



**ARSO METEO**  
Slovenian Environment Agency



# From drought watch to drought management at DMCSEE

dr. Andreja Sušnik

Workshop  
„When the Rain Stops: Drought on Subseasonal and Longer Timescale“  
September 9-14, Aspen, Colorado, USA



**DriDanube – Drought Risk in the Danube Region**  
Project co-funded by European Union funds (ERDF, IPA)



Drought reality in Europe/Slovenia

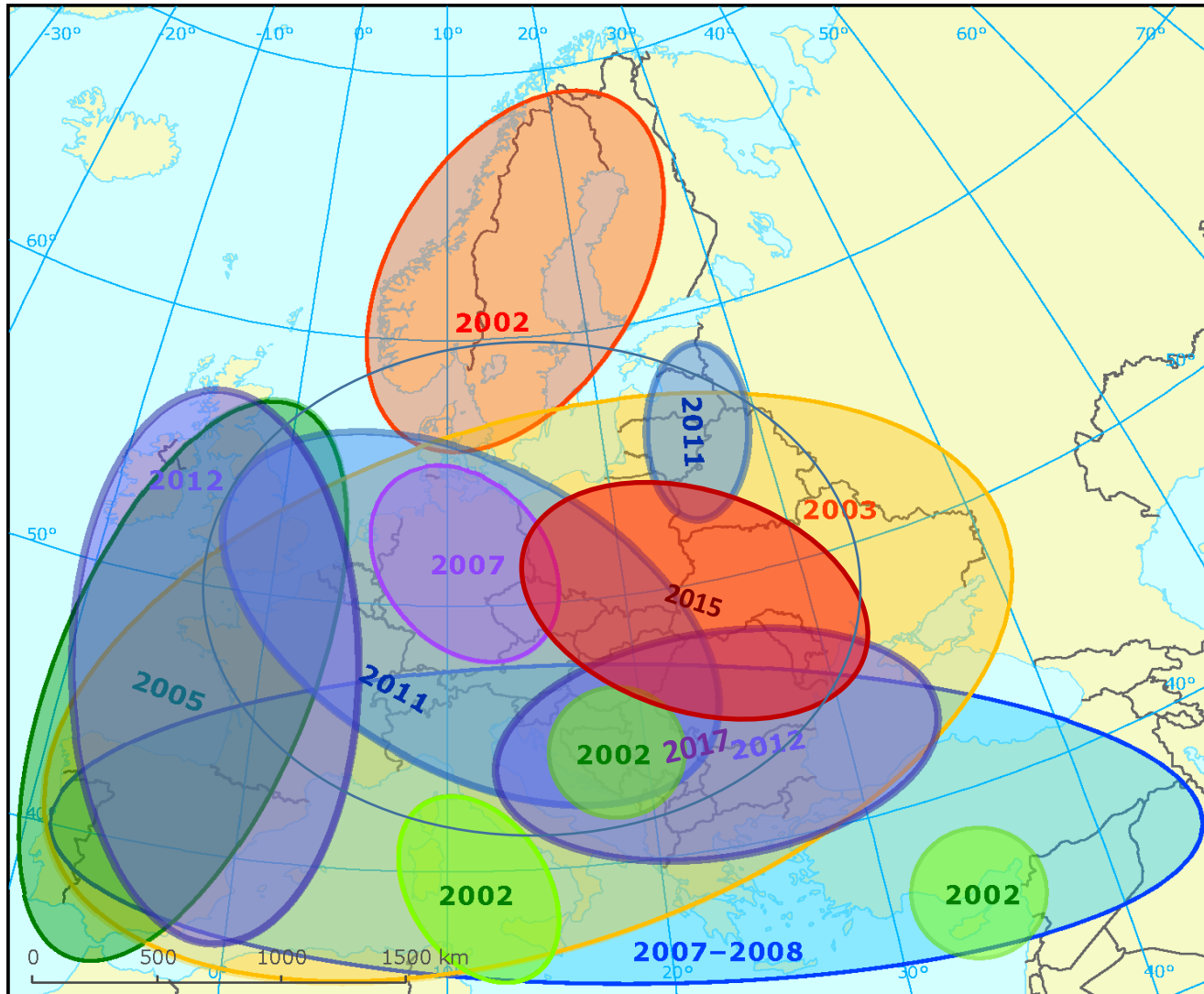
Multi sectoral impacts & monitoring tools

„Drought Projects“ DriDanube/DMCSEE

Global/regional cooperation

# Drought - increasing problem on European level

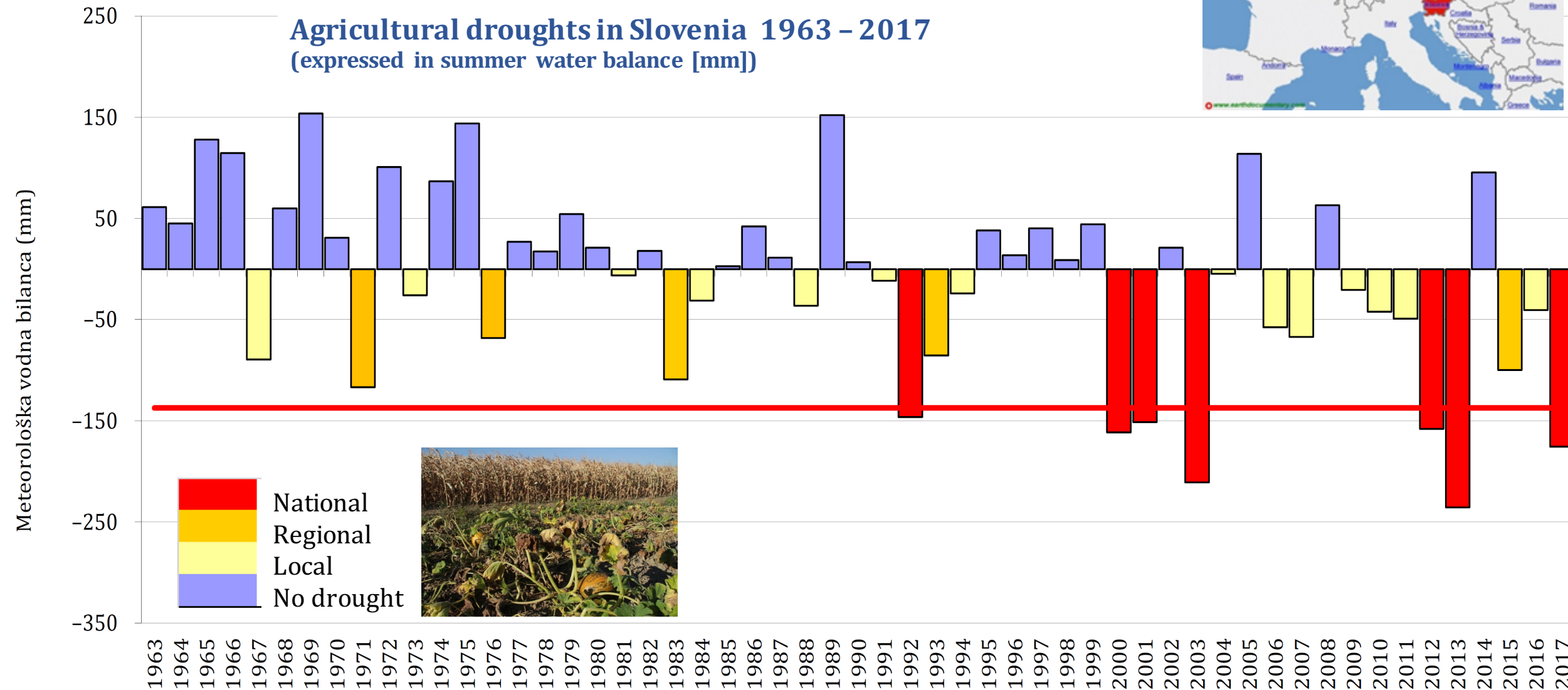
## European droughts 2002 – 2017



- In 1990s and 2000s, drought hotspots were Mediterranean area and Carpathian region;
- Large areas of EU have been affected by several major droughts in recent decades: significant European droughts occurred in 2003, 2011, 2015, 2017 in 2018. Many intense local droughts (2012, 2013).
- Severity and frequency of droughts have increased.
- Spatial and temporal variability is high.
- **Damage costs in 2003: 100 million people affected, 8.7 billion EUR.**

Source: (EEA, 2012; EEA, 2017)

# Ag drought reality in Slovenia





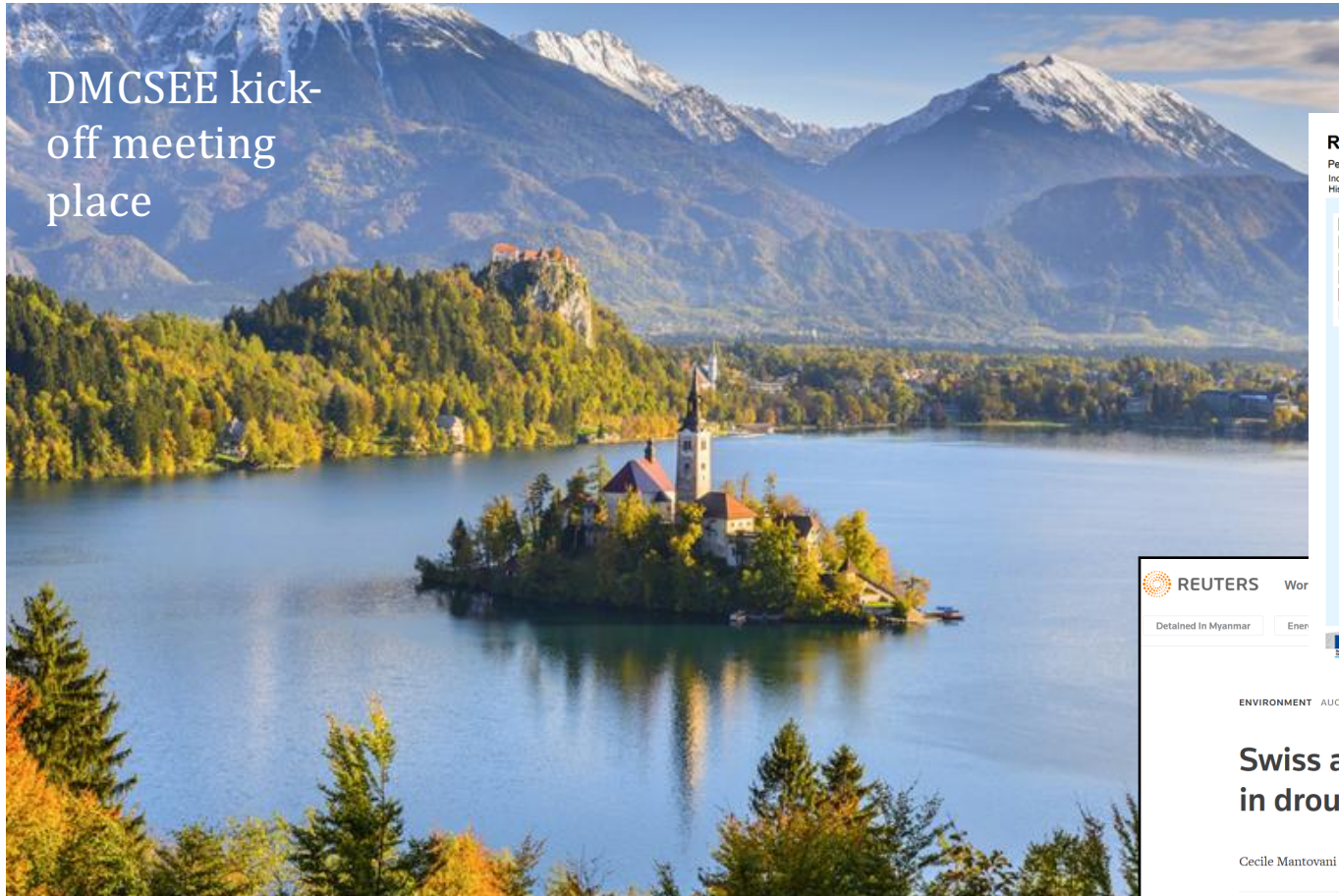
# Also rain rich countries are becoming drought-prone

MailOnline

## Dry ice: Thousands of holidays in the Alps ruined after the region is declared a 'drought zone' and resorts are banned from making fake snow

- Fifty resorts in Haute-Savoie will have to turn off snow cannons on their pistes
- If there is no downfall by the weekend, the machines will be banned in the region
- It has stretched water supplies after some places haven't seen snow in 50 days
- Across Europe, the warm weather and lack of snow is threatening ski seasons

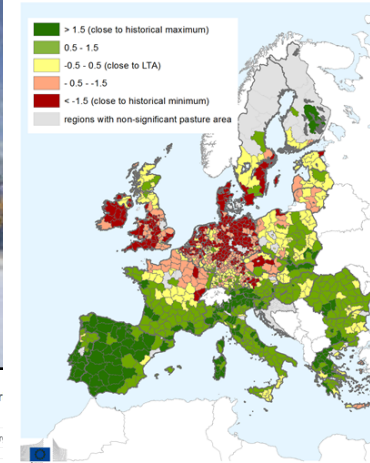
DMCSEE kick-off meeting place



Bled lake – Slovenia (Source: Siol.net)

### Relative index of pasture productivity

Period of analysis: 1 May - 31 July 2018  
Index based on Copernicus GEOV2 IAPAR 10-day product.  
Historical archive (LTA) from 1999 to 2017



REUTERS Wor

Detained In Myanmar Ener Future of Money

ENVIRONMENT AUGUST 7, 2018 / 4:38 PM / A MONTH AGO

### Swiss army airlifts water to thirsty cows in drought-hit pastures

Cecile Mantovani 2 MIN READ

ROSSINIÈRE, Switzerland - (Reuters) - Swiss army helicopters began airlifting water on Tuesday to thousands of thirsty cows who are suffering in a drought and heatwave that has hit much of Europe.





# Regional multi-sectoral drought impacts

In past decades, drought-related damages in the region of South-Eastern Europe (SEE) have had large impact on the economy and welfare, **mainly reflected in destroyed crops and devastated farmland** and other **water-related sectors**.

Agriculture
Navigation
Water supply (drinking water)
Energy (Hydropower)
Industry (cooling water)
Water quality
Ecology (Biodiversity)
Recreation
Others

Romania Energy/Utilities  
**Romania's Hidroelectrica Sees 15-25% Drop in Hydropower Output Because of Drought - Econ Min**

## Recent facts: Damage due to drought 2017

**Slovenia:** agriculture 65 mio EUR

**Czech Republic:** agriculture 120 mio EUR

**Bosnia and Herzegovina:** agriculture 126 mio EUR; 40 % losses in energy production (Bileća)

**Romania:** reduction of Danube flow for 60 % - higher electricity prices

**Serbia:** water shortage, dried-up lakes

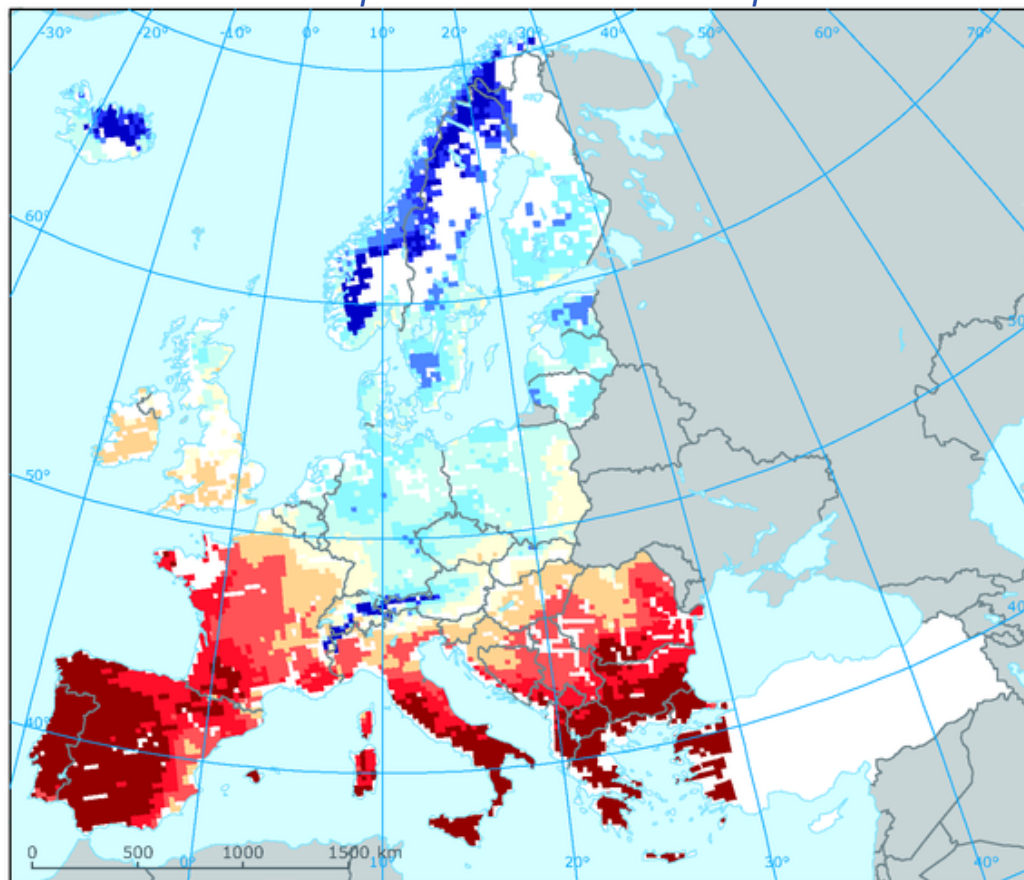


Suša "gasi" svjetla na Balkanu  
Amerin M. | četvrtak, 05. Septembar 2012 11:08  
Sviđa mi se Pošalji Budi prvi među svojim prijateljima kome se ovo sviđa.



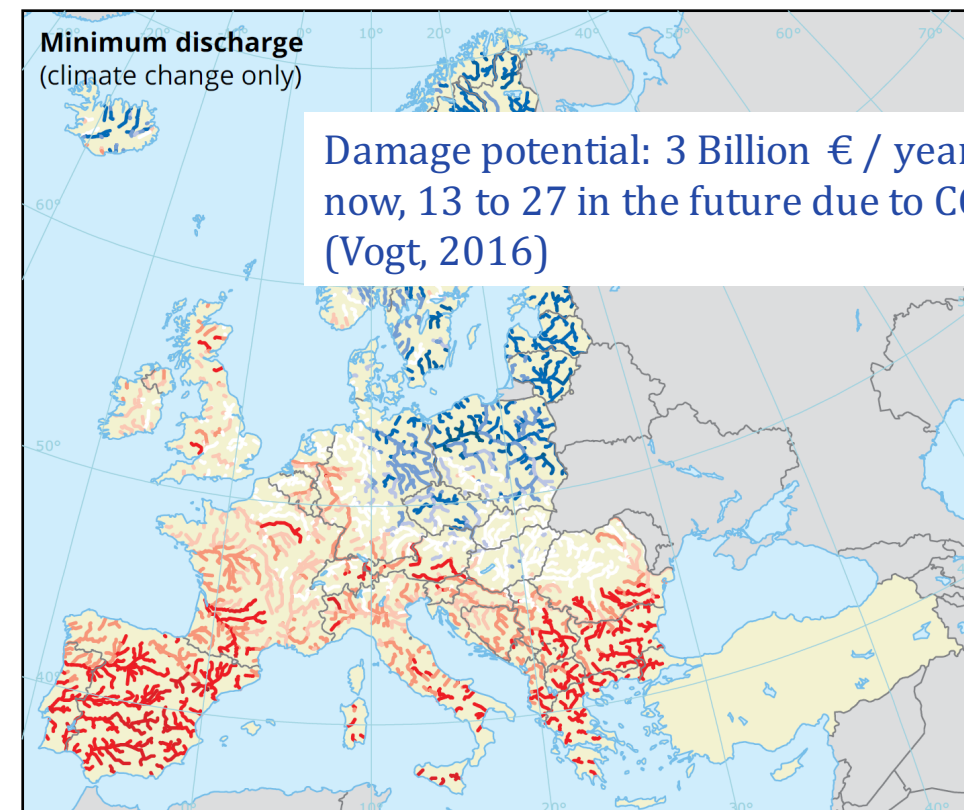
# Higher drought risk in the future?

Changes in *summer soil moisture* between 1961-1990 period and 2021-2050 period

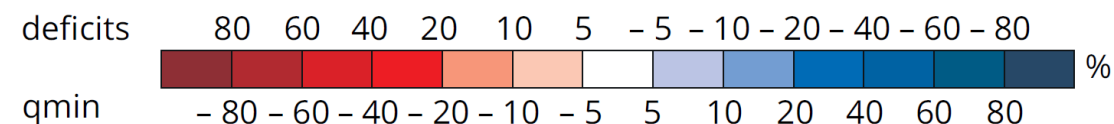


Source: EEA, 2017

Projected change in *20-year return level of minimum flow and deficit volumes* due to climate change

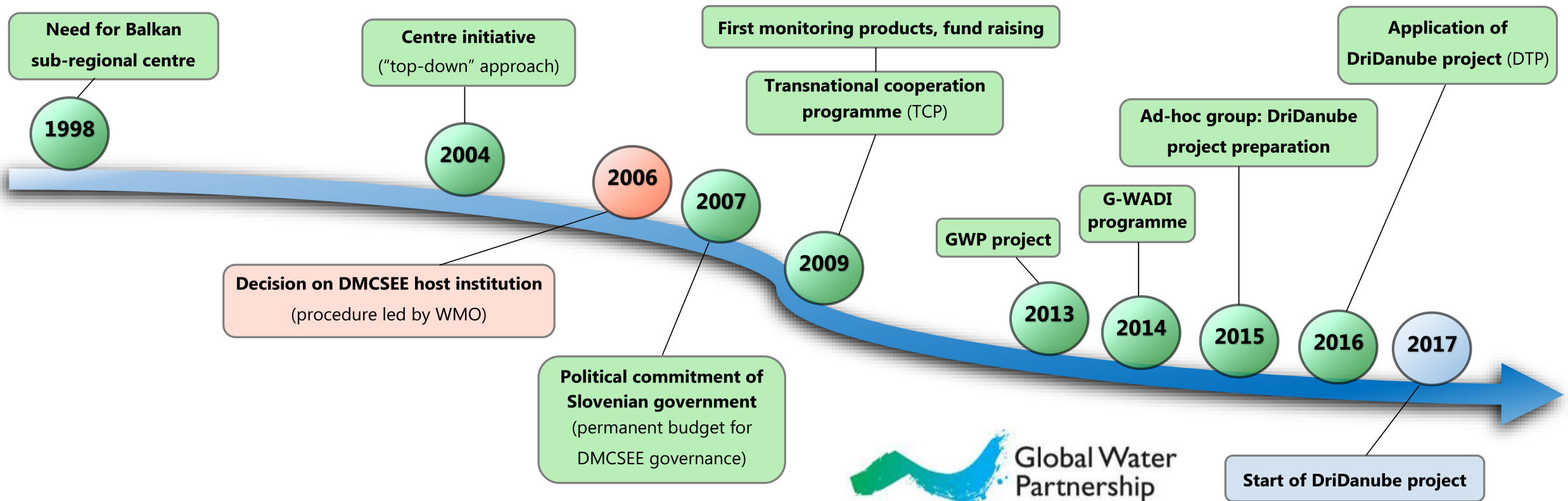


Damage potential: 3 Billion € / year now, 13 to 27 in the future due to CC (Vogt, 2016)



- Damage potential. Most affected regions bordering the **Mediterranean Sea** and **SEE regions** are expected to be especially dry – competition between different water users such as agriculture, industry and households

# Adaptation to drought with common approaches in SEE region







ARSO METEO

Slovenian Environment Agency



DMCSEE

Drought Management Centre  
for Southeastern Europe



SQ BG HR MK HU RO SI TR SR  
EN

#### Founding countries:

- Albania
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- FYROM
- Greece
- Hungary
- Moldova
- Romania
- Slovenia
- Turkey
- Montenegro
- Serbia

#### Founding agencies:

- WMO
- UNCCD



DMCSEE hosted by ARSO

- 13 countries
- web-based platform:  
**www.dmcsee.org**

### Drought Bulletin for SE Europe

Drought bulletin for SE Europe was formed in the scope of DMCSEE project in the framework of the Transnational Cooperation Programme. Please find more information (including Newsletters etc.) in section: [TCP project](#).

Recently, we have started to publish Drought Bulletin for SE Europe. Bulletin contains following sections:

- **Hot spot:** short (100 to 200 words) summary, possibly including a figure. It aims at very short insight of possible circumstances of drought at the time of issue.
- **Additional and auxiliary information** such as methodology used, more detailed information on water balance and temperature situation.
- **Report on impacts:** content of this section is based on information available in electronic media on the internet. To improve the information, **you are most welcome to participate by informing us of drought impacts in the current season in your region.** Send your contribution and comments through our [contact](#). Also any other comments on the bulletin content would be highly appreciated.

Please find published issues of bulletins in PDF format below.

#### Related documents

- Drought bulletin - 21st August 2018 (1,8MB)**
- Drought bulletin - 12th July 2018 (1,8MB)**
- Drought bulletin - 14th June 2018 (1,5MB)**
- Drought bulletin - early spring 2018 (2,1MB)**

# Operational system of DMCSEE

## Short term forecast

Outlook (up to 10 days ahead)  
NWP model forecast

## Real time monitoring

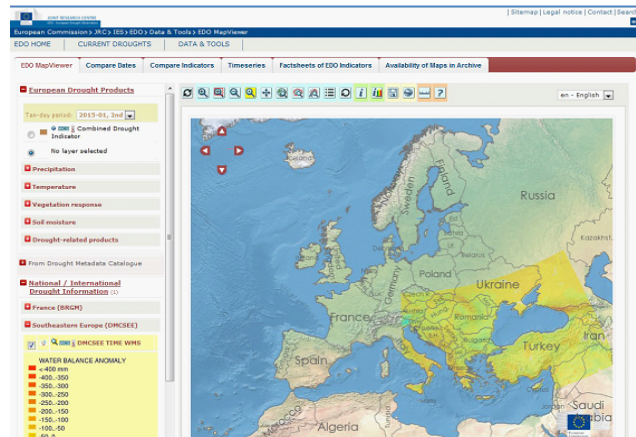
SPI index (GPCC)  
Station data (Slovenia only)  
NWP analysis:  
- precipitation anomaly  
- water balance anomaly  
Remote sensing: LSA-SAF

## Long term forecast

Not operational  
Cooperation with VCCC  
(Serbia)

**Seasonal forecast SEECOF**  
<http://www.seevccc.rs/SEECOF/SEECOF-18/Pre-COF/>

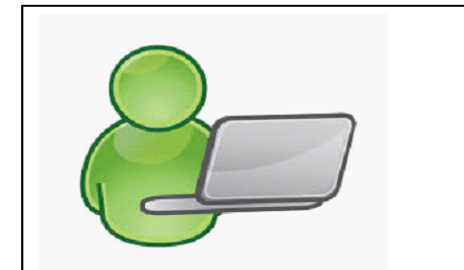
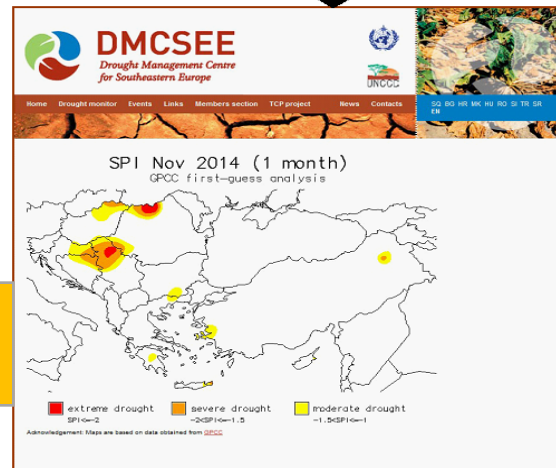
## International exchange (EDO)



## Database Map server

## Historical reconstruction

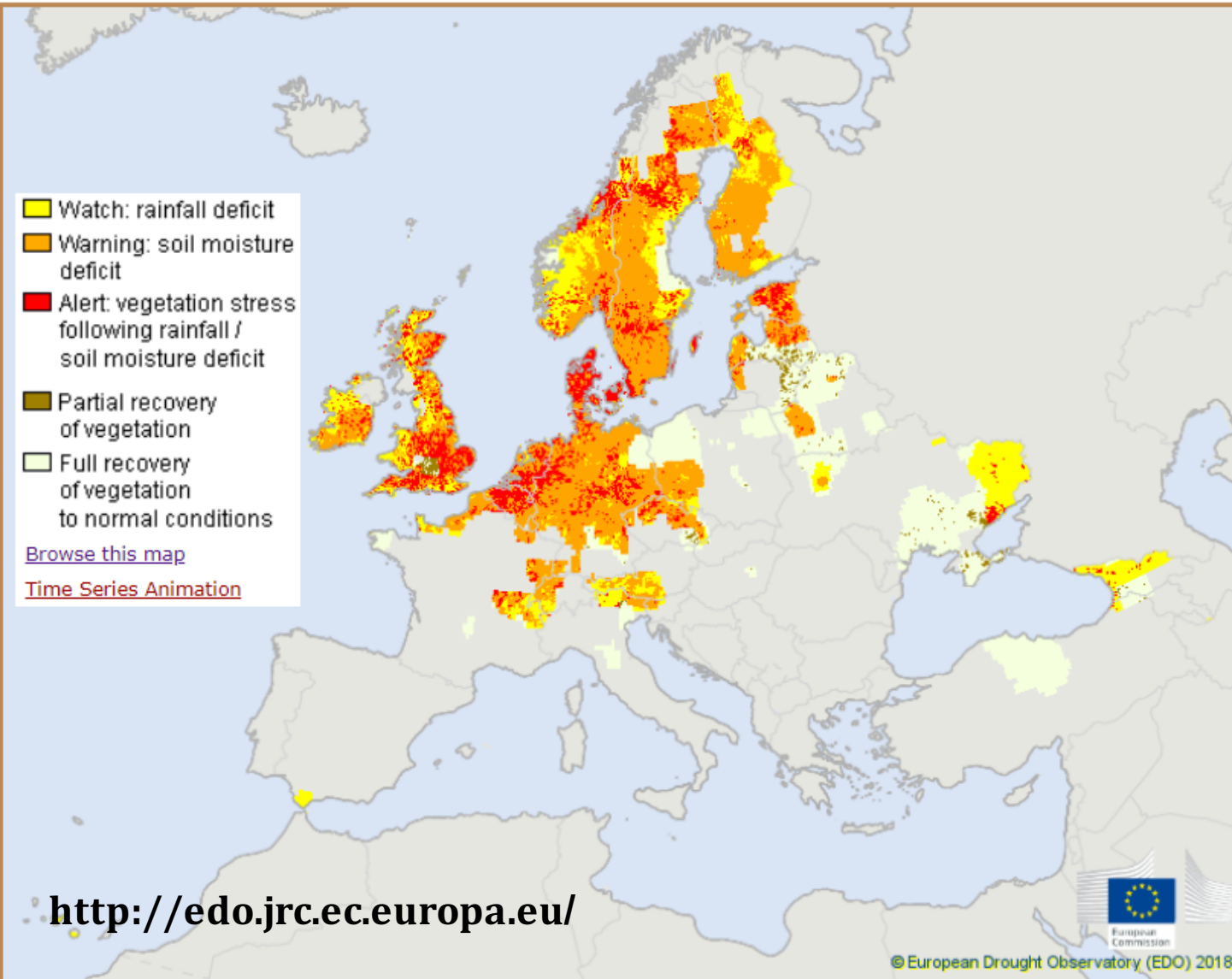
Station and raster archive  
Impact archive



**European Drought Observatory (EDO)**  
- <http://edo.jrc.ec.europa.eu/>

# Drought in 2018 – European Drought Observatory (EDO)

Combined Drought Indicator, 2nd decade of August 2018



- Established after 2011 & cooperation with DMCSEE
- leading disseminator on drought-relevant information and maps of indicators derived from a range of different data sources

- Watch: rainfall deficit
- Warning: soil moisture deficit
- Alert: vegetation stress following rainfall / soil moisture deficit
- Partial recovery of vegetation
- Full recovery of vegetation to normal conditions

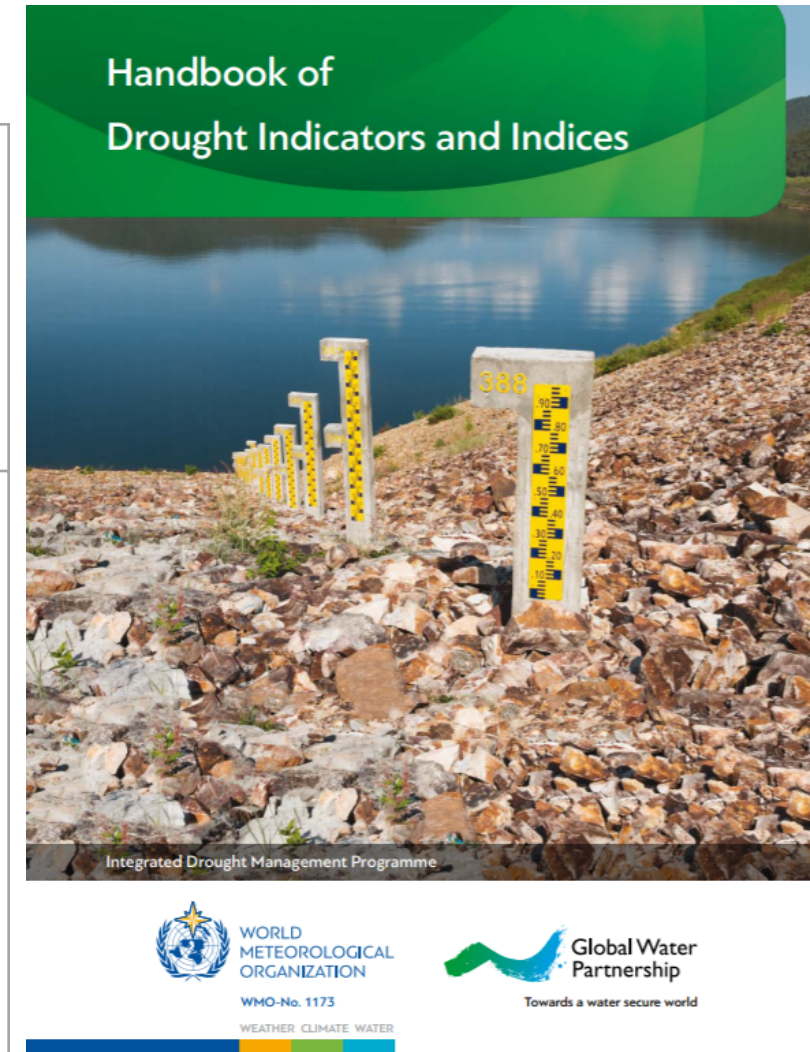
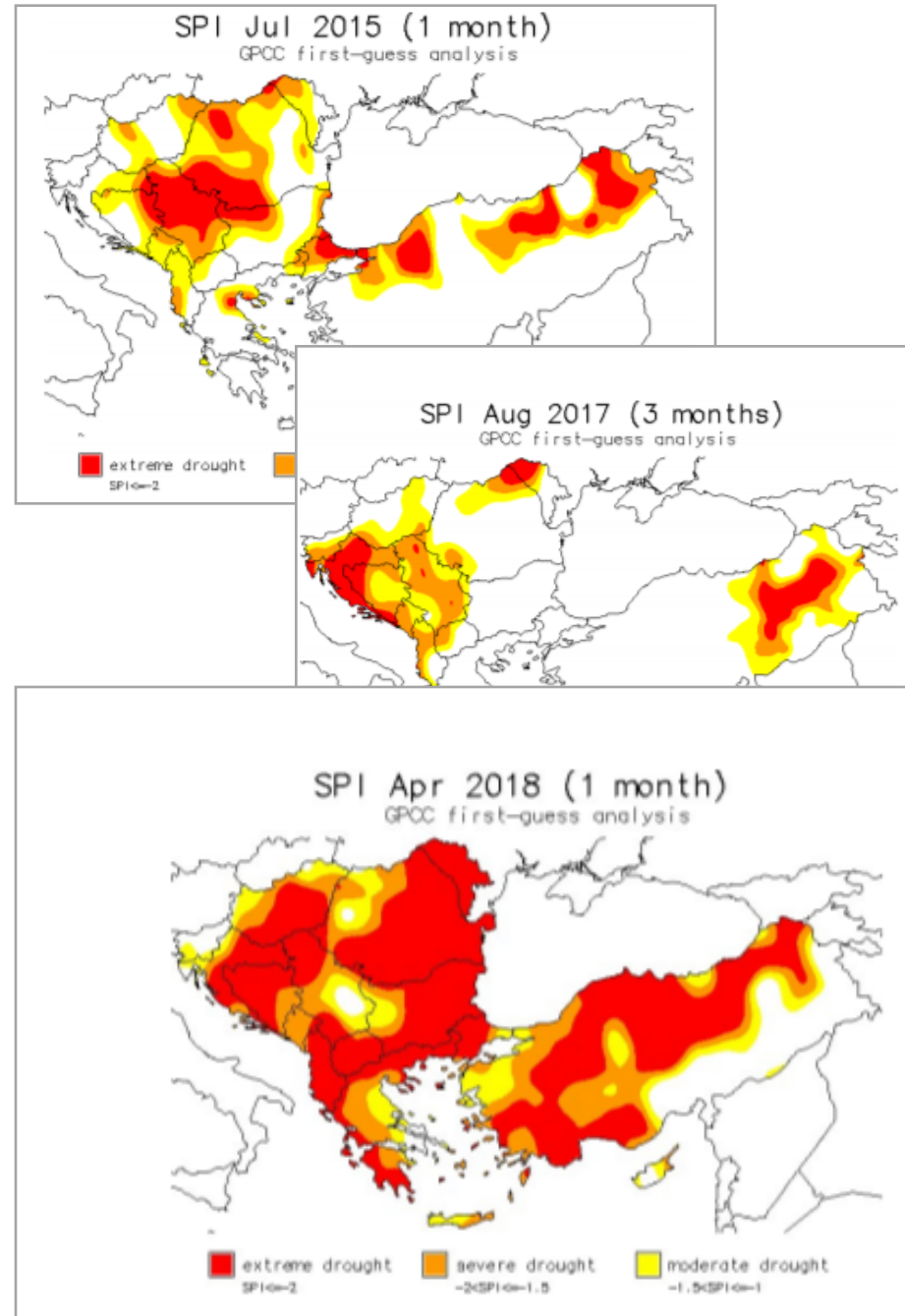
Source: Joint Research Center, EDO – European Drought Observatory, URL, 2018

<http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1000>



# How to guide drought EWS?

- Using a single indicator or index,
- Using multiple indicators or indices,
- Using composite or hybrid indicators.
- DEWS is ultimately concerned with impacts.
- In 2009, WMO recommended SPI as the main meteorological drought indicator.



# Monthly drought bulletin in SE Europe – vegetation season

[http://www.dmcsee.org/en/drought\\_bulletin/](http://www.dmcsee.org/en/drought_bulletin/)

- **Hot spot** - short summary, short insight of possible circumstances of drought at the time of issue.
- Additional and auxiliary information (methodology used, detailed info on surface water balance, temperature and SPI situation)
- **Report on drought impacts** (scarce info about drought impacts in the region!)
- **Outlook**



## DROUGHT MONITORING BULLETIN

21<sup>st</sup> August 2018

### HOT SPOT

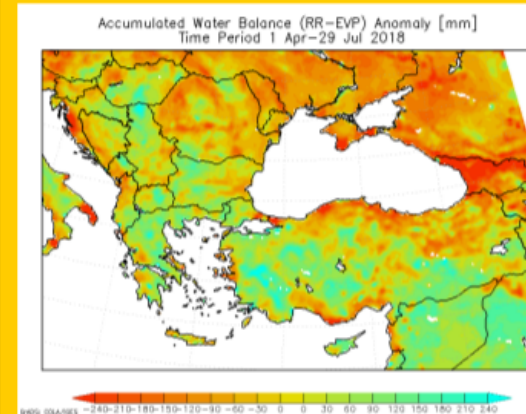


Figure on the left shows **accumulated surface water balance between 1<sup>st</sup> April and 29<sup>th</sup> July**. In comparison to accumulation from April to June, areas with positive surface water balance intensified and widened. Larger drier-than-normal areas persisted across northeastern Turkey and along the coasts in north and south of the country. Drier parts of Balkan Peninsula in this 4-month period are noticed in Romania and Moldova, along Adriatic coast from Croatia to northern Albania and in some smaller isolated parts in Hungary, Serbia, Bulgaria and Greece.

# WHY?

## Current status

### Monitoring

- untimely delivery
- cross-border inconsistencies
- lack of integration of risk and impact data
- increase in the number and duration of droughts in the Danube region in last decades (in 2003, 2007, 2015, 2016, 2017)

### Impacts and risk assessment

- no systematic collection of drought impacts
- lack and incomparable drought risk assessment methodologies
- despite the impacts on the economy and welfare of people, mainly in agriculture, drought is still not considered an issue of high priority

### Management

- reactive, dealing mainly with losses and damages
- cooperation between key actors is missing
- formal legislation does not exist

## Moving from SEE to CEE - motivation for „drought“ project in Danube countries

**Drought is becoming one of the major challenges in water management in the Danube region.**





# Drought Risk in Danube Region

## DriDanube

- Project financed by European regional development funds (85%)
- Lead partner: ARSO/DMCSEE
- Project budget: 1,974,750.00€
- Duration of project: 30 months (January 2017 – June 2019)



**7 EU countries**  
**3 Non-EU countries**  
**15 partners**  
**8 strategic partners**



#### Lead Partner:

- Slovenian Environment Agency (ARSO), Slovenia

#### Partners:

- EODC Earth Observation Data Centre for Water Resources Monitoring GmbH (EODC), Austria
- Global Change Research Institute CAS, (CzechGlobe), Czech Republic
- Global Water Partnership Central and Eastern Europe (GWP CEE), Slovakia
- Hungarian Meteorological Service (OMSZ), Hungary
- Vienna University of Technology (TU Wien), Austria
- Szent Istvan University (SZIU), Hungary
- National Meteorological Administration (NMA), Romania
- Centre of Excellence for Space Sciences and Technologies (SPACE-SI), Slovenia
- Meteorological and Hydrological Service (DHMZ), Croatia
- Slovak Hydrometeorological Institute (SHMU), Slovakia
- Faculty of Agriculture, University of Novi Sad (FAUNS), Serbia
- Republic Hydrometeorological Service of Serbia (RHMS), Serbia
- Institute of Hydrometeorology and Seismology (IHMS), Montenegro
- Republic Hydrometeorological Service of Republic of Srpska (RHMZ RS), Bosnia and Herzegovina

#### Associated Strategic Partners:

- International Commission for the Protection of the Danube River (ICPDR), Austria
- Administration of the RS for Civil Protection and Disaster Relief (URSZR), Slovenia
- The State Land Office (SLO), Czech Republic
- Agricultural Station/Forecasting and Warning Service of Serbia in plant protection (PIS), Serbia
- Environment Agency Austria (EAA), Austria
- Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW), Austria
- Ministry of Environment and Energy, Water management directorate (MZOIE), Croatia
- Ministry of Agriculture (FM), Hungary

#### Partners per country:

Slovenia - 2  
Austria - 2  
Czech Republic - 1  
Slovakia - 2  
Hungary - 2  
Romania - 1  
Croatia - 1  
Serbia - 2  
Montenegro - 1  
Bosnia and Herzegovina - 1

# Main Outputs are coming soon

**Improved drought emergency response** and better cooperation among operational services and decision-making authorities in the Danube region.

## **Drought User Service**

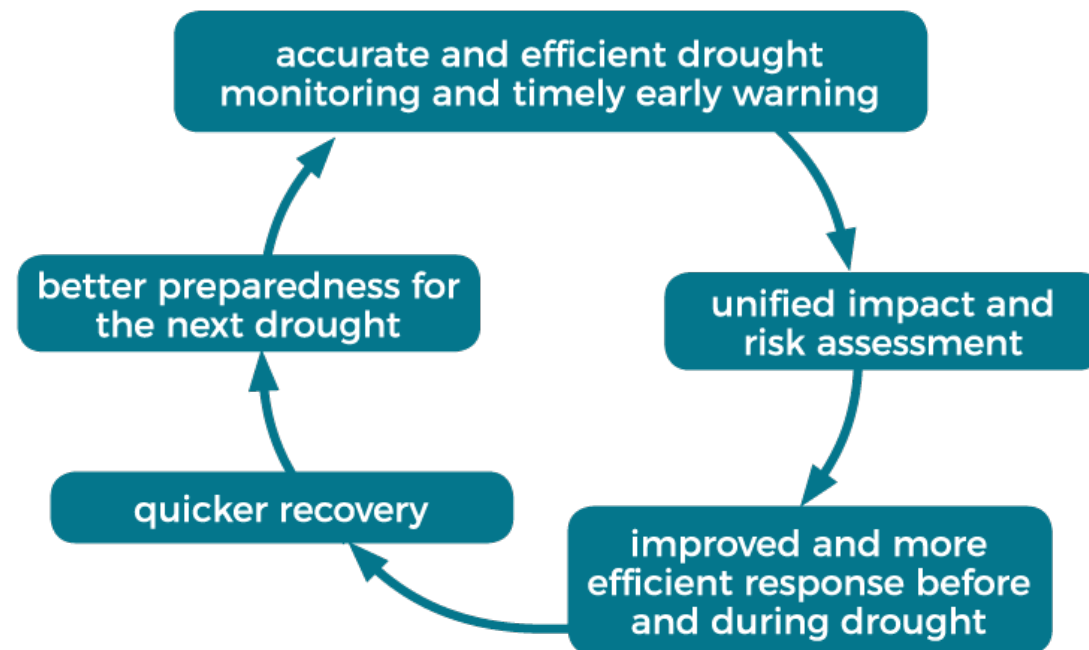
An innovative tool integrating all available data, including large volume of remote sensing products and serving the authorities to monitor, forecast and respond during drought development faster and with higher precision.

## **Methodologies for drought impact and risk assessment**

Unification and cross-border coherence of drought Risk and Impact assessments. Establishment of network of reporters as additional source of information for drought impacts in agriculture.

## **DriDanube Strategy**

A clear guidance for overcoming the gaps in the drought decision-making processes and improvement of drought emergency response in the Danube region.



# Result 1: Drought User service – DUS

- Web-based interface for drought monitoring in real-time
- Source of data: satellite (Big Data), meteorological data

Some integrated products:

**SWI anomalies** – product to express amount of water contained in soil (daily)

**NDVI anomalies** – Vegetation greenness/vigor (decadal)

**SWB** – Surface Water Balance from numerical weather prediction (NWP) model

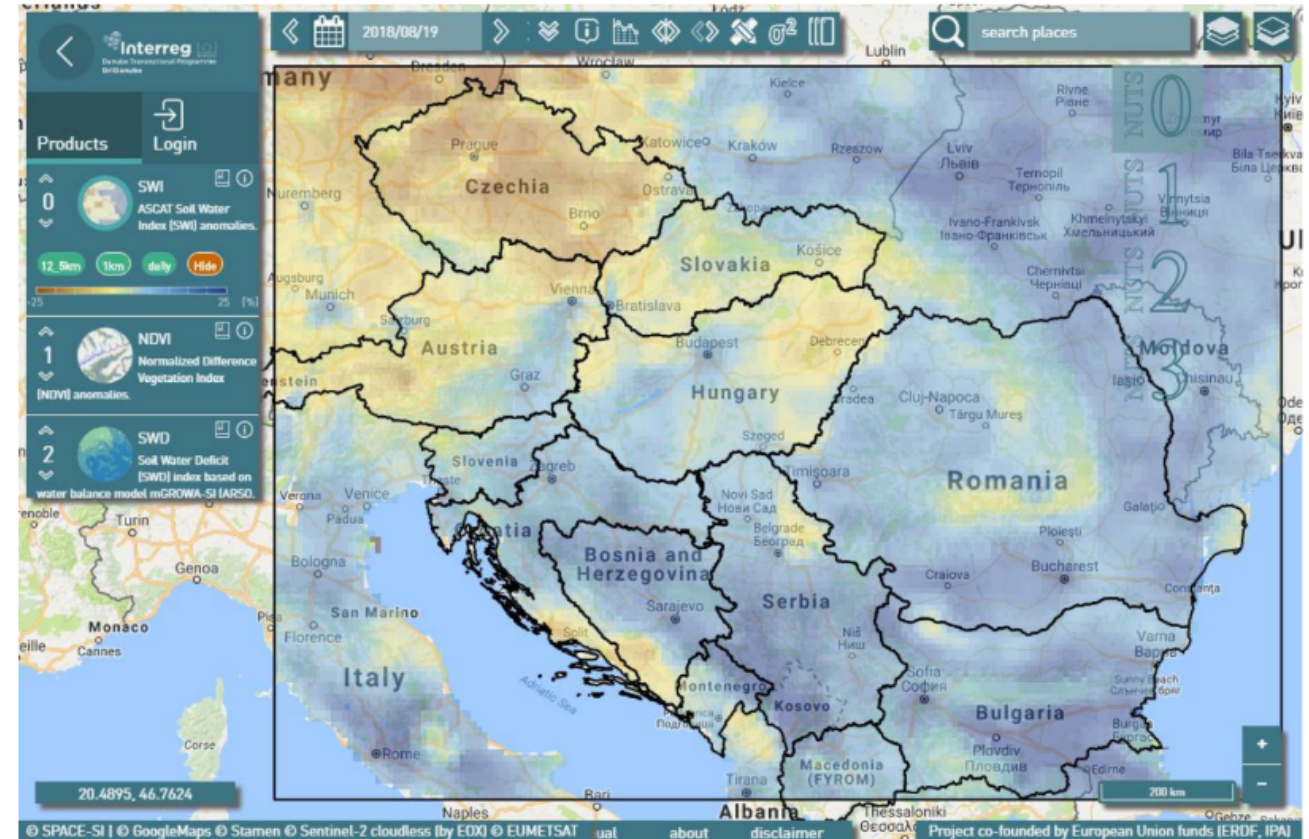
**SWBSLO** – Surface Water Balance from numerical weather prediction (NWP) model for the territory of Slovenia

**VegCon1** – Relative vegetation condition for crops and grasslands

**VegCon2** – Relative vegetation condition for all vegetation types

- **drought reporters/impact maps.**

Soil Water Index on 19 August 2018 across the region as seen in Drought User Service



*About Soil Water Index (SWI) in Drought User Service: Based on remote sensing data, SWI daily images show SWI anomalies on a 1-km spatial resolution to provide daily information on moisture conditions in soil depth of around 0-40 cm. SWI anomalies are calculated as a difference between SWI of a certain day and the average of 2007-2017 period of the same day. Negative anomalies are presented in shades of yellow-brown and positive anomalies are presented in shades of blue, and can be used to describe soil water deficit or soil water surplus, respectively.*



# DriDanube Questionnaire for reporters - entry

DriDanube Questionnaire

About Project Contact

## DriDanube - Drought Risk In The Danube Region

The main objective of DriDanube project is to increase the capacity of the Danube region to manage drought related risks. Your contribution to the project bring the information about drought impacts currently in real time from your locality. Thank you for your cooperation.

<http://questionnaire.intersucho.cz/en/>

### How it works

1

#### Register

The automatical registration will be created with the first filling in a questionnaire. Please, use your email adress to login to the system thereafter.

2

#### Fill in questionnaire

Please, make sure you complete your questionnaire carefully according to field of your activity at the location of your business conducting. Instructions for questionnaire completing are attached [HERE](#).

3

#### Continue in work

Please, keep reporting every week. Reporting continuity is core for entire cooperation. If you need an assistance, do not hesitate to contact us.

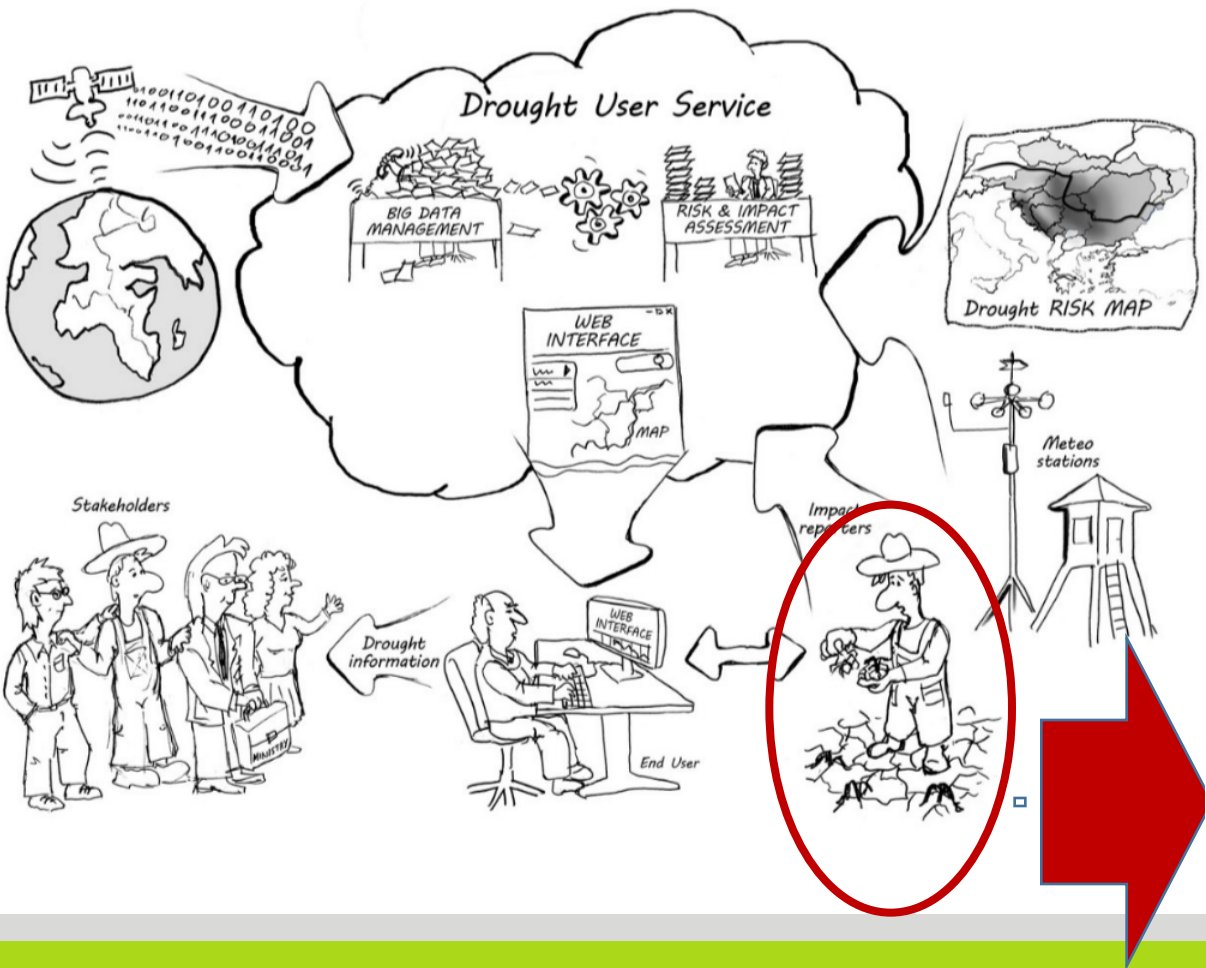


Vir: <https://blog.donedeal.ie/2013/09/make-farming-21st-century>

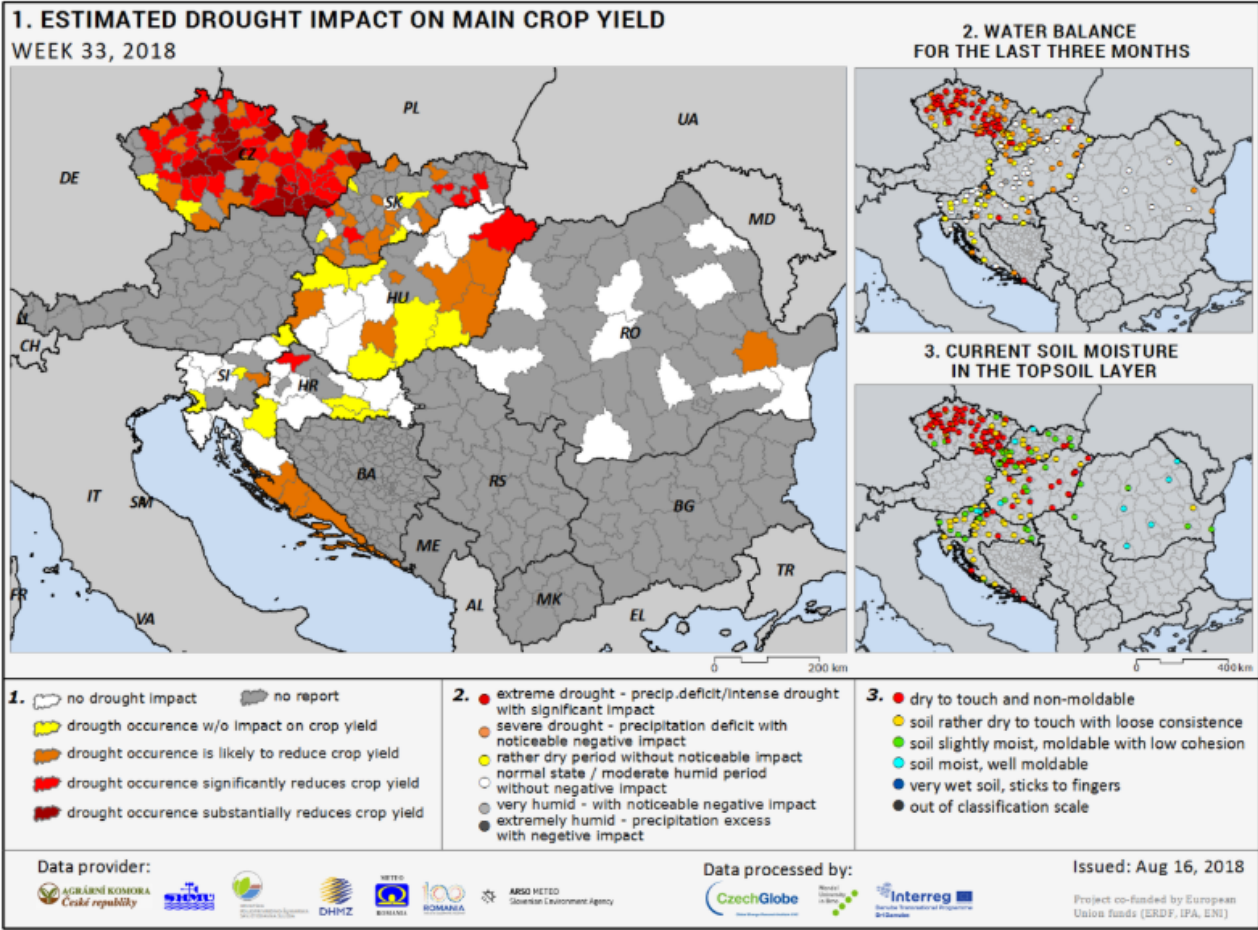




# Result 2: Metodology for drought impacts assessment – interactions with reporters on weekly routine



Estimated drought impacts on vegetation for week 33 (between August 6-16)



# Drought Watch report in Danube region 2018

Will Danube region experience drought in 2018 again?  
Let's follow its development with DriDanube tools!

## DriDanube Drought Watch

### Regional Drought Situation



Drought User Service map



Impacts map

## Drought Risk in the Danube Region

Home  
Partners  
Library  
News and events  
Gallery  
Newsletters  
Contact  
Calendar of events  
Operations  
Project videos  
Project promotion  
Drought 2018 Watch

## DROUGHT 2018 WATCH

Will Danube region experience drought in 2018 again?  
Let's follow its development with DriDanube tools!

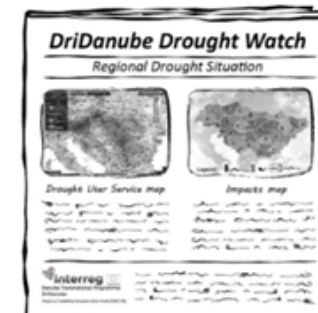
Welcome to

our DriDanube Drought 2018 Watch section.

This summer we decided to test DriDanube tools, the prototype of our Drought User Service and our constantly growing reporters network, to monitor the drought situation in the Danube region.

We will be regularly publishing the Regional drought bulletins, together with the maps documenting the situation. This current information will be provided by DriDanube partners from 10 countries.

Watch this space to check our Regional drought situation reviews!



Be prepared. Know the risks. Take action.

### REGIONAL DROUGHT SITUATION REVIEW No.5 Week 30 and 31 (23 July – 5 August 2018)

In this issue you will find:

- Summary of the state of soil
- Summary of the impacts on vegetation
- Summary of the impact reports

Click for the full report [HERE](#)



### REGIONAL DROUGHT SITUATION REVIEW No.4 Week 28 and 29 (9 – 22 July 2018)

In this issue you will find:

- Summary of the state of soil
- Summary of the impacts on vegetation
- Summary of the impact reports



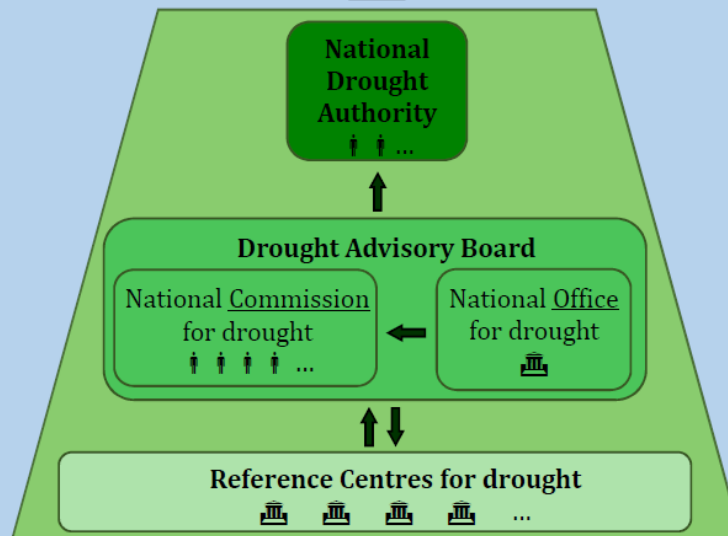


# Result 3: DriDanube Strategy

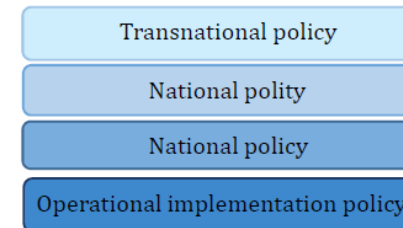
**International, regional policy**  
strategies, conventions, resolutions, agreements...

**National polity**  
legislation itself and the way it is implemented

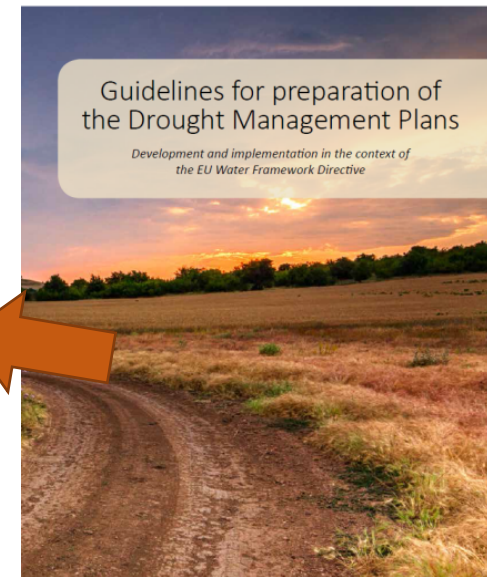
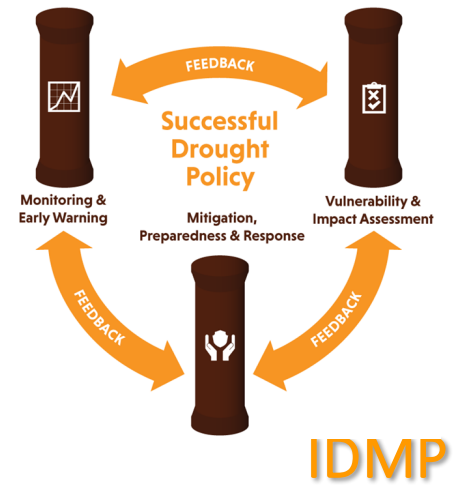
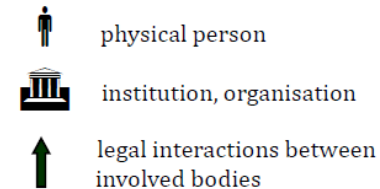
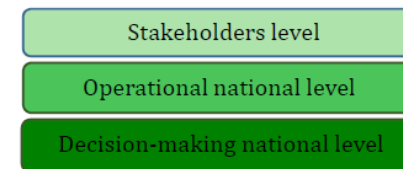
Existing national policy  
resolutions, plans, programmes...



**Pillar I – Drought policy framework:**



**Pillar II – Institutional scheme:**



**LINK:**  
[http://www.droughtmanagement.info/literature/GWPCEE\\_Guidelines\\_Preparation\\_Drought\\_Management\\_Plans\\_2015.pdf](http://www.droughtmanagement.info/literature/GWPCEE_Guidelines_Preparation_Drought_Management_Plans_2015.pdf)

# For better understanding of XXX droughts...



## Sustainable Drought Early Warning

- active participation in existing platforms (global, regional – EDO, DMCSEE), sector specific indicators, harmonized data collection, methodologies (impact & risk) to develop, forecast to improve; NMHs (entry points), EWS (Meteoalarm).

## Networks

- DMCSEE and consortium partners, **EDO/EU JRC, IDMP partners, drought teams (Aspen workshop)**.
- impacts reporters networks establishment for validation of monitoring for all drought types (term flash drought is not introduced at EU level).

## Common projects/research

- GWP/WMO IDMP programme, WMO, project calls (**new initiatives**), donors/funding search.

## Change of management paradigm

- missing policy; DriDanube Strategy will be launched in 2019 (IDMP guidelines);
- Drought Legislation (Slovakia Action Plan);

## Public awareness / capacity building / stakeholders involvement

- drought news, media campaigns, videos, subscribe for DriDanube newsletters;
- guidelines, manuals, trainings, publications, articles, contribution to reports (GAR2020, IDMP, WMO CAgM...).

