Drought in Romania and in Europe

Insights on impacts

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WORLD BANK GROUP

Water Global Practice

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Droughts… What is it and why should we care?

The term is widely used but there is confusion about some drought-related concepts

… such confusion often leads to misguided approaches and actions

Drought is an exceptional deficiency of precipitation (or flow) that often results in a water shortage for the environment or society.

It is an anomaly and can happen in any type of climate

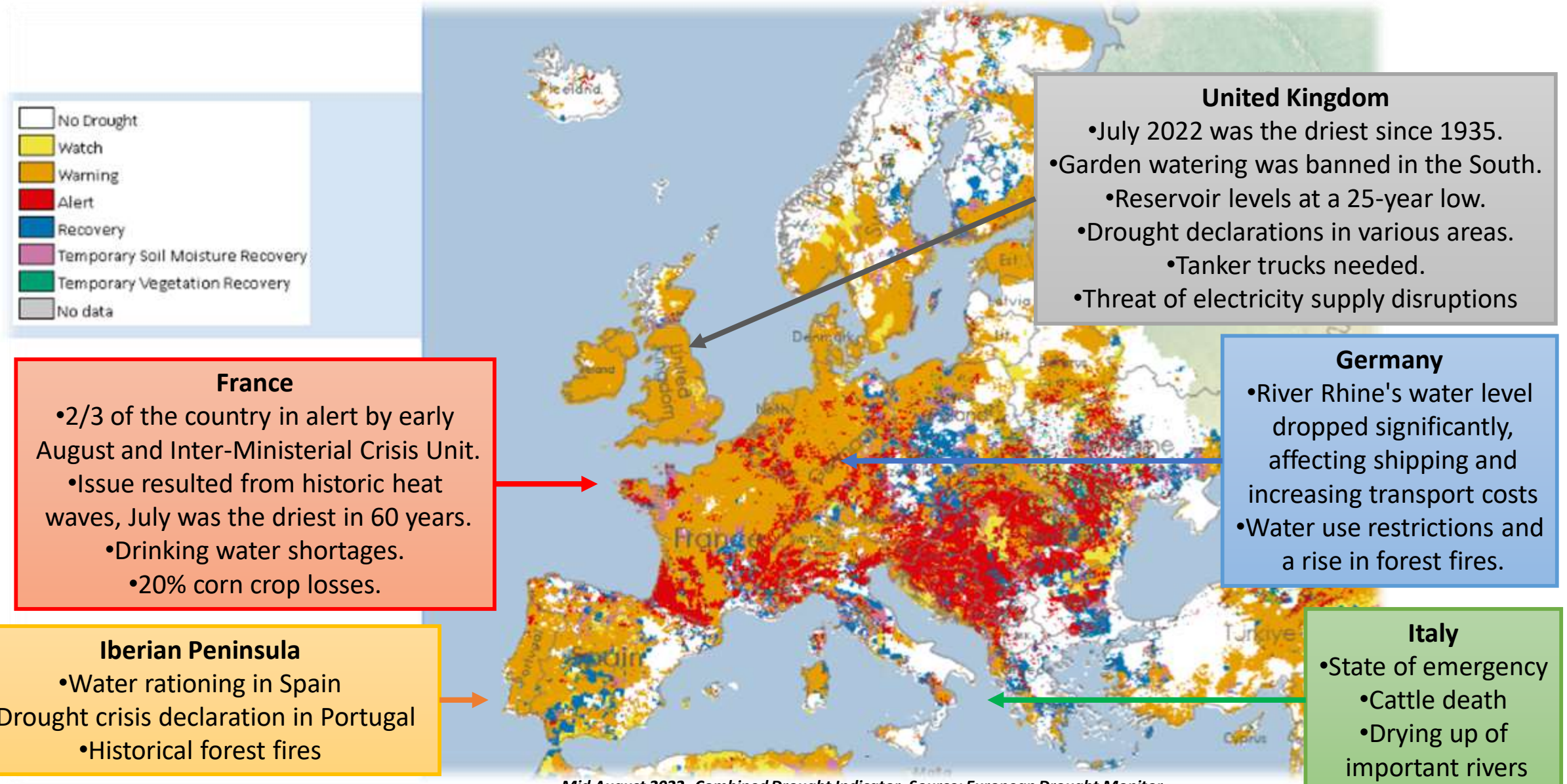
Aridity refers to permanent and usual conditions of water scarcity.

It is a characterizing feature of certain climates

Water shortage is the existence of less available water supply than the society demands, caused by droughts or by poor water management

SOURCE: http://www.droughtmanagement.info/find/glossary/

In terms of extension and severity, the 2022 drought in Europe was exceptional, with significant impacts…



United Kingdom
- July 2022 was the driest since 1935.
- Garden watering was banned in the South.
- Reservoir levels at a 25-year low.
- Drought declarations in various areas.
- Tanker trucks needed.
- Threat of electricity supply disruptions

France
- 2/3 of the country in alert by early August and Inter-Ministerial Crisis Unit.
- Issue resulted from historic heat waves, July was the driest in 60 years.
- Drinking water shortages.
- 20% corn crop losses.

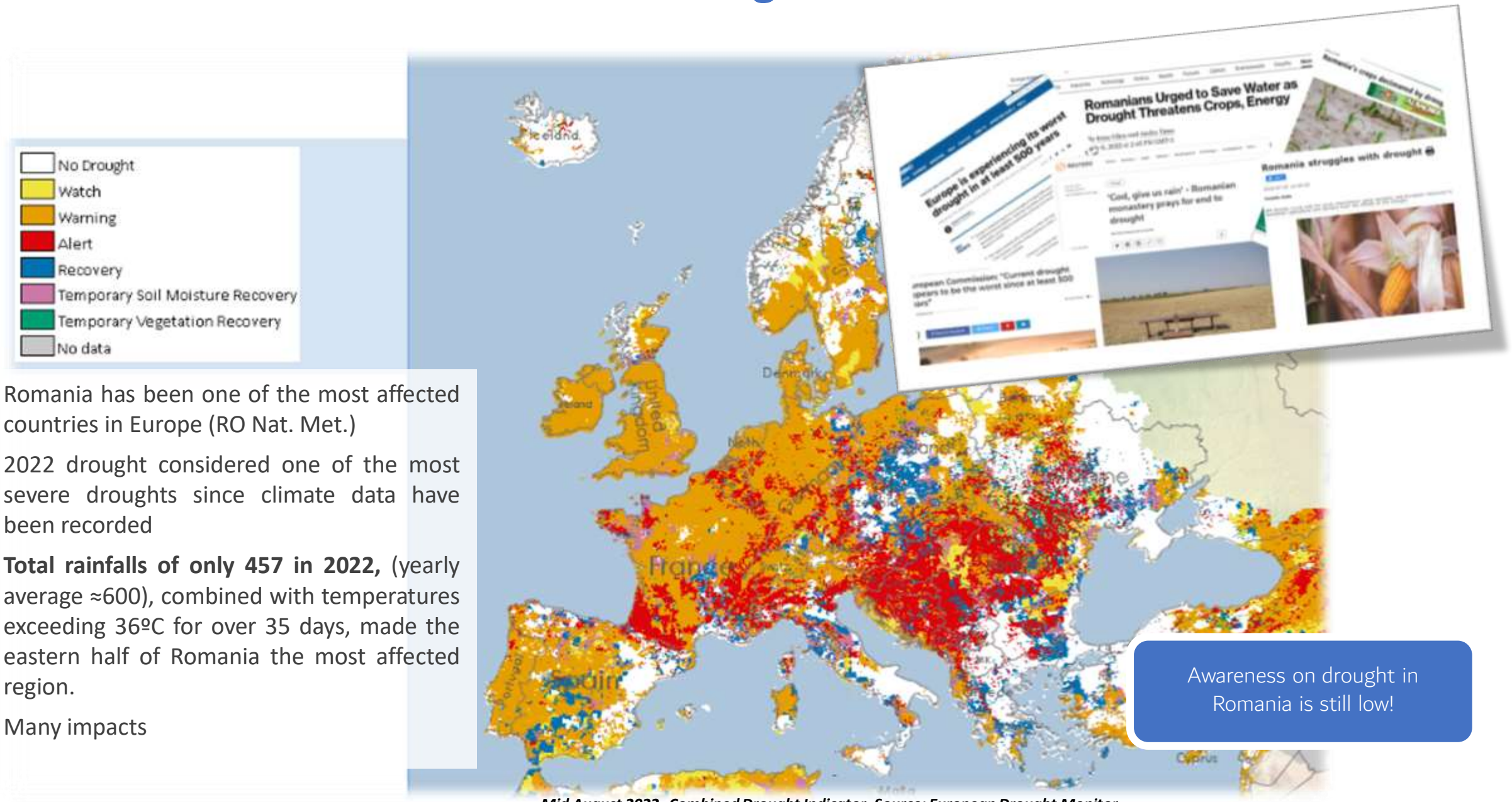
Germany
- River Rhine's water level dropped significantly, affecting shipping and increasing transport costs
- Water use restrictions and a rise in forest fires.

Iberian Peninsula
- Water rationing in Spain
- Drought crisis declaration in Portugal
- Historical forest fires

Italy
- State of emergency
- Cattle death
- Drying up of important rivers

Mid August 2022- Combined Drought Indicator. Source: European Drought Monitor

… and hit the Danube region and Romania too



Romania has been one of the most affected countries in Europe (RO Nat. Met.)

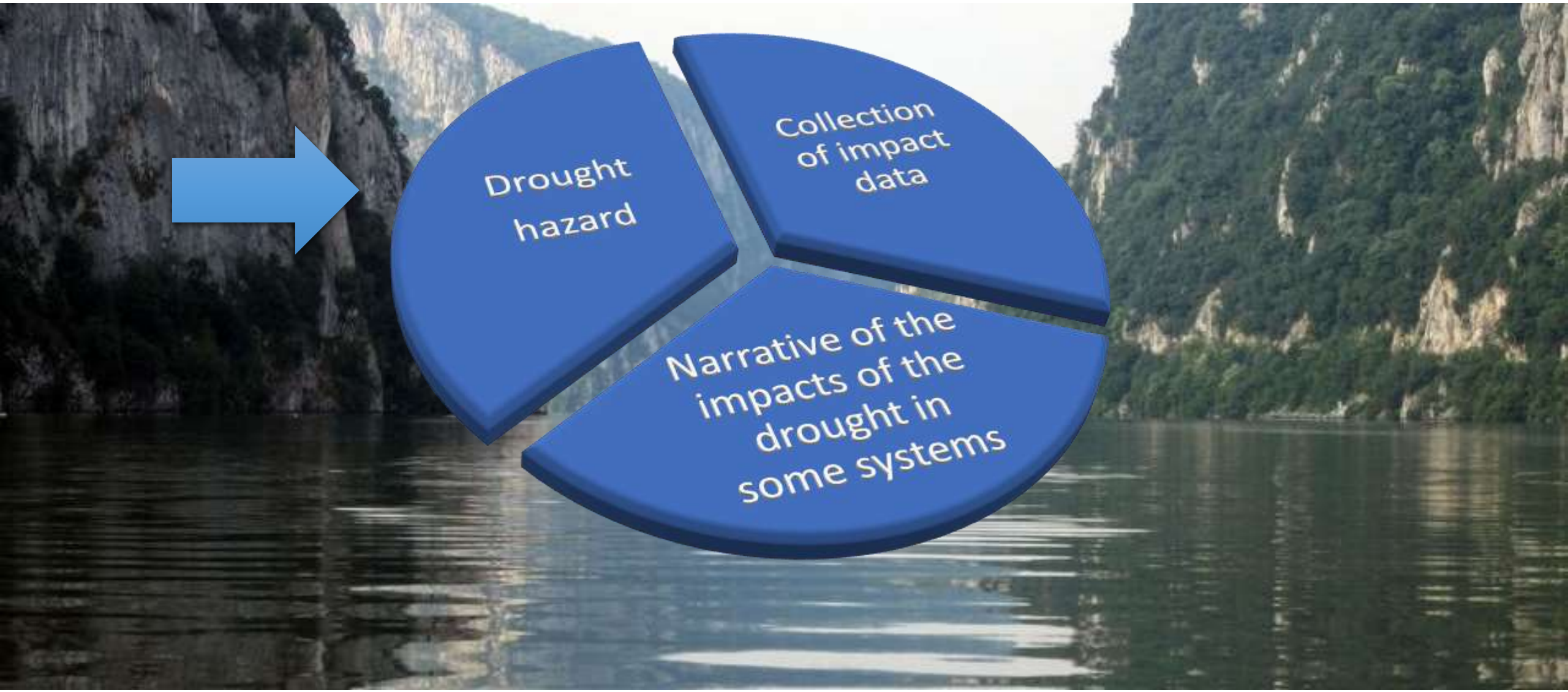
2022 drought considered one of the most severe droughts since climate data have been recorded

Total rainfalls of only 457 in 2022, (yearly average ≈600), combined with temperatures exceeding 36ºC for over 35 days, made the eastern half of Romania the most affected region.

Many impacts

Awareness on drought in Romania is still low!

Mid August 2022- Combined Drought Indicator. Source: European Drought Monitor


Drought hazard
Collection of impact data
Narrative of the impacts of the drought in some systems

Hydroclimatic drought hazard characterization, what did we do?

Standardized drought hazard indices (SDHI) widely used to represent drought hazard because they provide a standardized and quantitative way to assess the severity and spatial extent of drought (here SPI & SPEI)

SPI (different scales: SPI6, SPI12…)

Departure of cum. Precipitation (P) from long-term normals

Ex: SPI6 of each month is the comparison of the last 6 months to historical 6 months accumulations

Ex: SPI12 of each month is the comparison of the last year to historical equivalents

1950 to 2022 monthly P in CRU TS v.4.07

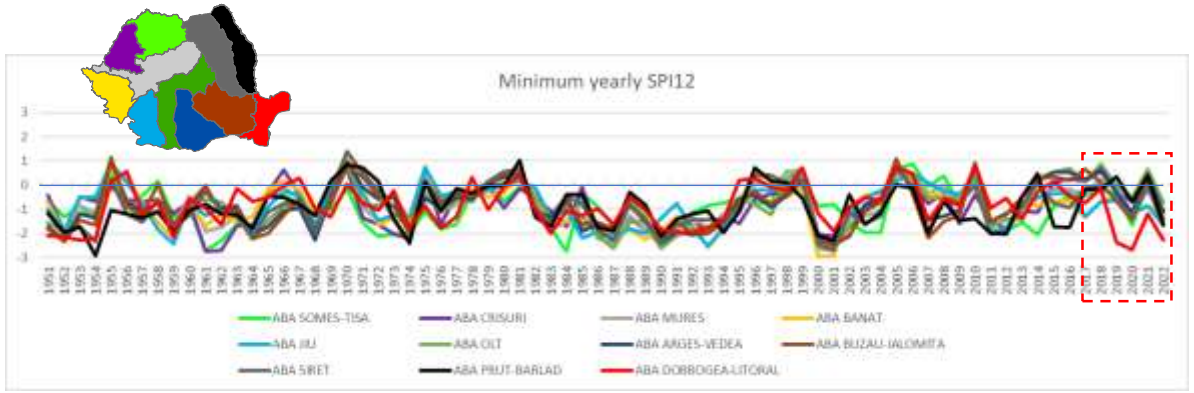
SPEI (different scales: SPEI6, SPEI12…)

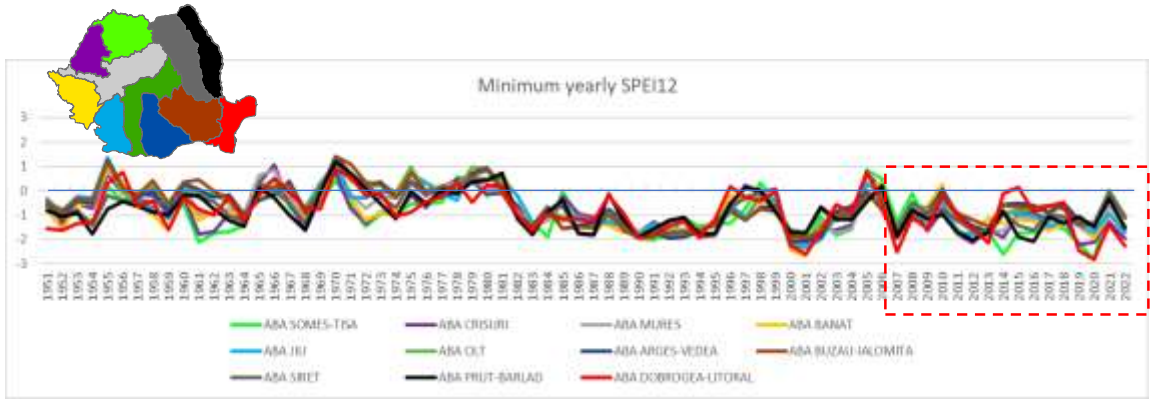
Similar, but considers water balance, or net precip. (P-ET) instead of just P

1950 to 2022 monthly, calculated with GPCC P and temperature data from NOAA NCEP CPC GHCN_CAMS

Everything averaged both by basins (RBD) and per NUTS2 and NUTS 3 regions, we present here selected scales

The hazard characterization reveals interesting aspects of the recent drought



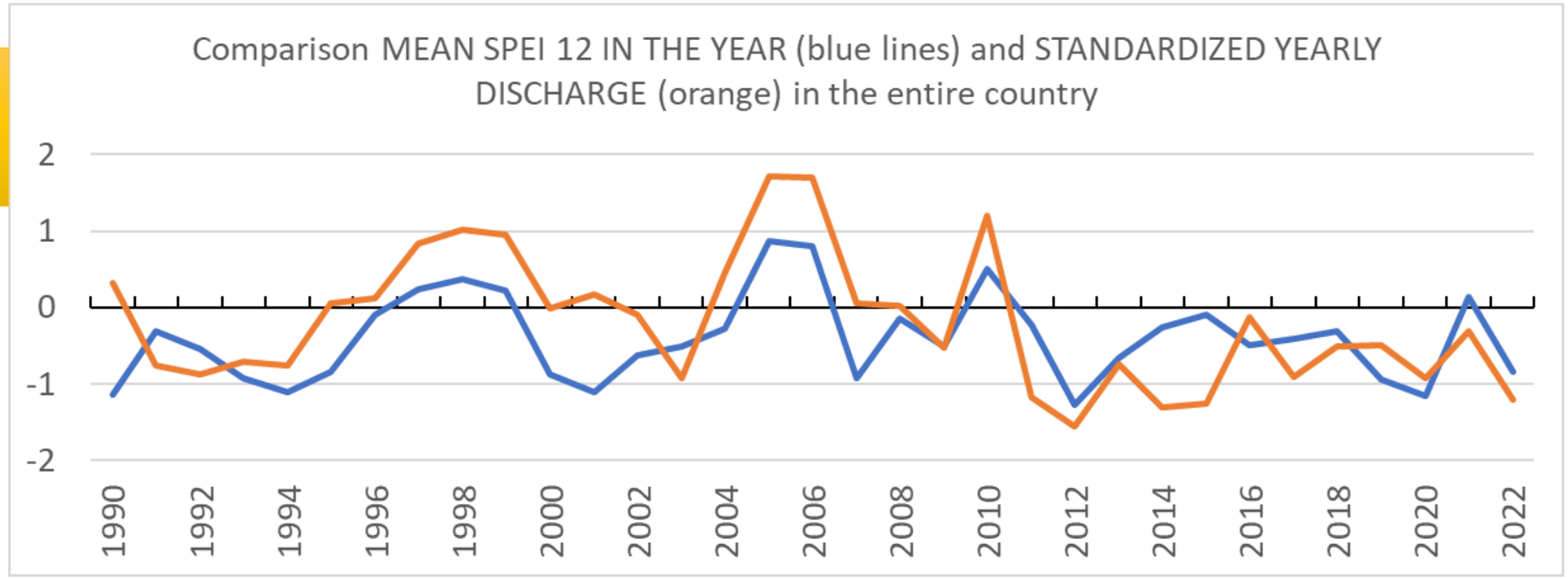


…rainfall drought (SPI 12) only shows 2019-2020 and 22 as deficit years, and generally not the worst of the last decades

…but in the SPEI12 index (accounting for net precipitation), the deficit lasts more tan a decade, in which temperature was anomalous

Runoff is much more connected to the SPEI indices

DATA: Eurostat+ HydroRO yearly outflow for Romania 1990-2022

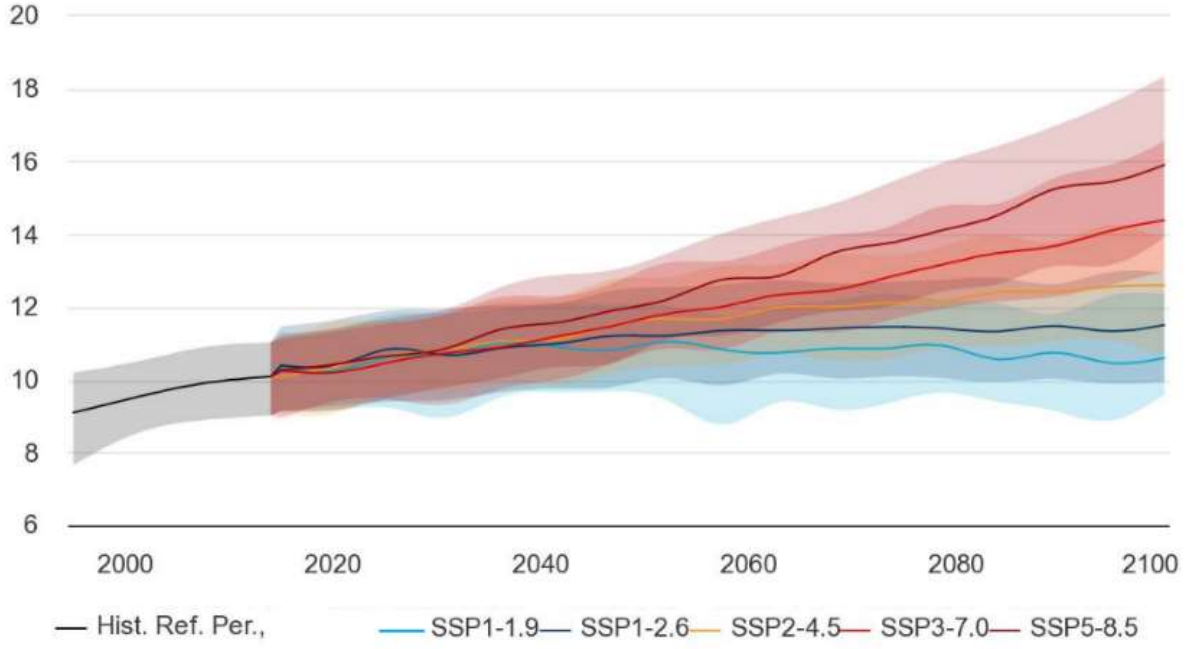


…**Discharge is dwindling**, following the steadily declining water balance índices (SPEI)

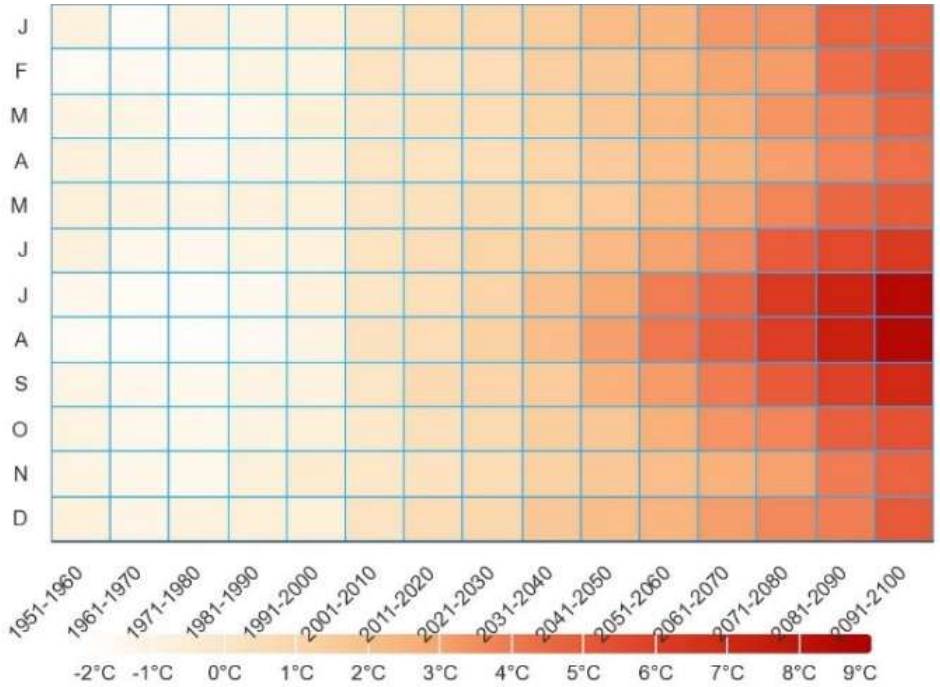
The pattern is similar if we analyse it basin by basin

Temperature in Romania is projected to increase, as will ET

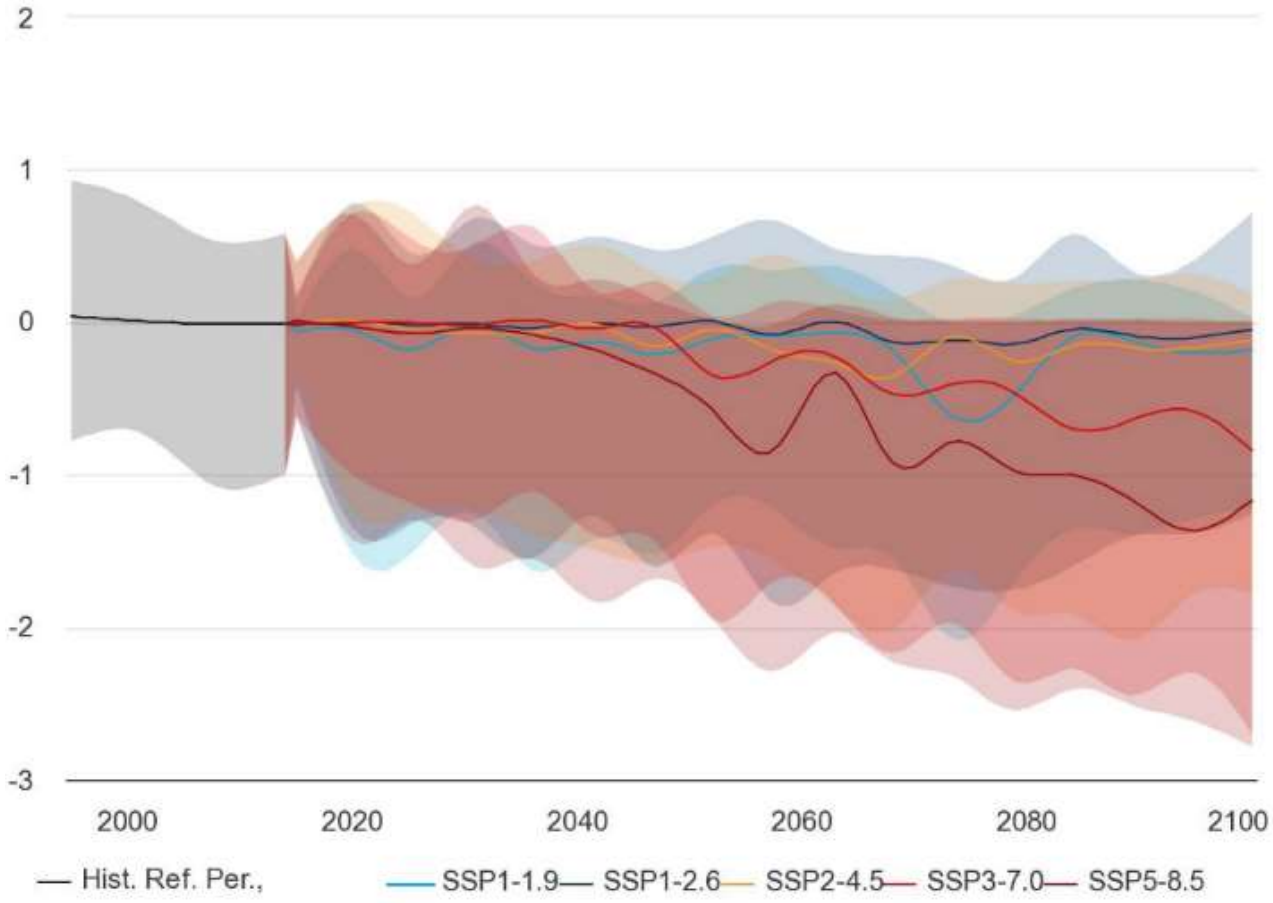
Projected Mean-Temperature in Romania over the century under different scenarios (Reference period: 1995-2014), Multi-Model Ensemble. ***SOURCE: Coupled Model Inter-comparison Project 6, World Climate Research Program***



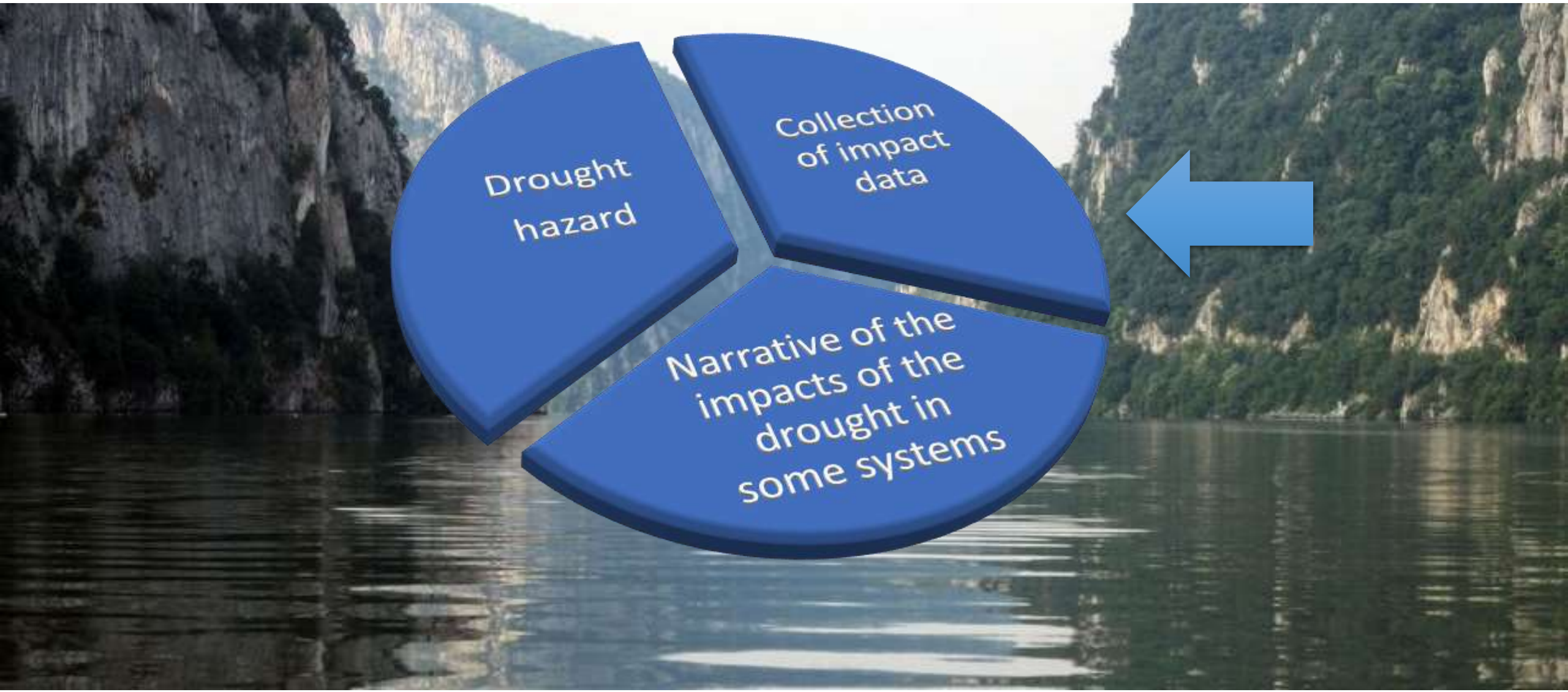
Projected Mean- Temperature Anomaly in Romania for the 12 months over the century under different scenarios (Reference period: 1995-2014), Multi-Model Ensemble. ***SOURCE: Coupled Model Inter-comparison Project 6, World Climate Research Program***



The projected ET will drive the SPEI and water availability towards even lower values



Projected Annual SPEI Drought Index in Romania (Reference period: 1995-2014), Multi-Model Ensemble. *SOURCE: CMIP6, World Climate Research Program*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Narrative of the impacts of the drought in some systems

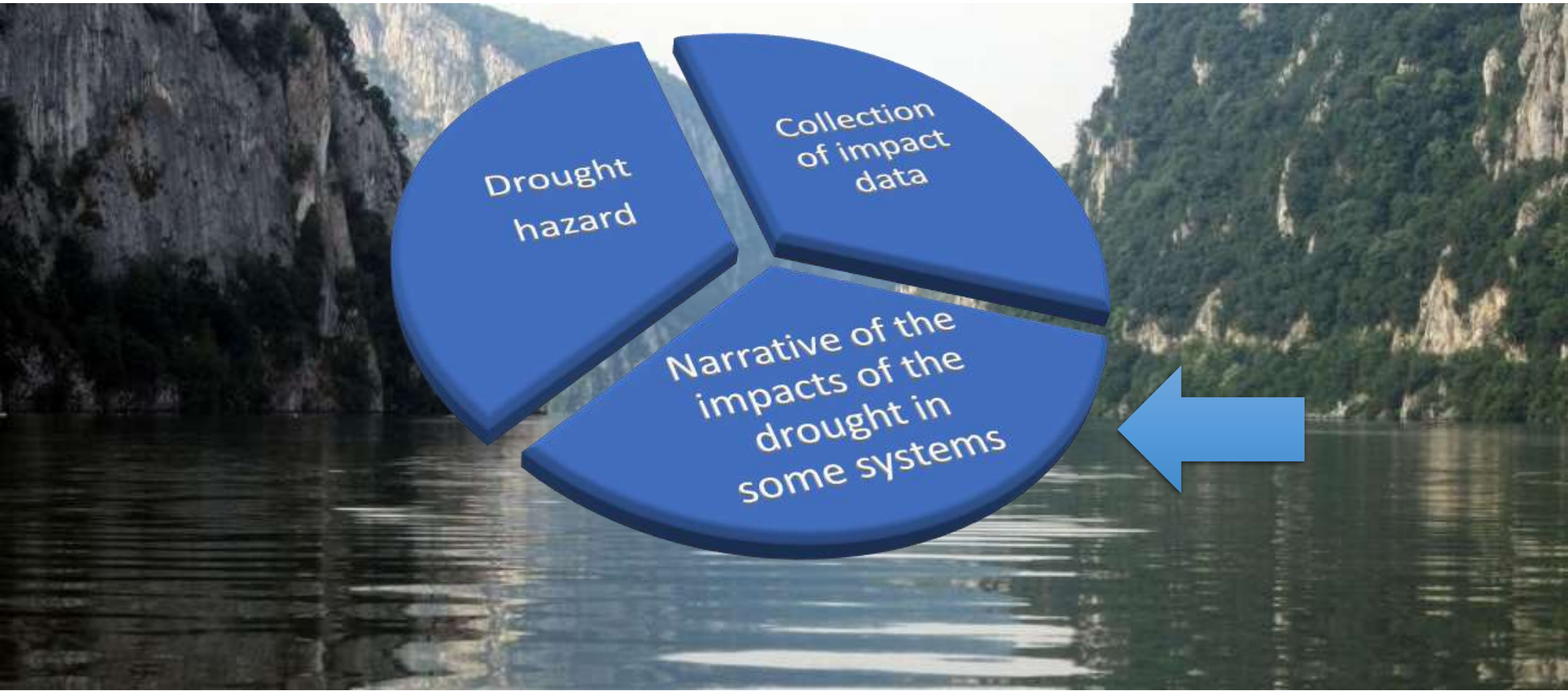
Collection attempt: data on drought impacts with the collaboration of the sectors (drought 2022 and historical time series)

Sector	Data	Source
Climate	Temperature data (monthly averages and peak values) historically, by region	ANM
	Rainfall data (monthly averages) historically, by region	ANM
	Climate indicators monthly values historically (SPI, CDI, Soil Moisture Anomaly, FAPAR) - calculated?	ANM
	Heat waves duration historically	ANM
Water Resources	Flow rate/stock on main water courses (Danube and internal rivers) - monthly averages historically	MEWF/ANAR/INHGA
	Updated estimates on likely future change of stock on main water courses/basins (towards 2030/2050)	MEWF/ANAR/INHGA
	Variability of water storage in reservoirs for water supply for population, industry and agriculture	MEWF/ANAR/INHGA
	Impact on ecological flow on water courses	MEWF/ANAR/INHGA
	Groundwater depletion identified in gauges	MEWF/ANAR/INHGA
	Low Flow Index calculated?	MEWF/ANAR/INHGA
Water Supply & Sanitation	Number of localities affected by supply restrictions by region, historically	ANRSC/ARA
	Number of population affected by supply restictions, by region, historically	ANRSC/ARA
	Number of days/hours per day of supply restrictions, by region, historically	ANRSC/ARA
	Financial Impact of restrictions on water operators (regional&local), historically	ARA/ANRSC
	Localities / population with own supply affected by	Ministry of Health (Public Health

Sector	Data	Source
Agriculture	Area with crops (winter and spring) affected - in total, by season, historically	MARD
	Crops affected by drought (%), historically	MARD
	Teritorial distribution of area affected by drought, by season, historically	MARD
	Size of drought effects (% of expected production), historically	MARD
	Compensations to farmers - impact on budget	MARD
	Economic/financial impact of output drop, historically	MARD/MPF
	Historical data regarding crop yields by region/county	MARD
	Area irrigated, by month and county	MARD/ANIF
	Drought impact on soils, historically	ASAS/ICPA
	Change in soil production over time (2010-2022) under recurrent drought	ASAS/ICPA
	Modeling of drought impact on soils	ASAS/ICPA
Forestry	Drought effects on forests (new and consolidated) vegetation status, by region, historically	ASAS/ICAS/Romsilva
	Observed effects on forests during 2010-2021 under recurrent droughts	ASAS/ICAS/Romsilva
	Forest fires, historically, by region	IGSU

- ARA
- ISGU
- Ministry of Energy
- Hidroelectrica
- Ministry of Transport
- AFDJ
- MEWF
- ANM
- INHGA
- ANAR
- MARD
- ANRSC

Sector	Data	Source
Energy	Variation of storage in hydropower reservoirs, monthly	Min. of Energy/ Hidroelectrica
	Energy production annually	Min. of Energy/ Hidroelectrica
	Drought impact on Nuclear Plants	Min. of Energy/ Nuclearelectrica
	Restrictions imposed to MHP	Min. of Energy/ Hidroelectrica
	Energy production lost from MHP restrictions	Min. of Energy/ Hidroelectrica
Transport	Number of days (period) with sailing restrictions on Danube River, by sector	Min. of Transp./AFDJ Braila
	Freight / weight restrictions enforced on Danube River	Min. of Transp./AFDJ Braila
	Rail transport restrictions enforced on main rail lines (passengers and freight) - number of hours/day, number of days, lines	Min. of Transp./CFR Infrastructure/Calatori
	Number of pasengers affected by rail restrictions, by region	Min. of Transp./CFR Infrastructure/Calatori
Finance	Estimated economic/financial impact of droughts on GDP	MPF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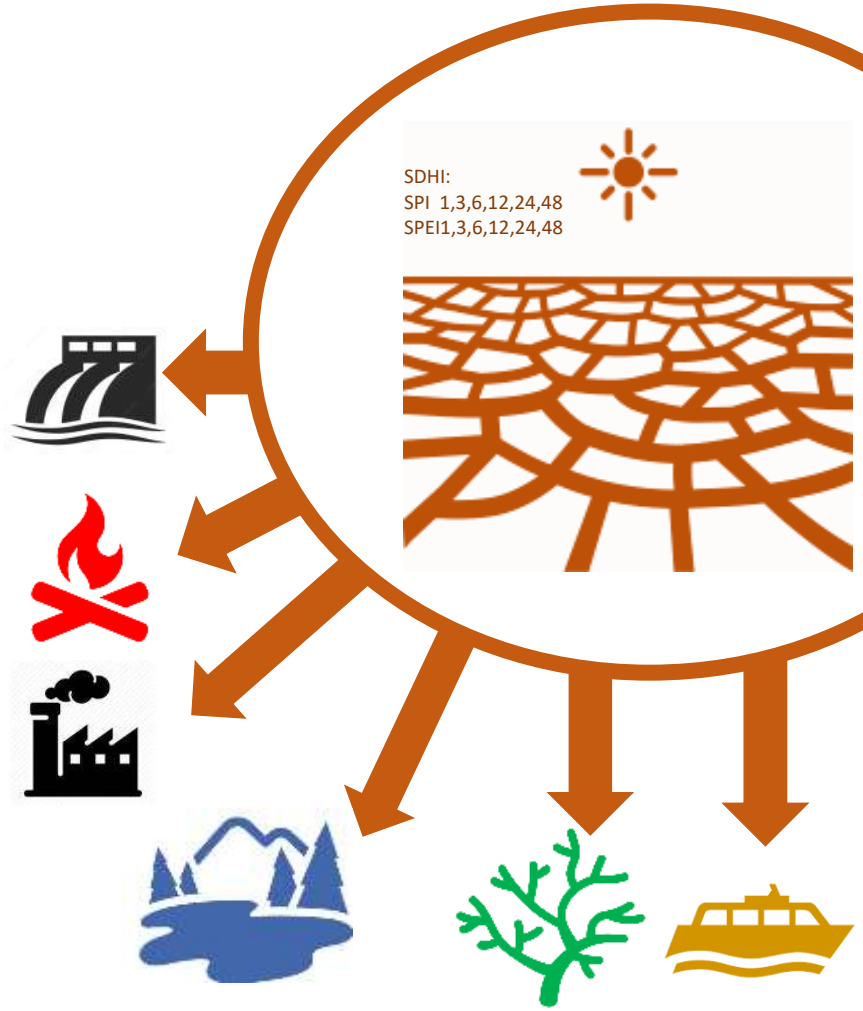
We performed an impact characterization with the collected data

- Water for domestic use
- Agricultural and livestock production and related services
- Energy production
- Riverine navigation and transport
- Industry outputs
- Ecosystem aspects subject to degradation due to drought

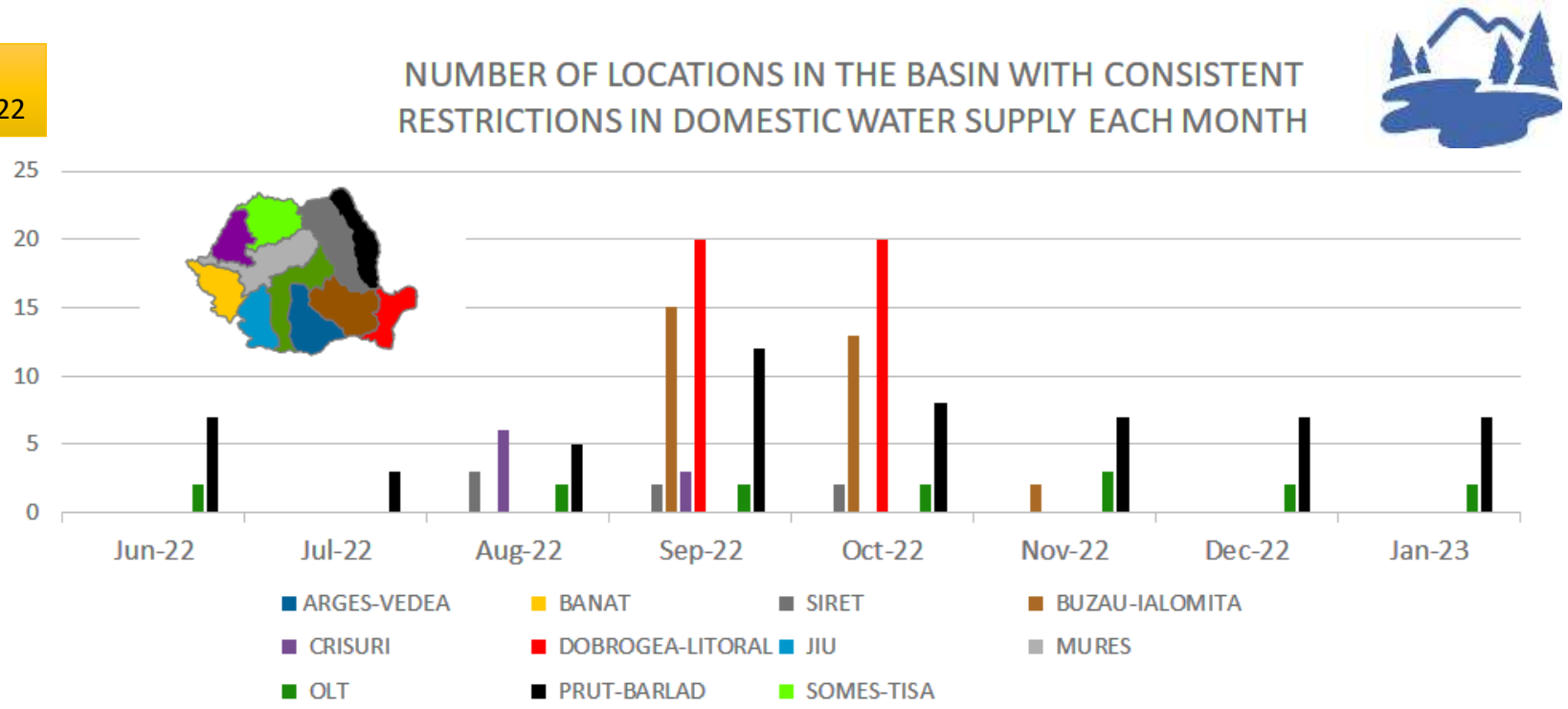
Deseasonalized, detrended (when needed) and standardized, and then compared to the SPI and SPEI time series generated previously



Whenever there are 2022 figures available, it is possible to delimit the impacts suffered that year as a reference, but otherwise a historical perspective on drought and the fluctuation of the variables is provided, with the aim of understanding the overall risk due to drought

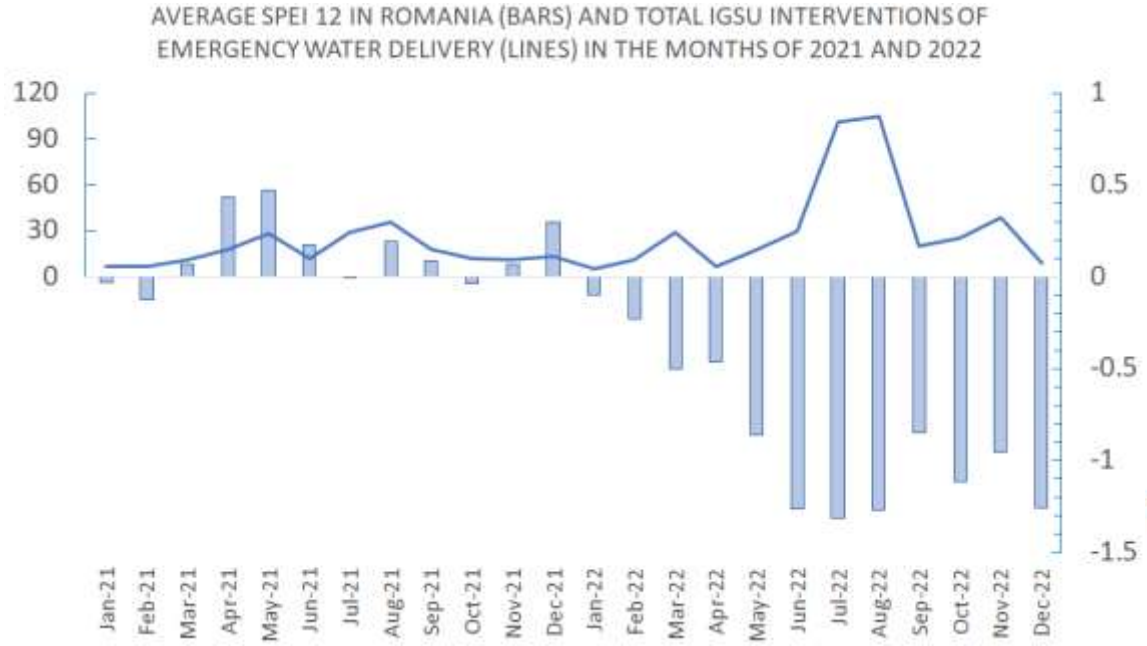
The year 2022 triggered restrictions in domestic water for six River Basin Districts

DATA:
ANAR, 2022

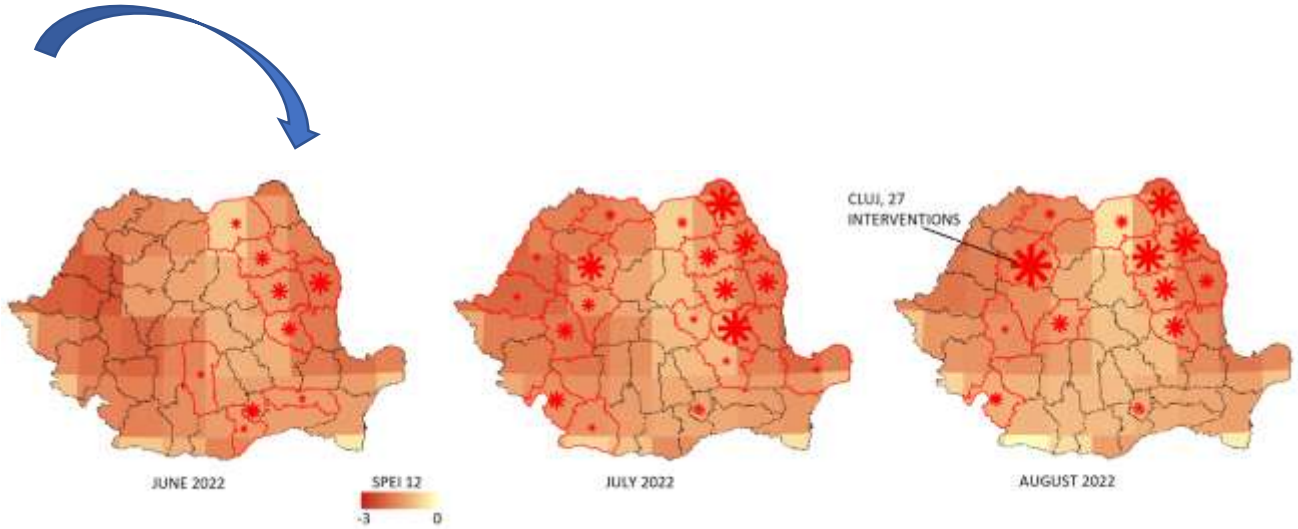


…Dobrogea- Litoral, Prut- Barlad and Buzau- Ialomita, suffered more restrictions than the rest of the country, and these restrictions concentrated mainly in September and October of that year, the peak of the drought (SPEI) in them

The peak of the drought forced emergency water deliveries



DATA: IGSU, 2021-2022

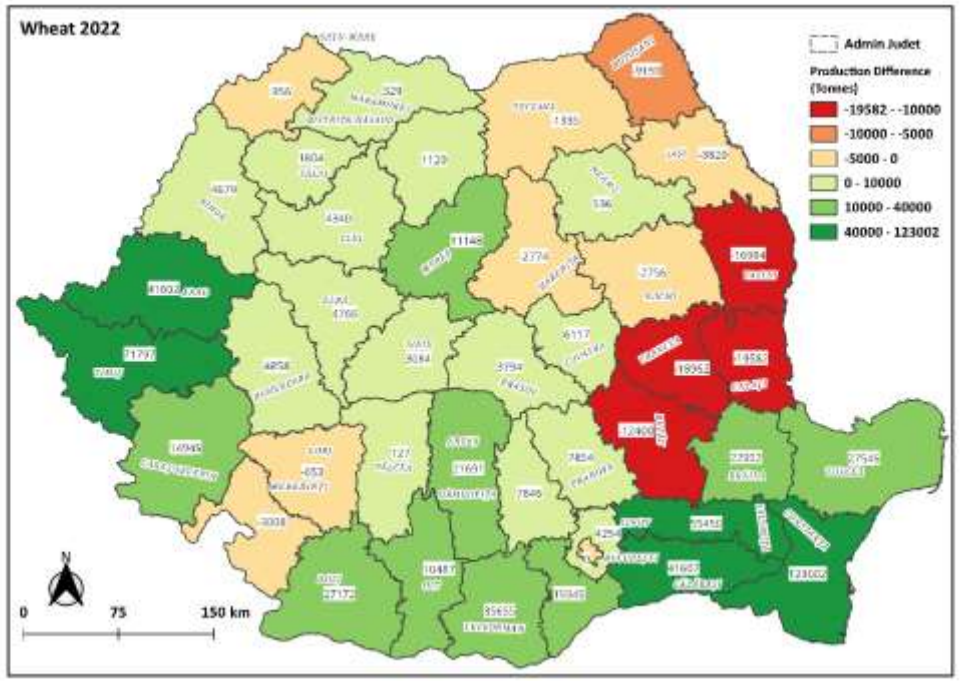


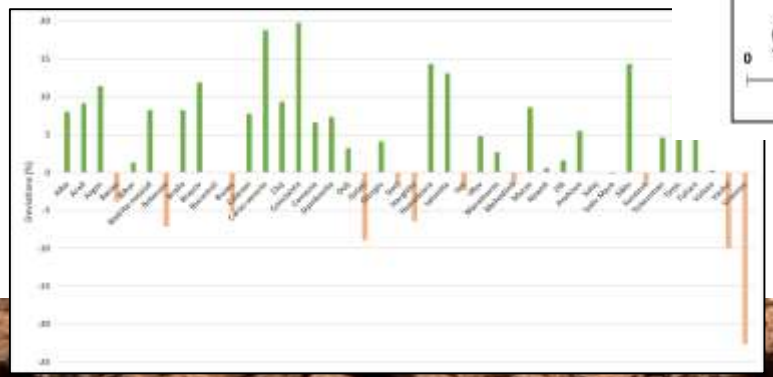
SPEI 12 during summer 2022 (background pixels) and number of IGSU interventions to deliver drinking water in each county in each month (red graduated symbol)

Wheat production October 21- May 22 were low in many eastern counties, in agreement with the drought

Wheat Production (tonnes), difference from average in the county

Season 1: October to May



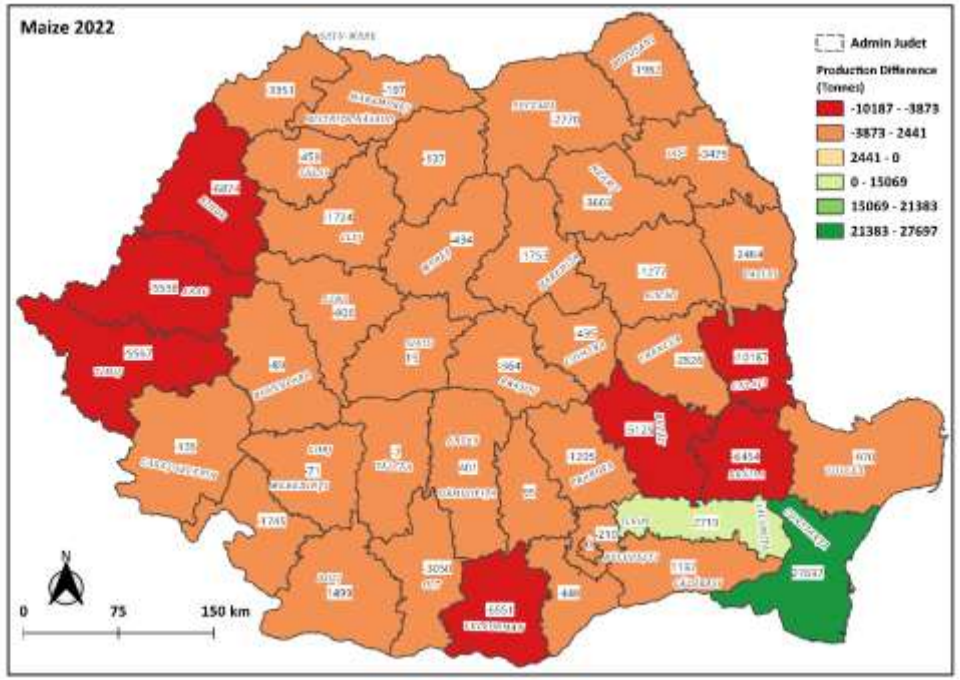


DATA: Copernicus Dry Matter Production RS data and government statistics

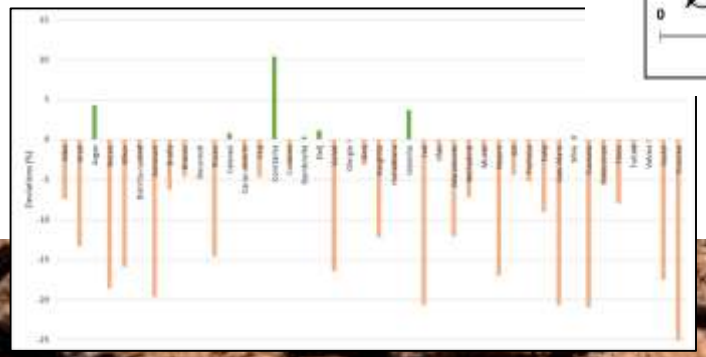
Maize production and yield in season April- September 22 were generally low

Maize Production (tonnes), difference from average in the county

Season 2: April to September

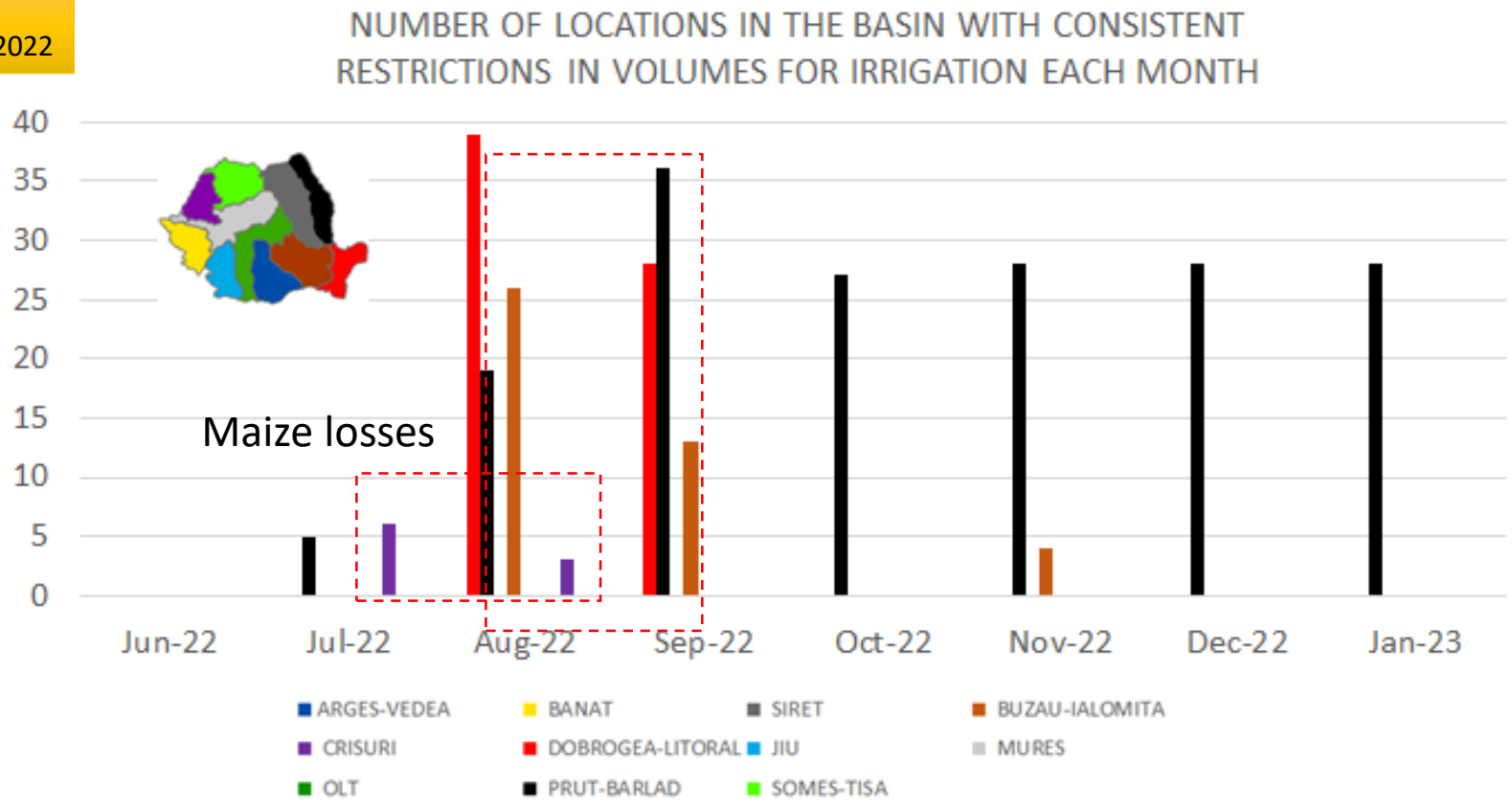


DATA: Copernicus Dry Matter Production RS data and government statistics

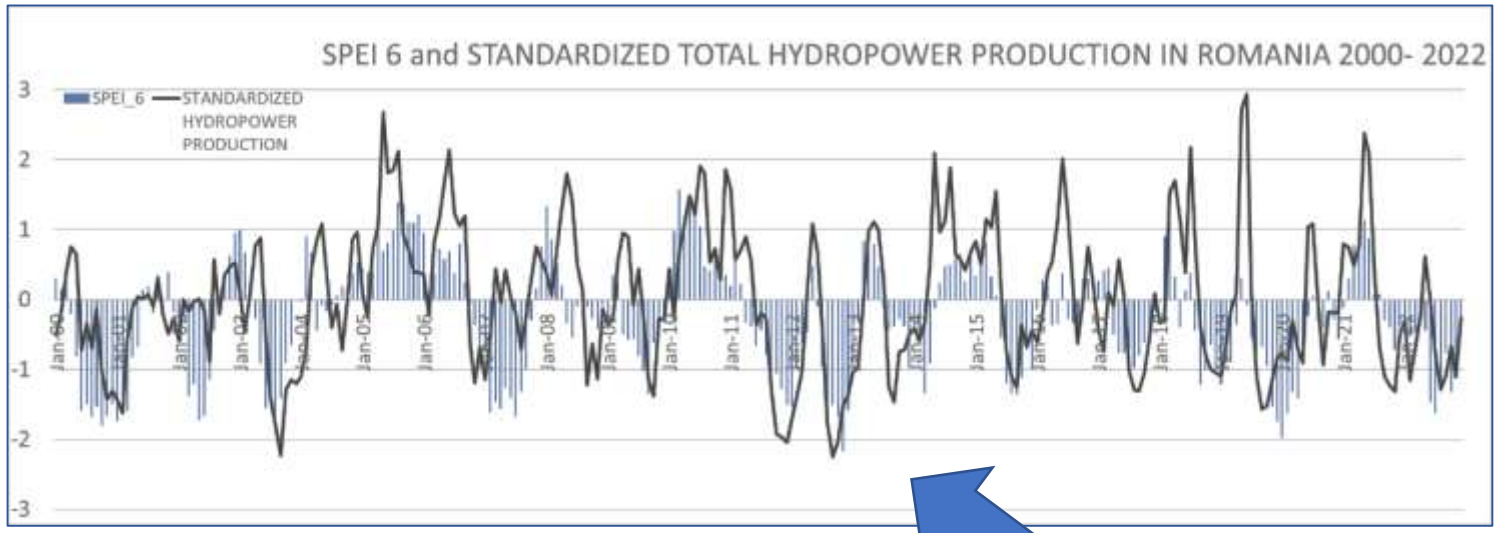


Some of the affected areas experienced restrictions in irrigation allocations during 2022

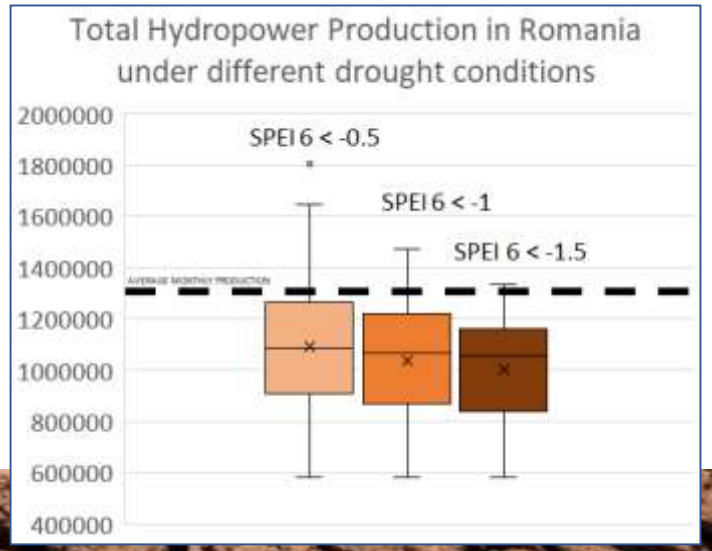
DATA:
ANAR, 2022



Seasonal drought controls hydropower production, and 2022 was not an exception



DATA: Hidroelectrica RO, megawatt hour production, 2000-2022

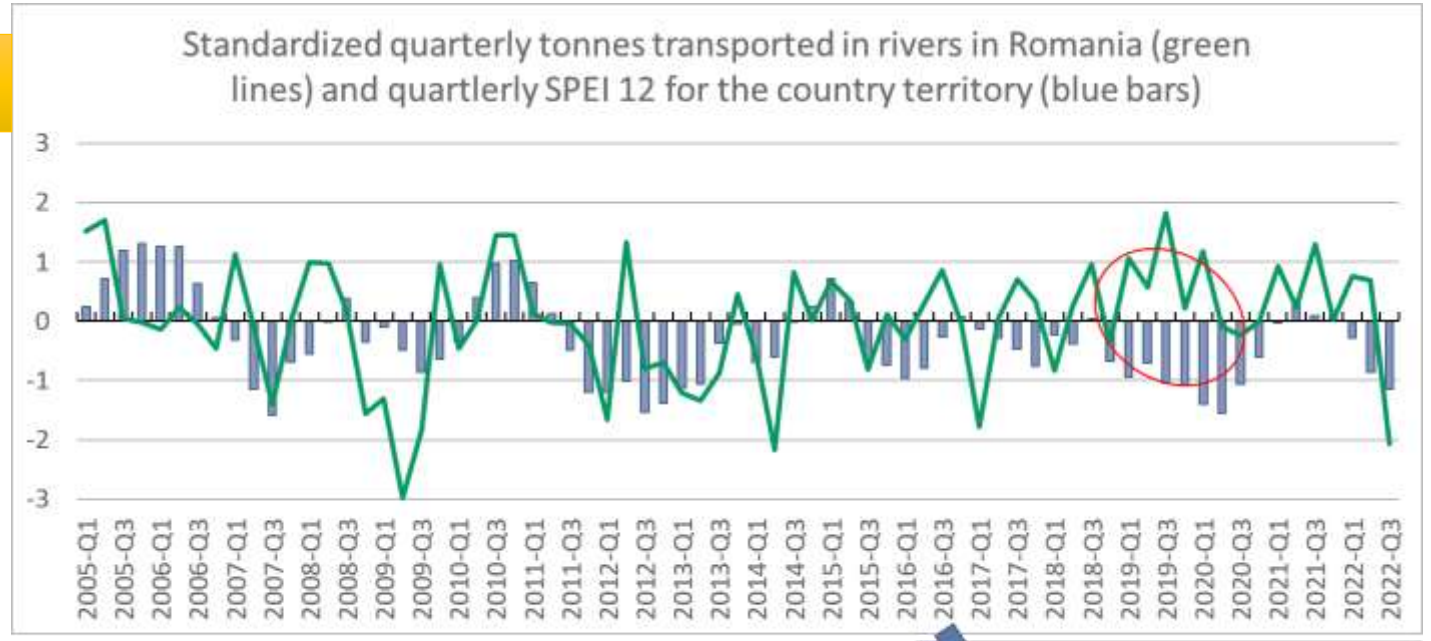


… every time that the previous 6 months have been significantly dry, hydropower production was anomalously low (it also matches ANAR data for water allocated for hydropower)

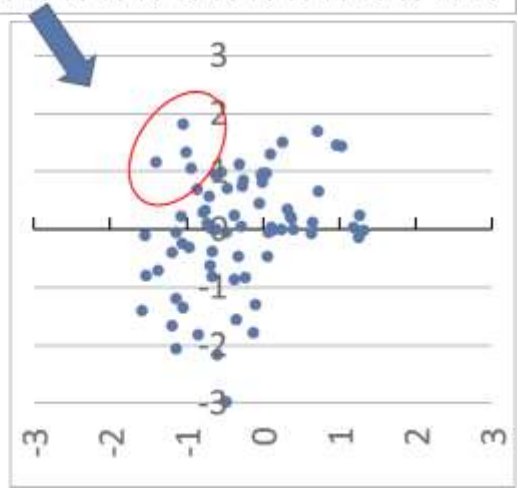
… with growing intensities of the drought, MWh production declines

Drought influences riverine navigation and transport

DATA: Eurostat, 2017- 2022

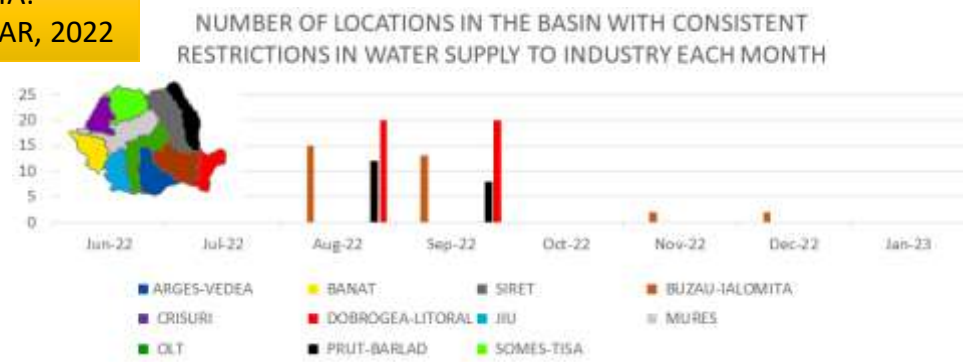


… **2019 is divergent**, transport grows even in drought
… **2022 has a minimum in transport** (drought+ other shocks? drought in the Danube basin? longer-term accumulation of deficit?)



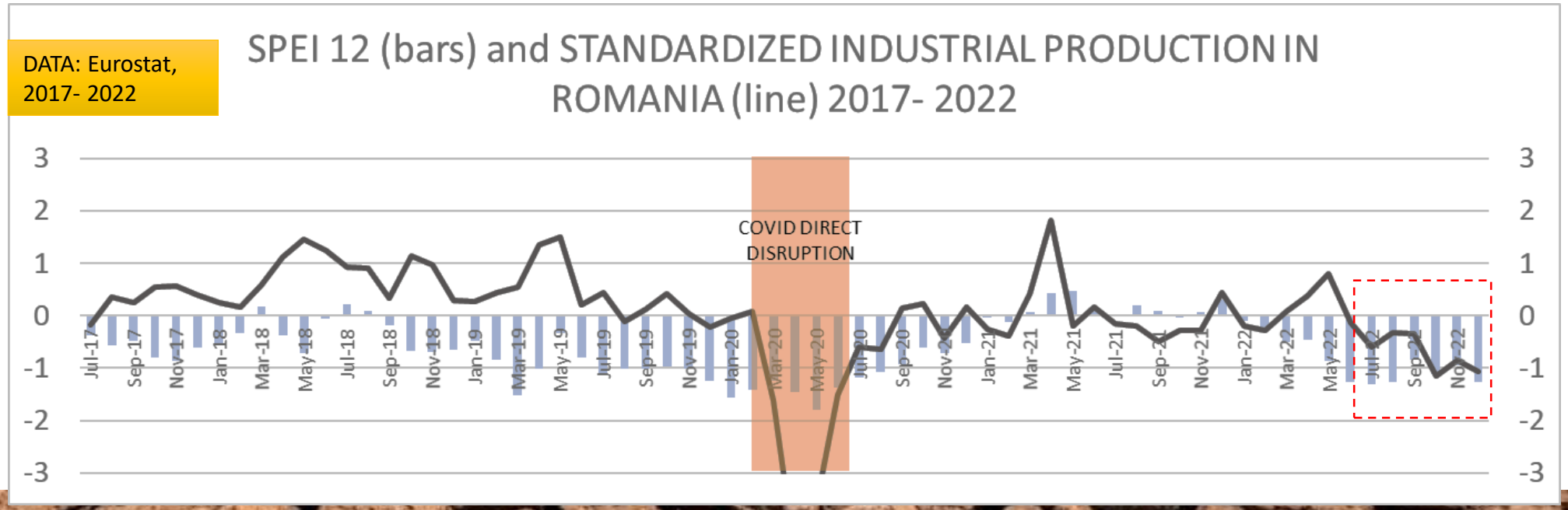
Restrictions of water allocated to industries in 2022 could have impacted production

DATA:
ANAR, 2022

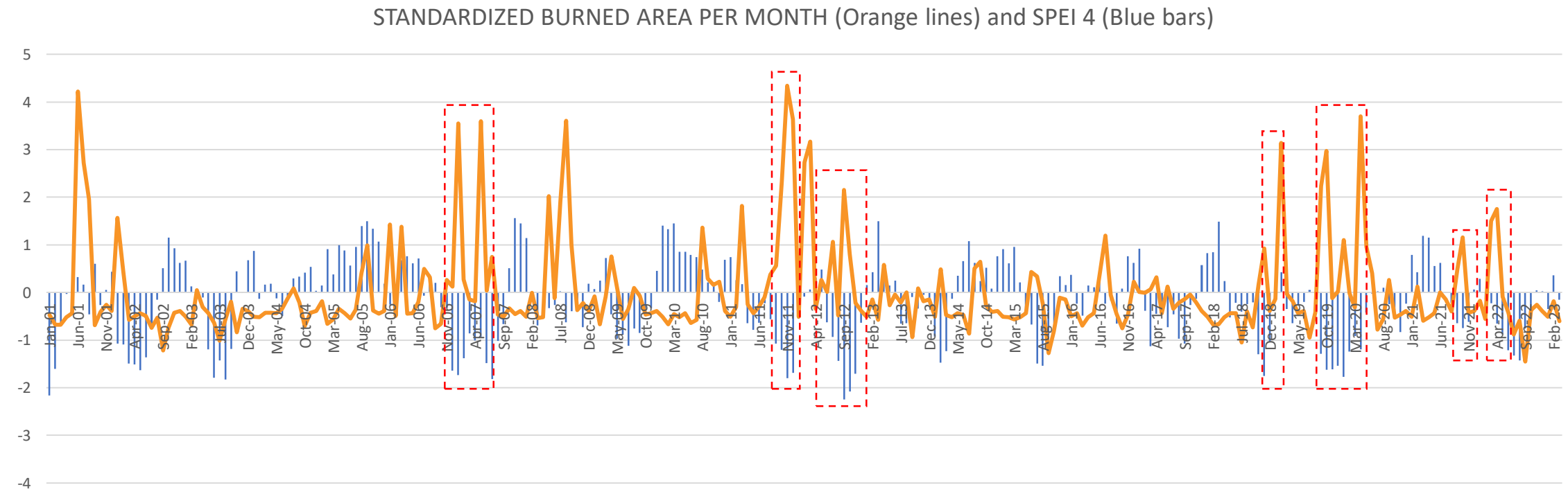


…industry has suffered restrictions in summer 2022, from those months production was much lower in the country (synergy with energy crisis)

DATA: Eurostat, 2017- 2022



Burned Area in Romania peaks with moderate seasonal drought



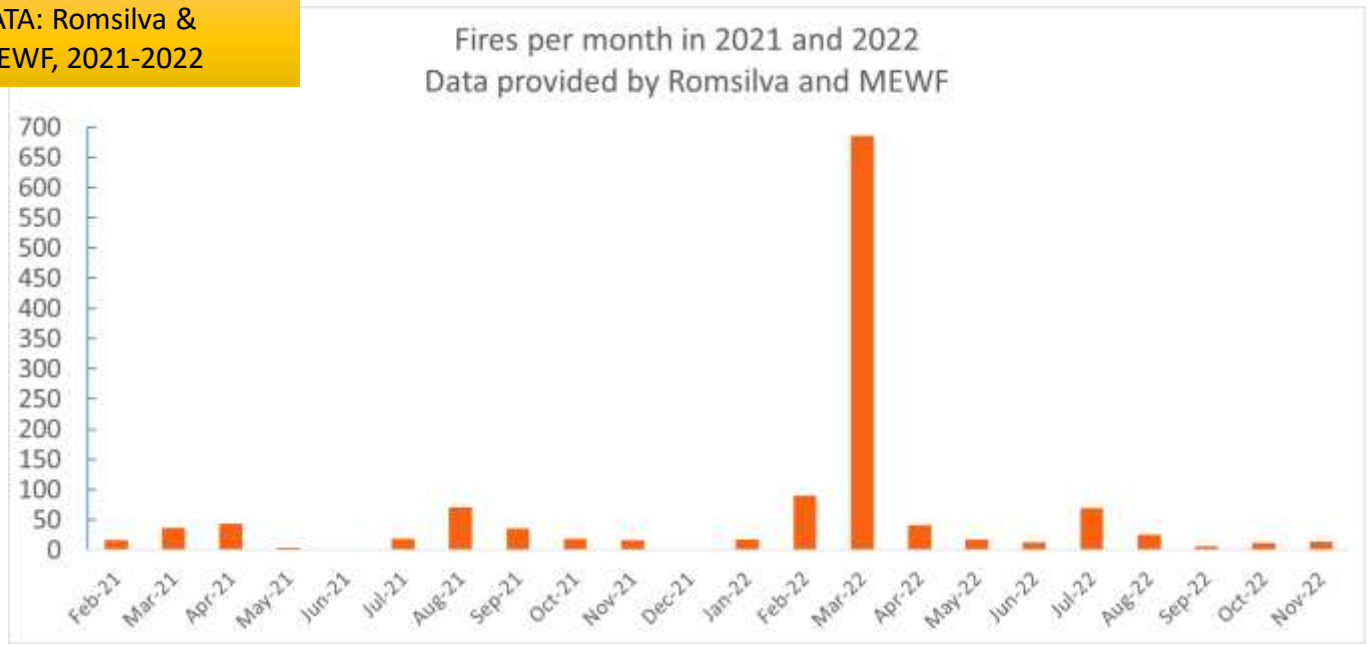
DATA: REMOTE SENSING BURNED AREA PRODUCT 2001-2023

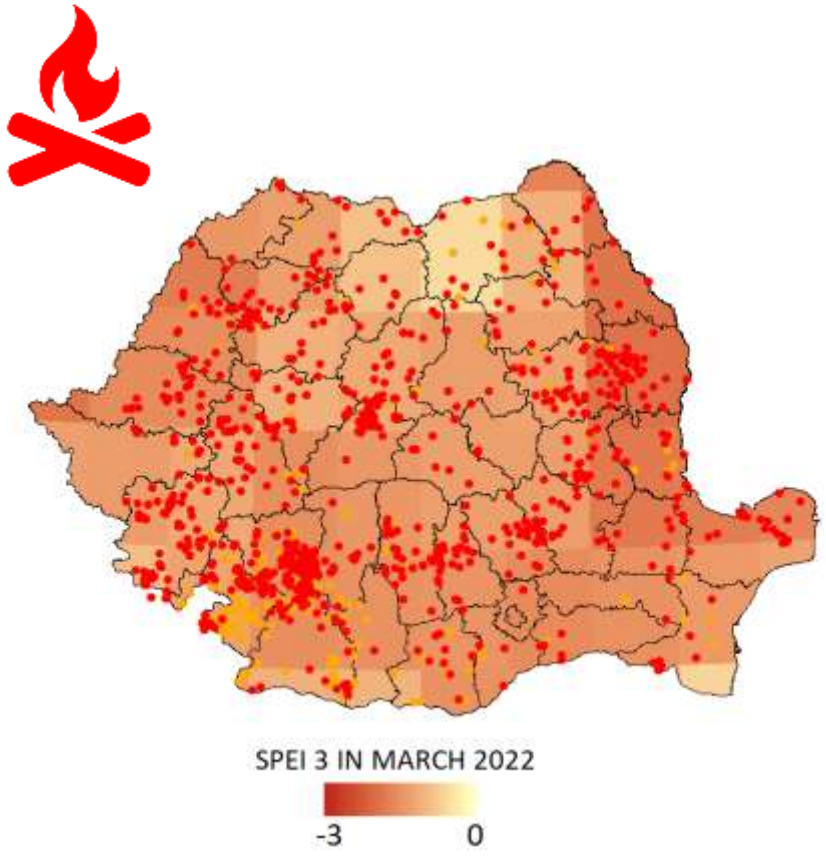
…according to a Remote Sensing analysis, most of the observed anomalies in burned area occur with SPEI4 deficit (<-1)

… similar patterns when the analysis is at the county level

Recent inventories of fires confirm the peaks when drought started intensifying in 2022

DATA: Romsilva & MEWF, 2021-2022





…the three first months of 2022 were anomalously dry, especially in the areas that registered more fires

With this and much more data, a deep-dive EC JRC/ EDORA data-driven risk assessment for Romania has been performed

EDORA

European Drought Observatory for Resilience and Adaptation

+

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- + Improve drought impact and risk assessment
- + Enhance cooperation between drought observatories in the EU
- + Drought management, policy and adaptation review

+

Academics and experts from all over Europe

THANK YOU!

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