental protection and multiple use of water;

Carries out **projects, actions and cultural initiatives and educational**;

Promotes studies and research of a technical-scientific nature.

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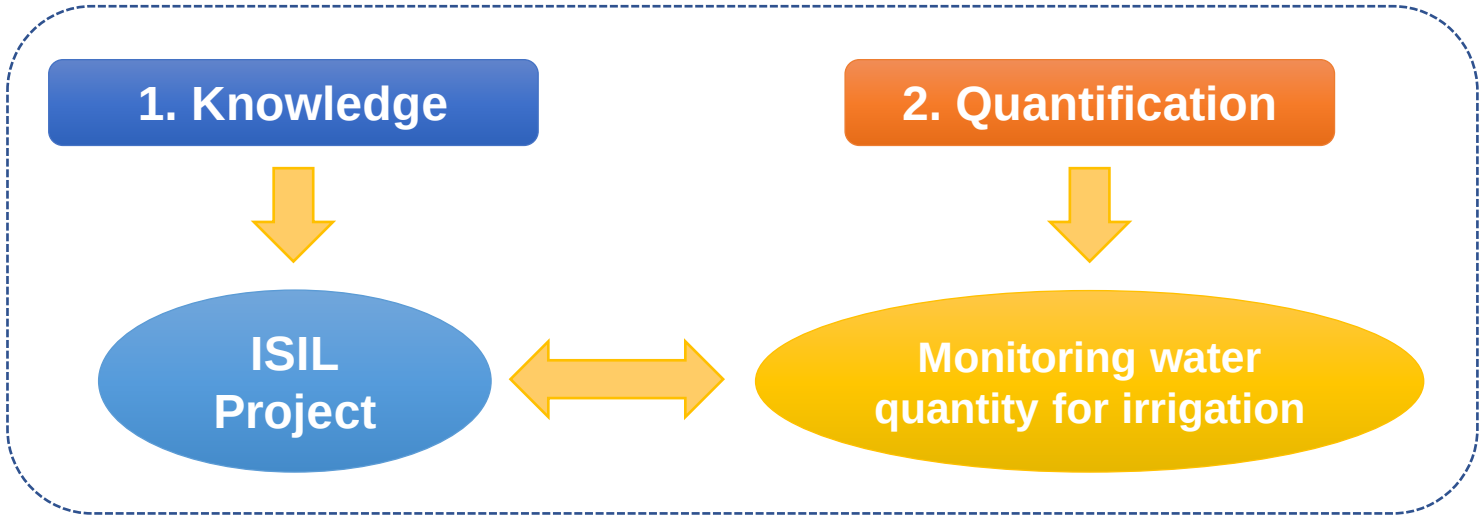
CEDATER: the advanced data center for the Lombardy plain (and not only…)

TARGET: build a centralized and homogeneous system of all information regarding the regional irrigation systems

BEFORE: in 2015, the Lombardy Region funded the ISIL project to collect data for describing irrigation systems

DEVELOPMENT: in 2017 the Data Center was launched, in close collaboration with the Lombardy Region and UniMi-DiSAA for scientific content



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External collaborations and partners

MIPAAF e CREA
- SIGRIAN Update
- Compliance with EU directives

Agreements with ARPA e ERSAF
- Meterological data provider
- Agricoltural land use and estimates of irrigation needs

Università degli Studi - DISAA
- Studies, projects and research
- Cartographic elaborations
- Simulation of irrigation needs

Consorzi di bonifica
- District reclamation plans
- Specific studies

Regione Lombardia
- Hydrological balance
- PTA
- General reclamation plan
- PSR
- Drought management

Autorità di bacino
- Data Exchange on Strategic Flow Meters
- District Water Use Observatory

The infrastructure of the data center

Storage → GEO-DATABASE

Sharing → GEO-SERVER

Visualization, Processing → CLIENT

Open Source systems, developed by non-profit associations and without a commercial license (called **GFOSS** - Geographic Free and Open Source Software).

Technical staff

Hardware & Software

Spatial Data Infrastructure

WHY OPEN SOURCE

- ✓ **excellent benefit/cost ratio**;
- ✓ high quality and **continuous software development** based on the voluntary cooperation of experienced users;
- ✓ presence of **a very large online community** to discuss strategies for solving common problems;
- ✓ guarantee of **data interoperability** with the main systems on the market, both Open Source and proprietary
- ✓ **flexibility**: allows the system to be adapted to any request

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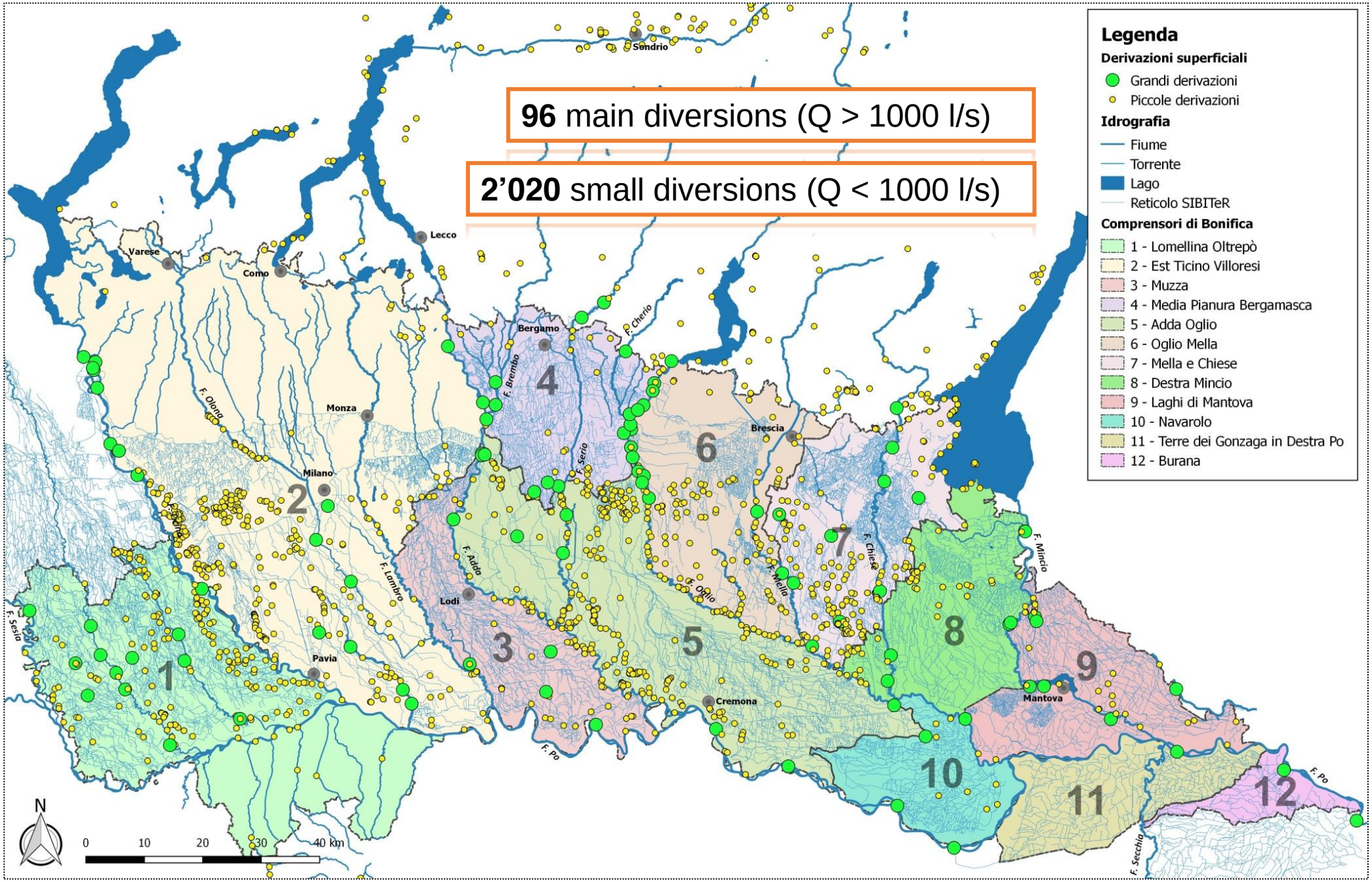
Regione Lombardia

Diversions

Rivers: total average flow under concession of about 740 m^3/s

Springs: 66 m^3/s overall



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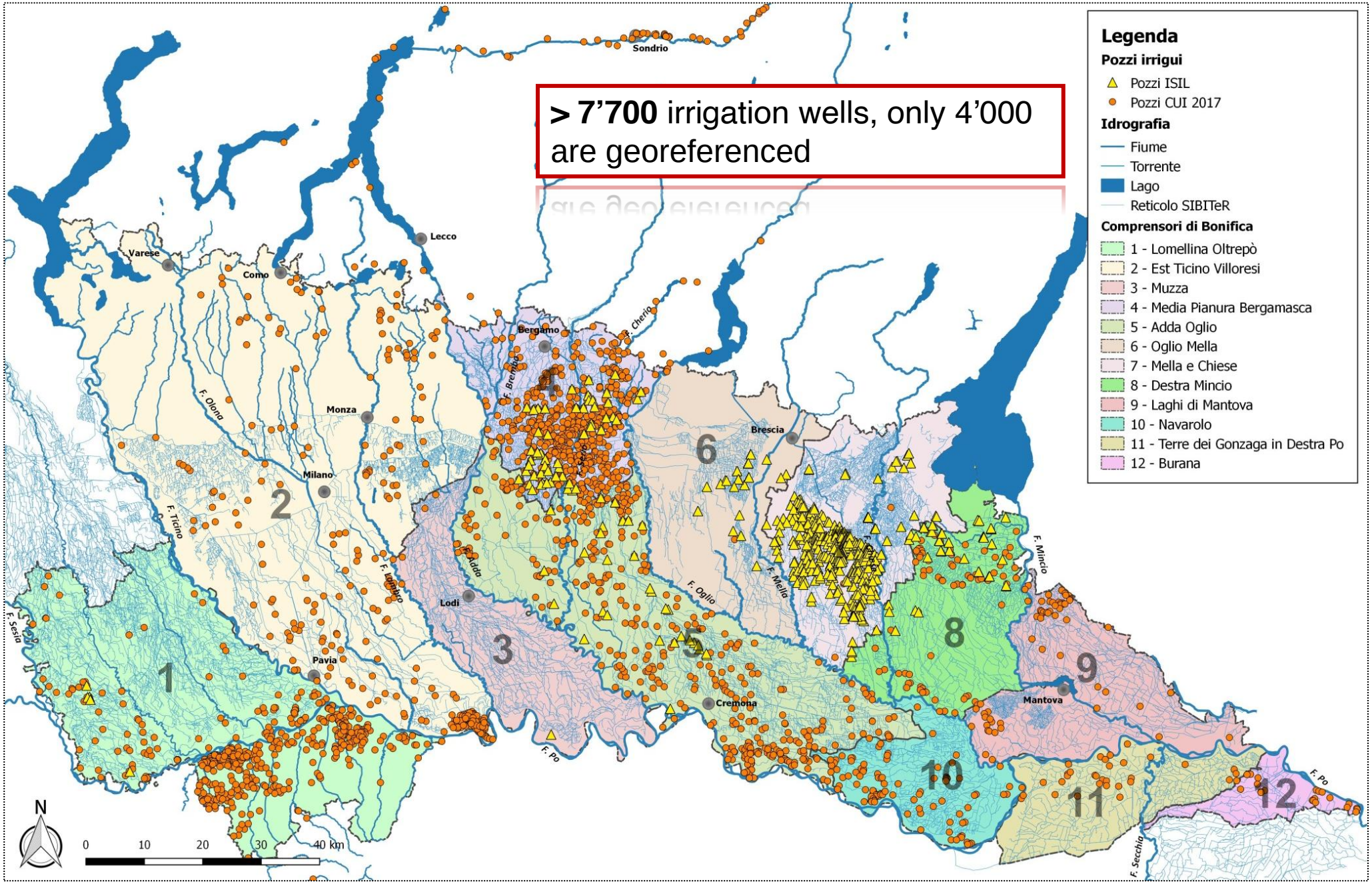
Regione Lombardia

Wells

The data on wells are very fragmentary and incomplete, but there are 7,700 irrigation wells estimated, for a total average flow rate under concession of 107 m^3/s



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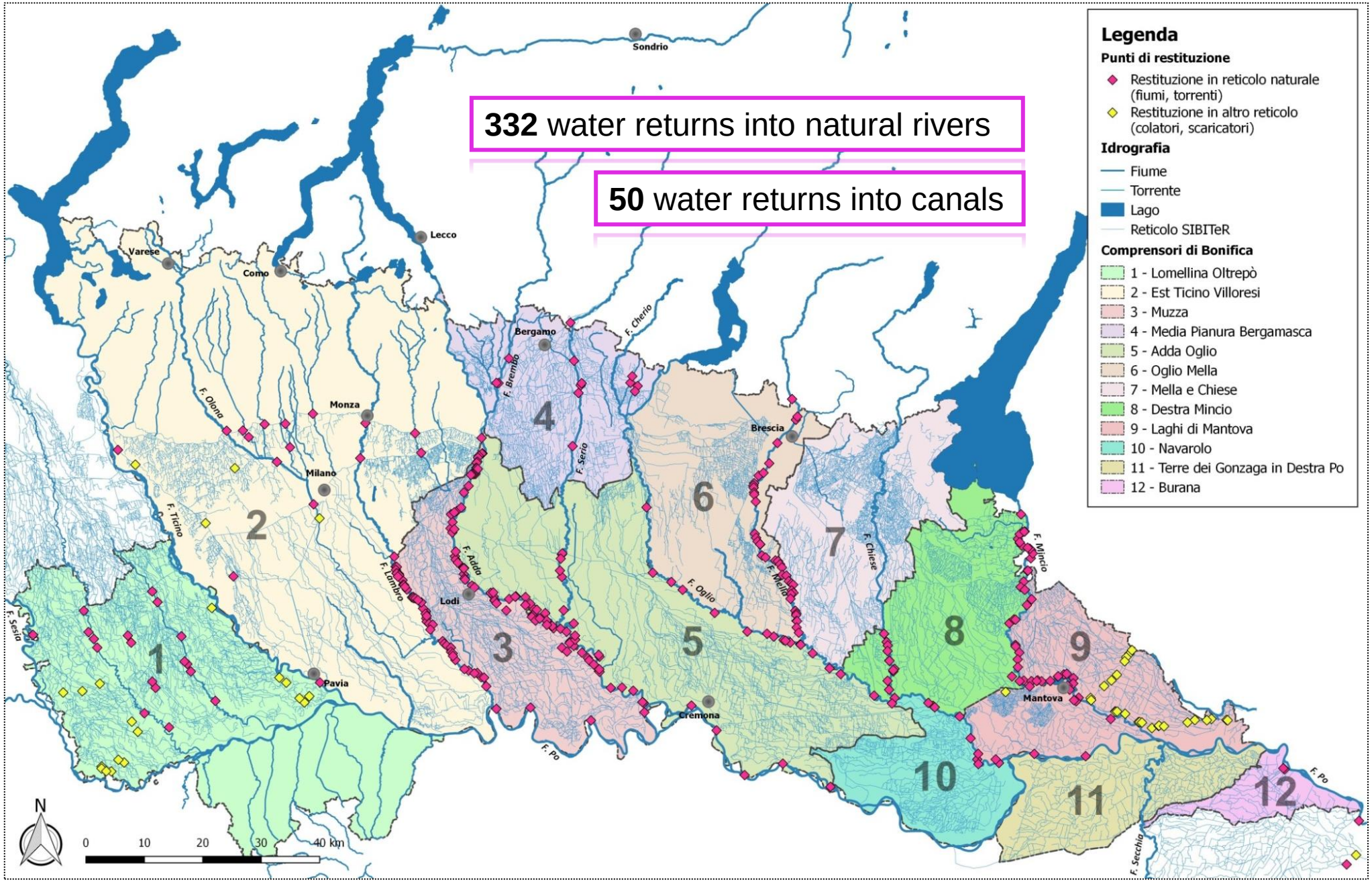
Returns

Returns are the points where water, at the end of agricultural use, is returned to natural water bodies.

Beside the releases into the groundwater they are important for closing the water balance.



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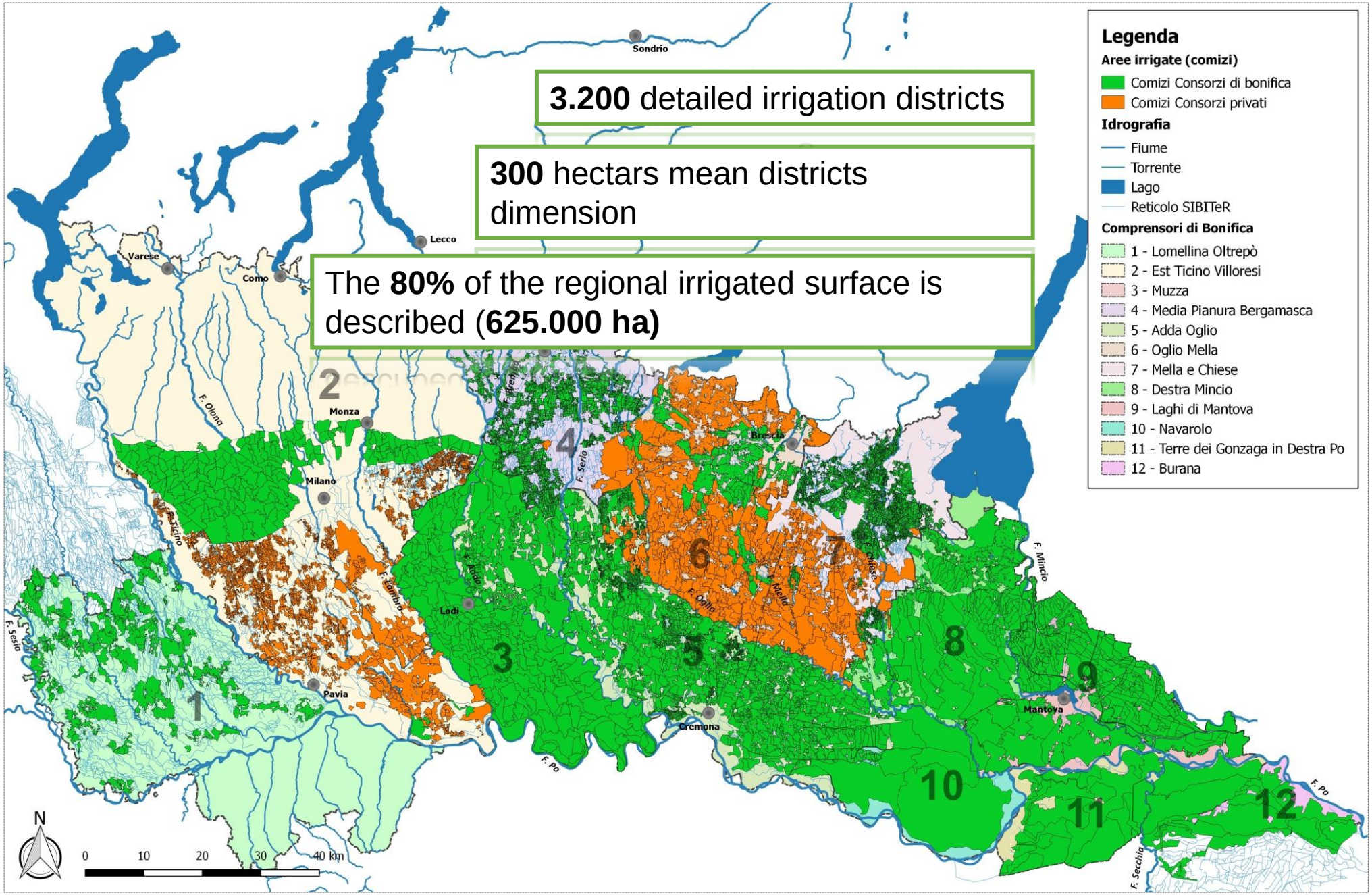
Irrigation districts

Areas irrigated by a single canal and the information needed to describe it (irrigation method, efficiency, ecc.)



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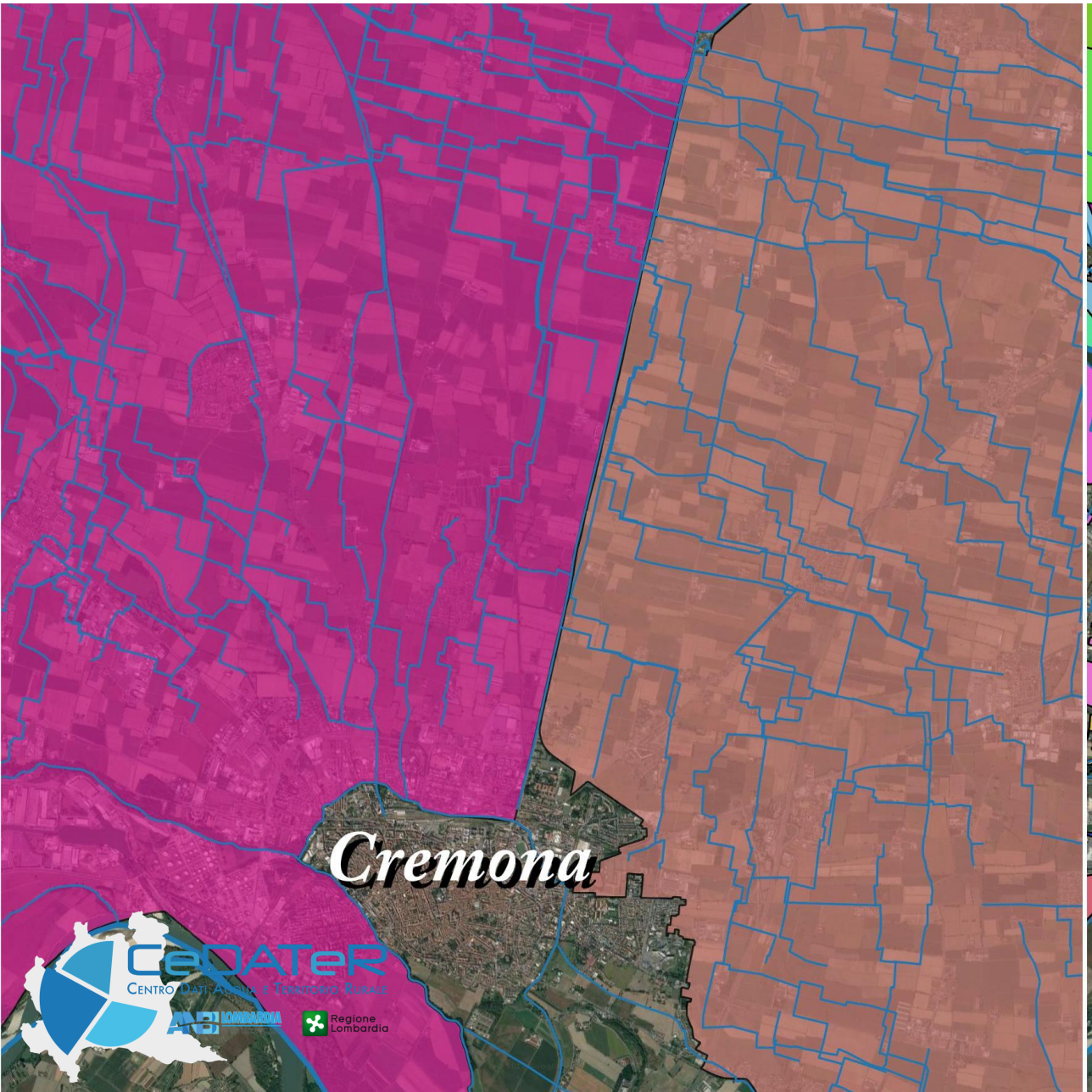
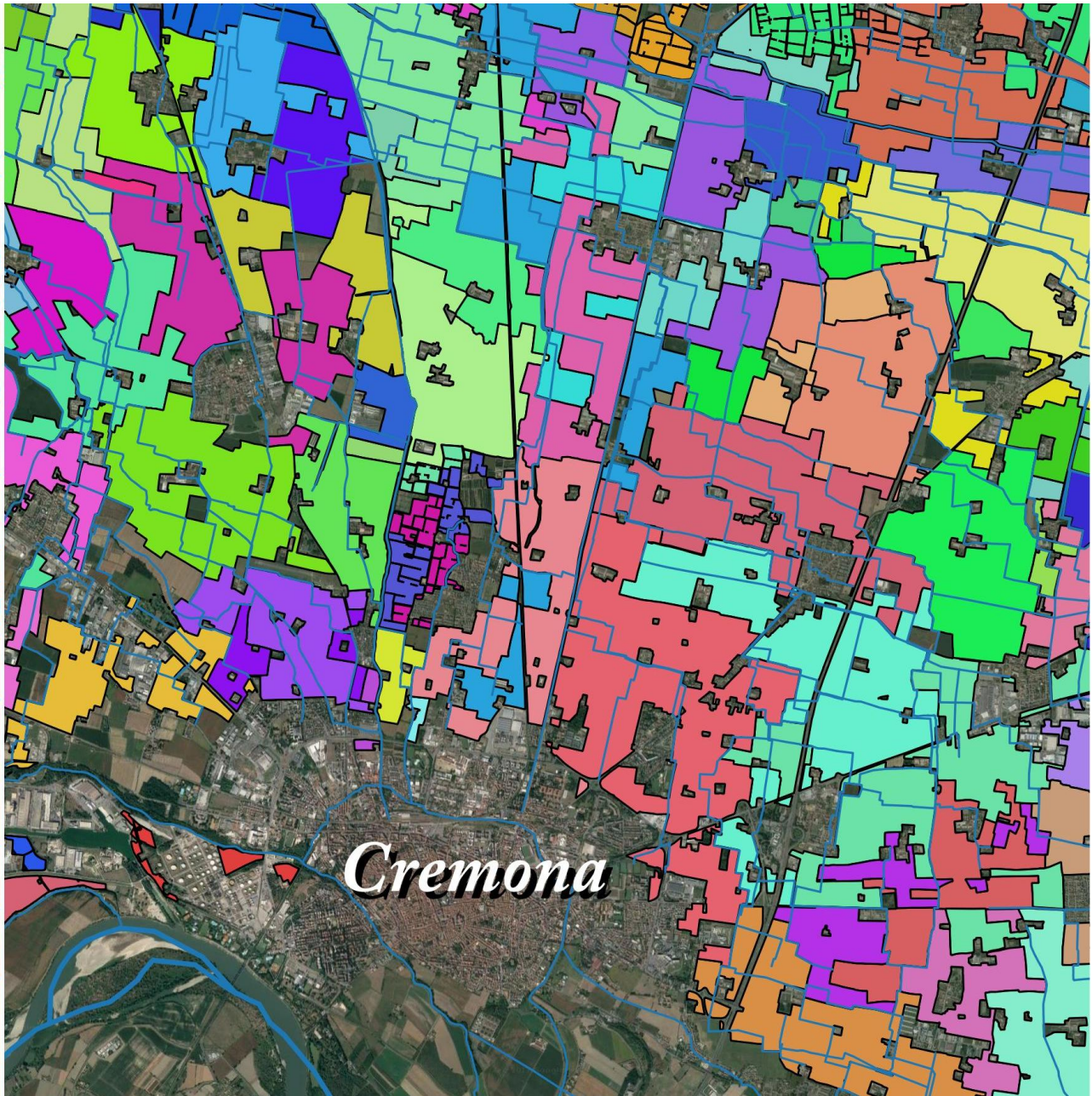
Irrigation districts at different scales





Cedater main activities

- ✓ Constant and continuous updating of the information layers of the database
- ✓ Collection and updating of data on irrigation systems
- ✓ **Management of the regional monitoring system of water for irrigation use**
- ✓ **Modelling irrigation needs (University of Milan - DiSAA)**
- ✓ Updating and populating the SIGRIAN ministerial database, designed and managed by CREA
- ✓ Report on the irrigation season in Lombardy, since 2020.
- ✓ Carrying out studies and research on the water use, also in collaboration with third parties and university institutes.

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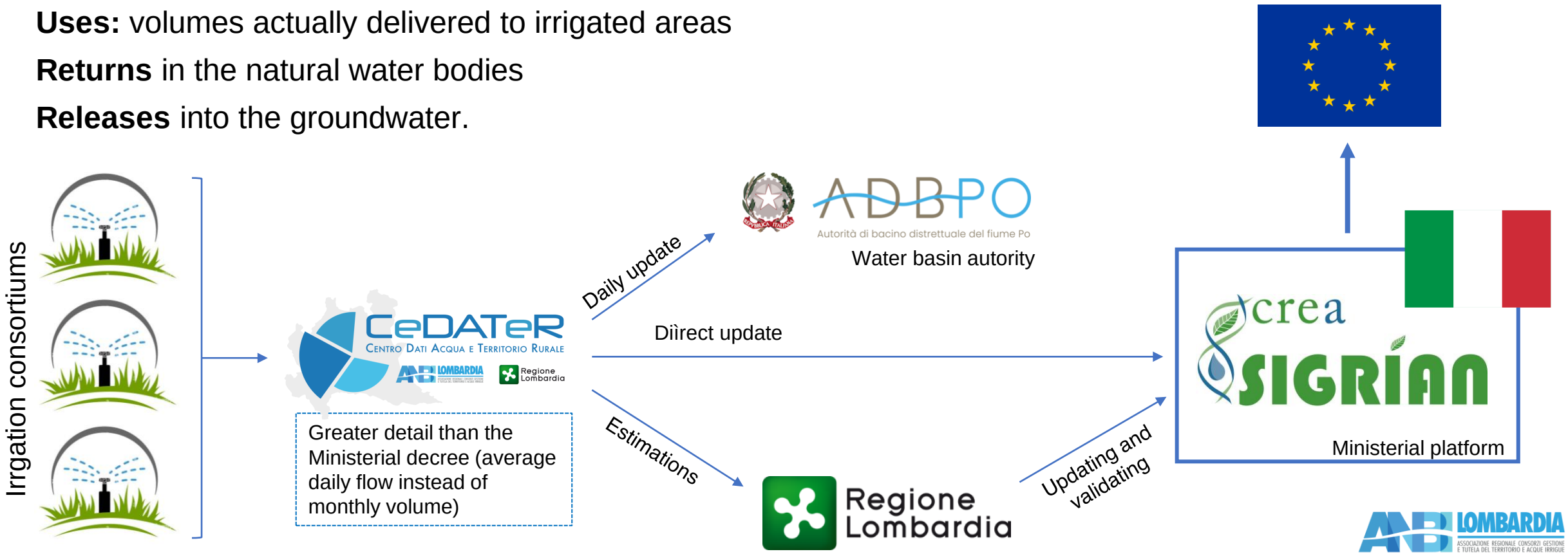
Regulatory references on monitoring irrigation volumes

Ministerial Decree of 31 july 2015
and **D.G.R. no. 6035/2016 Regione Lombardia**

They implement the quantitative monitoring requests made by the **Water Framework Directive (2000/60 CE)** and establish the obligation to quantify:

- **Withdrawals** from surface and underground water
- **Uses:** volumes actually delivered to irrigated areas
- **Returns** in the natural water bodies
- **Releases** into the groundwater.



Management of the regional monitoring system of water for irrigation use

The CeDATeR monitoring system collects the average daily flow data coming from hundreds of monitoring points located throughout the Lombardy plain following the specifications provided for by DGR no. 6035/2016.

The data collected differ in type and mode of transmission:

TYPE OF SENSOR

Diversions, returns, irrigation districts

Average daily flow rate

Wells and others irrigation districts

Monthly volume

TRANSMISSION MODE

Manual

WEB portal

Monthly or seasonal update

Automatic (88 meters)

FTP protocols

Daily update

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The regional monitoring system in numbers

Throughout the Lombardy plain, 427 monitoring points are active and connected to the regional database, divided into:

Diversions from **surface water bodies**
152 flow meters 80%

Points of withdrawal from the aquifer through **wells**
143 volume meters 10%

Returns to surface water bodies
26 flow meters

Delivery points at the head of **irrigation districts**
95 flow meters

Despite the small number of monitoring points compared to the total number of derivations (152 out of 2,116, equal to 7%), in terms of volumes actually the monitoring is coverig the 80% of the average flow rate under concession from surface water.

Different the situation for the wells, covering only 10% of the average flow under concession in Lombardy.

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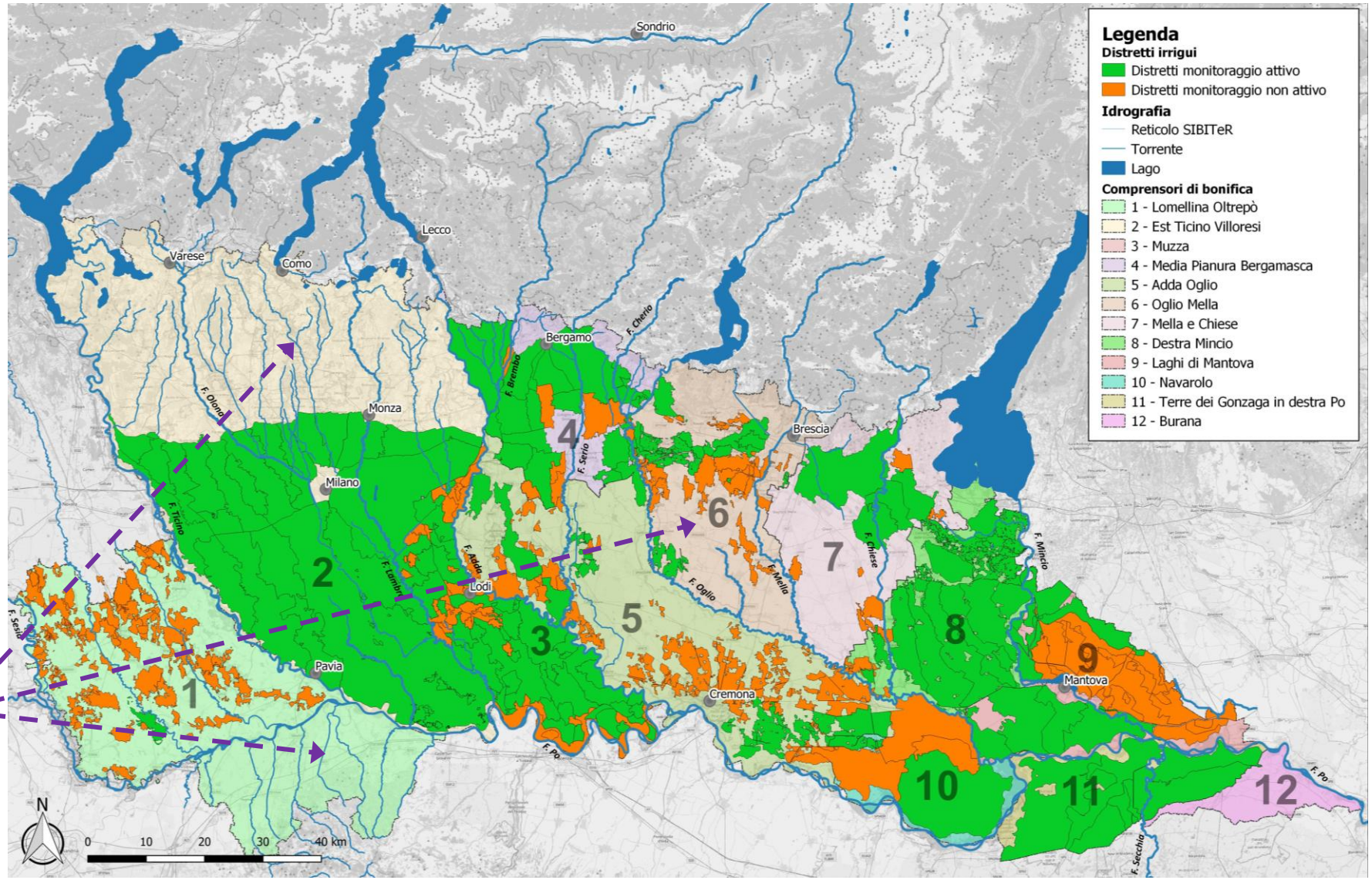
Areas without data or monitoring points

Irrigation districts with active monitoring (green areas – 139), **irrigation districts without monitoring** (orange areas - 197) for a total surface of 650’000 hectares (336 total districts).

Other irrigated areas whitout information on the irrigation systems, managed by private subjects with their own water concessions.

SELF SUPPLYING
(280’000 ha)



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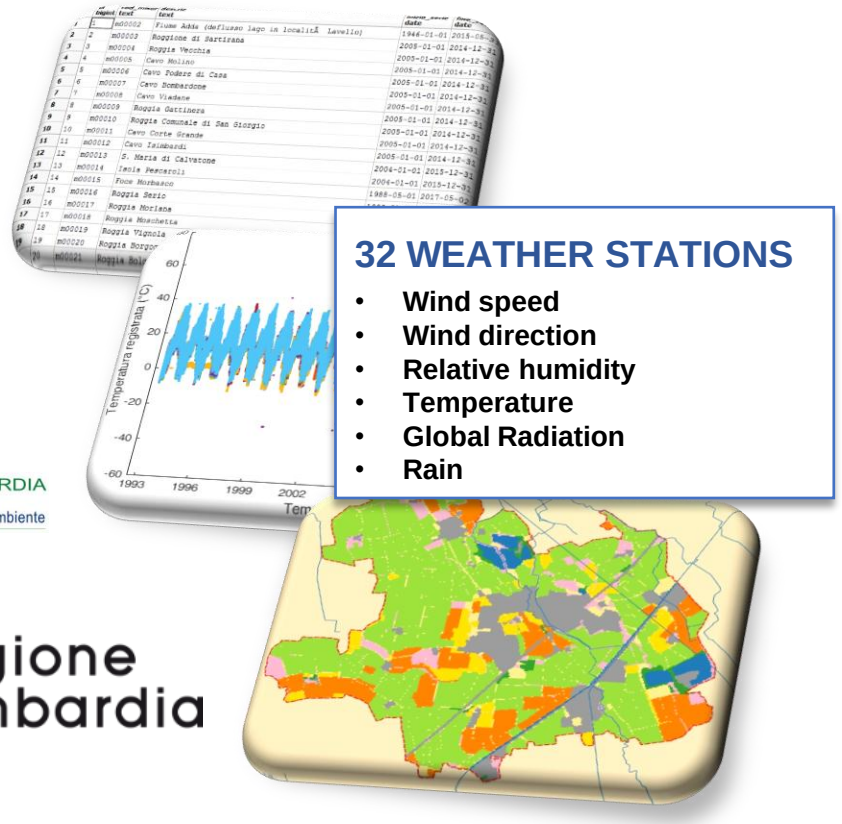
Modeling estimations of irrigation volumes

For all other districts not monitored, and for self-supplied territories, it is required to provide an estimate of the volumes used through mathematical models.

Estimation is made from the water needs of cultivations, using the IdrAgra agrohydrological model, developed by University of Milan - DiSAA.

INPUT DATA

- Average diverted flow rates
- Agro-meteorological variable series
- Agricultural land use

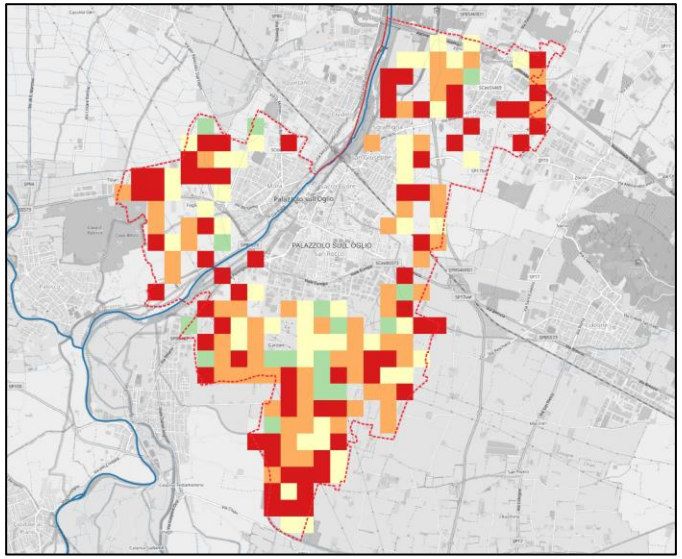


32 WEATHER STATIONS

- **Wind speed**
- **Wind direction**
- **Relative humidity**
- **Temperature**
- **Global Radiation**
- **Rain**

DATA OUTPUT

Monthly irrigation needs 250x250 meters



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Agenzia Regionale per la Protezione dell'Ambiente

Regione Lombardia

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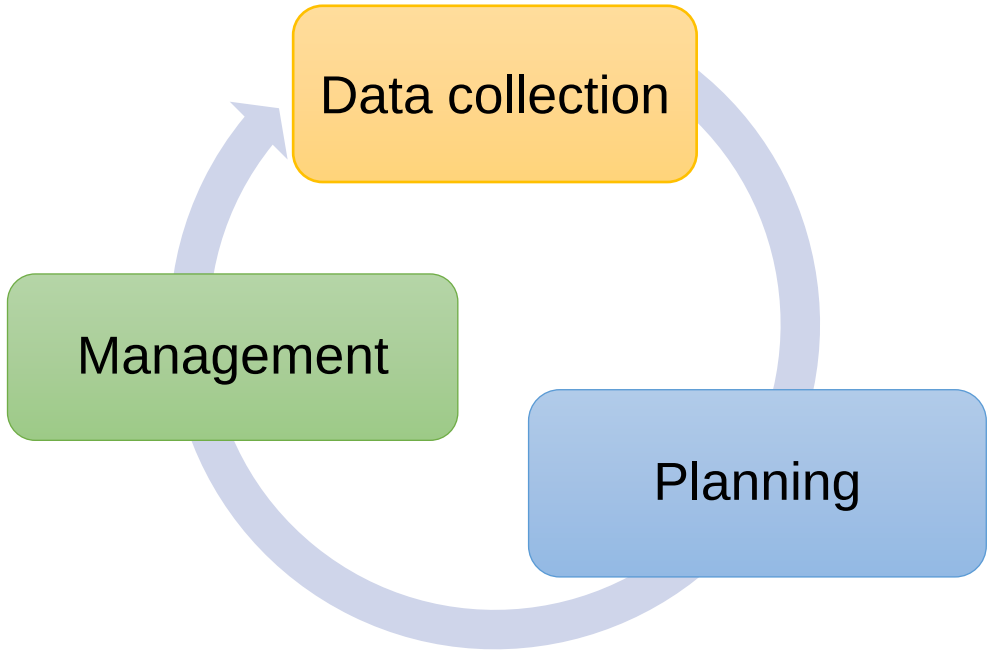
Why collecting data?



Planning examples:

- ✓ **Regional hydrological balance:** updated data on withdrawals have been provided in order to increasingly refine the calculation of the Regional Water Balance.
- ✓ **Environmental/ecological Flow:** the role of the Data Center is fundamental for the definition and refinement of corrective factors, as well as for the planning of further site-specific studies**.**
- ✓ Support to the Lombardy Region in the preparation of the **General Land Reclamation Plan**, containing the guidelines for land reclamation and irrigation in the region.

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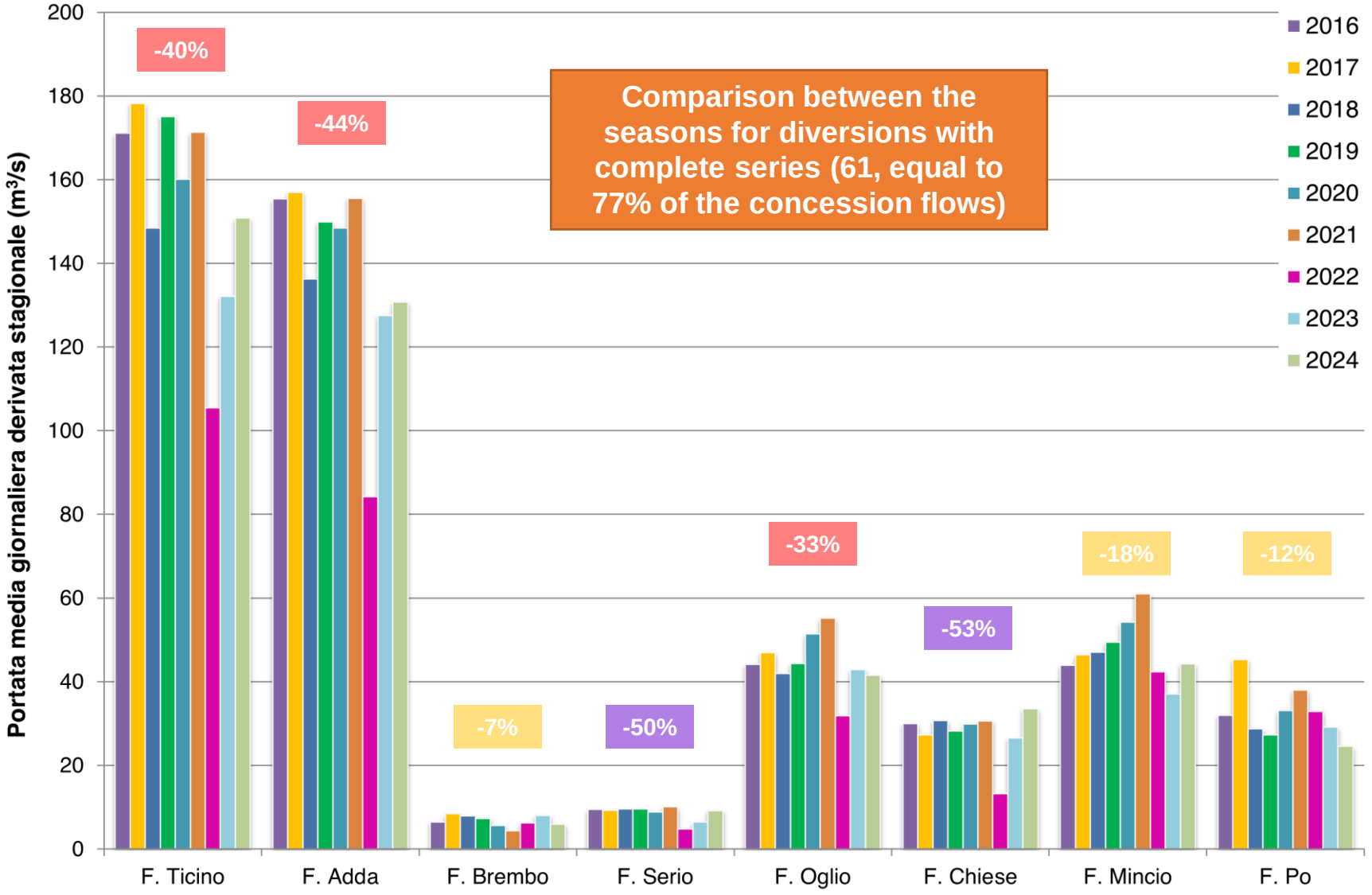
Examples from data collected: difference between irrigation seasons

The rivers that have contributed most in terms of volume to support agriculture in Lombardy are, in order of consistency: Adda, Ticino, Mincio, Oglio and Po.

In 2022, significant reductions in derived flow rates amounted to approximately -36% compared to the average value for the 2016-2021 period.

Comparison with 2017 and 2021: high needs but in those cases good irrigation availability.



The graph takes into account only the meters with a complete time series starting from 2016.

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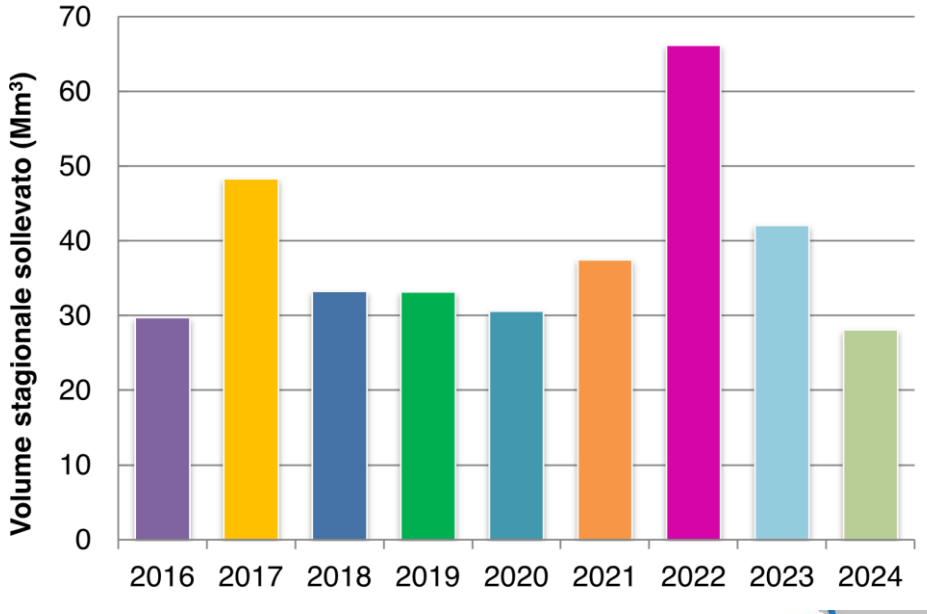
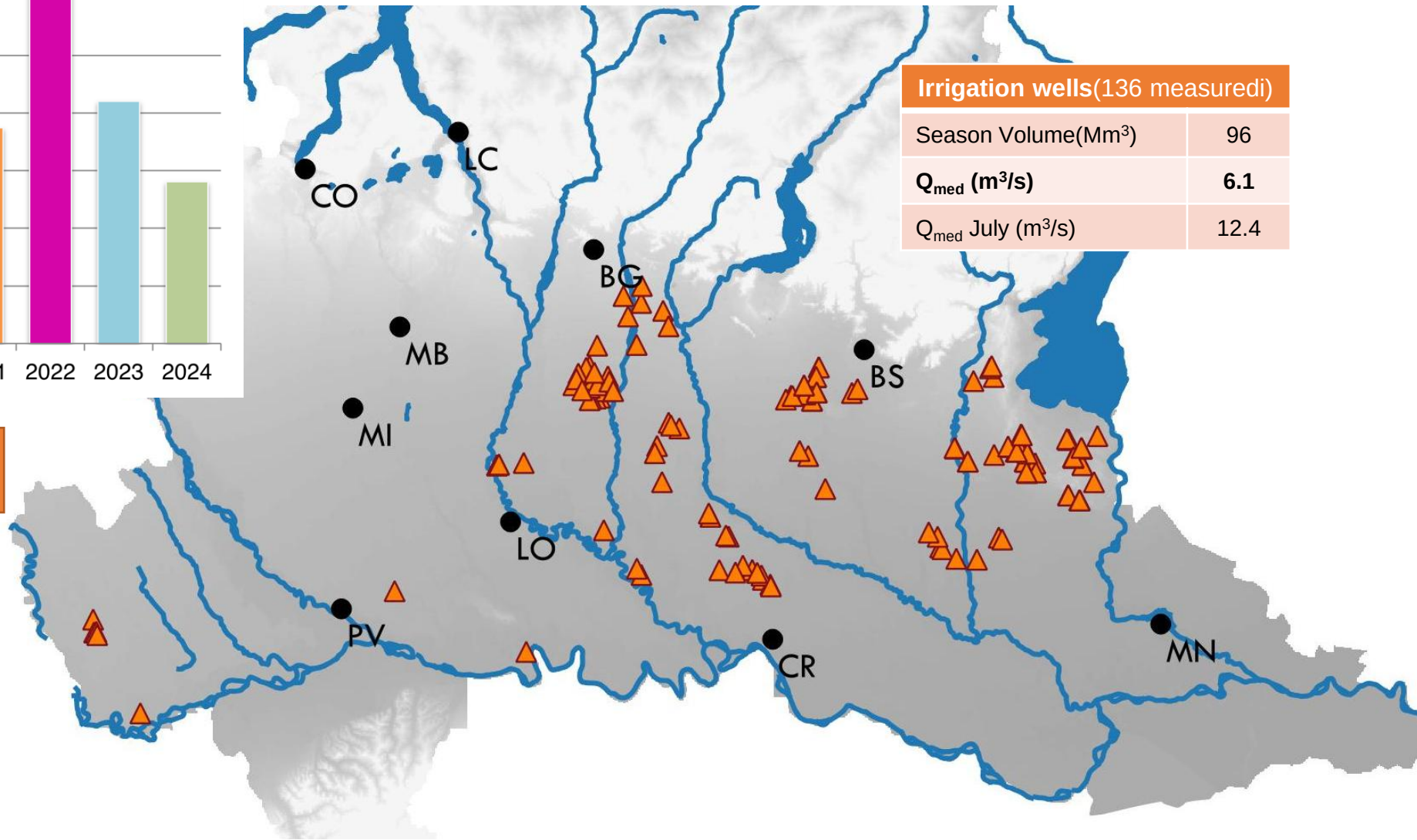
Examples from data collected: difference between irrigation seasons



Comparison of seasons for wells with full series (52)



Irrigation wells(136 measuredi)	
Season Volume(Mm³)	96
Q_{med} (m³/s)	**6.1**
Q_{med} July (m³/s)	12.4

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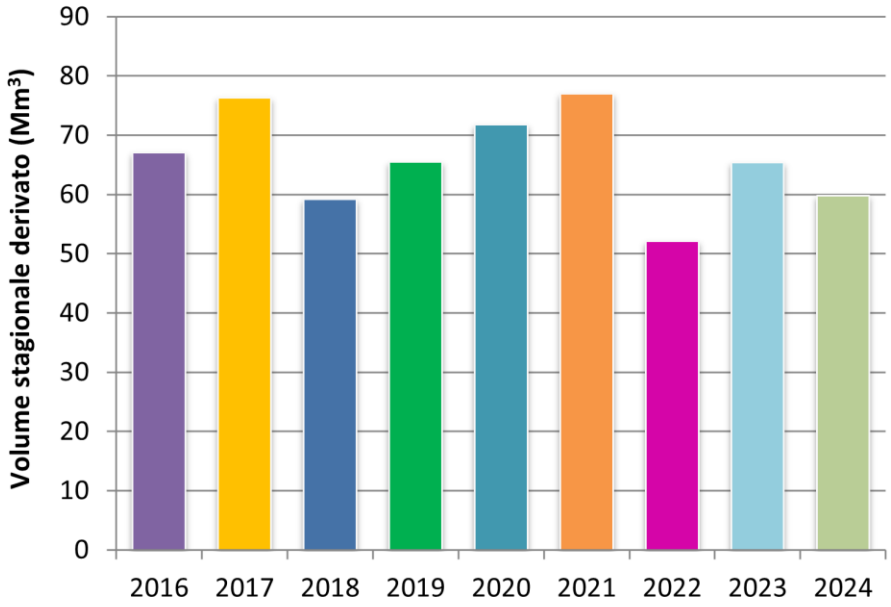
Examples from data collected: difference between irrigation seasons

DRAIN

96 Mm³ of water diverted



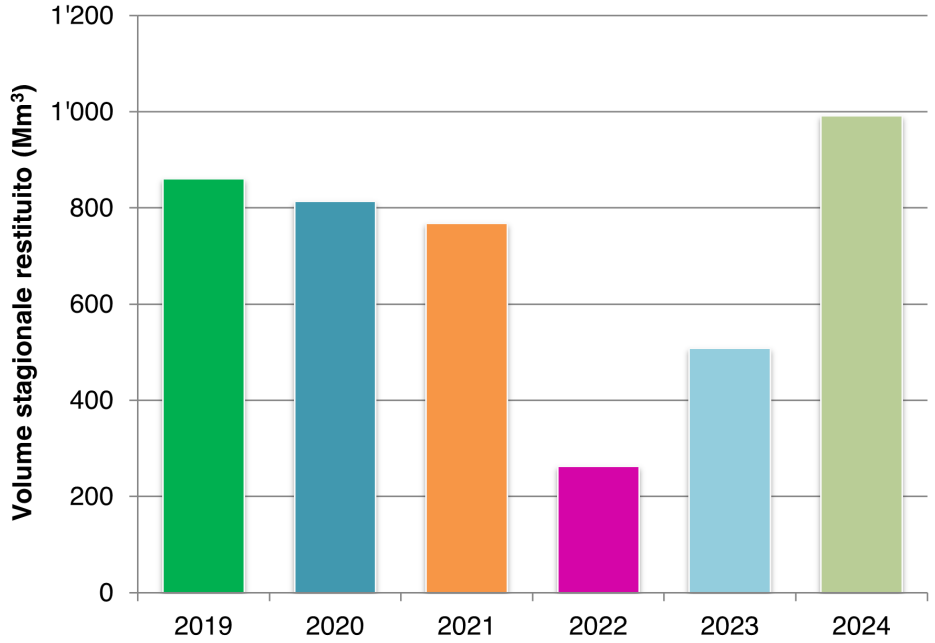
The change in the volume diverted in 2022 is -25% compared to the average value of the 2016-2021 period.

Comparison between seasons on full series

Reduced flow rates in the drain also lead to reductions in the flow rates returned

RETURNS

262 Mm³ of water returned



The change in the overall volume returned in 2022 is -67% compared to the average value of the 2019-2021 period.

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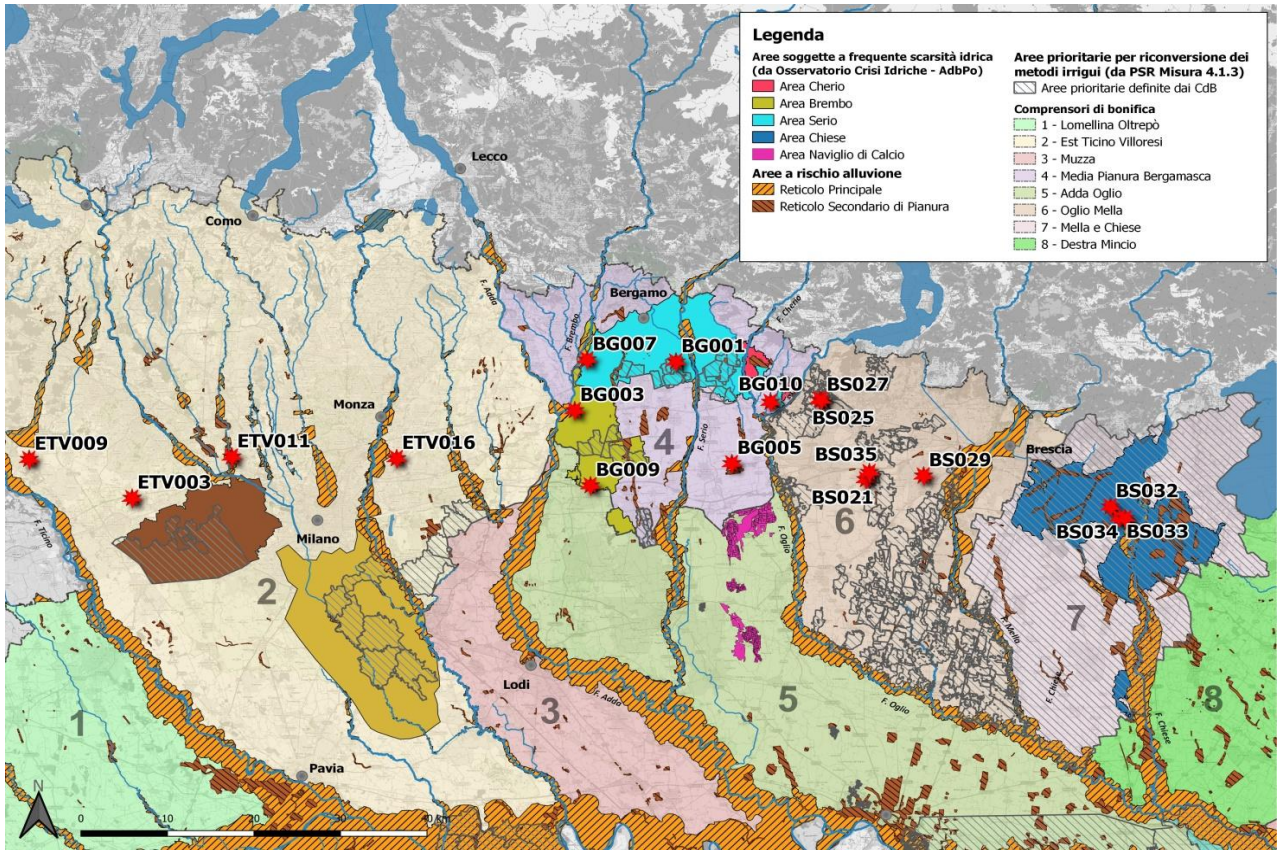
Example of data collection, planning and management: finding new water reserves



Study for the identification of the most suitable **disused quarries** for the function of water reserve tanks and/or for flood lamination.

70 potentially convertible disused quarries have been identified.
Of these, 18 are considered priority and one is already realized, another one is under construction.

Castrezzato (BS)

Calcinatello (BS) – under construction

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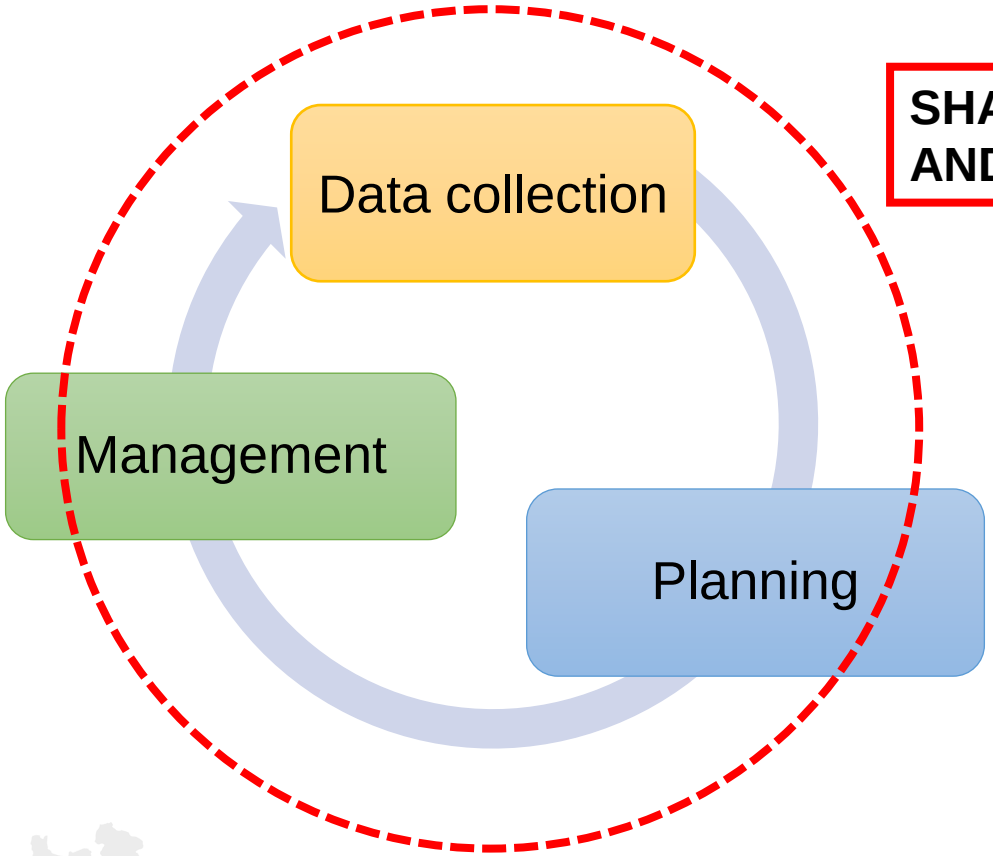
The importance of sharing

Last but not least, the data collected by CeDATeR is shared and used, mainly in two ways: the annual report on the progress of the irrigation seasons and the web portal with public content or content reserved for members (ANBI members and institutions).



SHARING AND DISSEMINATION

Irrigation Season Report

CeDATeR web portal

Services

- PSR Call
- Flow rate monitoring

Dissemination

- Quarry study
- Status of water reserves

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The importance of sharing: irrigation season report

REPORT SULLA STAGIONE IRRIGUA IN LOMBARDIA 2024

REPORT 2024 SOON AVAILABLE !!

REPORT 2020-2023 ARE AVAILABLE ON:

CEDATER.ANBILOMBARDIA.IT/REPORT

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Ecosystem services and traditional irrigation methods

There are numerous positive repercussions that traditional irrigation (flood irrigation and natural lining canals in gravity networks) has on ecosystems. Some of the most important:

- WATER SUPPLY FOR NATURAL AREAS, INCREASING BIODIVERSTY
- NATURALISTIC AND ECOLOGICAL VALUE OF THE SPRINGS AND THE NETWORK OF NATURAL LINING CANALS
- PHYTODEPURATION AND HYGIENIC FUNCTION
- RECHARGE OF THE AQUIFER THROUGH NATURAL LINING CANALS AND TRADITIONAL IRRIGATION METHODS

Fundamental for maintaining the vitality of the springs, whose supply strictly depends on the interaction between surface and underground water circulation triggered by irrigation activity. Springs are considered strategic for the conservation of biodiversity in the Lombardy plain.

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The ANBI Lombardia projects and activities for the environment

1. "**EVES EValuating Ecosystem Services - The economic evaluation of ecosystem services associated with the Irrigation Systems of Lombardy**": the first result of the project, in collaboration with the University of Brescia, is a detailed report which classifies and defines ecosystem services and identifies the best mathematical models to be used to calculate their economic value;
2. **the AcquaPluss Project - Acqua Plurima for Sustainable Development**, proposing interventions for introducing innovative technologies and management methods for:

Water saving

Improving the efficiency of irrigation systems

- Automation and remote control
- Conversion of irrigation methods
- Irrigation Counseling Tools

the promotion of tourist-recreational activities

Cycle-tourist routes, farmhouses and educational farms

- New routes and cycling guides
- Rest areas and illustrative panels

the protection of the environment and the landscape

The redevelopment of the springs and the re-naturalization of the canals

- Operation and maintenance protocols
- Interventions for the restoration and protection of biodiversity

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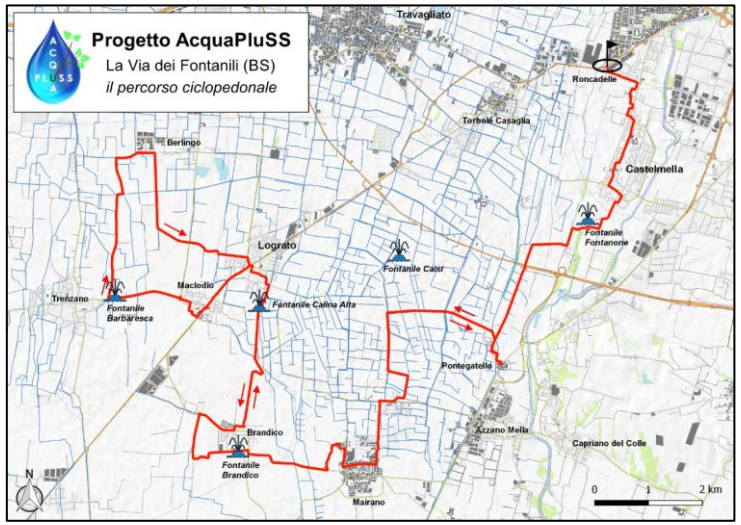
An example of AcquaPluSS intervention: the recovery of the Fontanone

During 2021, the first intervention was carried out in the pilot area of the springs near Brescia city, the Fontanone spring in Castel Mella in the Oglio Mella Consortium District, aimed at preserving and indeed increasing the irrigation function and at the same time enhancing its environmental and landscape value.

Following a detailed vegetation study, which recovered the shrub essences typical of the plain area and the ecosystem of the springs, replanting interventions were carried out, creating an area of naturalistic interest that is now a real educational laboratories for school at every level.

Completed with the cycling route of the "Via del Fontanili".



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An example of AcquaPluSS intervention: analysis of irrigation needs in Franciacorta vineyards

Franciacorta is one of the **most prestigious wine-growing areas** at national and international level for the production of high quality sparkling wines. Only a small part of the territory is served by irrigation systems. **The increase in the frequency and intensity of drought events is stimulating a growing interest of winegrowers in the extension of irrigation systems.**

1°RESULT: Estimation of the **irrigation needs of the Franciacorta area in the current agro-climatic conditions and considering the effects of climate change**. In particular, for the vineyard areas, the needs for growing factors and defense against frost and heat waves will be taken into account.

2°RESULT: **Analysis of the possibilities of extending the irrigation service** provided by the Oglio-Mella Consortium to the Franciacorta area, with particular attention to the vineyard areas.

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Conclusions and future developements

The model adopted for the creation of the Data Center is characterized by using best technologies available, based on maximum flexibility in order to respond to every new need/request.

However, the success of CeDATeR is only made possible by the continuous collaboration between ANBI Lombardia and the consortiums, which provide data and expertise.

CeDATeR is able to promote and support modern planning and management of water resources based on scientific knowledge of the regional irrigation system.

The challenges of the near future mainly concern the fight against climate change.

DROUGHTS

- Dashboard and automatic reports on water availability for irrigation
- Increase modeling and developing decision support systems

FLOODS

- Dashboard and automatic rainfall reports (soon available)
- New data about land reclamation and areas at hydraulic risk

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THANK YOU FOR YOUR ATTENTION

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Regione Lombardia