



JRC Ispra



Po River Basin Authority

PARMA



EDO User's Meeting

Joint Research Centre (JRC) | Ispra | 9-10 November 2017



Drought Management Tools in the Po Basin



Claudia Vezzani - Po River Basin Authority

PO RIVER BASIN CHARACTERISTICS

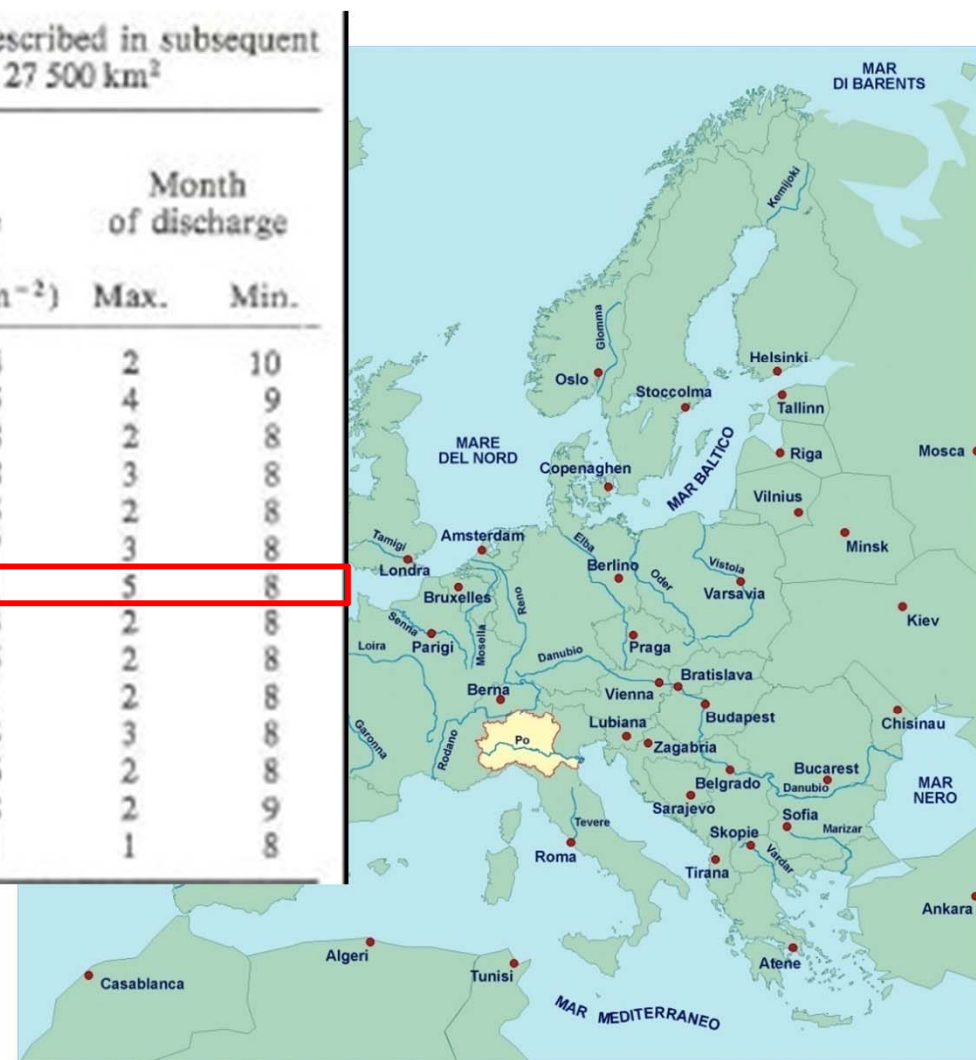


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Main European Rivers

TABLE 1. Major rivers of western Europe. Those in parentheses are not described in subsequent chapters. Data from UNESCO (1974). Threshold drainage area 27 500 km²

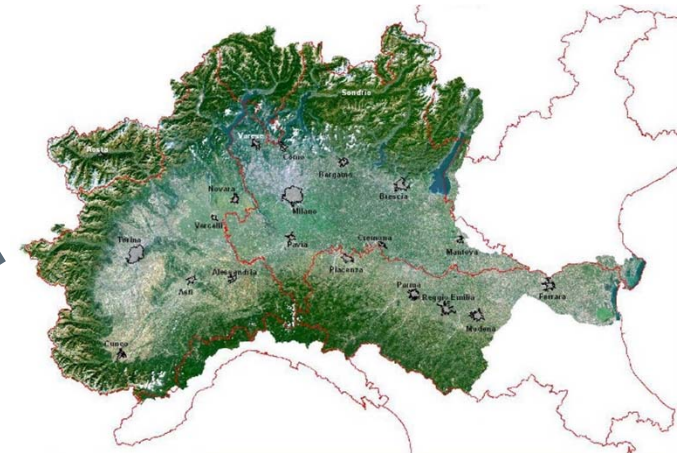
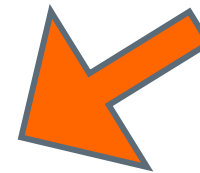
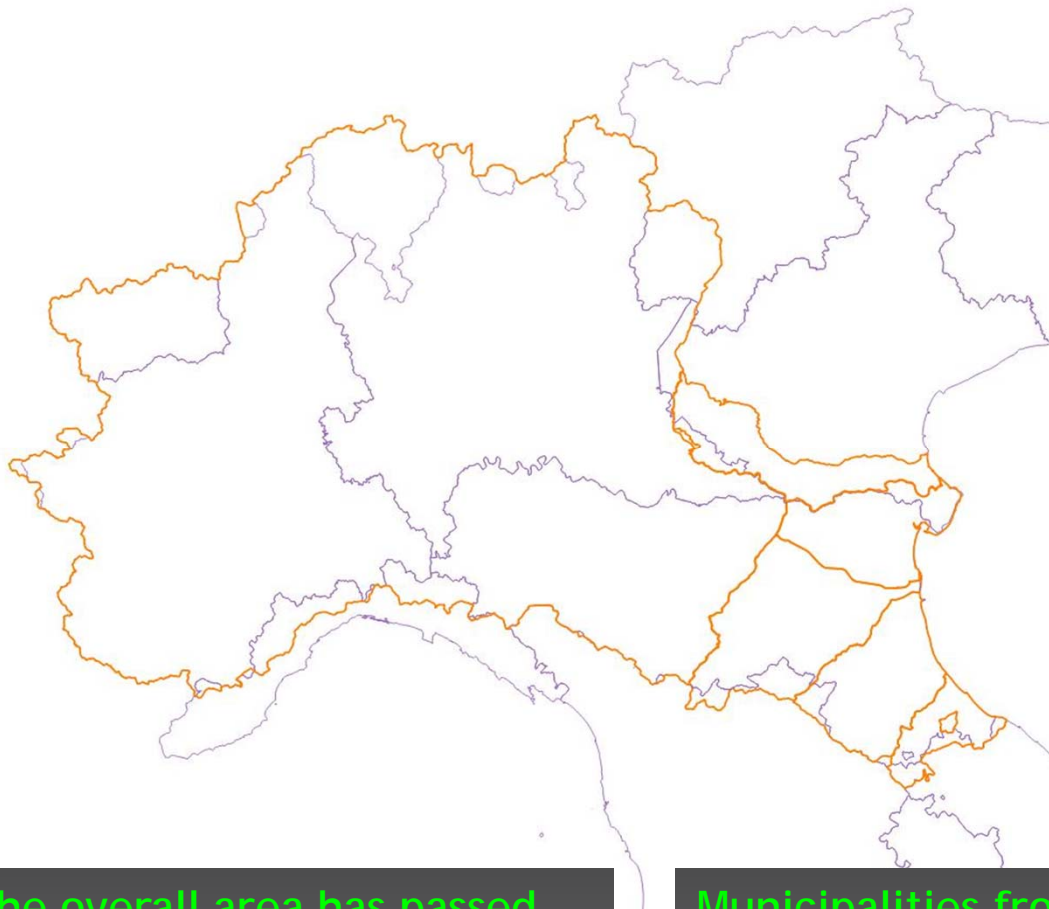
River	Basin	Drainage area to gauging station (km ²)	Climatic class*	Mean discharge		Month of discharge	
				(m ³ s ⁻¹)	(m ³ s ⁻¹ km ⁻²)	Max.	Min.
Rhine	North Sea	159 680	C	2210	0.014	2	10
Elbe	North Sea	131 950	A	700	0.005	4	9
(Loire)	Atlantic	110 000	A	874	0.008	2	8
Rhône	Mediterranean	95 590	C	1712	0.018	3	8
Douro	Atlantic	91 491	B	496	0.005	2	8
Ebro	Mediterranean	84 230	B	552	0.007	3	8
Po	Adriatic Sea	70 091	D	1480	0.021	5	8
(Guadiana)	Atlantic	60 883	B	202	0.003	2	8
(Tagus)	Atlantic	59 167	B	305	0.005	2	8
Garonne	Atlantic	52 000	D	590	0.011	2	8
(Guadalquivir)	Atlantic	46 995	B	189	0.004	3	8
(Seine)	Atlantic	44 320	A	273	0.006	2	8
Weser	North Sea	37 790	A	305	0.008	2	9
Meuse	Rhine	28 950	C	325	0.011	1	8



PO RIVER BASIN CHARACTERISTICS



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Law 221/2015: determination of the area of competence of the new Po River District Authority. Addition of Romagna and of some part of Marche, and of the irrigation district of Fissero Tartaro Canal-Bianco

The overall area has passed from 74.144 to 86.731 Km²

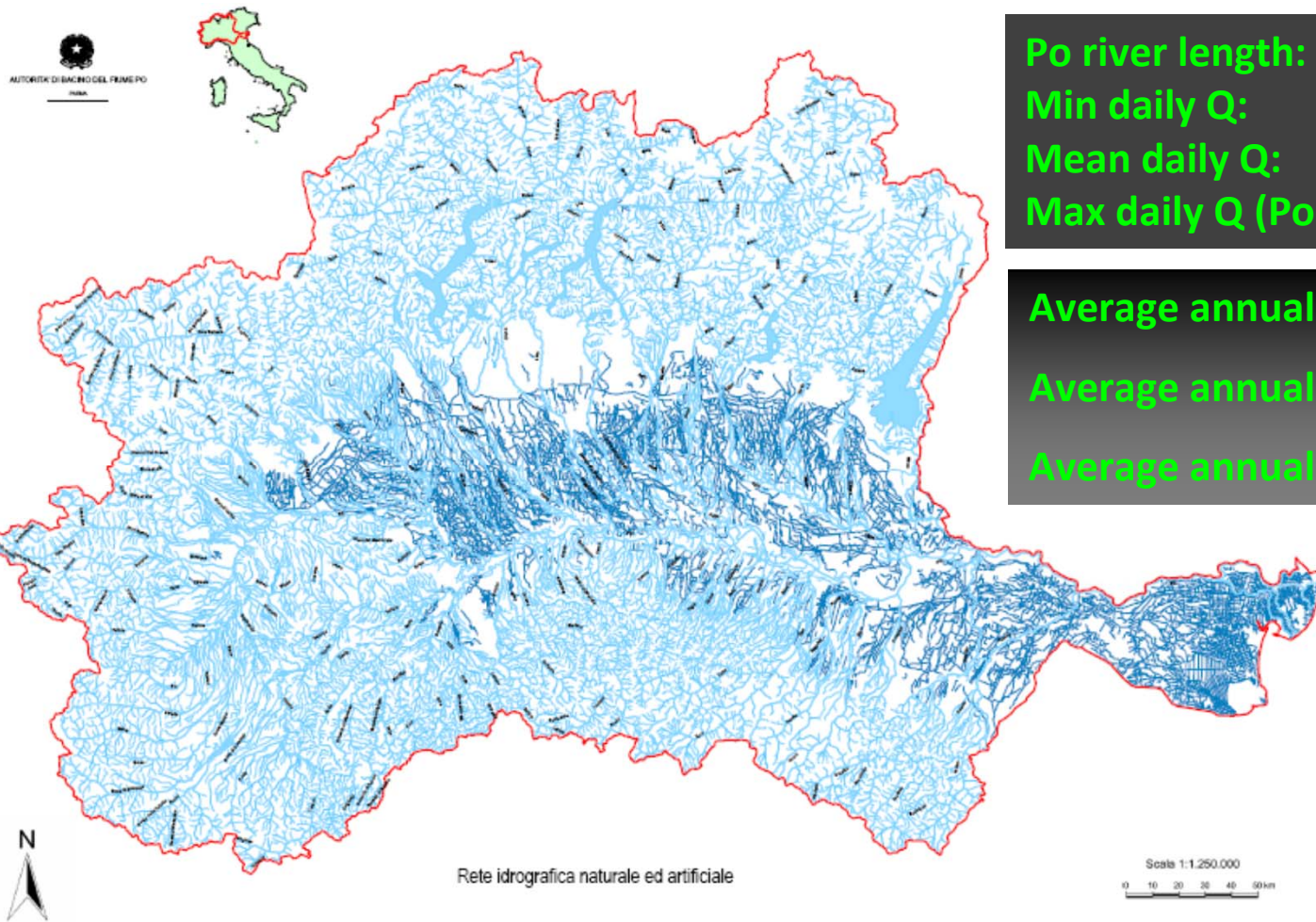
Municipalities from 3204 to more than 3385

Population from 17.000.000 to 19.500.000

NATURAL FRESHWATER AVAILABILITY



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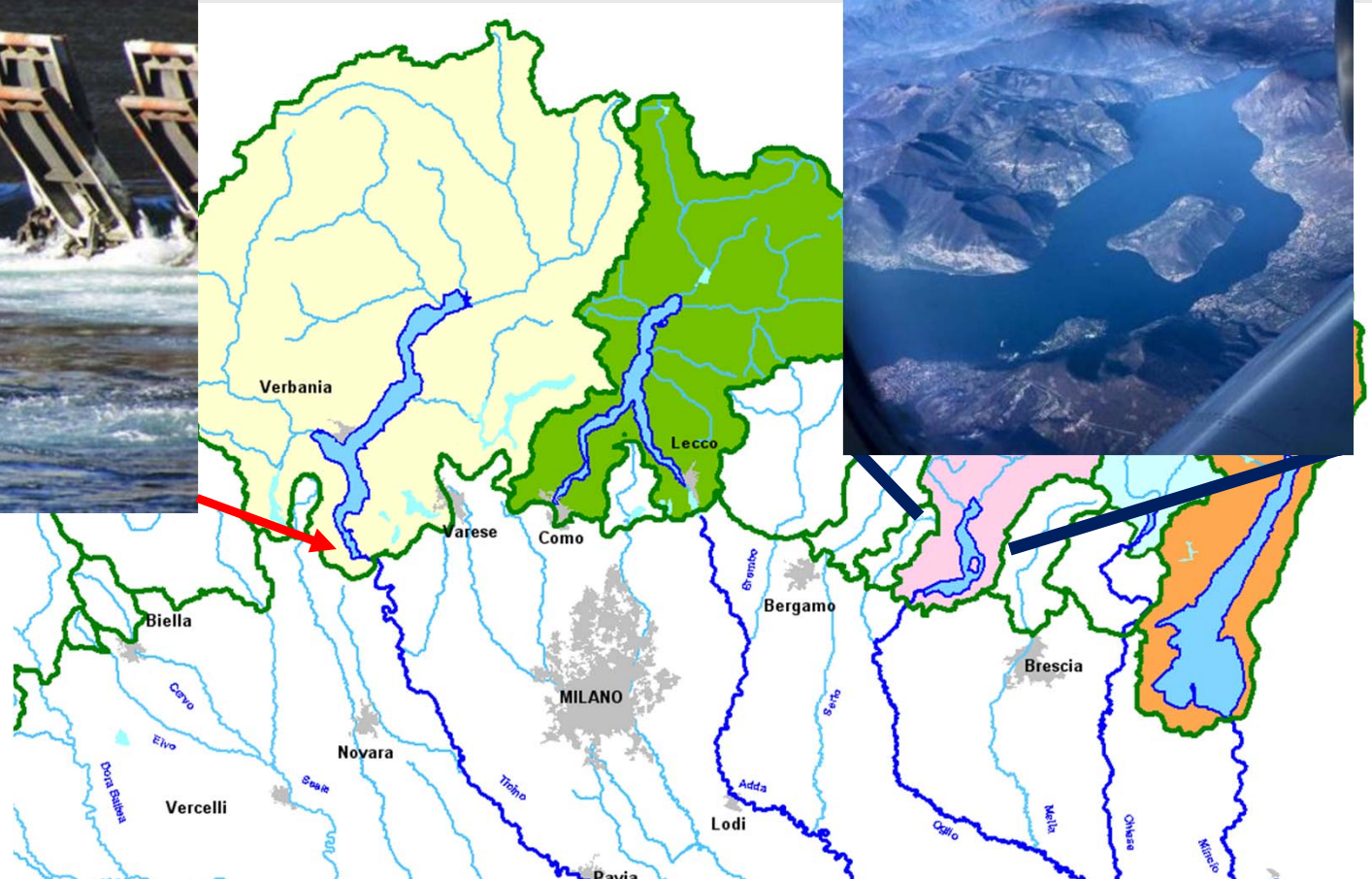
Po river length: 652 km
Min daily Q: 168 m³/s
Mean daily Q: 1500 m³/s
Max daily Q (Pontelagoscuro): 10.300 m³/s

Average annual weather influx 78 * 10⁹ m³/y
Average annual surface flow 46,5 * 10⁹ m³/y
Average annual groundwater 9 * 10⁹ m³/y

ALPINE REGULATED LAKES



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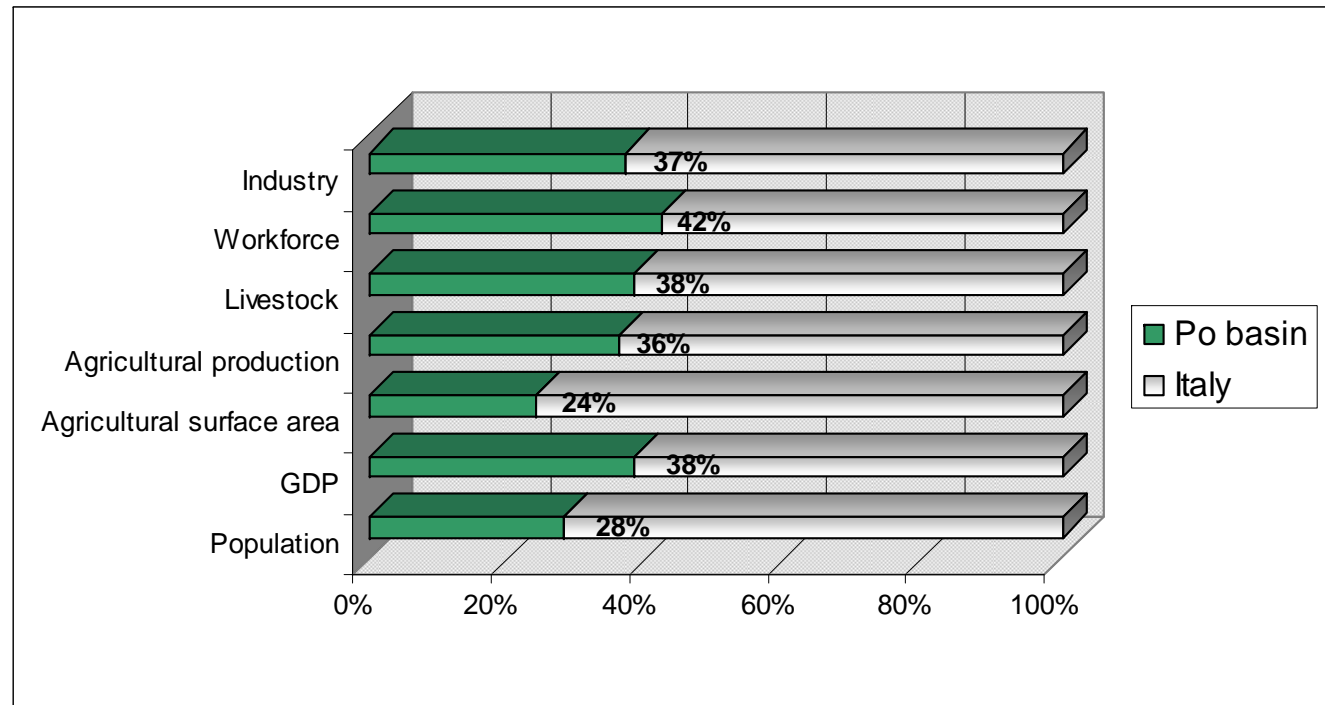
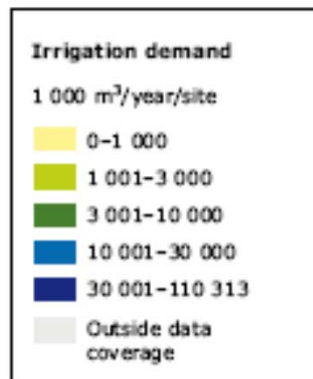


The presence of lakes allows water storing during fall/winter early spring seasons, and water releasing during irrigation period. Expert management is hystorically implemented, enabling very sophisticated operations.

MAIN PRESSURE AND WATER USE



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Use	Annual withdrawn volume (millions)	From surface water	From groundwater
Drinking water and civil supply	2.500	20%	80%
Industry (no hydropower)	1.537	20%	80%
Irrigation	16.500	83%	17%
Total	20.537	63%	37%

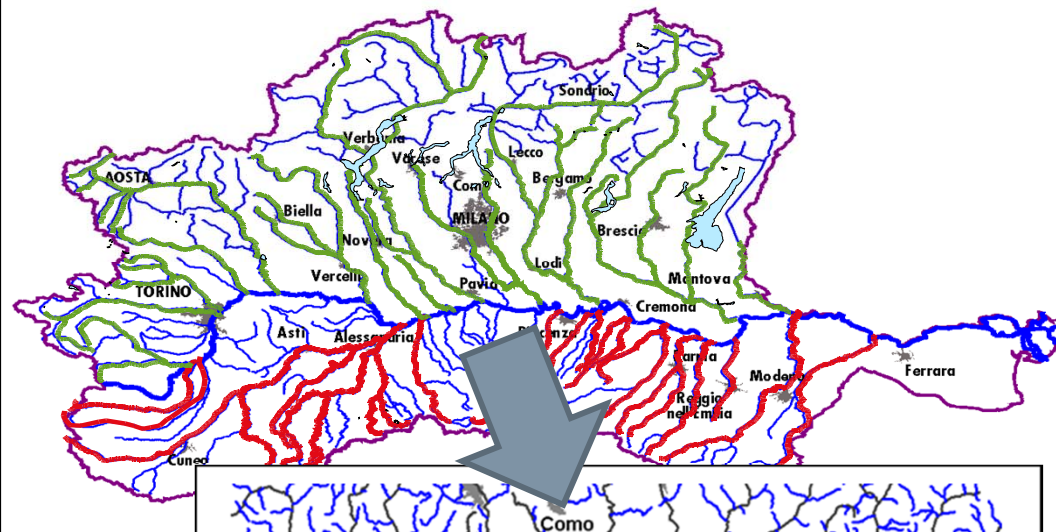
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PO RIVER BASIN: HYDROGRAPHIC SYSTEM'S MAIN FEATURES

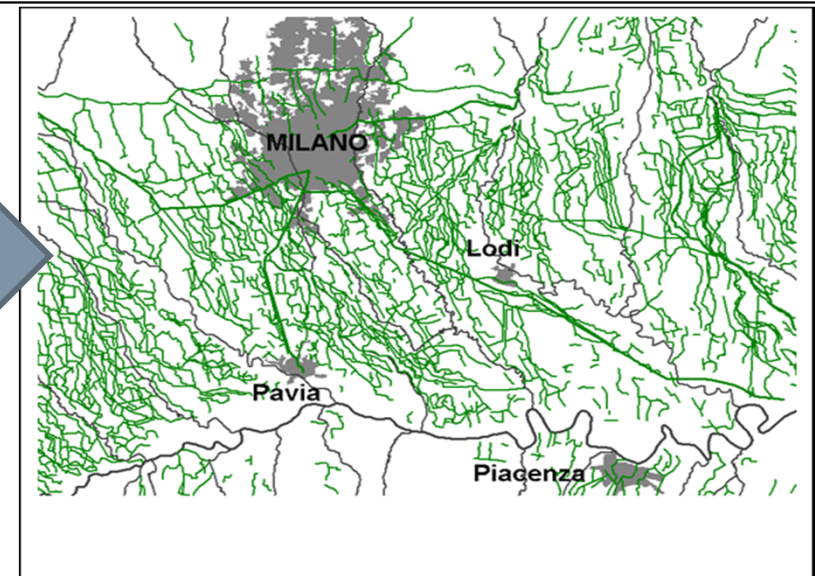
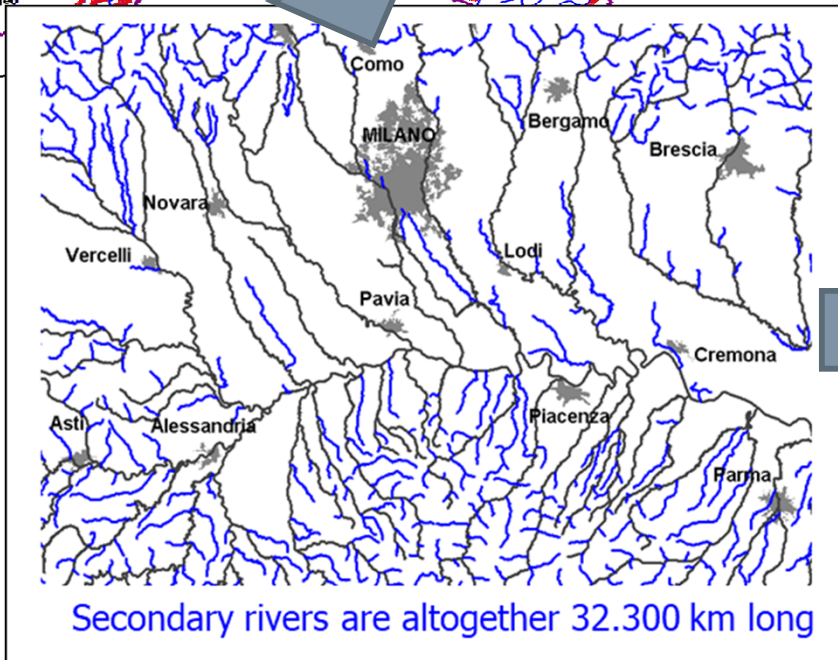


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Main rivers total length : 6.750 km (main rivers: longer than 20 km, or directly flowing into Po river - 28 rivers - or directly flowing into Po affluents - 16 rivers)



Corsi d'acqua (affluenti in sinistra)			Corsi d'acqua (affluenti in destra)		
II ordine	III ordine	IV ordine	II ordine	III ordine	IV ordine
Pellice Dora Riparia Stura di Lanzo Orco Dora Baltea Sesia Agogna Terdoppio Ticino Olona Lambro Adda Oglio Mincio	Chisone Cervo Toce Brembo Serio Chiese Mella	Elvo	Varaita Maira Tanaro Scrivia Trebbia Nure Chiavenna Arda Taro Parma Enza Crostolo Secchia Panaro	Stura di Demonte Belbo Bormida Ongina Stirone Baganza	Orba

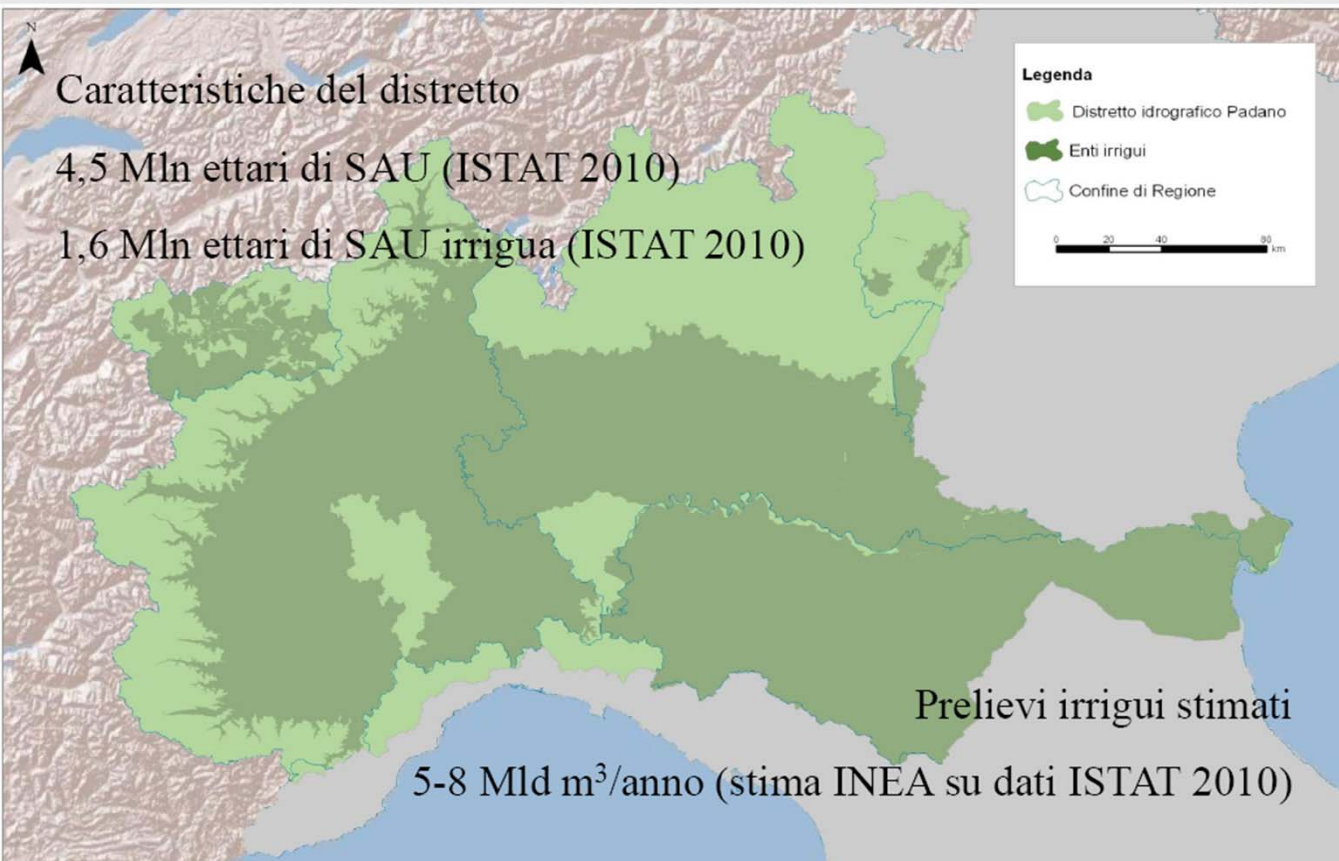


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MAIN PRESSURE: IRRIGATION



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Main water consuming use.

Area devoted to agriculture is 4.5 million ha

Irrigated portion: 1.6 million ha

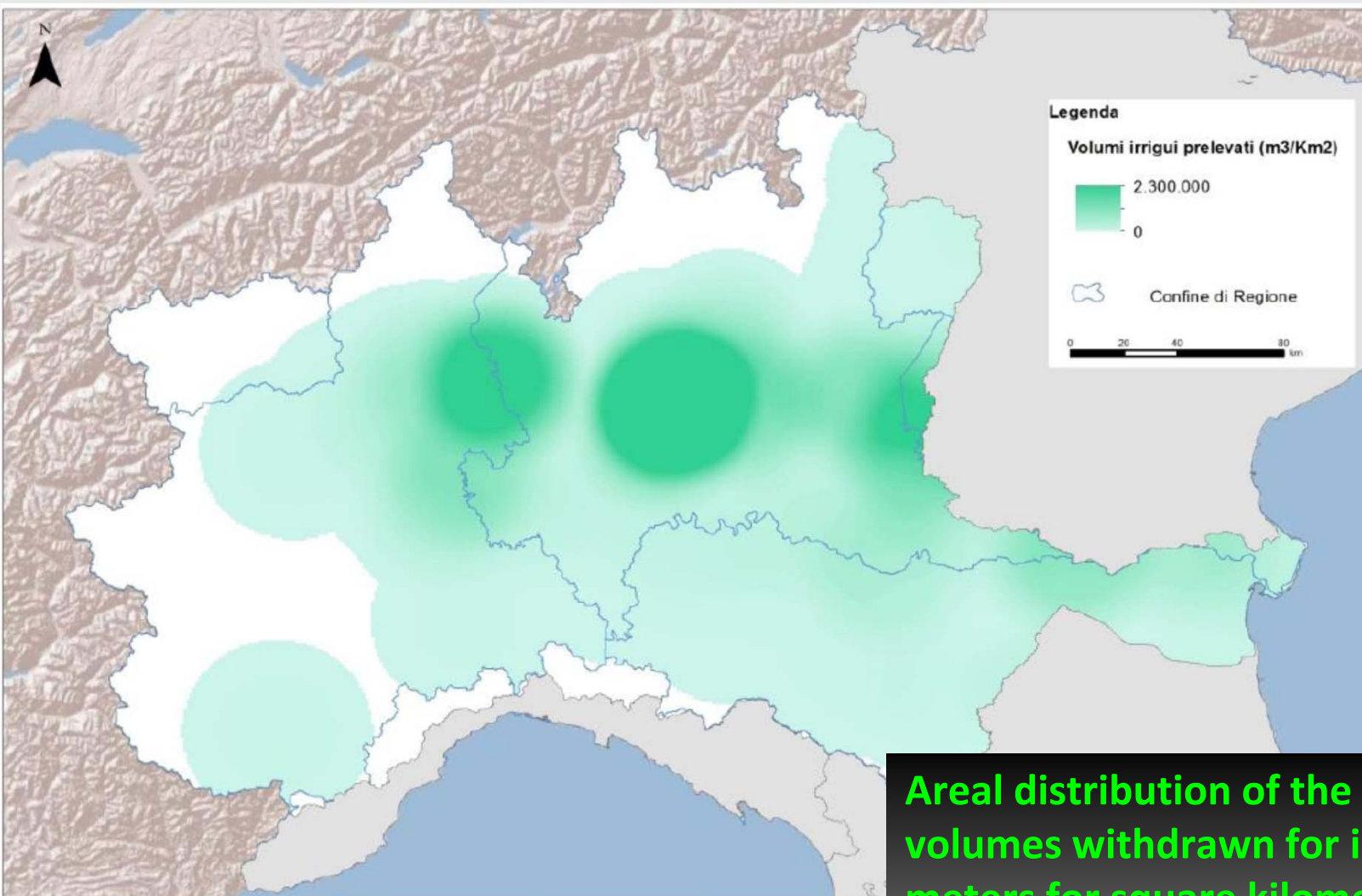
Light green: extension of the district.

Dark green: area under the administration of an irrigation-entity.

DISTRIBUTION OF SPECIFIC VOLUMES WITHDRAWN FOR IRRIGATION



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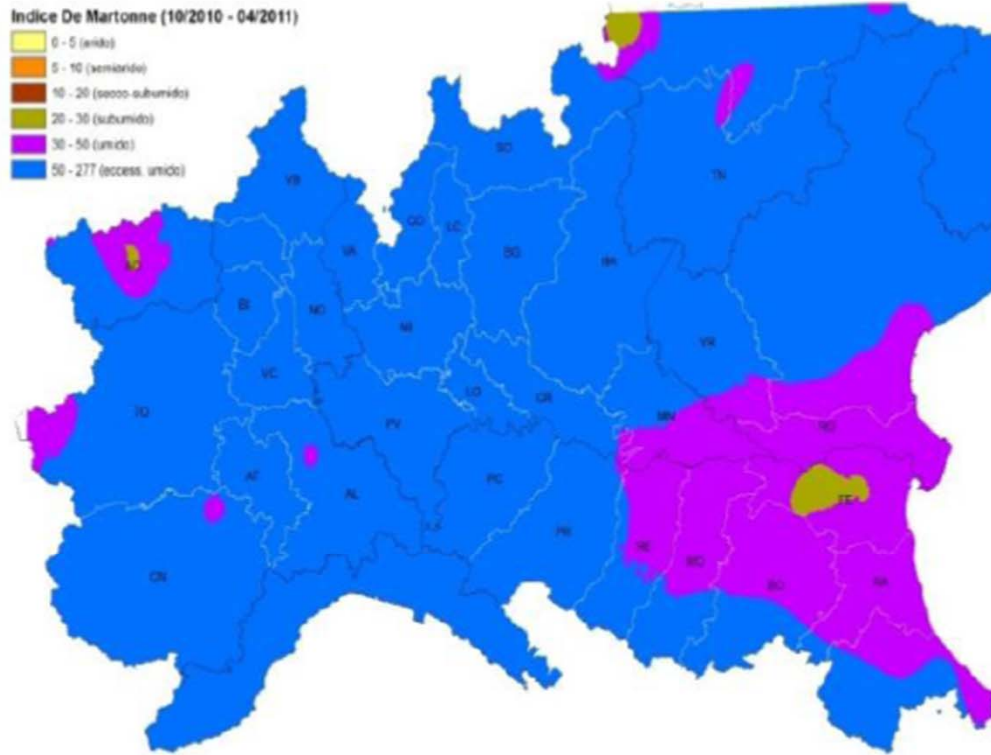
Areal distribution of the mean specific volumes withdrawn for irrigation, in cubic meters for square kilometre. The darker parts correspond to areas historically voted to agriculture, due to the greater water natural availability.

ARIDITY

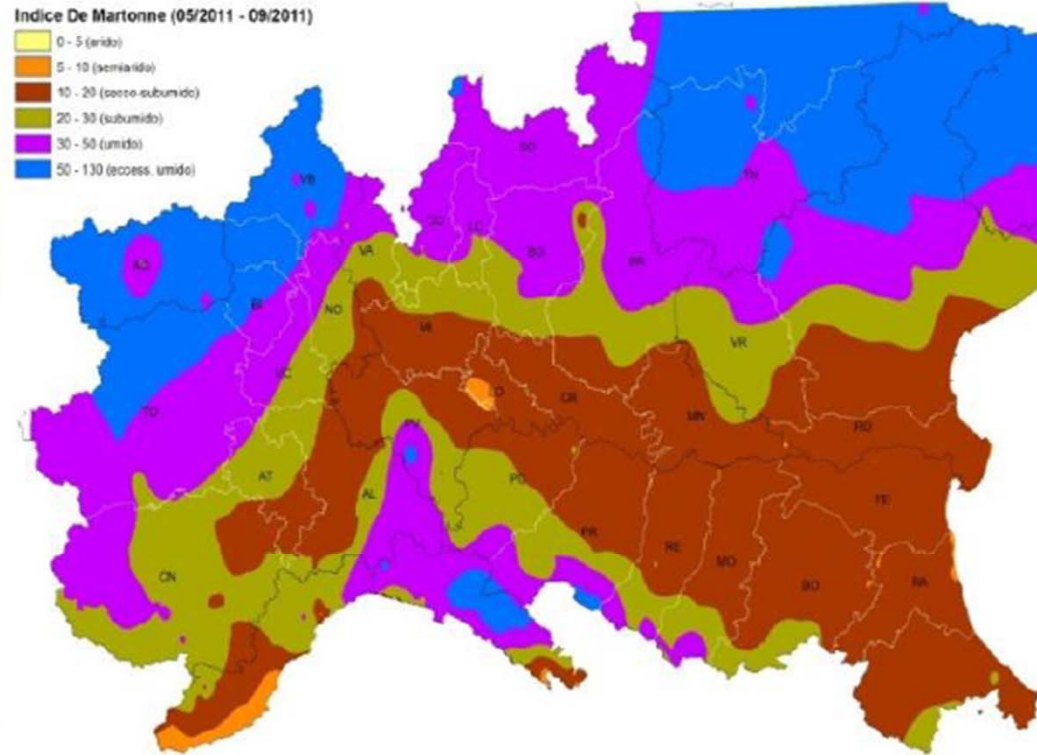


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Indice De Martonne (10/2010 - 04/2011)



Indice De Martonne (05/2011 - 09/2011)

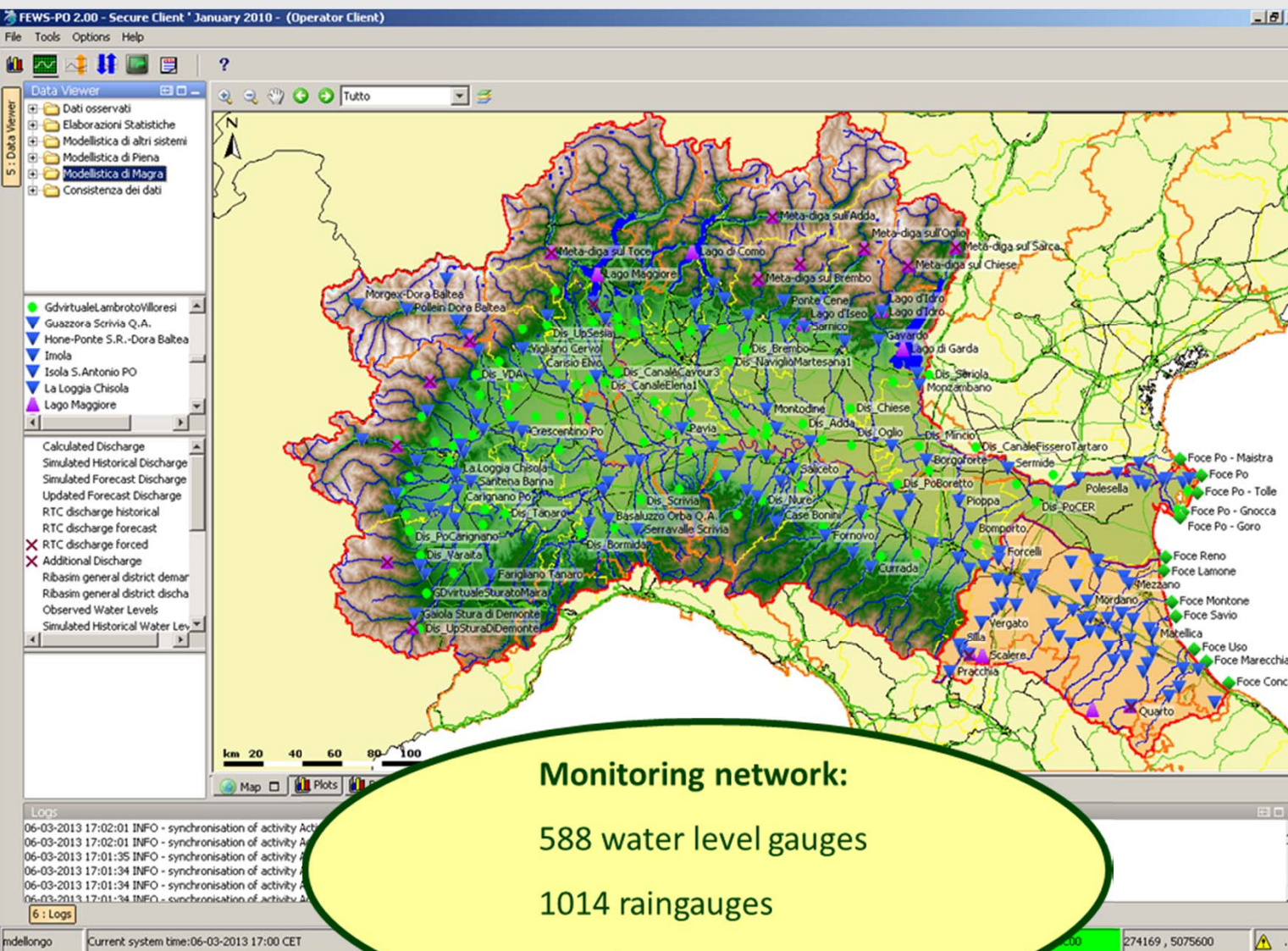


Spatial distribution of “De Martonne” meteorological aridity index”, defined as the ratio between rainfall and temperature. On the left the situation during non irrigation period, on the right the situation during the irrigation period. In the Po district, the problem of efficient water use, water scarcity and drought is a “seasonal” problem, and the season in which there's a greater need of water corresponds to the season in which there is naturally fewer availability.

DEWS-PO: DROUGHT EARLY WARNING SYSTEM PO



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Monitoring network:

588 water level gauges

1014 raingauges

756 thermometers

High density
observational network:

Rainfall

Temperature

Level/discharge

(telemetry data)

Meteorological input:

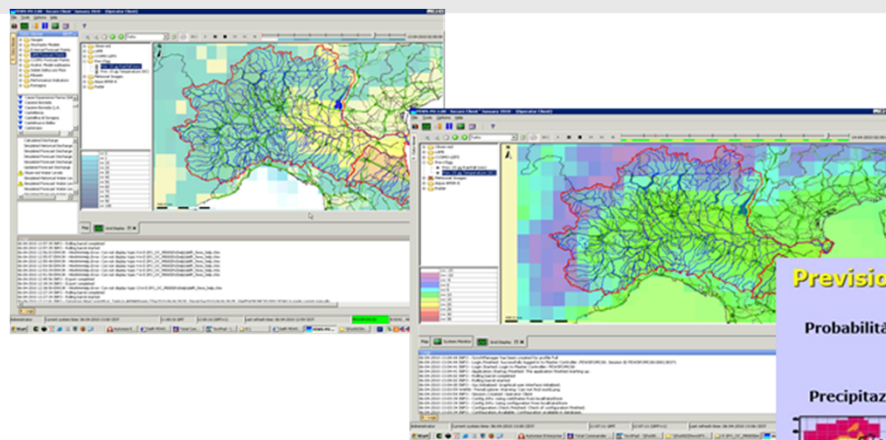
Deterministic Model
(15 days) (ECWM)

Model ensemble
(seasonal forecasting)

MODEL'S COMPONENTS

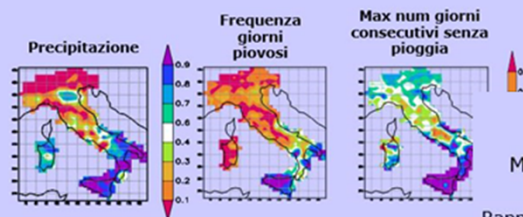


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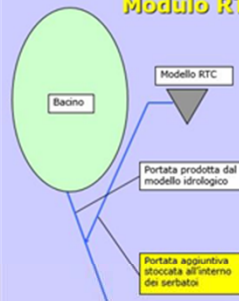


Previsioni stagionali Apr-Mag-Giu 2010

Probabilità anomalia positiva rispetto al 1971-2000 per:



Modulo RTC (Deltares)



Soluzione equazione di bilancio :

$$I(t) - Q(t) = dS(t)/dt$$

Con : I = portata in ingresso al serbatoio

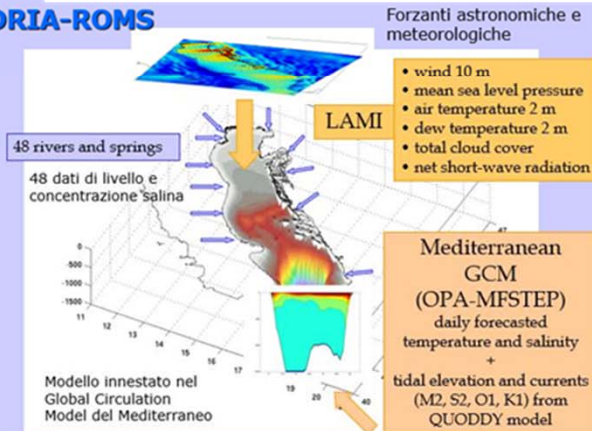
Q = portata in uscita dal serbatoio

S = volume stoccato nel serbatoio

Diverse modalità per la determinazione della portata di uscita:

- 1 _ regola livello/portata in stagionale
- 2 _ possibilità di imporre un percentuale aggiuntiva sulla uscita calcolata con la regola
- 3 _ portata in uscita impost dall'esterno

ADRIA-ROMS



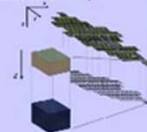
Modello Idrologico TOPKAPI

Modello idrologico di tipo distribuito e fisicamente basato

Rappresenta gli idrogrammi di piena a partire dall'input meteorologico e dalle caratteristiche fisiche e morfologiche del bacino idrografico. Non è necessario descrivere in maniera accurata la geometria della sezione dell'alveo, ma è sufficiente darne una rappresentazione schematica.

Cartografia Tematica:

- Modello Digitale del Terreno
- Tipi di suolo
- Coefficienti di drenaggio del suolo
- Uso del suolo e copertura vegetale
- Temperature medie mensili (ETP)



WHAT DOES IT HAPPEN DURING WATER SCARCITY EVENTS

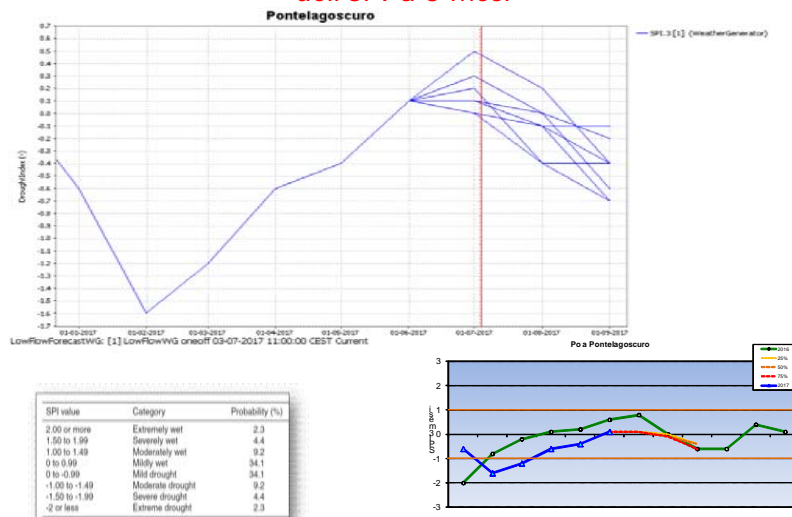


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1- Monitoring and forecasting According to the Drought Management Plan

Pontelagoscuro – Previsioni stagionali dell'SPI a 3 mesi

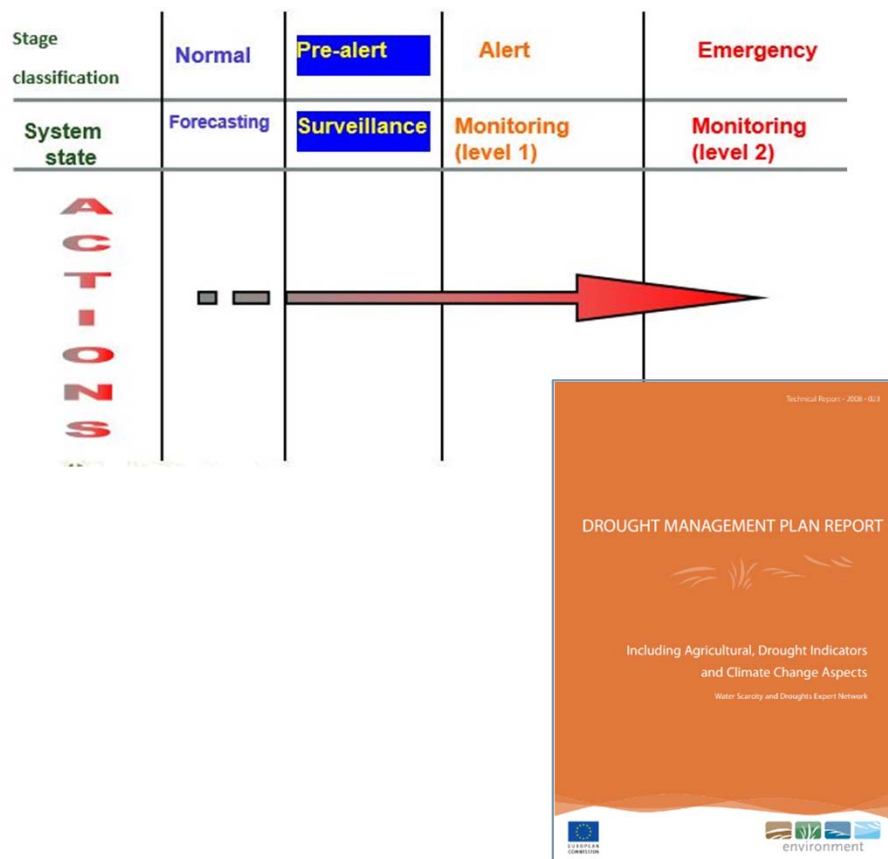


First meeting of the Po Observatory



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2- Definition of the "Severity scenario" - according to National Civil Protection directive (and Drought Management Plan Report)



...taking action...

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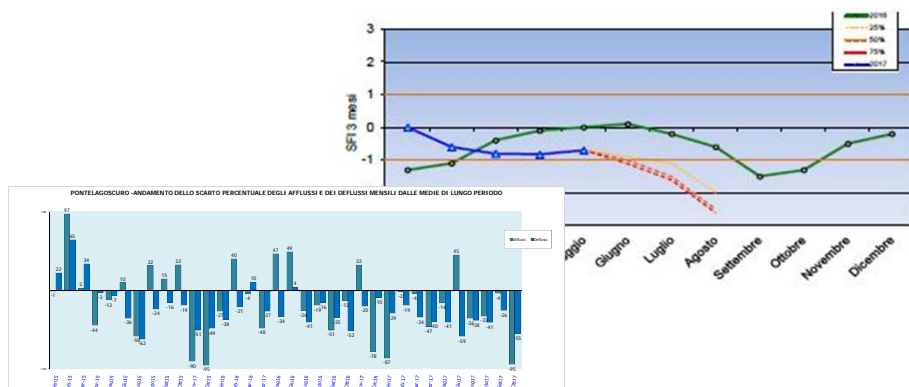
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...monitoring and forecasting...

following meetings of the "Po
Observatory" ...



Final reporting: overall performance
of indicators;
statistics



Resolution
Discussion on
...what did it work?
...what went wrong?
...planning future improvements...

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20



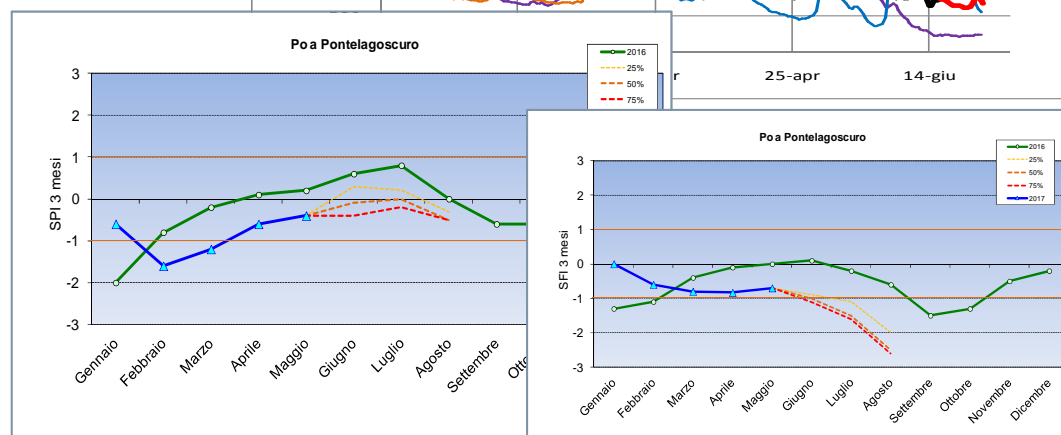
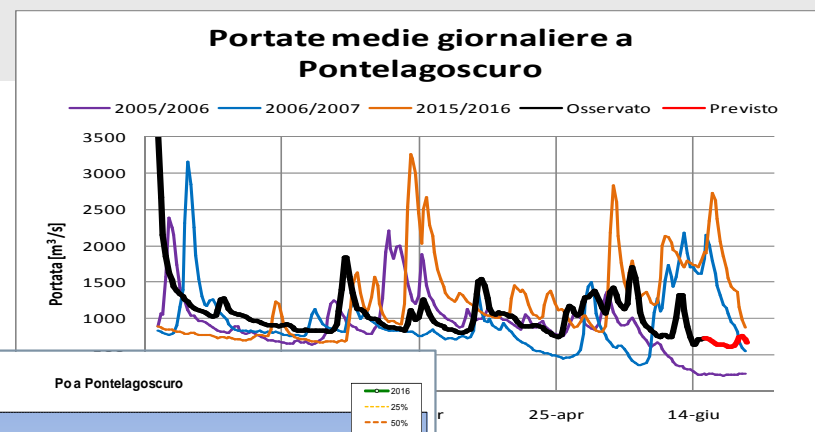
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3- Subsequent meetings:

- 04/05/2017
- 29/05/2017
- 15/06/2017
- 20/06/2017
- 23/06/2017
- 17/07/2017
- 25/07/2017
- 03/08/2017



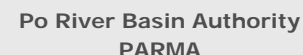
Field campaigns for flow measurements
Severity scenario: pre-alert,
surveillance.



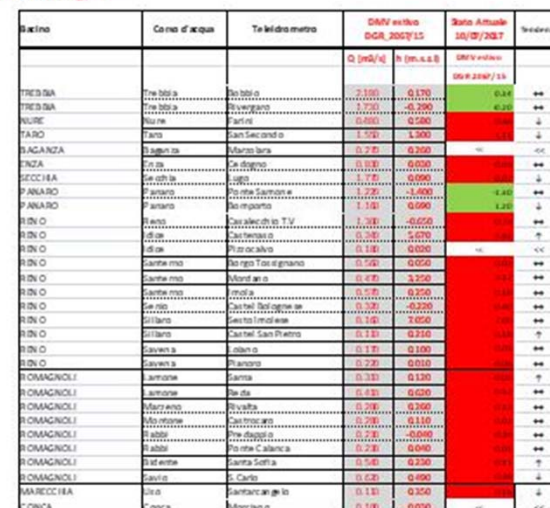
VALUTAZIONE STATO IDROLOGICO ATTUALE RISPETTO AL DMV IN ALCUNE SEZIONI SIGNIFICATIVE DEI BACINI DELLA REGIONE EMILIA ROMAGNA

Bacino	Corso d'acqua	Teleidrometro	DMV estivo		Stato attuale	Tendenza	Note
			Q (m³/s)	h (m.s.l.)	DMV estivo		
					DGR 2067/15		
TREBBIA	Trebbia	Bobbio	2.180	0.170	0.27	↔	
TREBBIA	Trebbia	Rivergaro	1.730	-0.290	-0.28	↔	
NURE	Nure	Farini	0.480	0.580	0.48	↓	
TARO	Taro	San Secondo	1.550	1.300	1.11	↔	
BAGANZA	Baganza	Martolara	0.270	0.260	0.29	↔	
ENZA	Enza	Cedogno	0.830	0.030	-0.02	↔	
SECCHIA	Secchia	Lugo	1.770	0.090	0.13	↔	
PANARO	Panaro	Ponte Samone	1.220	-1.400	-1.27	↔	
PANARO	Panaro	Bomporto	1.160	0.690	1.29	↔	
RENO	Reno	Casalecchio T.V.	1.300	-0.650	-0.48	↔	
RENO	Idice	Castenaso	0.340	5.670	1.43	↔	
RENO	Idice	Pizzavento	0.180	0.870	-0.48	↔	
RENO	Santeramo	Borgo Tossignano	0.560	0.050	0.04	↔	
RENO	Santeramo	Mordano	0.470	3.250	1.03	↔	
RENO	Santeramo	Imola	0.570	0.250	0.18	↔	
RENO	Senio	Castel Bolognese	0.320	-0.220	-0.19	↔	
RENO	Sillaro	Sesto Imolese	0.160	7.050	7.02	↔	
RENO	Sillaro	Castel San Pietro	0.110	0.210	0.17	↔	
RENO	Savena	Lolano	0.170	0.100	0.05	↔	
RENO	Savena	Pianoro	0.220	0.010	-0.04	↔	
ROMAGNOLI	Lamone	Sarna	0.310	0.120	0.06	↔	
ROMAGNOLI	Lamone	Reda	0.410	0.620	0.55	↔	
ROMAGNOLI	Marzeno	Rivalta	0.200	0.260	0.14	↔	
ROMAGNOLI	Montone	Castrocaro	0.280	0.110	0.06	↔	
ROMAGNOLI	Rabbi	Predappio	0.230	-0.040	-0.13	↔	
ROMAGNOLI	Rabbi	Ponte Calanca	0.250	0.040	0.01	↔	
ROMAGNOLI	Bidente	Piazza Sofia	0.540	0.230	0.08	↔	
ROMAGNOLI	Savio	S. Carlo	0.620	0.490	0.00	↔	
MARECCHIA	Uso	Santarcangelo	0.110	0.350	0.27	↔	
CONCA	Conca	Morciano	0.100	0.030	0.01	↔	

CONTROLLO
DMV
19/06/2017



In this moment, analyses are carried out to define and understand “prolonged drought”.



CONTROLLO
DMV
17/07/2017

WHAT NEEDS TO BE IMPROVED

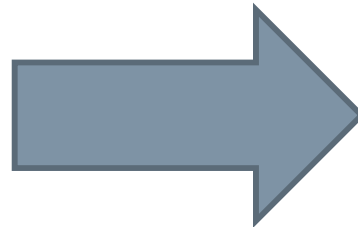


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The resolution was attributed to natural causes...

...intelligent rainfall!

Withdrawals were not substantially limited.



How can we strengthen the governance action?

Which instruments (technical, regulatory...) do we need...

The Observatory needs of a stronger mandate to act as a "regulatory authority"...we're working to achieve this within the national network.

How can the EDO help us or we contribute?

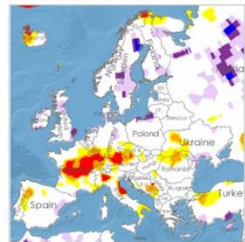


THRESHOLDS

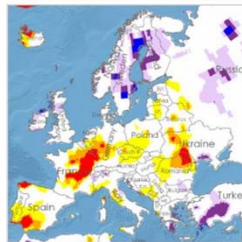


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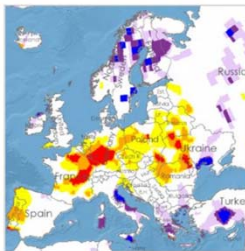
Precipitation Anomalies



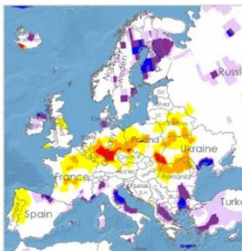
SPI-1 (July)



SPI-3 (May-July)



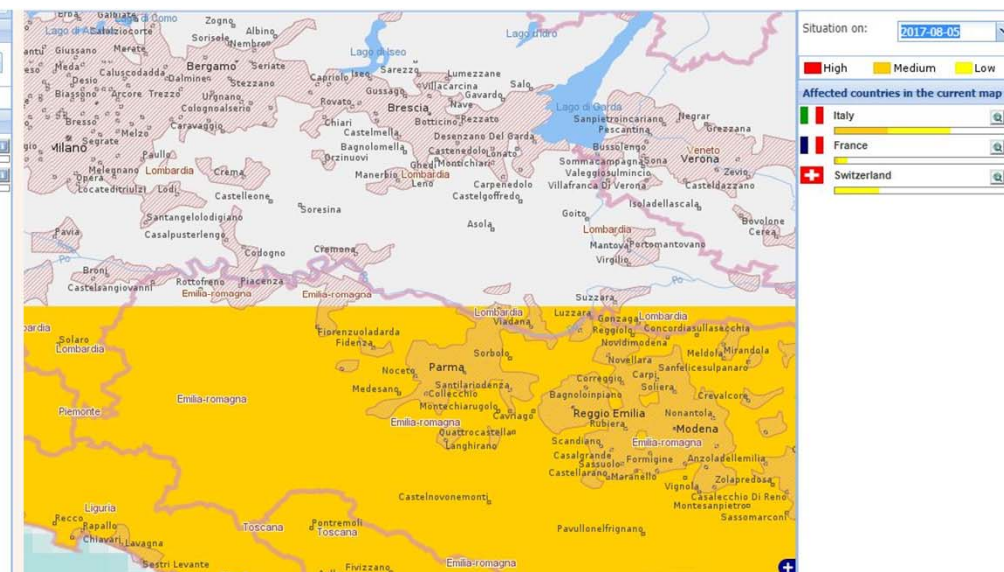
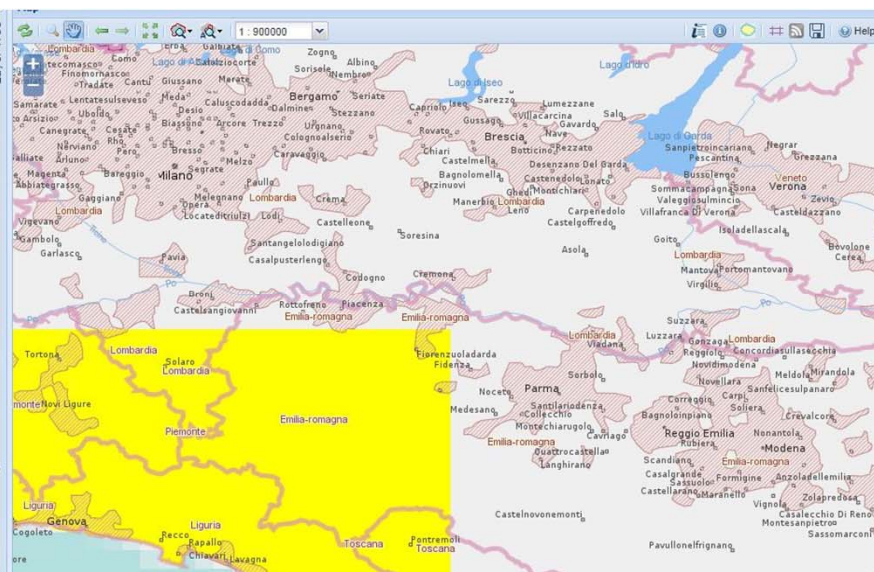
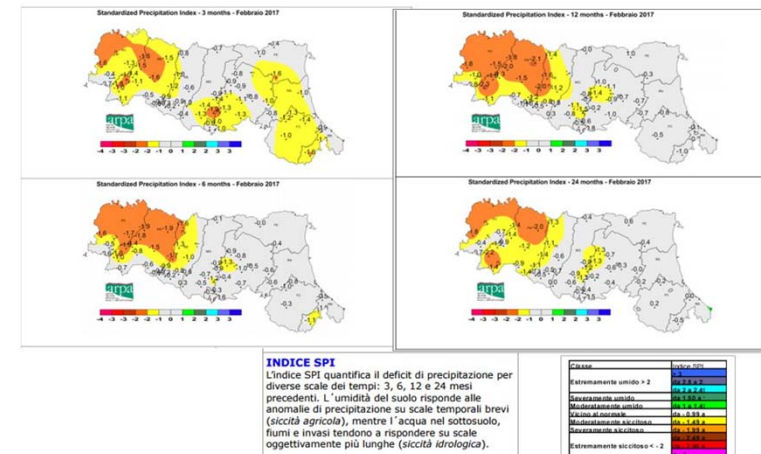
SPI-6 (February-July)



SPI-9 (November-July)

Need to define concerted thresholds (local, at a district level...), and tools to detect “prolonged drought” to activate the exemption under art. 4.6 WFD

Indice SPI



THRESHOLDS



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- Harmonizing district and European drought monitoring...
- Share practicable measures and good practices

...and...

...impacts...

- How to detect them...
- Environmental, Socio-Economic impacts...
- Restoration measures...

PRODUCT FACT SHEET: Combined Drought Indicator – EUROPE Version 2 (April, 2013)

Combined Drought Indicator

PRODUCT FACT SHEET: ACRONYME – EUROPE Version 1 (Sept. 2011)

Type	Vegetation response
Soil moisture	Daily, Anomaly and Forecasted values

Figure 1: Exam

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe



Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

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Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

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Soil moisture	Daily	5 km	Europe

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Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

Type	Temporal scale	Spatial scale	Geo. coverage
Soil moisture	Daily	5 km	Europe

THAN YOU FOR YOUR ATTENTION



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Autorità di Bacino del Fiume Po
Po River District Authority



[www..adbpo.gov.it](http://www.adbpo.gov.it)



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