Autorità di Bacino
del Fiume Arno

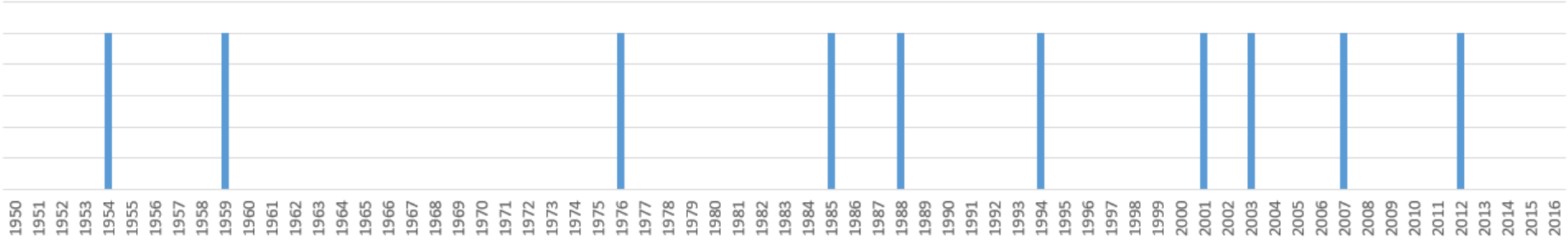
Drought Risk Management in Italy

Bernardo Mazzanti

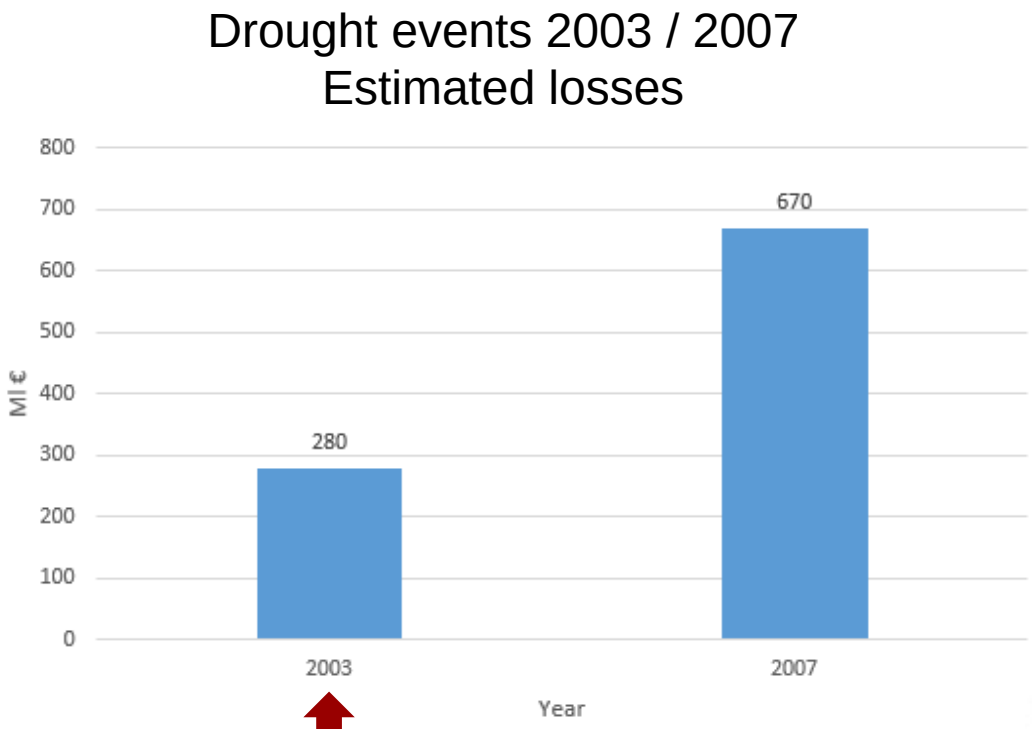
Arno River Basin Authority (I)

14-15 Dec. 2016, Athens, Greece
SWIM-H2020 SM “Drought Risk Management (DRM) Mainstreaming” Regional Training

Drought events during last 60 years in Italy



Damages and risk evaluation



Critical condition of the whole national energy supply network

source:

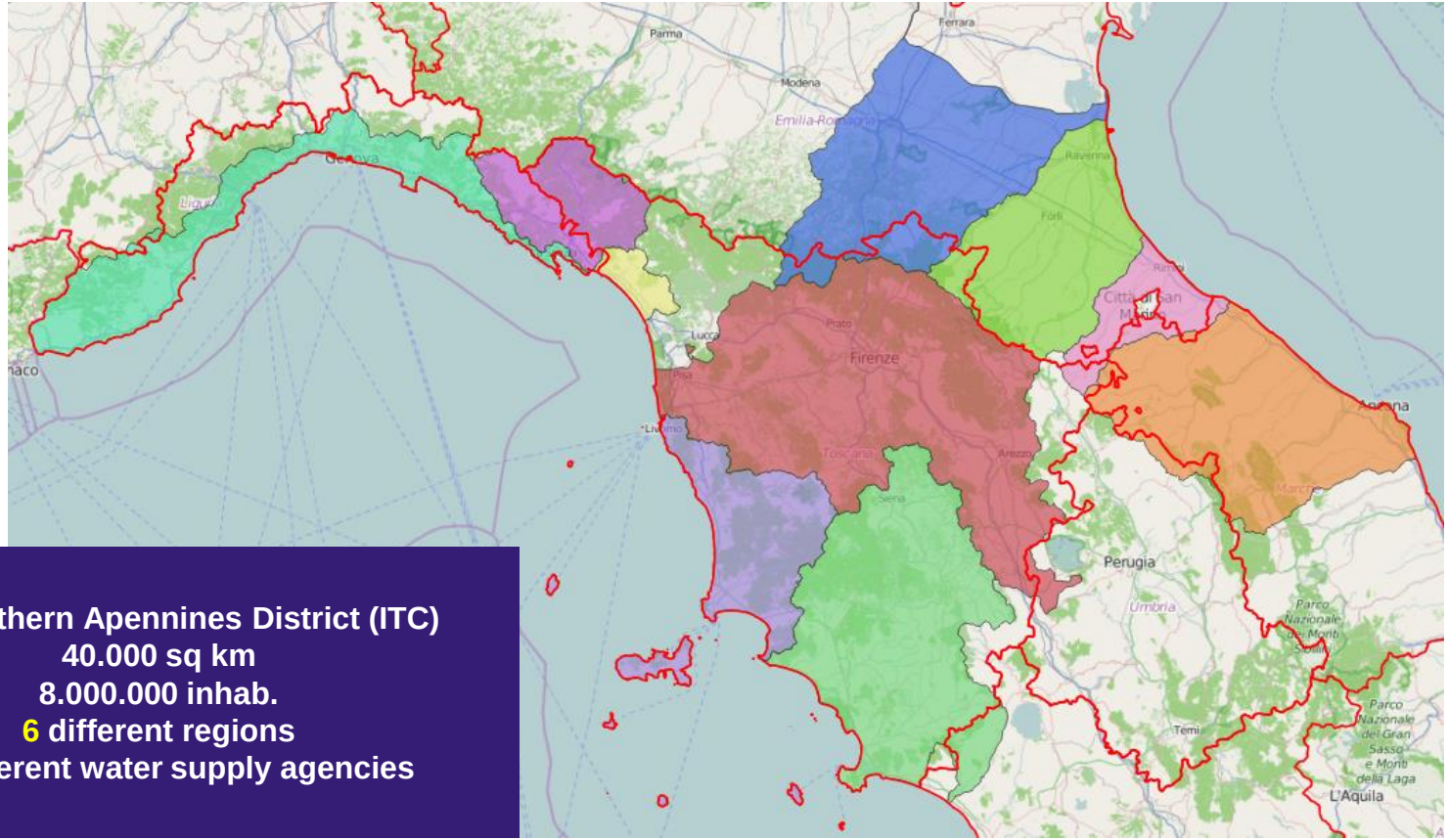
Water2Adapt

Resilience enhancement and water demand management for climate change adaptation

Setting the scene: hydrographic districts (WFD)

2017

The institutional framework - critical issues



The Northern Apennines District (ITC)
40.000 sq km
8.000.000 inhab.
6 different regions
18 different water supply agencies

The institutional framework - critical issues

4th European Water Conference & COM (2015)120 – March 2015

Water Abstraction: insufficient measures to control abstraction and ecological flow

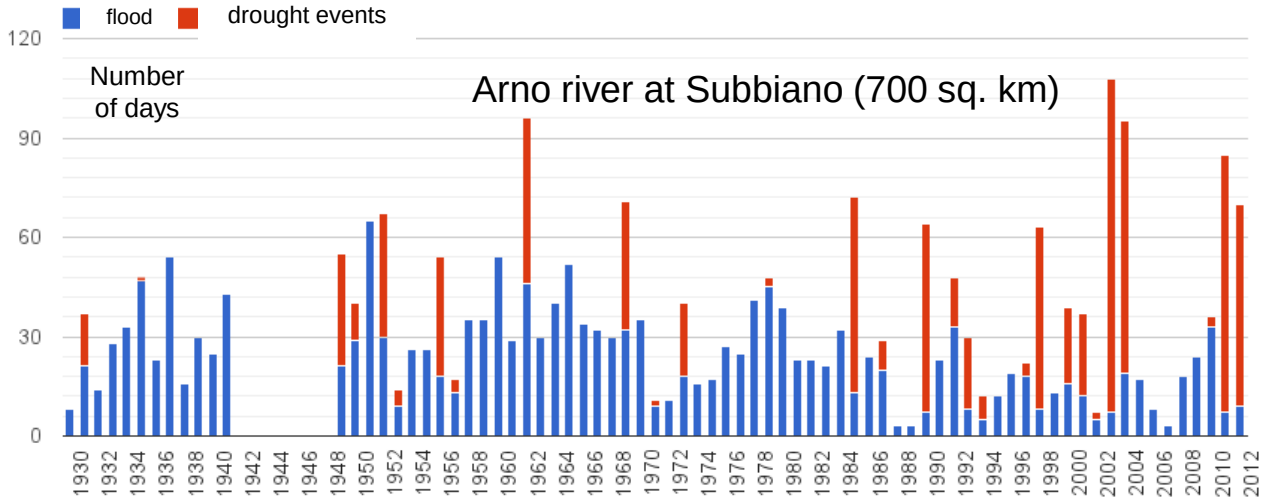
Review permits to ensure sustainable use

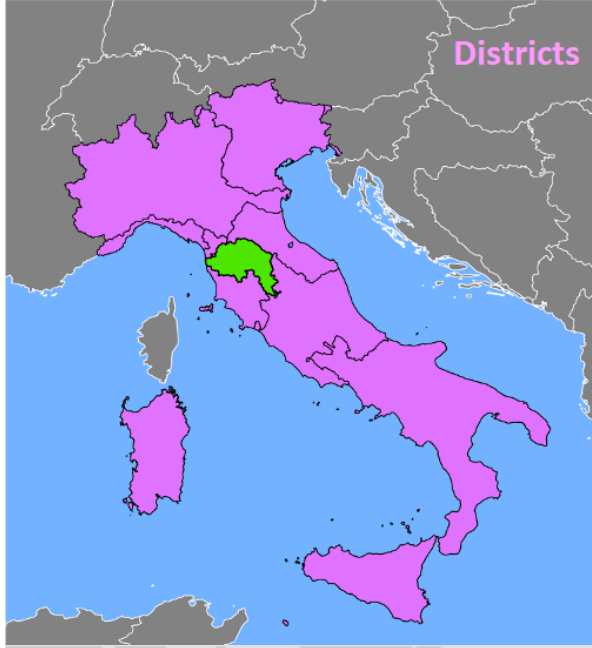
Improve monitoring and enforcement

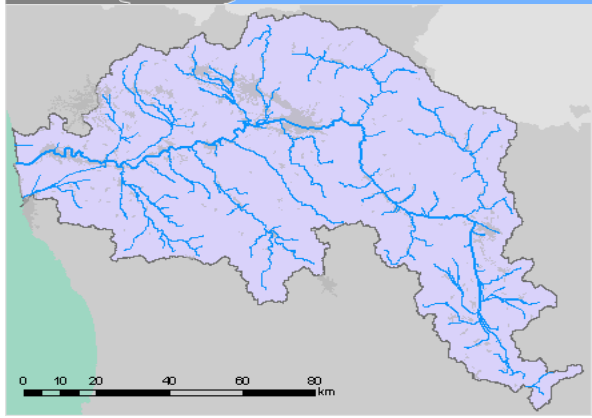
Drought occurrence and trend

Arno river basin

- ❑ River length of 241 km
- ❑ Surface area of 8.228 sq. km

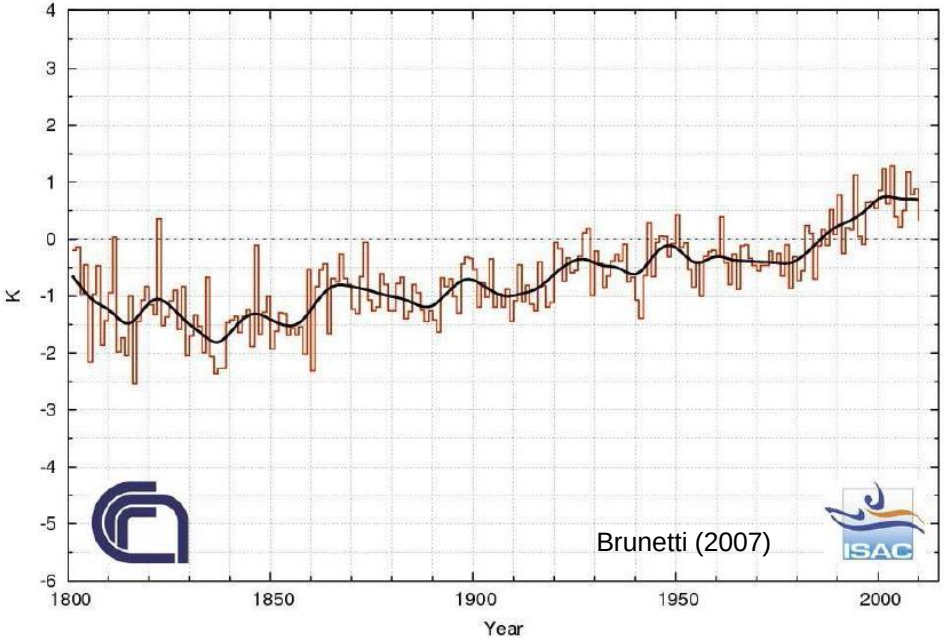


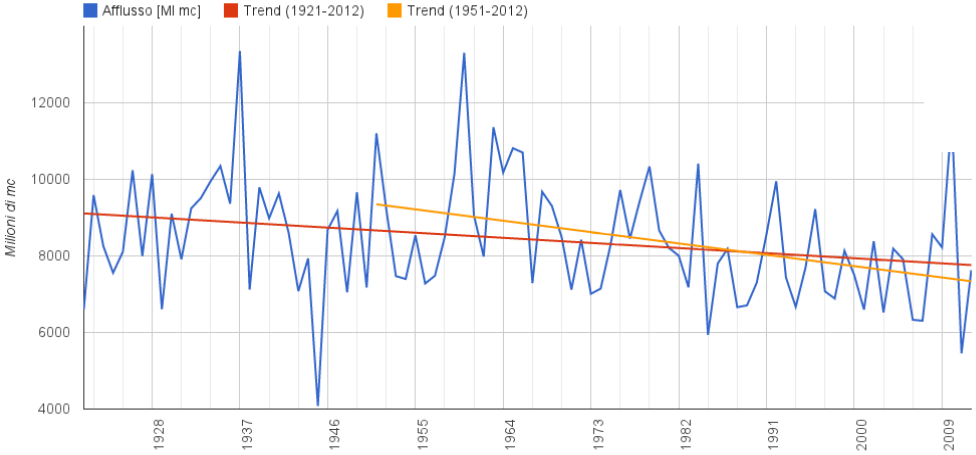




Climate change evidences

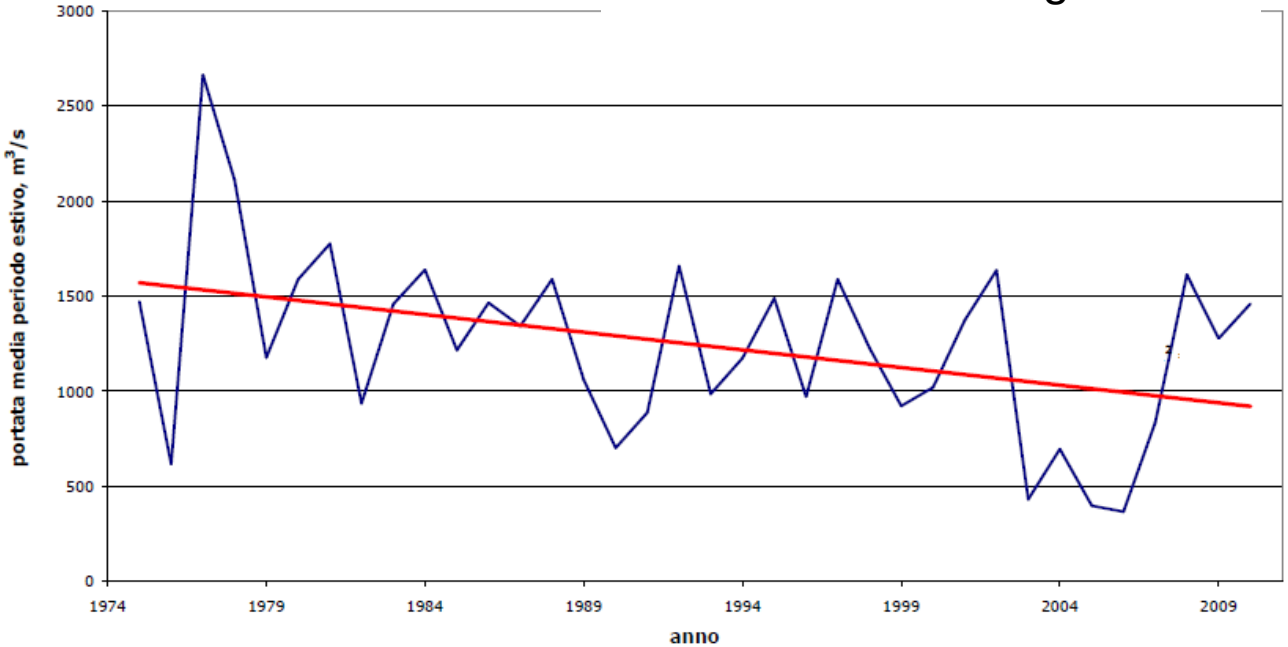
Mean annual temperature (1800-2007)



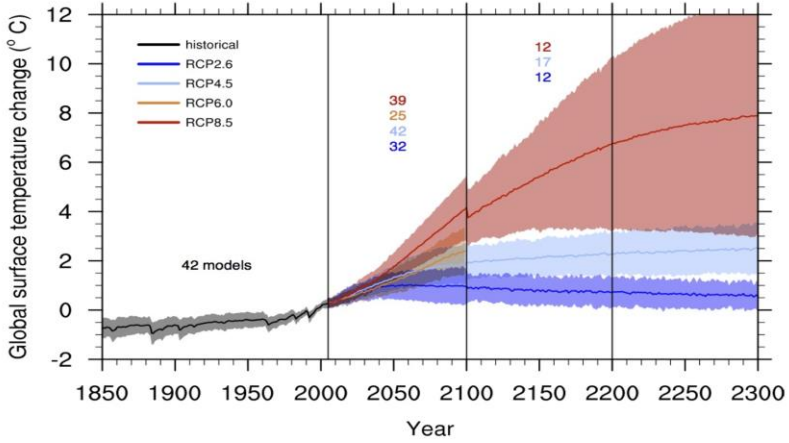


Po river basin

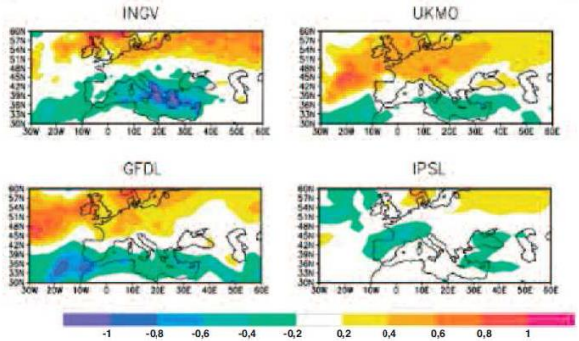
Mean summer discharge
Po river at Pontelagoscuro



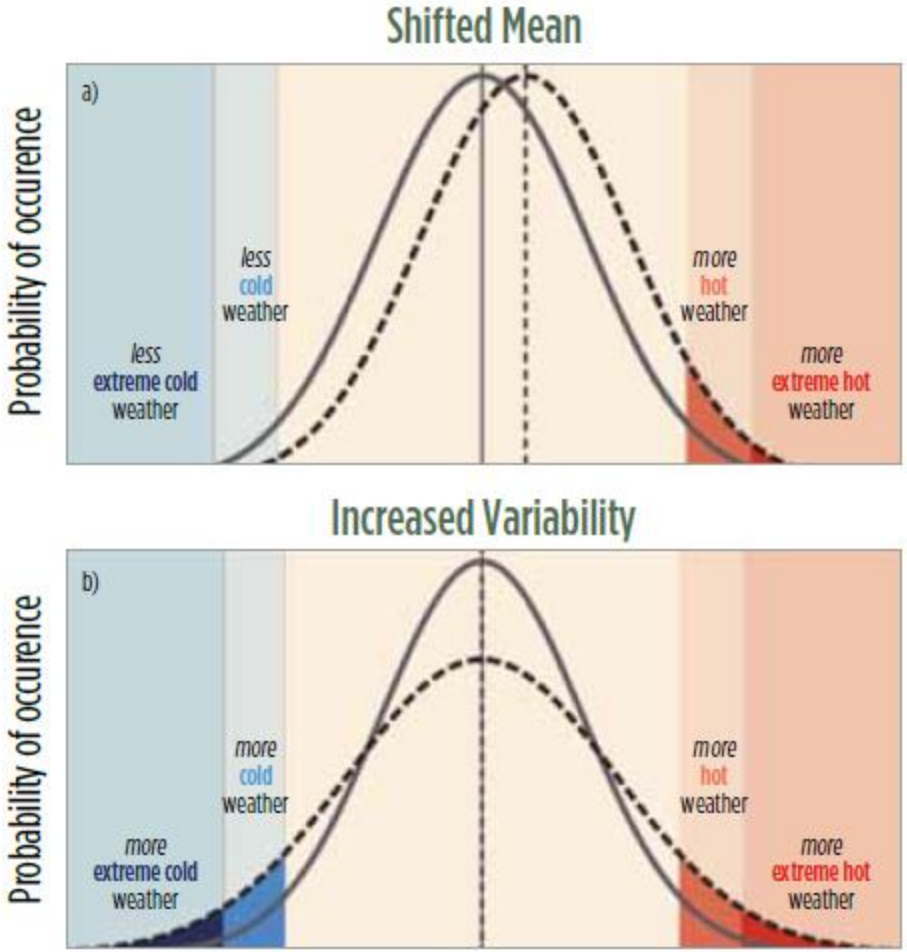
Climate change future trends



Rainfall amount variation JFM ([2061-2090] - [1961-1990])



Navarra (2007)



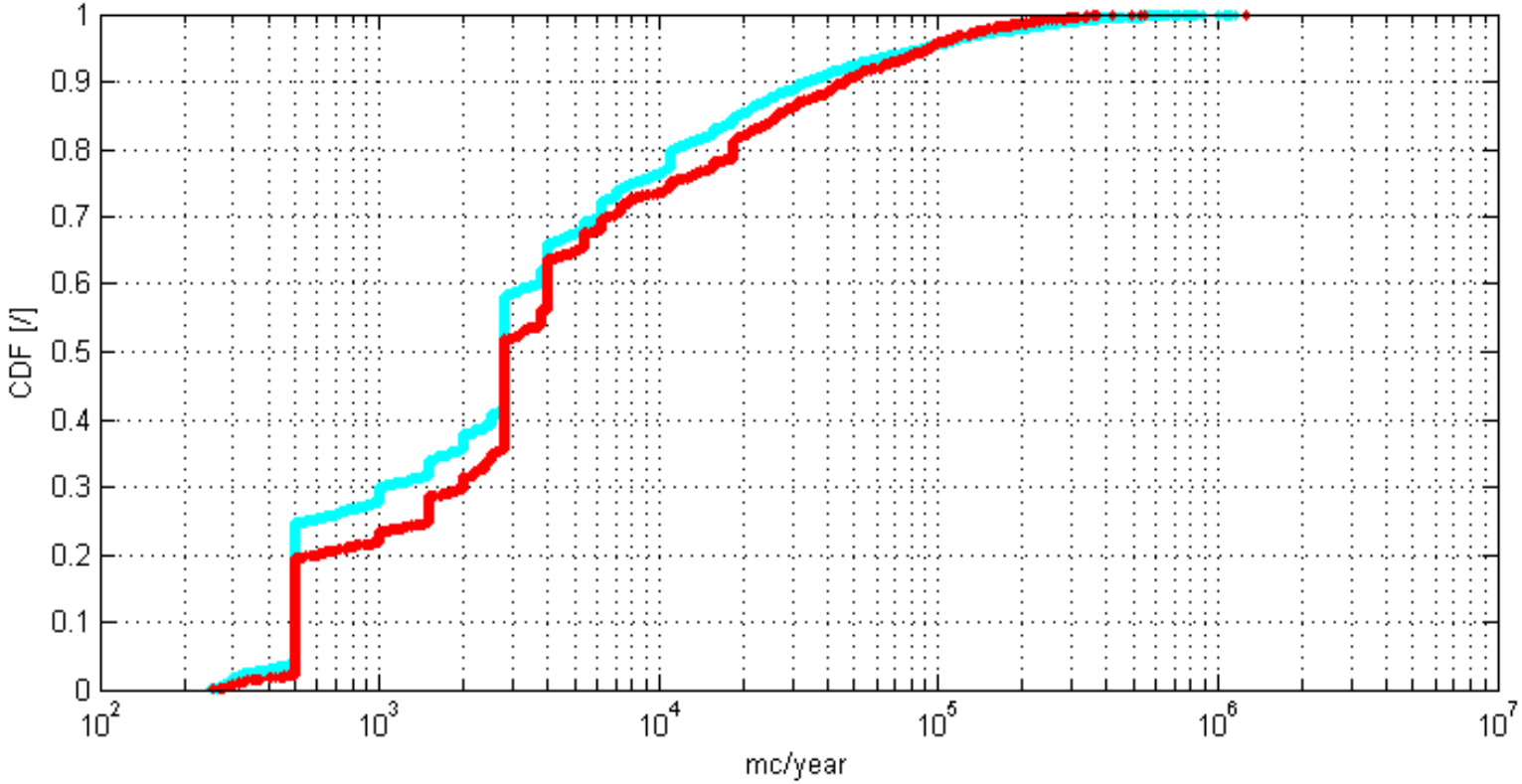
Drivers and pressures

Reporting WISE WFD

Significant pressure: 3.x
ABSTRACTION

Drivers and pressures

Abstraction distribution



Estimation of drought impacts

Grant Agreement No.
07.0329/2013/671279/SUB/E
NV.C.1

Developing Water Accounts Tools

Use of different data sources with (very) different data formats

Combine heterogeneous data (temporal and spatial scale)

Use well-defined procedures for data processing

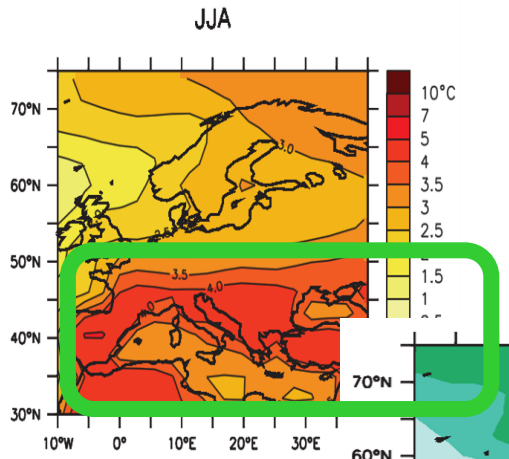
Make easy, continous tables' updates

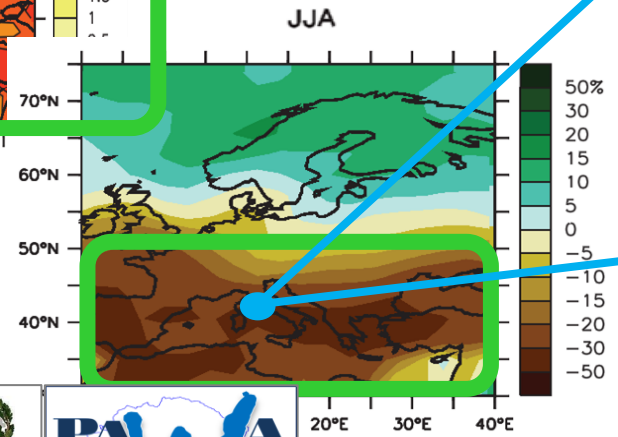
Set-up of a "System":
- open
- shared
- documented
- easy-to-proof
- easy-to-update

It means:
- on the web
- SQL standard
- in a non-proprietary (free) format
- using URI/URL to identify items
- linkable to external sources

Water Accounts: Climate Change Impact Assessment

IPCC
INTERGOVERNMENTAL PANEL ON climate change





MOBIDIC
Hydrologic Model

Fully distributed, physically-based parameters

ISPRA Istituto Superiore per la Protezione e la Ricerca Ambientale

SEMIDE EMWIS

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PAWA Pilot Arno Water Accounts

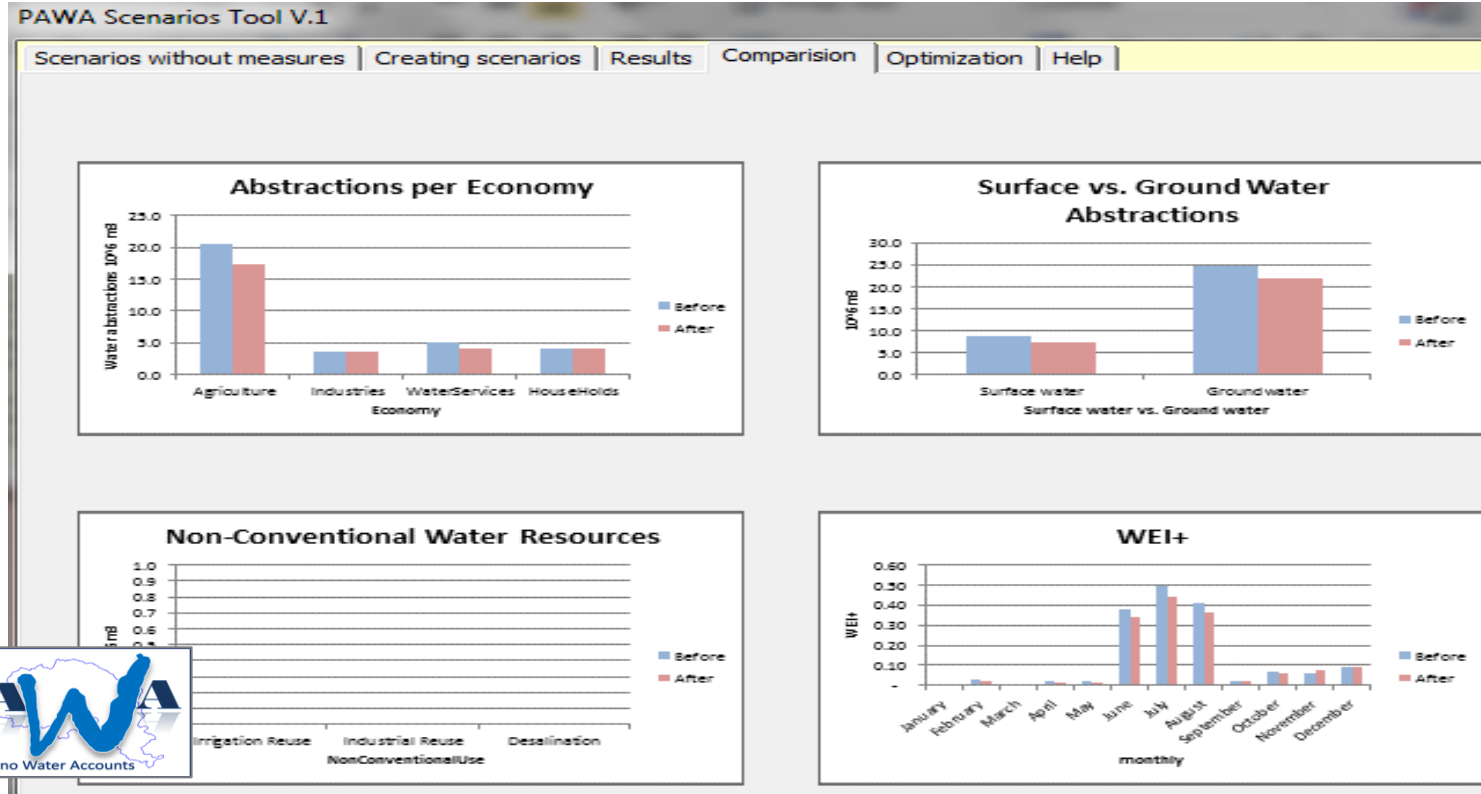
Water Accounts: Climate Change Impact Assessment

Climate Change Scenarios

Id	Scenario	Description
1	Real	Based on measured hydrological data, 1993-2013
2	CNRM_RCP45	Synthetic hydrological data derived from 1993-2012 measured data, biased in order to copy with global ciculation model output for a long-medium term temporal horizon (2070-2090) CNRM - CM5 global circ. Météo France http://www.cnrm-game.fr/spip.php?article126&lang=fr
3	CNRM_RCP85 	
4	MOHC_RCP45	Synthetic hydrological data derived from 1993-2012 measured data, biased in order to copy with global ciculation model output for a long-medium term temporal horizon (2070-2090) Met Office Hadle Center http://www.metoffice.gov.uk/
5	MOHC_RCP85 	
6	IPSL_RCP45	Synthetic hydrological data derived from 1993-2012 measured data, biased in order to copy with global ciculation model output for a long-medium term temporal horizon (2070-2090) Institut Pierre Simon Laplace des Sciences de l'Environnement Global (IPSL) http://igcmg.ipsl.jussieu.fr/
7	IPSL_RCP85 	

Water Accounts: Climate Change Impact Assessement

Testing Measures' effects in a climate change scenario



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PAWA Pilot Arno Water Accounts

Responses: RBMP measures

Mitigation of drought effects

List of measures potentially useful

Classification

Infrastructural

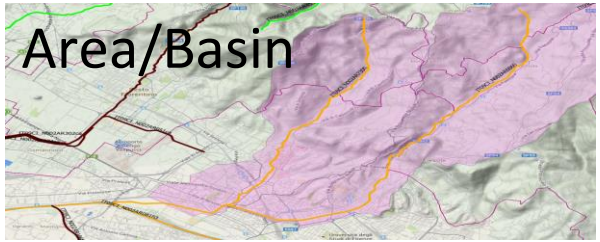
Non-Infrastructural
Regulatory

Agriculture

Industry

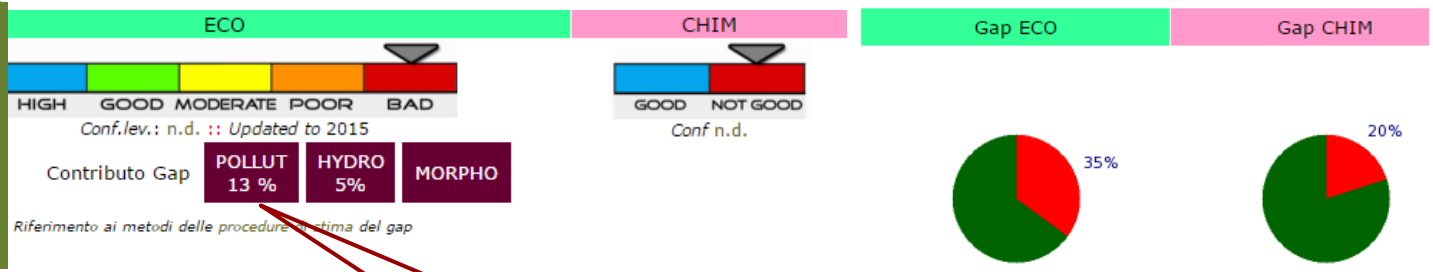
Water service

Rural / Domestic Use



RBMP Measures - Gap Assessment

Environ mental Status



Based on pressures and monitoring results

Estimation of nutrient pollution load		
Direct load	40.62	[Hm^3/Y]
Water pollution load	120.31	[Hm^3/Y]
Total water volume	1496.89	[Hm^3/Y]
Annual mean discharge	47.47	[mc/s]
Threshold value for good status	114.78	[Hm^3/Y]
Water Resource related to MVF	105.87	[Hm^3/Y]

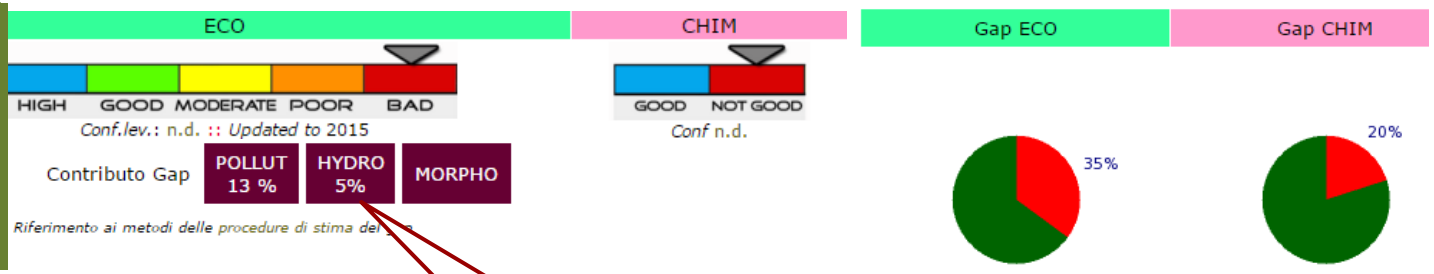
1

Pollution Load

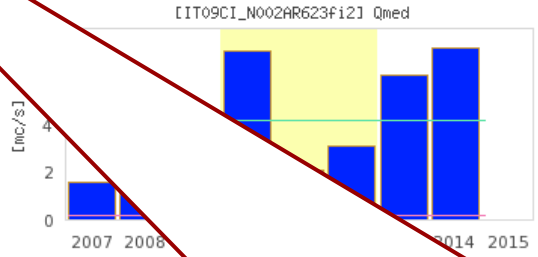
Grey Water

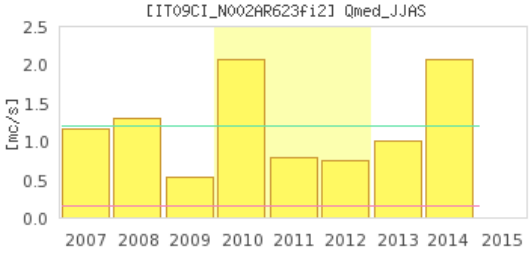
RBMP Measures - Gap Assessment

Environ mental status

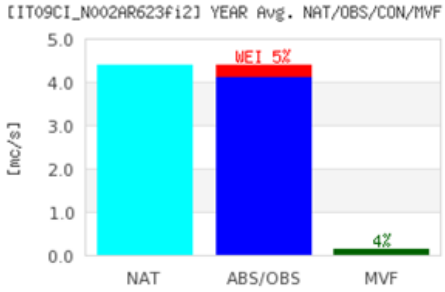


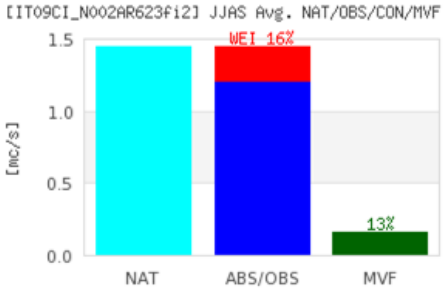
2 Water Exploitation





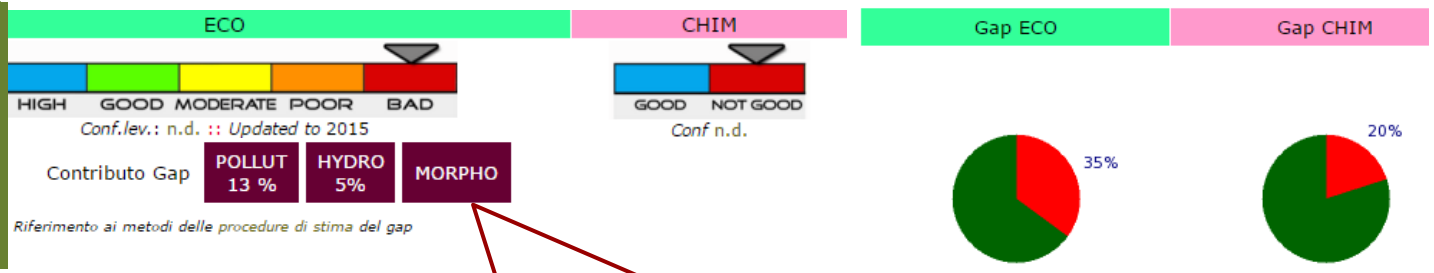
WEI+ (modified ***Water Exploitation Index***)





RBMP Measures - Gap Assessment

Environ mental status



3 Morphological alteration

Indexes (IQM) or **empirical evaluation**, confirmed by monitoring results

BQEs

- **MacroBenthos**
- **MacroFithos**
- **Fish fauna**

RBMP Measures - List of intervention

Infrastructural

Leakages reduction (domestic use)

Non-Infrastructural

Household awareness campaign on water savings

Distribution of water saving devices for households

RBMP Measures - List of intervention

Reduction of permits

Increase of prices in drought periods

Non- Infrastructural

Reuse of urban wastewater by agriculture with secondary distribution network

Introduction of resistant crops

Improvment in irrigation techniques

Infrastructural

Sensitization campaign through implementation of water efficiency devices

Non- Infrastructural

Develop decentralised wastewater reuse in industrial areas

Infrastructural

RBMP Measures - List of intervention

Rehabilitation, maintenance and use of existing rainwater harvesting systems by households

Infrastructural

Sensitization campaign

Increase of prices in drought periods

Non- Infrastructural

Desalination plants

Infrastructural

Rehabilitation of polluted aquifers

Reservoirs Management

Non- Infrastructural

General

Appraise of Extreme Phenomena

Other factors to justify exemptions under Art. 4.6 - To be taken into consideration!

Extreme events (**prolonged drought**, floods) in the last six years

Water scarcity caused by agricultural uses

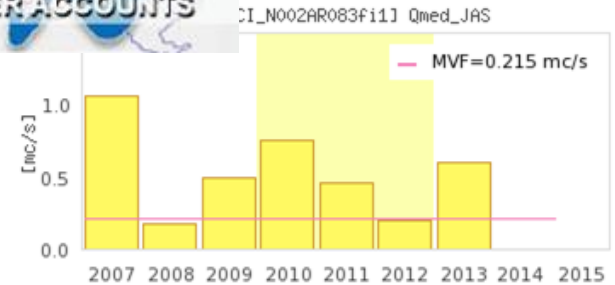
ARNO case study

hystorical timeseries

climate change scenarios

quantitative indicators and their thresholds → **water abstraction permits reduction**

Grant Agreement No. 07.0329/2013/671279/SUB/ENV.C.1



ERC - Resource cost

UPP

Incentive pricing

The institutional setting

First examples of drought management tasks

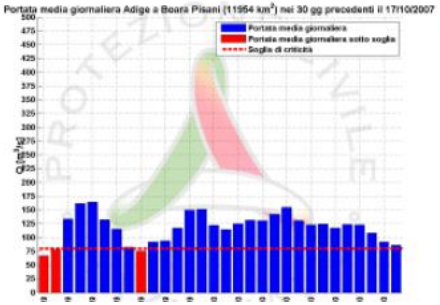
Po river - “Cabina di Regia siccità”
Drought Control Unit
promoted by Po River Basin Authority

2001

Arno river - “Commissione Tutela delle Acque”
Water Protection Commission
promoted by Arno River Basin Authority

1998

Po river basin



Real time monitoring

Commissario delegato per l'emergenza idrica ex. O.P.C.M. n. 3598 del 15.06.2007

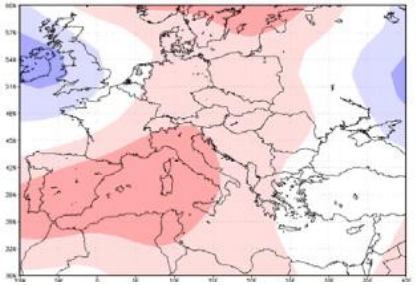
Crisis management

Regional plans of interventions

Water resource regulation

Technical information

Control of illegal abstraction



Monthly and seasonal forecasts

Information / citizens' involvment

Po river Basin - Drought Control Unit

Involved subjects

- Ministry of Environment
- Ministry of Agriculture
- Terna (Electric supply company)
- AIPO
- Agencies for lakes' management
- Ministry of Economic Development
- Dams' control Office
- Po River Basin Authority
- Regions
- Agencies for reservoirs' management

Po river Basin - Drought Control Unit

Operational activities

- Hydropower plants management
  - Revision of production plans
  - Maintenance management
- Lakes management
  - Revision of restitution plans
  - Exemption to ordinary regulation limits
- Irrigation management
  - Revision of abstraction plans
  - Water saving measures
  - Controls' increase

Arno river Basin - Water Protection Commission

“Commissione Tutela delle Acque”
since 1998

- Monitoring drought situation
- Mid- and long-term meteo forecast analysis, regarding ground- and superficial water bodies recharge
- Application of collaborative policy for the management of water reservoirs and limitation of withdrawals

Arno river Basin - Water Protection Commission

- local adminstrations
- municipalities
- water management companies
- government representatives

During drought periods:

- continuous activity
- monthly meeting during winter-spring period
- daily management and weekly meeting during summer period

The elaboration of a "drought management plan" is included in the Programme of Measures of RBMP for Northern Apennines District, together with:

- Definition of the **hydrological balance** and **Environmental Flow**
- Management of **withdrawals** and **releases**, including volume reduction granted, which aims to ensure environmental protection (i.e., respect of EF) and optimization other water uses

Drought indicators

Needs

- avoid failures
- minimize false alarms
- easily update

Issues for

- data acquisition (and validation)
- indicators elaboration

continuity

reliability

Drought indicators

continuity

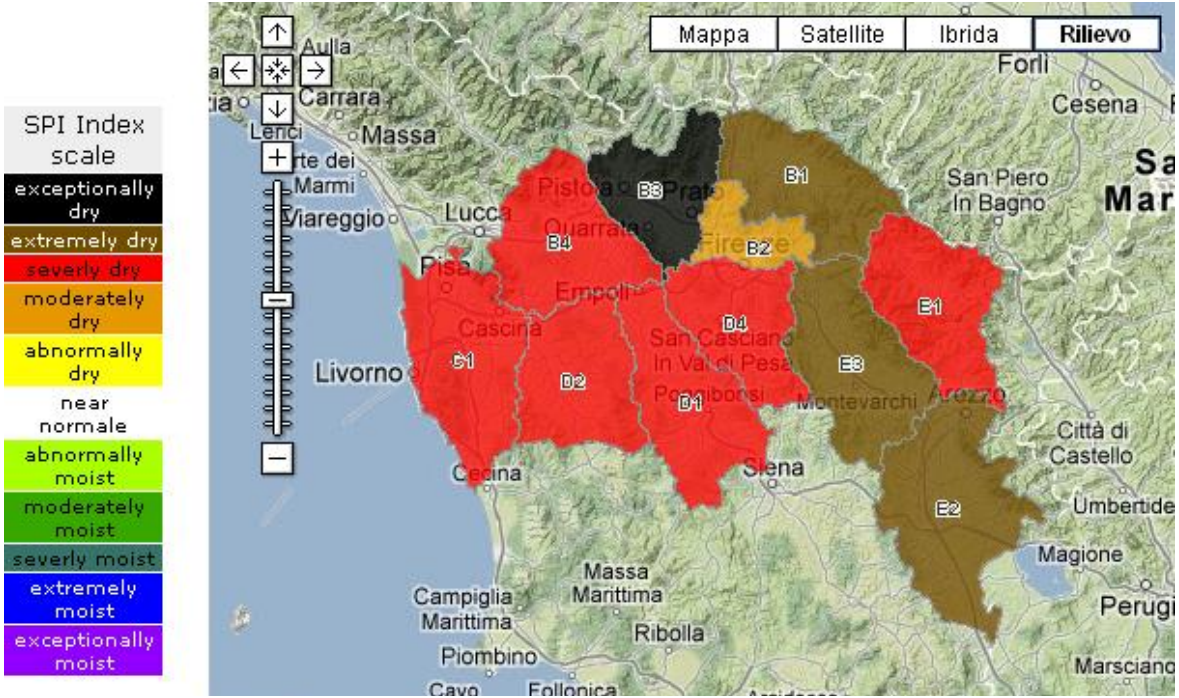
reliability

Tested indicators

Indicator	Status	Pro	Cons
SPI	operational	continuous availability; easily calculation	w/o ground effect
SRI	experimental	continuous availability; "integral" indicator	maintenance of discharge - level curves
NDVI	tested in 2009	detailed spatial indicator effectiveness of drought effect representation	temporal availability; calibration
Q vs. EF	operational	continuous availability; "integral" indicator	availability only in a limited gauge number

Drought risk maps

SPI evaluation for subbasin (alert areas)

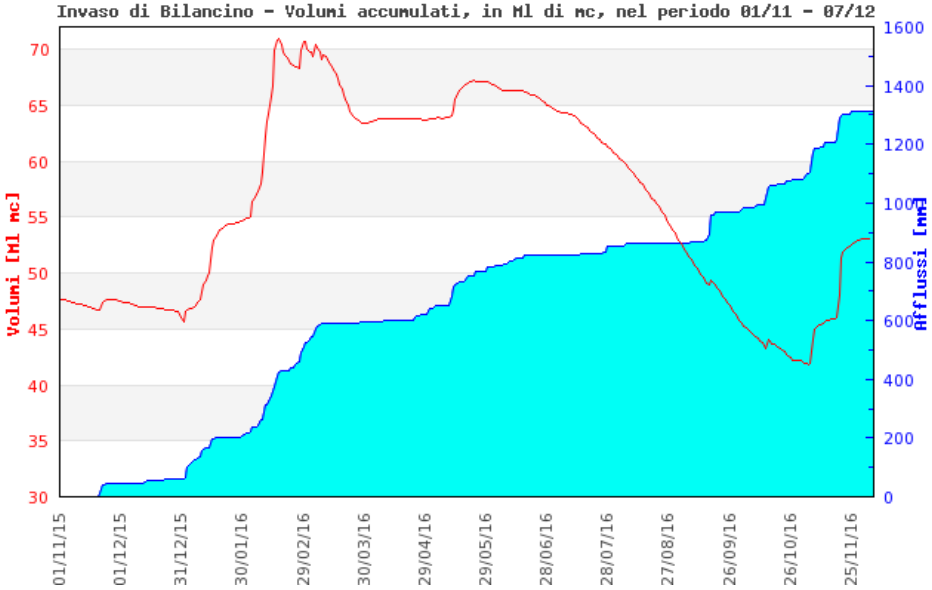


SPI referred to precipitation cumulated on last 180 days

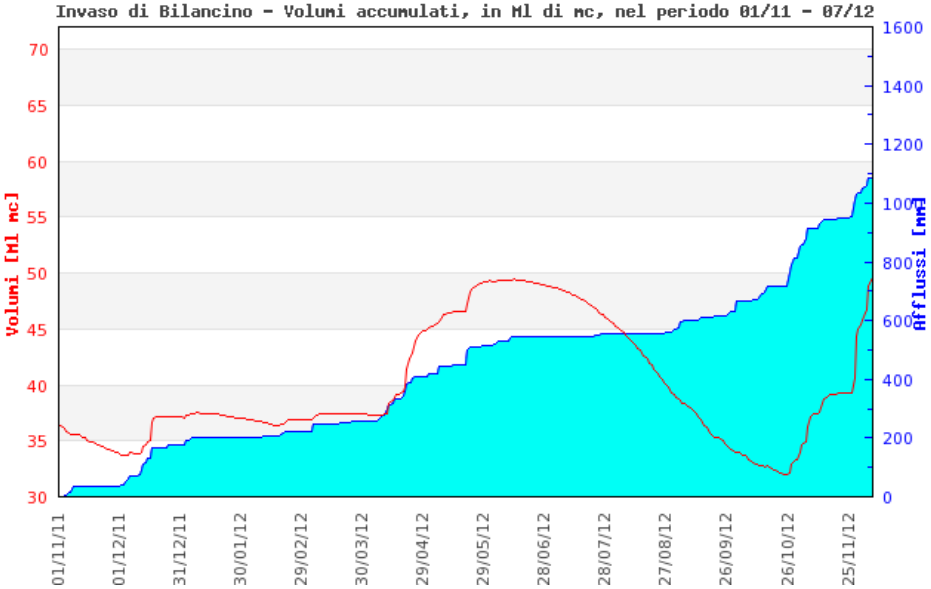
Reservoirs' status

Bilancino Dam (water supply)

2016



2012



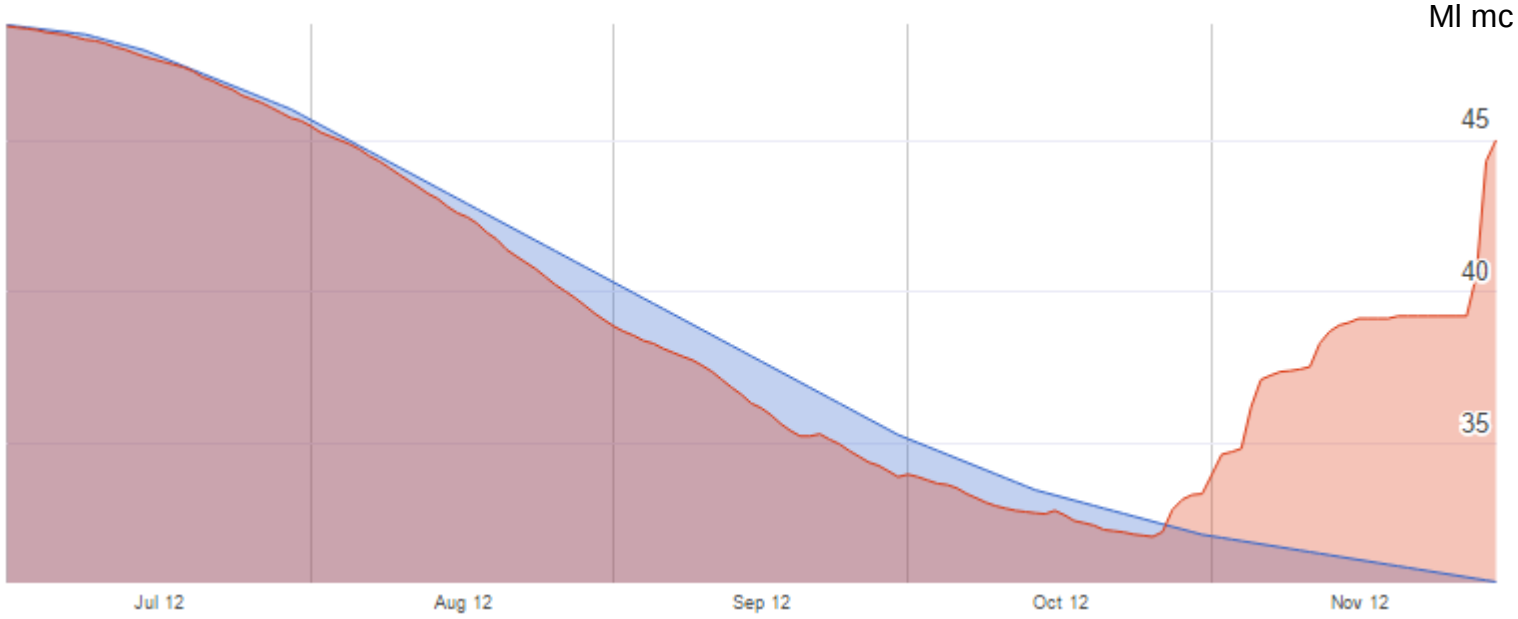
Comparison on the same time interval

Reservoirs' management

Bilancino Dam (water supply)

Forecasted volume

Effective volume



Testing (and verifying) different releases scenarios

Drought Observatory Units

Ministerial Decree **July 2016**

Institution of 7 “**Drought Observatory Units**”

in each Hydrographic District

Drought Observatory Units

Central / local administrations

District Authorities

Environmental regional agencies

Water supply agencies

Hydropower management agencies

3 different level of intervention
(low - medium - high level of water scarcity condition)

Goals

To strengthen collaboration between central and local administrations

To promote WFD objectives: sustainable water use

To implement prevention / preparation measures

To improve drought events management

To promote climate change adaptation

Critical issues

Data sharing

Selection of an effective set of (hydrological) indicators / parameters

Define decisions mechanisms

Measures’ effectiveness and efficiency evaluation

Keep attention alive during “normal” periods/years

Recommendation

Adopt pro-active measures

Increase public **and** private stakeholders involvment

Use multi-temporal scales indicators (from yearly to daily update)

Perform calibration process

Develop sinergy between Observatories’ activity and RBMP updates

Bernardo Mazzanti

www.adbarno.it

www.appenninosettentrionale.it

Thank You