

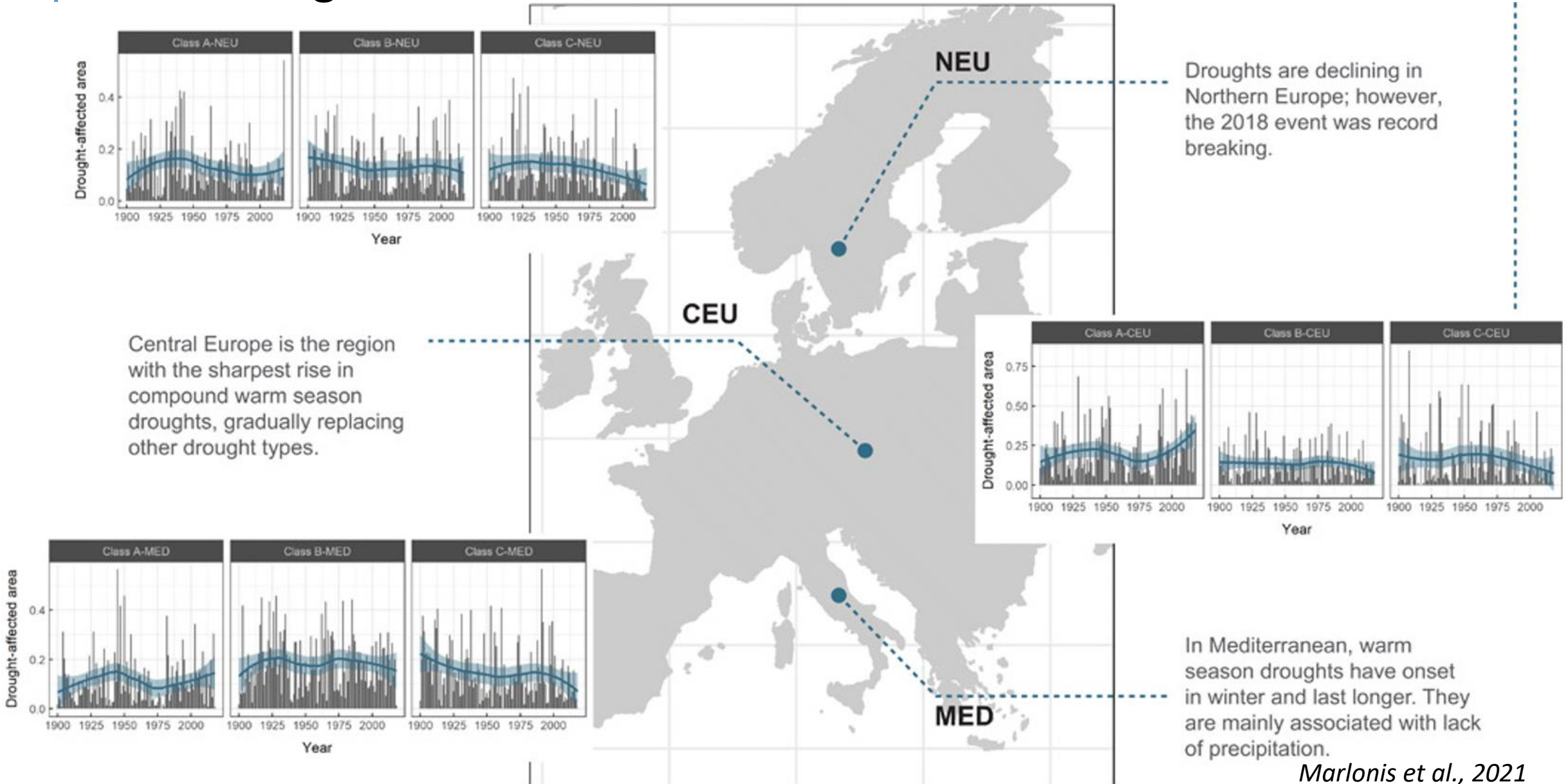
# European Drought Observatory for Resilience and Adaptation EDORA

*Dario Masante*

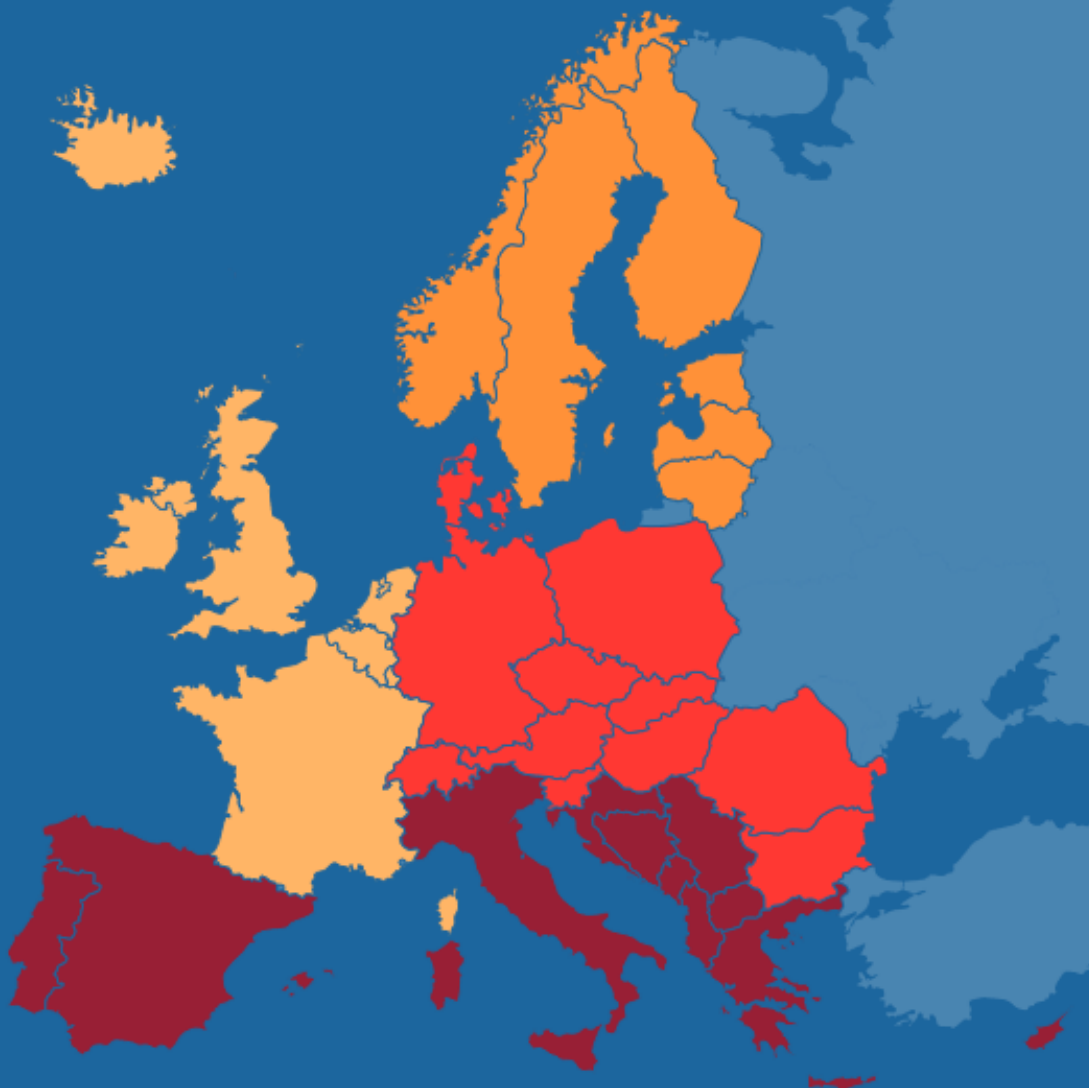
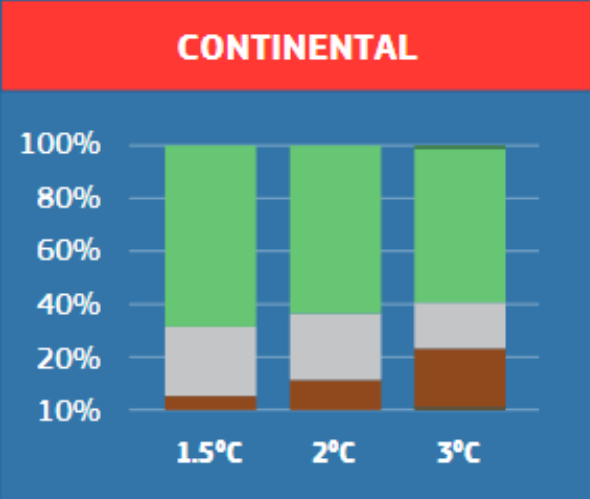
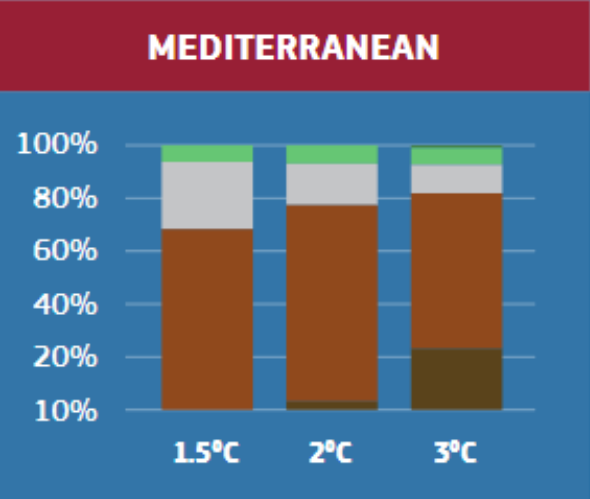
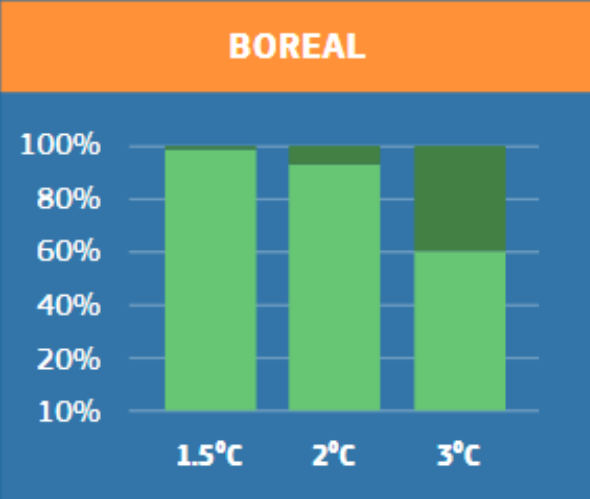
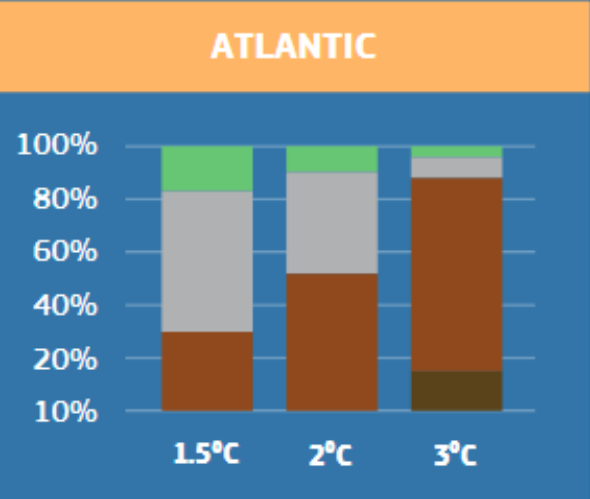
*European Commission Joint Research Centre*

*European Drought Observatory (EDO) - E.1 Drought Team*

# Have droughts increased?



# Drought projections



Fraction (%) of area exposed per region

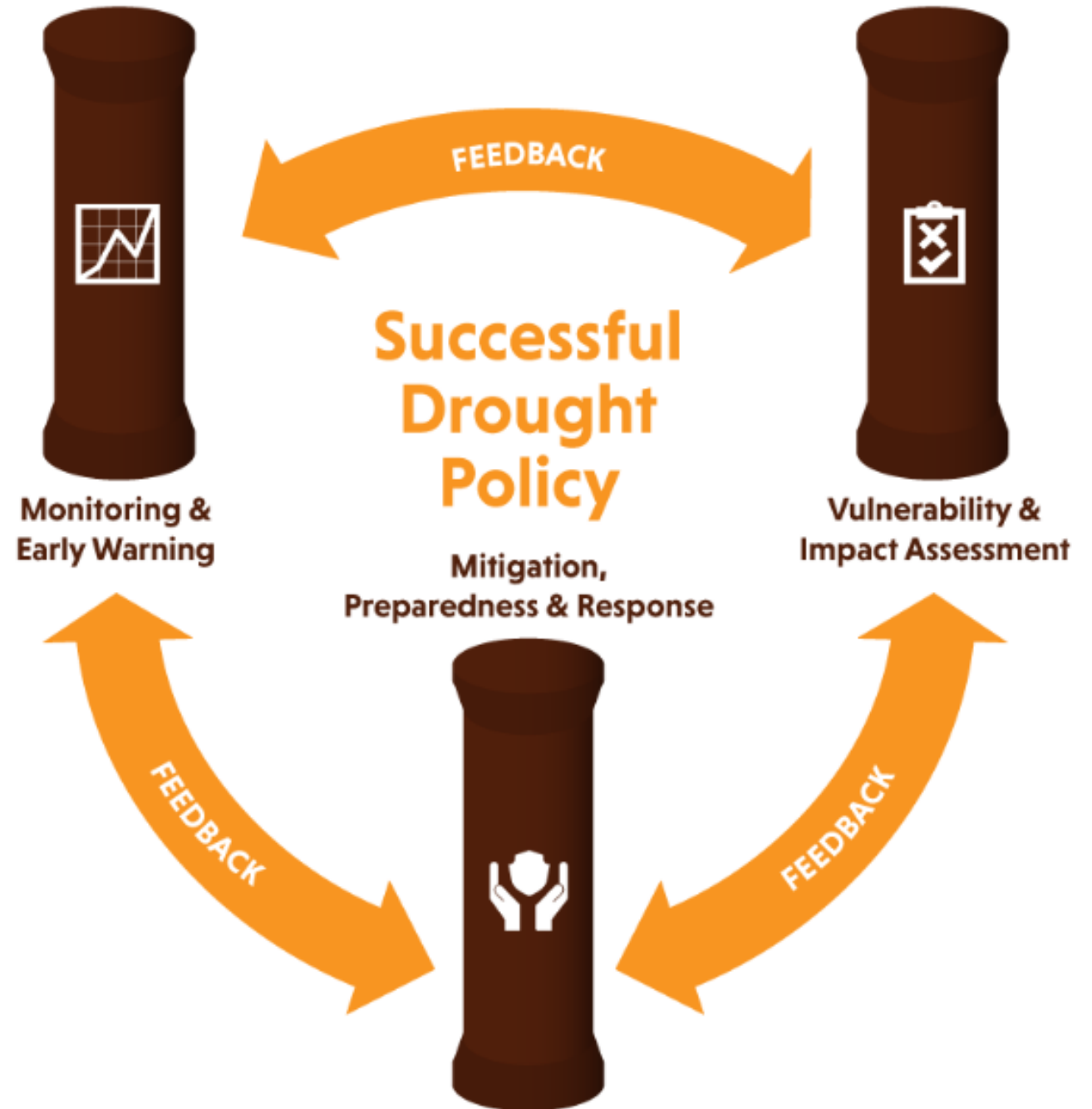
- Doubling in frequency
- Increase in frequency
- Uncertain change
- Halving in frequency
- Decrease in frequency

Modified from IPCC

# Reducing risk

-> Risk reduction over crisis management

-> Based on evidence



# Impacts on all key sectors + ecosystems



Agriculture



Public water supply



Energy supply



River transportation



Ecosystems

Rain fed agriculture

Irrigated agriculture

Hydropower

Nuclear

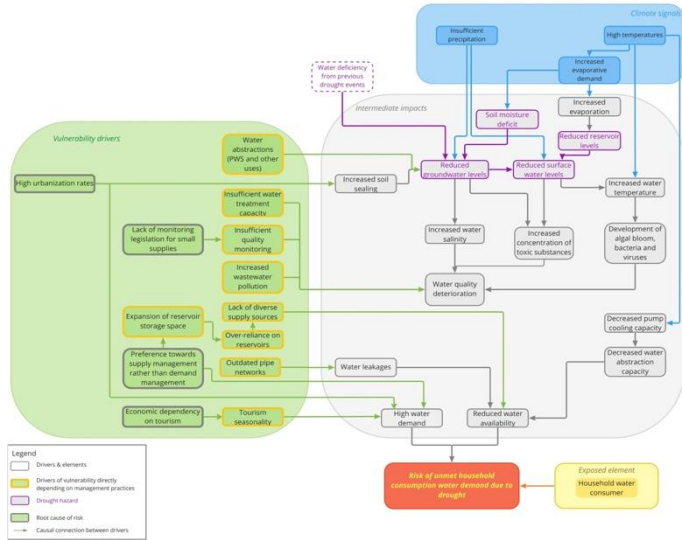
Terrestrial ecosystems

Freshwater ecosystems



# Drought risk atlas

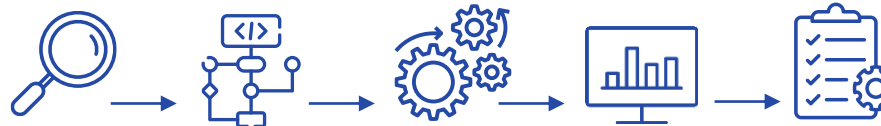
Conceptual models +



Impact-based data-driven analysis = European Drought Risk Atlas

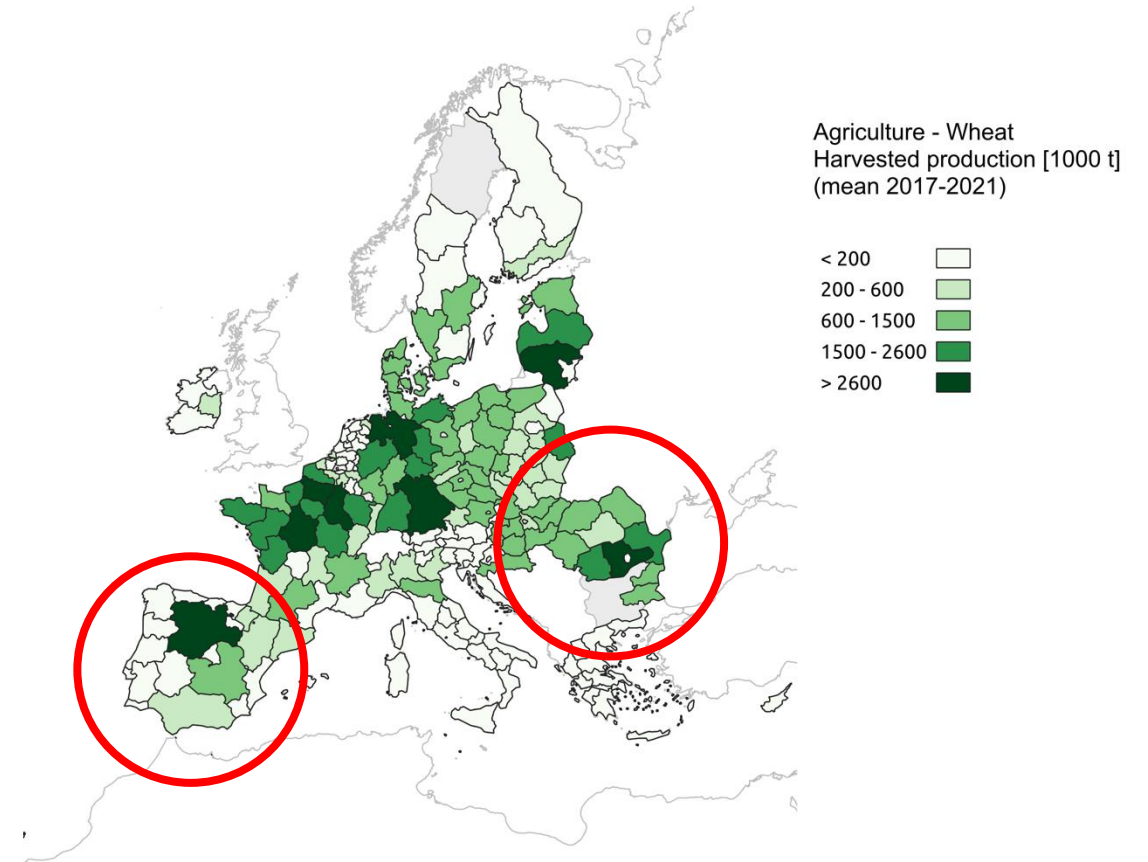
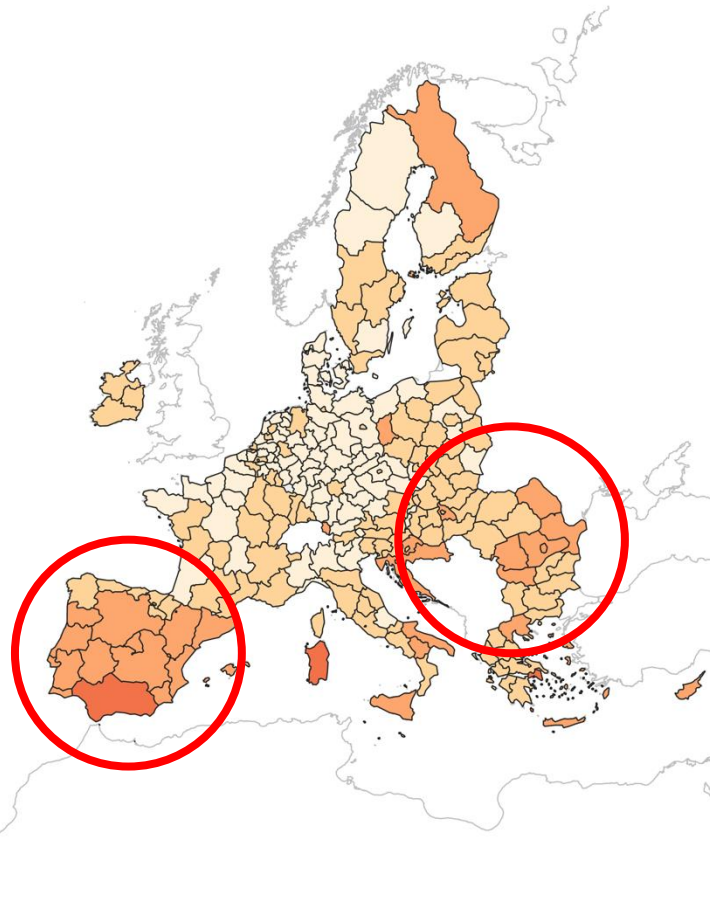


MACHINE LEARNING





# Wheat: Average annual yield loss

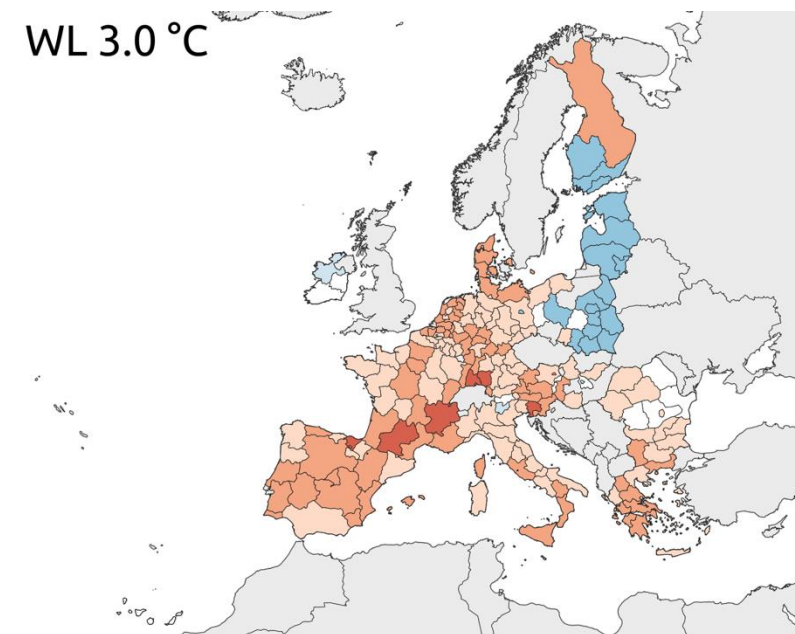
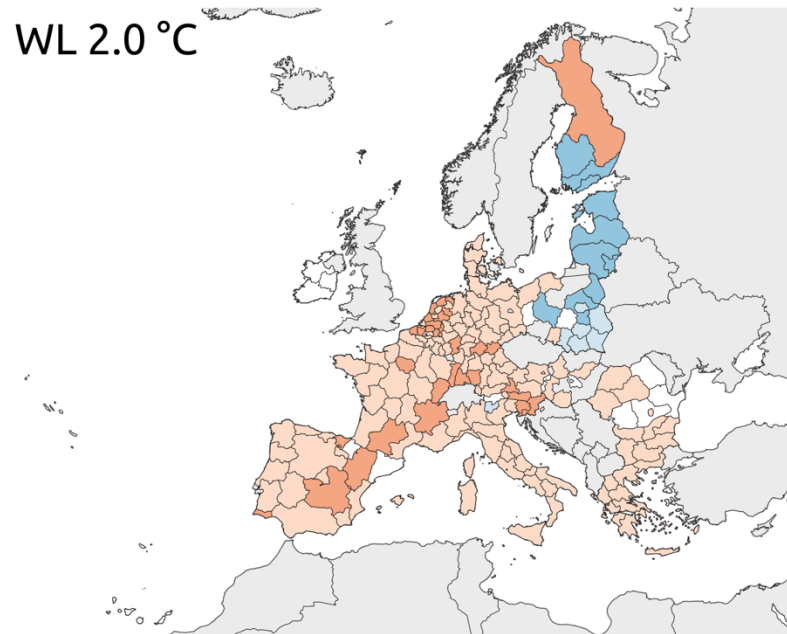
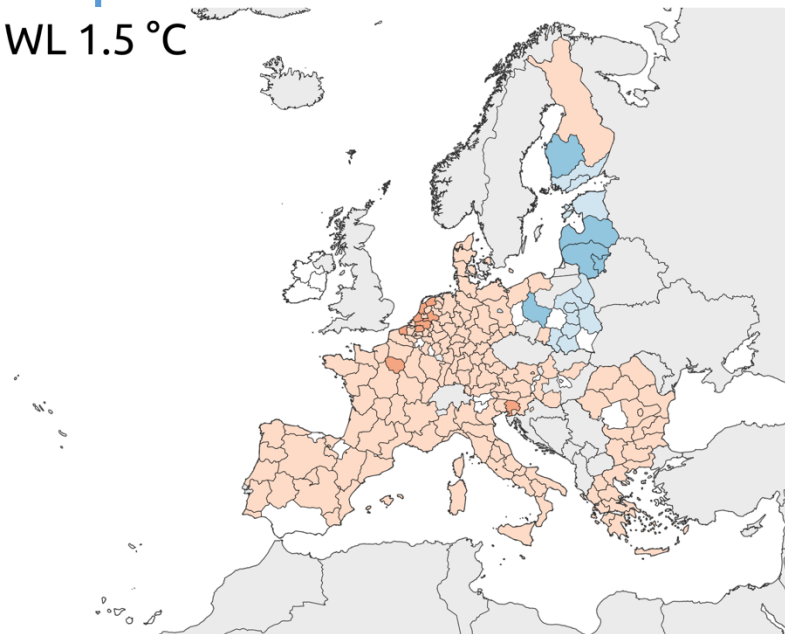


# Wheat: Projected / Current losses









WL 1.5 °C

WL 2.0 °C

WL 3.0 °C



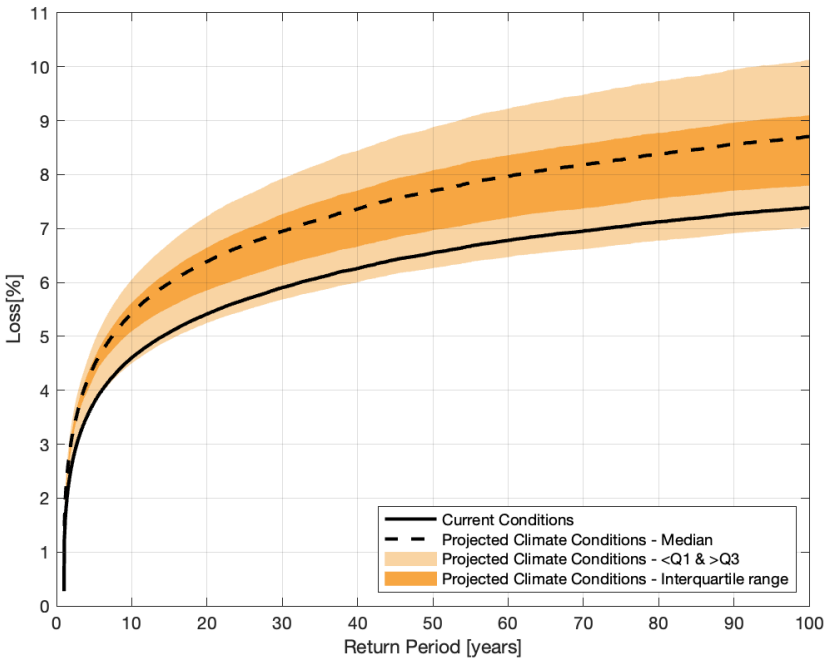
## Projected Loss / Current Loss

- |   |  |
|---|--|
|  reduction of more than 25%          |  increased by a factor of 1.5 to 2    |
|  reduction between 10% and 25%       |  increased by a factor of 2 to 3      |
|  no important variation              |  increased by a factor of 3 to 4      |
|  increased by a factor of 1.1 to 1.5 |  increased by a factor of more than 4 |

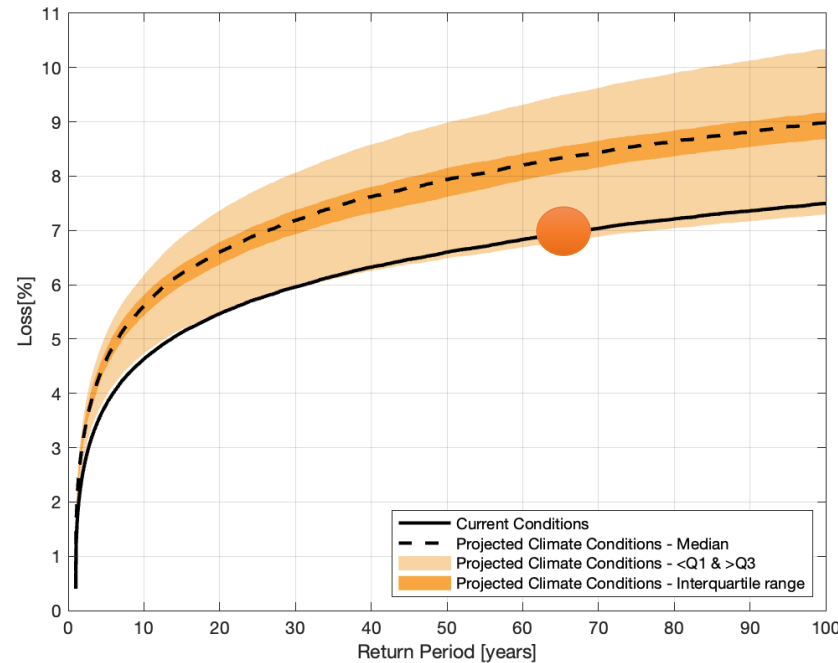


# Wheat: PML curves at European Level

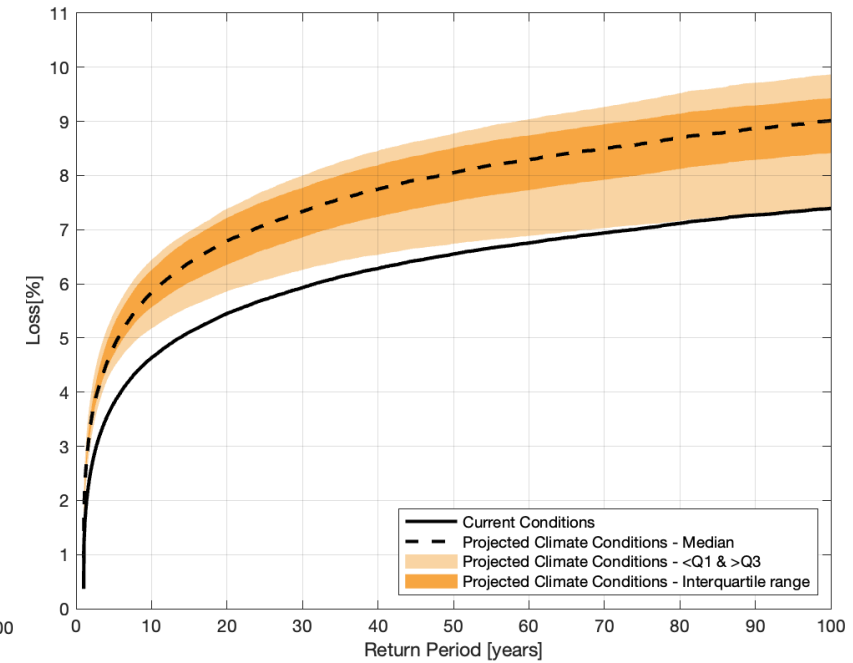
wheat - Warming Level + 1.5°C



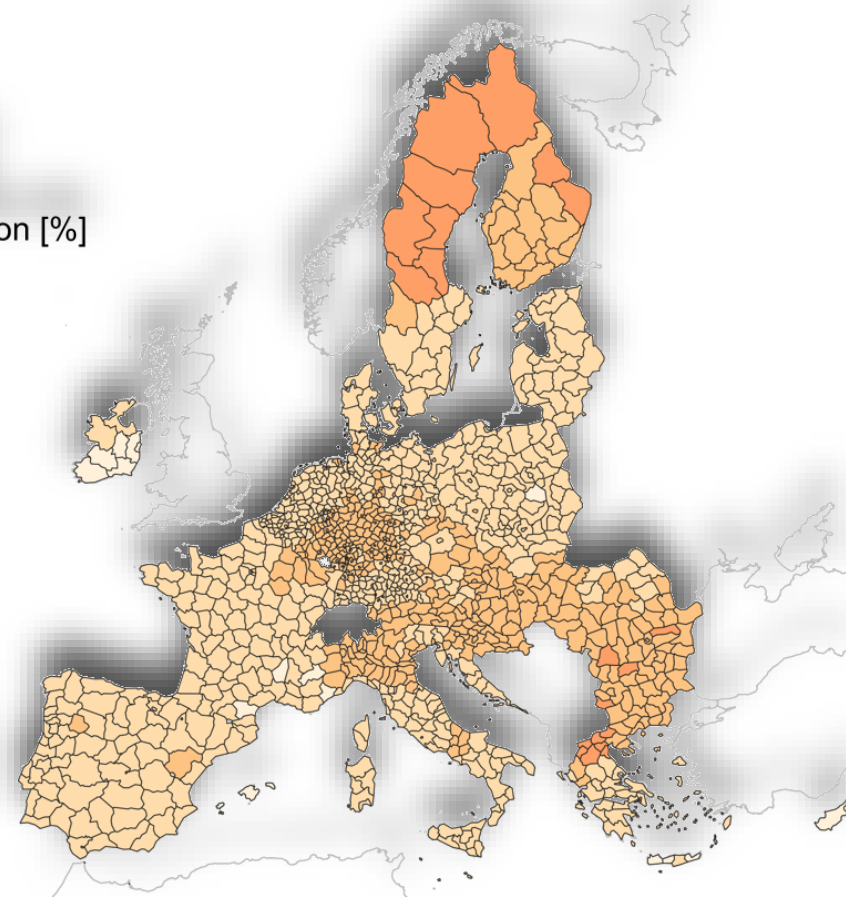
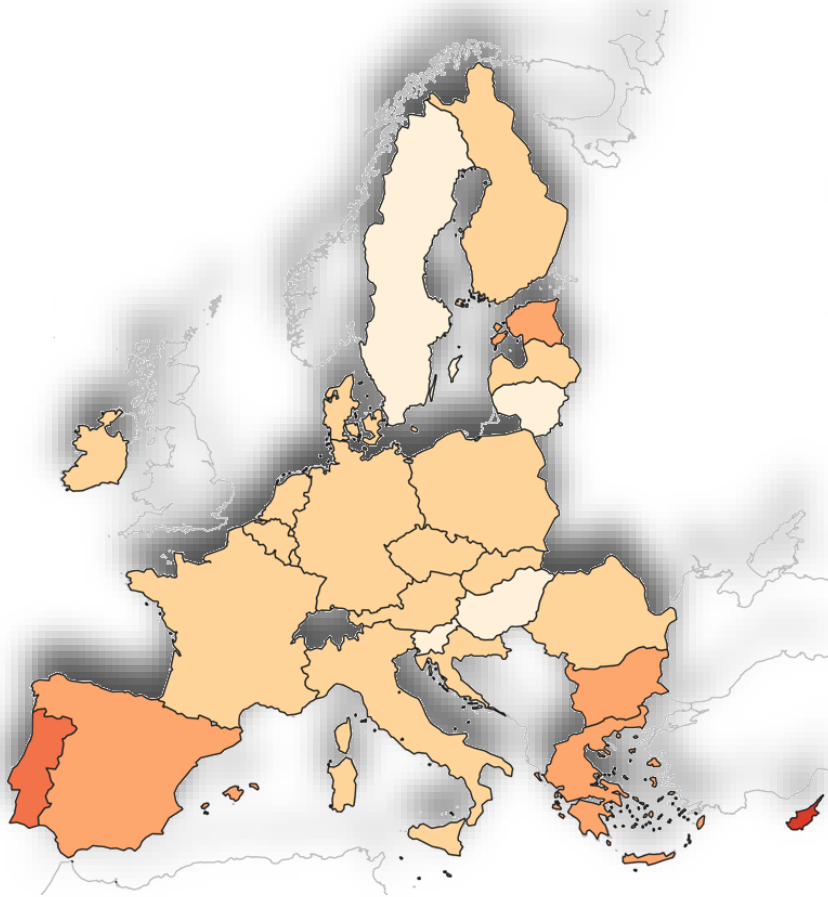
wheat - Warming Level + 2.0°C



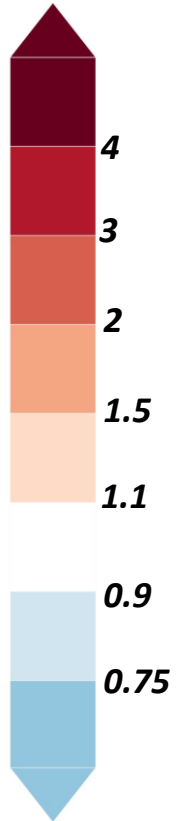
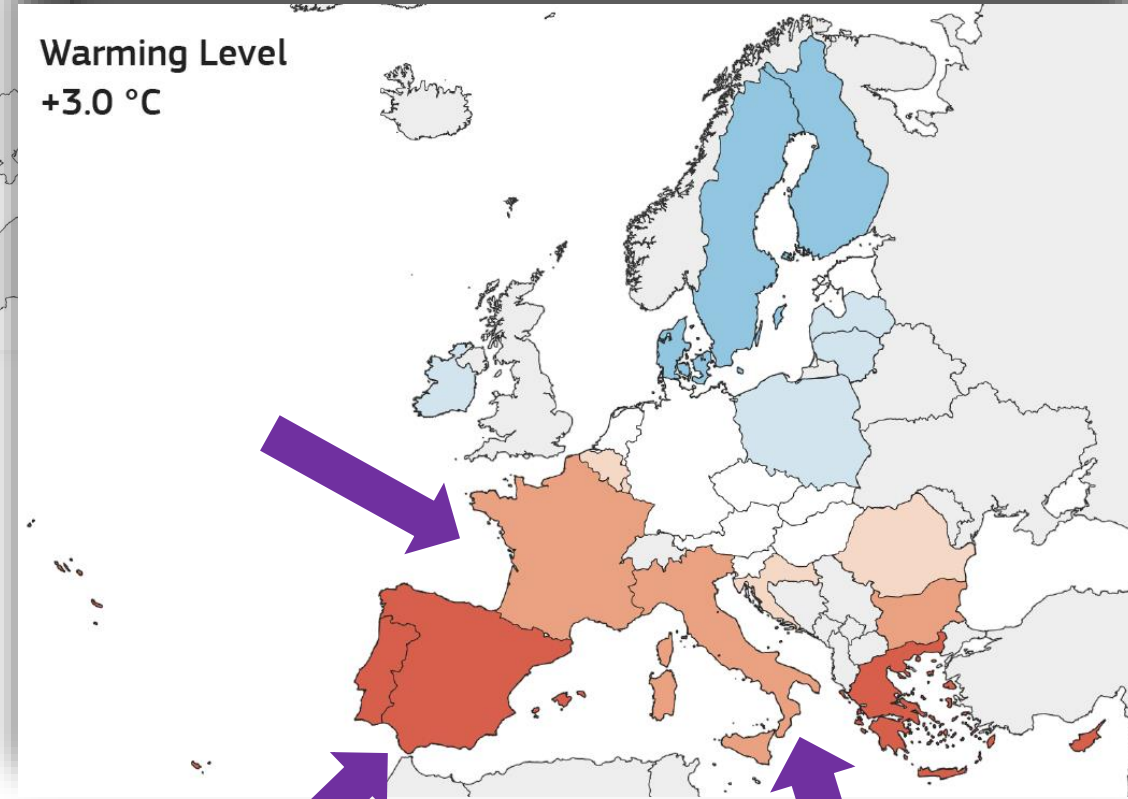
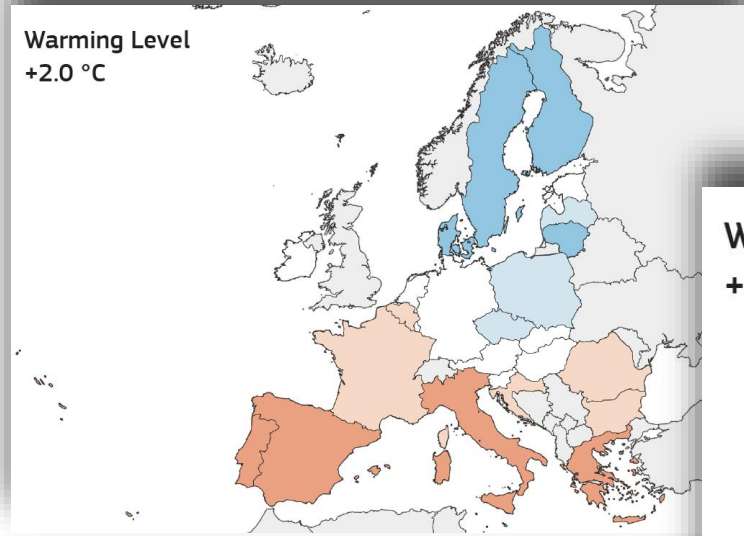
wheat - Warming Level + 3.0°C



# Current drought risk

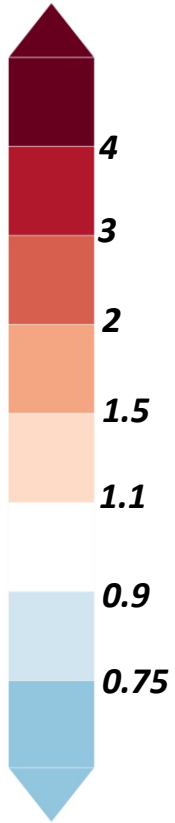


# Hydropower - drought risk

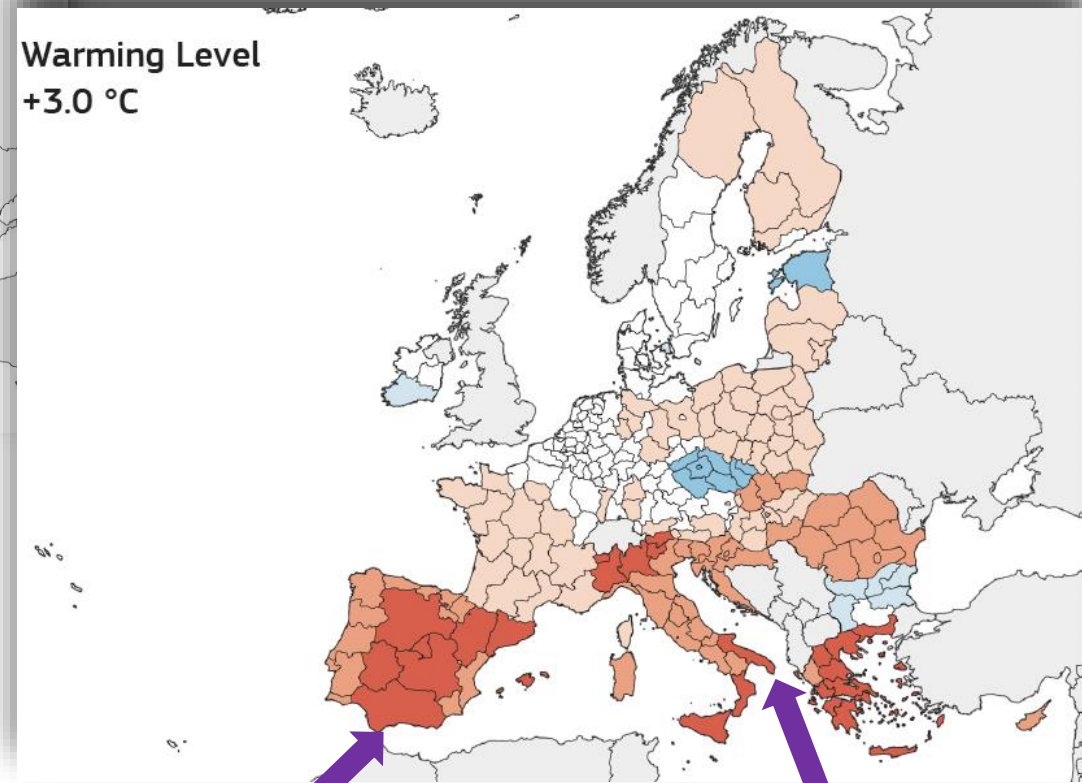
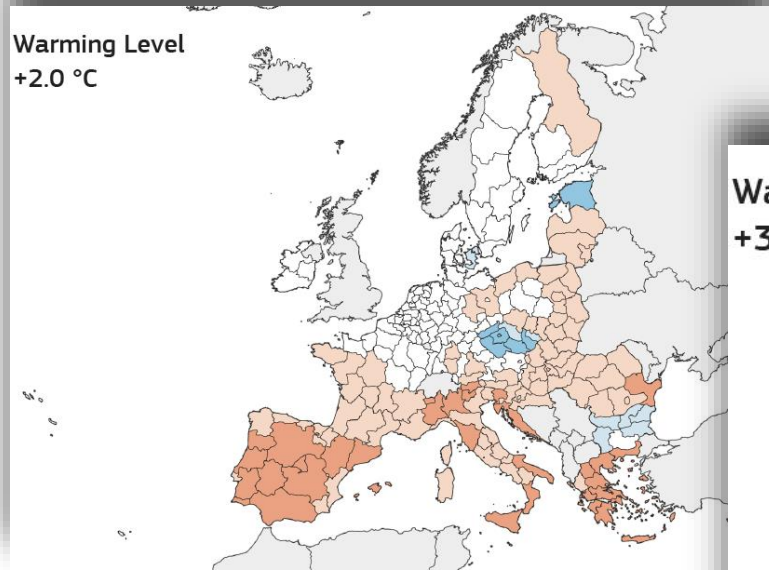


CL = Current Losses

# Public water supply - drought risk

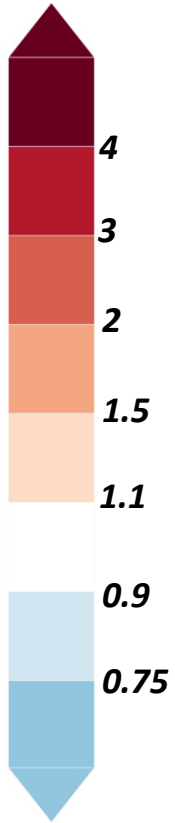


CL = Current Losses

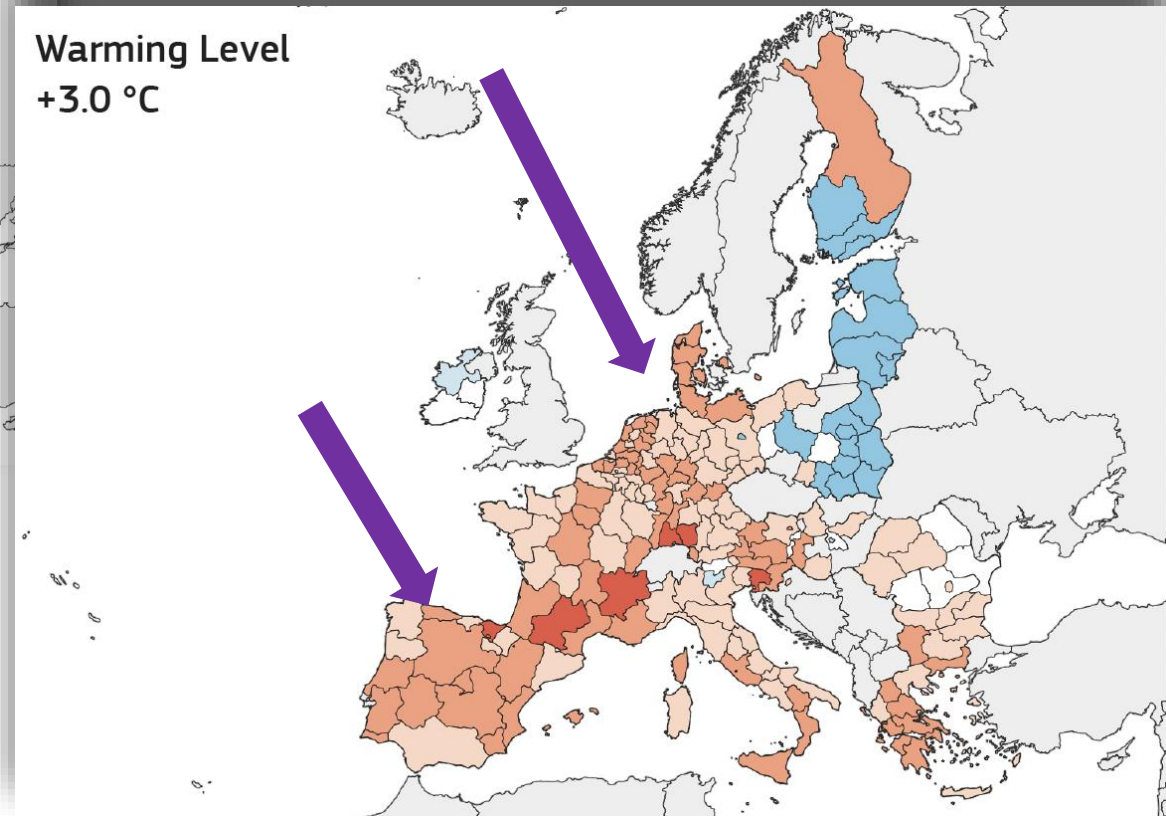
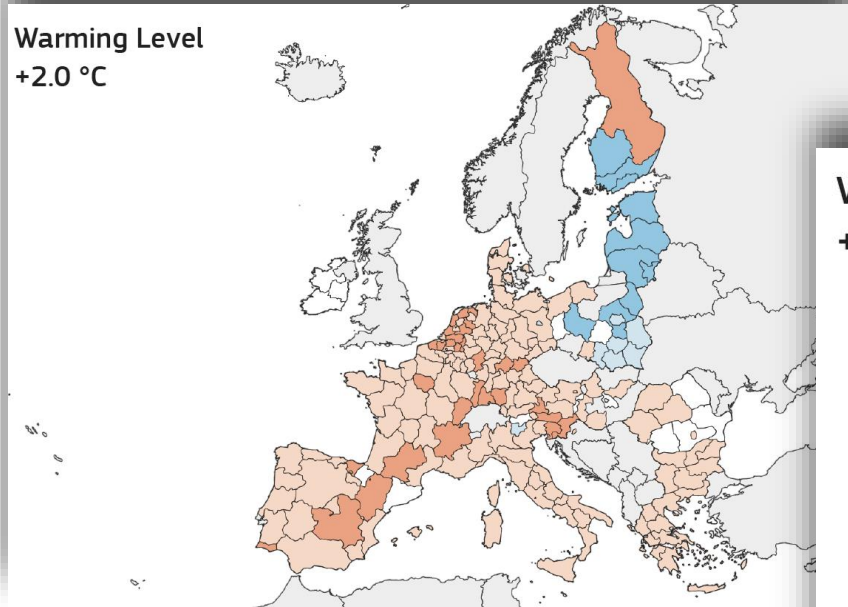




# Agriculture (wheat) - drought risk

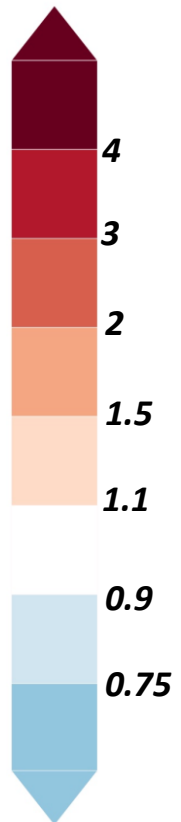


CL = Current Losses

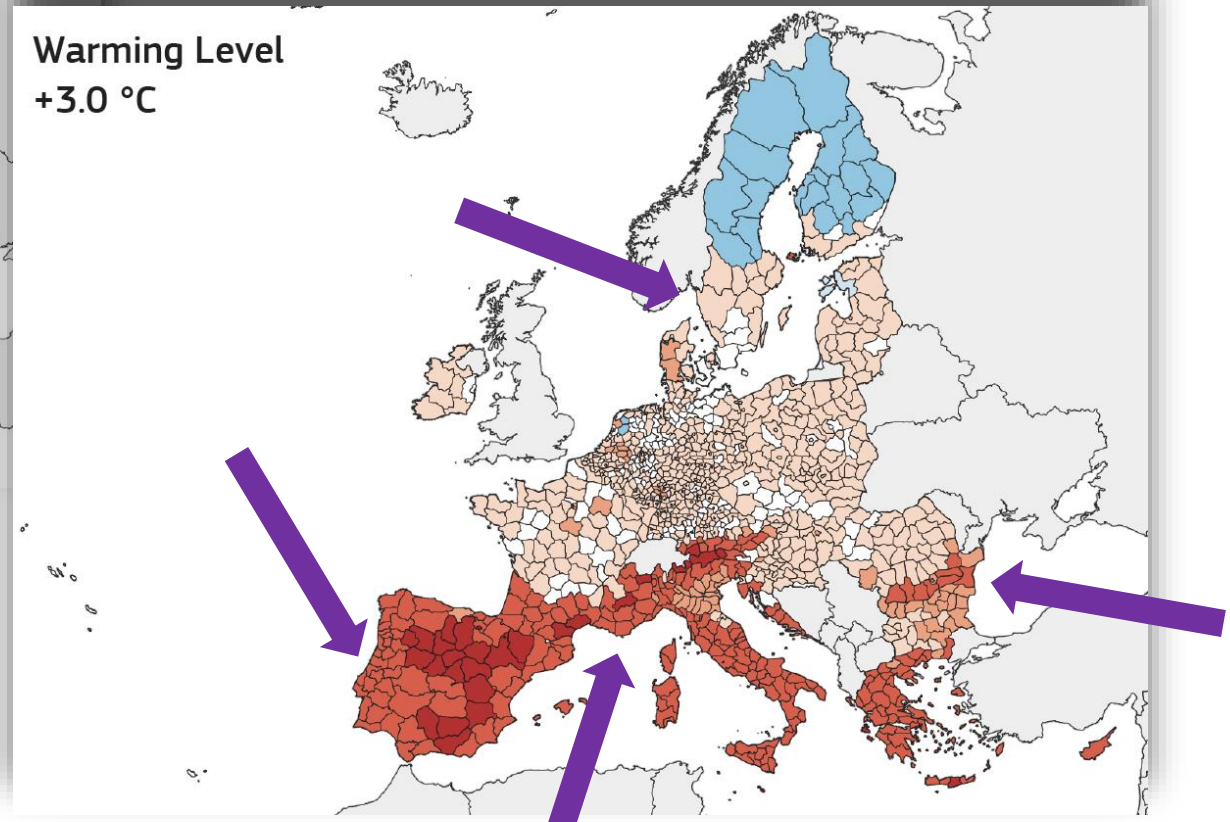
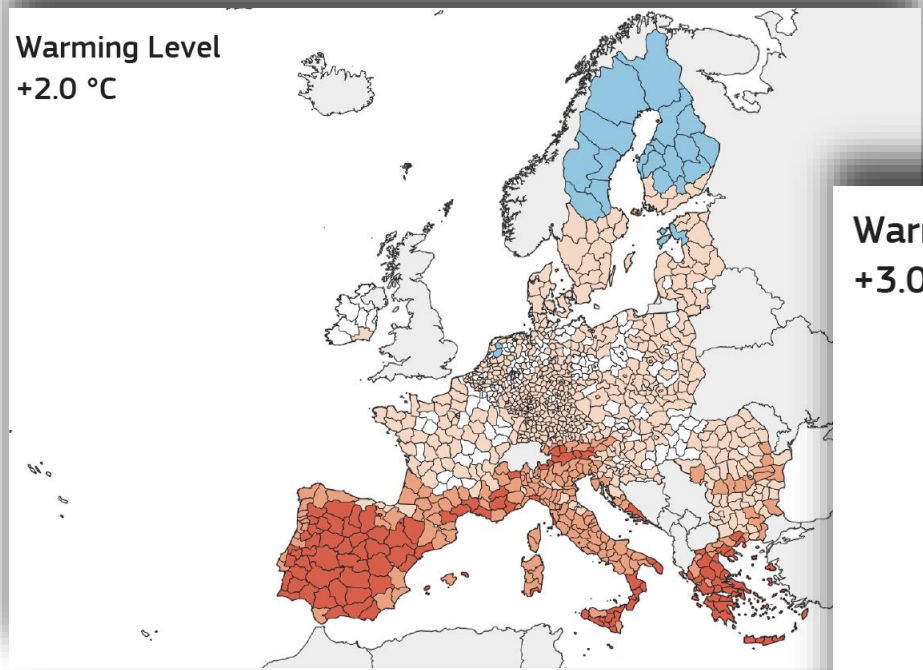




# Ecosystems (terrestrial) - drought risk



CL = Current Losses



# Conclusions 1/2

## Agriculture

Risk increase in almost all EU for wheat.  
Spain and Romania hotspots  
*Droughts can impact quantity and quality of yields*

## Water supply

Increase in Med area, Spain is a hotspot  
*Water quality during droughts is an emerging issue*

## Hydropower

Evident south-north gradient  
Increase (x3) in future risk in Med area  
*Many systems need to be redesigned to operate efficiently with less water*

## Nuclear power

France hotspot for both current and projected conditions  
*Increase water temperature during drought may hinder cooling systems*

## Riverine transport

Meuse-Rhine still area at risk  
Risk Increase in the Danube  
Cascading effect for other sectors  
*Tipping points of multi-modal goods transport system*

## Ecosystems (both)

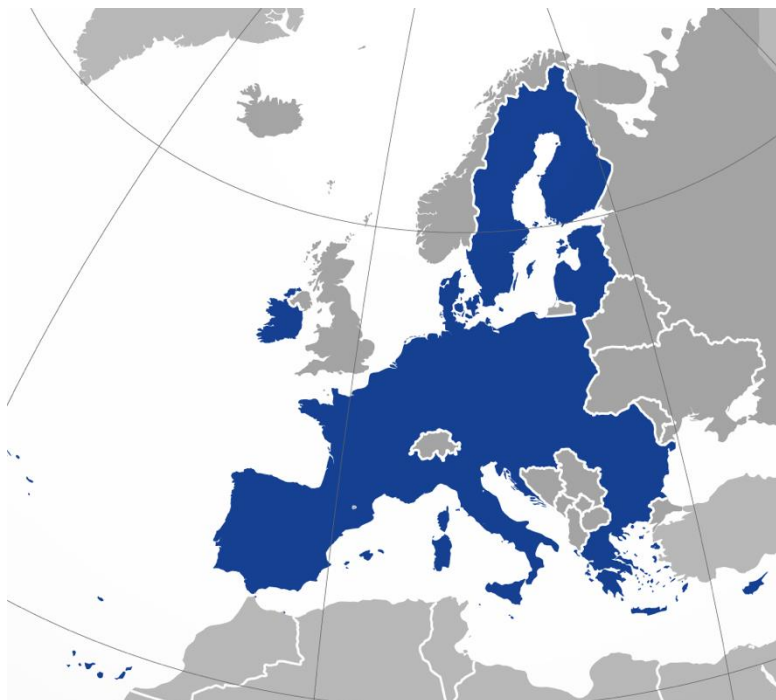
South-north gradient  
Med clear hotspot for the future (x4)  
*Frequent and prolonged droughts can trigger regime shifts (difficult recovery)*

- Needs for complete dataset
- Drought risks and impacts are different in these systems, but **cascade** through them
- Reducing drought risks requires a **systemic perspective on sectoral interdependencies**

EU cooperation is essential

*Risk is sector-dependent  
It increases in most of Europe  
under warming scenario.*

*Regional **HOTSPOTS**  
per sector emerge*



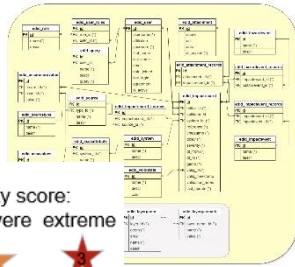
Varying risk scenarios. In some areas of  
**Northern Europe changes**

**Romania** hotspot for Agriculture, Water  
Supply, Ecosystems

**Opportunities** may emerge in some  
areas with **sustainable adaptation &  
effective mitigation**

***Mediterranean**  
Increase in drought risk in all sectors  
& ecosystems*

# EDID 1.0: method development (summary)



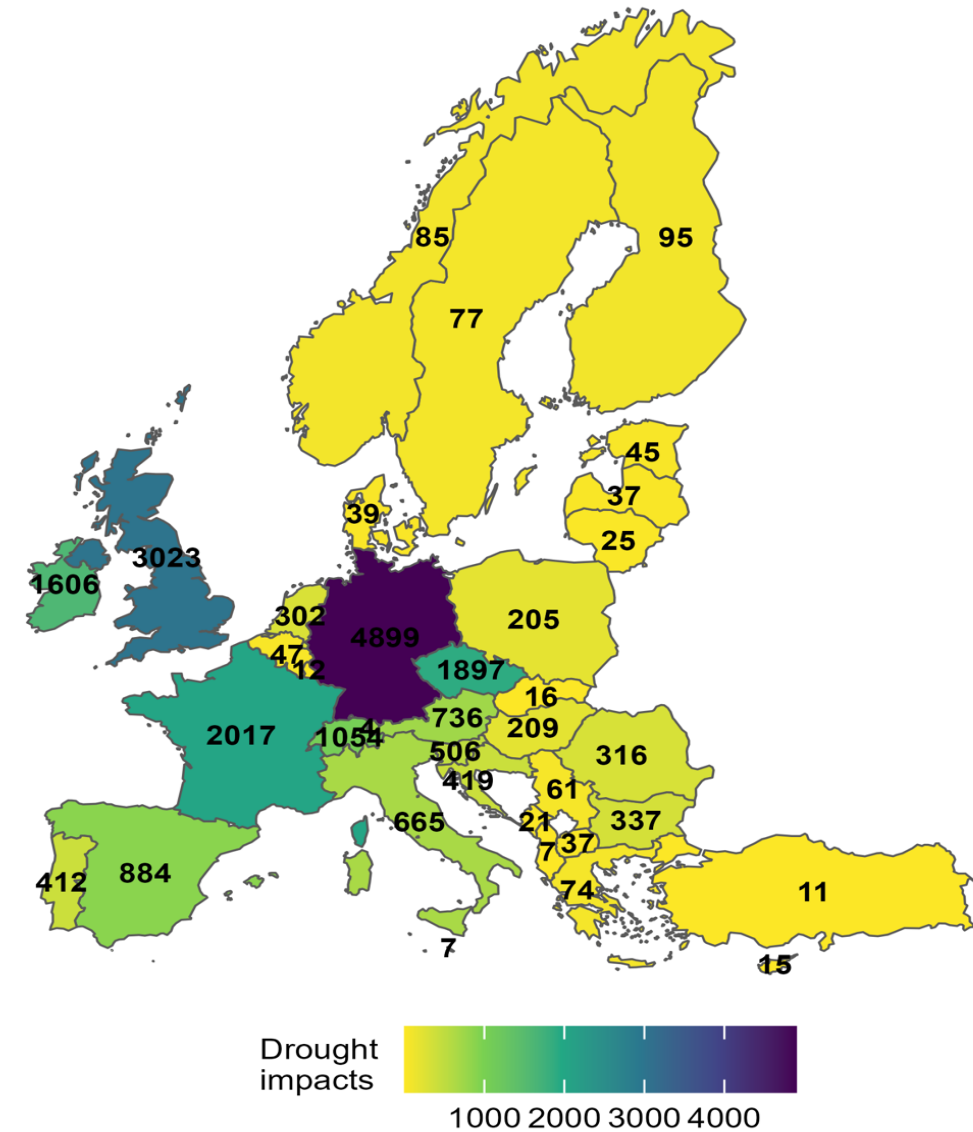
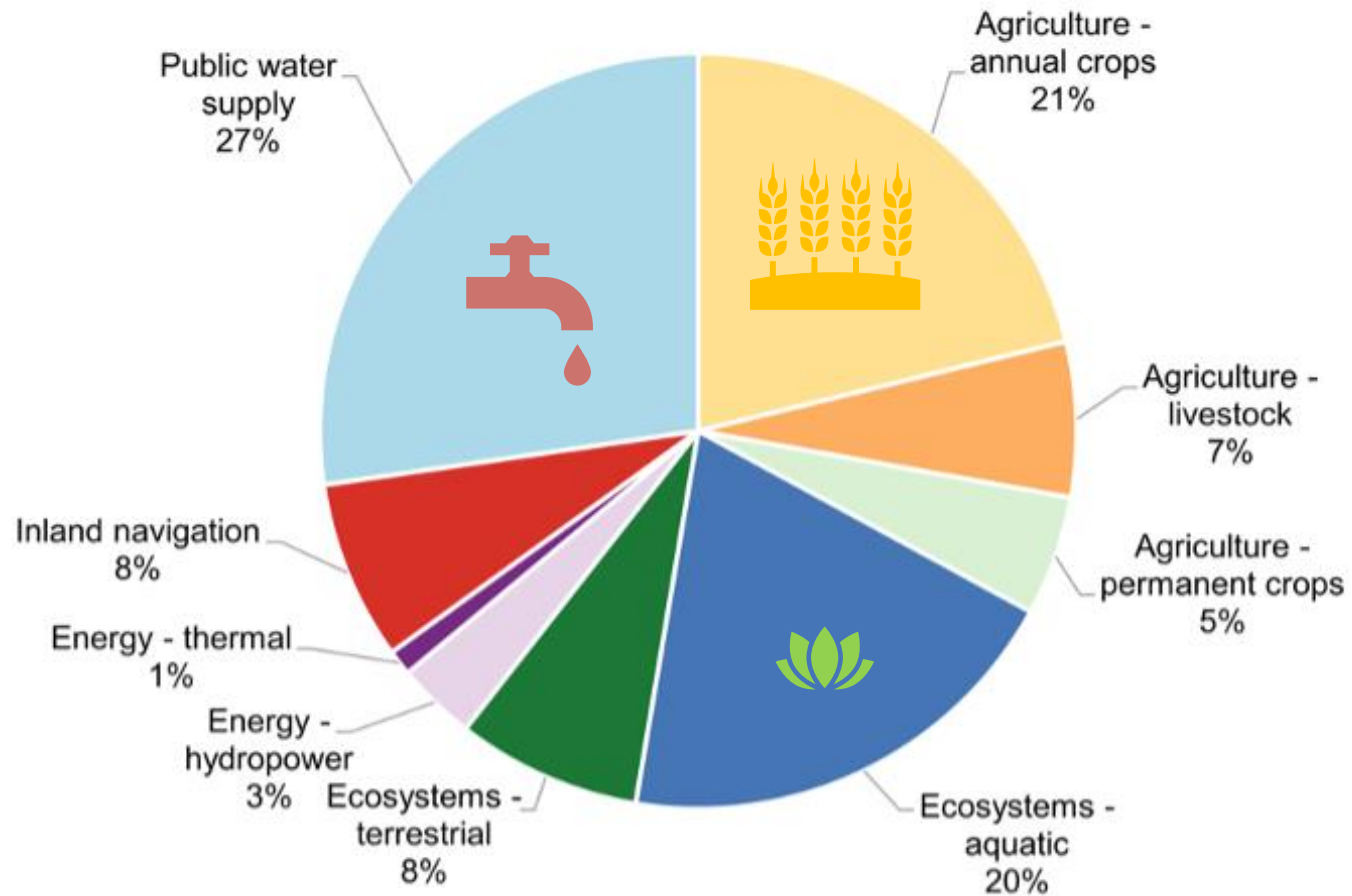
Impact severity score:  
moderate severe extreme

★ ★ ★



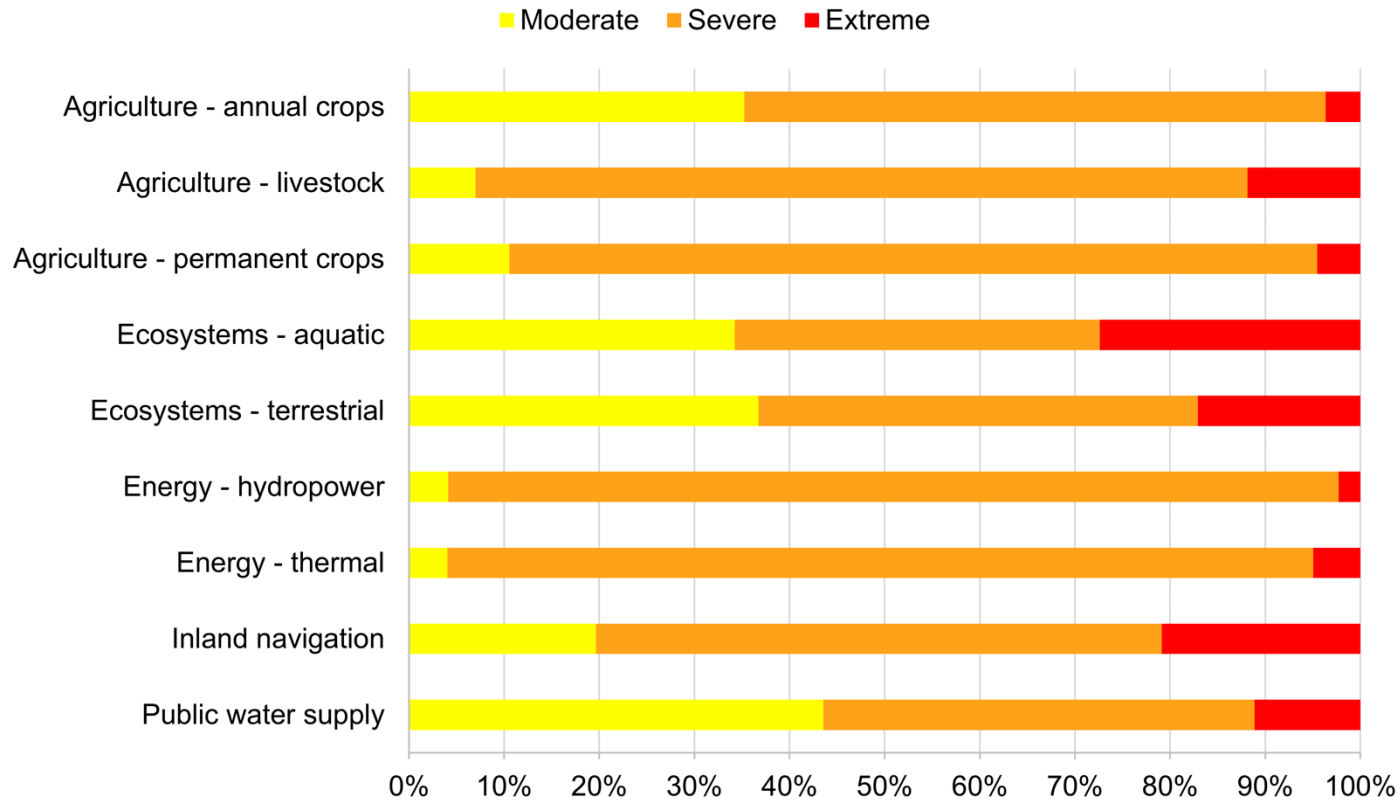
- Selection of 9 systems
- Structuring data & data model
- Additional and sector specific attributes, severity scores
- Building Content (transfer and addition)
- WEDID (Web-EDID) implementation

# Drought impacts





# Additional Information: New Severity Score

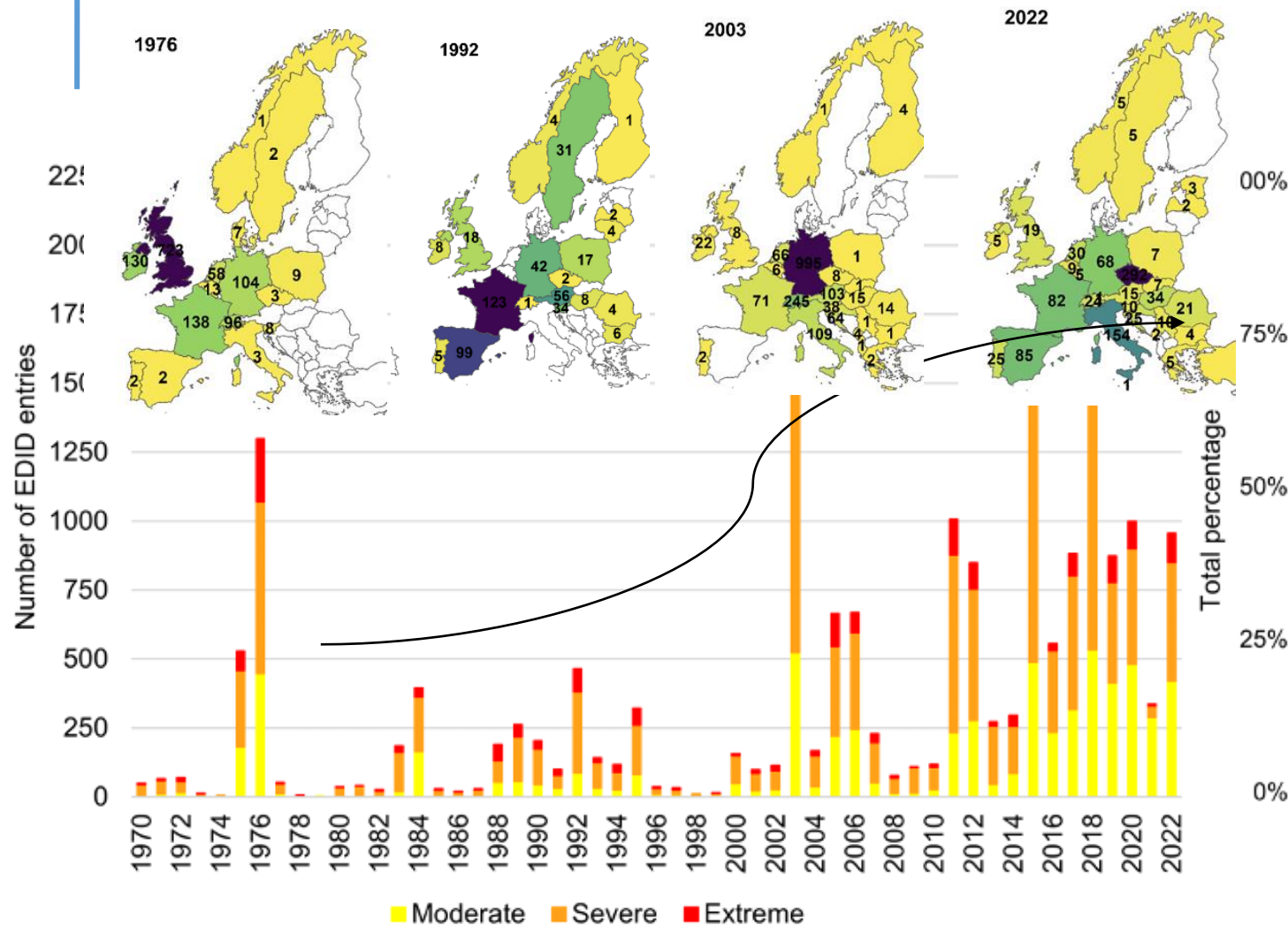


**Level 1** refers to warning or an expected impact with direct and local/individual influence

**Level 2** refers to more widespread direct and indirect impacts

**Level 3** refers to impacts related to enormous losses and cascading effects, irreversible deterioration, emergency actions over large areas

# Contents of EDID 1.0 over time



## Impact records

- Increase in time
  - Rise of online media
- Use of gap filling with webcrawling
- Impact numbers still reflect major drought events in Europe

# Collecting & sharing data on impacts

**Filters Panel:**

- Textual Search: Start writing something
- From (\*): 01/06/2018
- To (\*): 30/09/2018
- Filter by area of interest:  Draw a rectangle on the map
- Sector/System: -
- Severity Level:  1 - Moderate,  2 - Severe,  3 - Extreme
- Hazard Event: -
- Source Type: -
- Validation Status: -
- System specific attributes (ASSA)
- QSEARCH

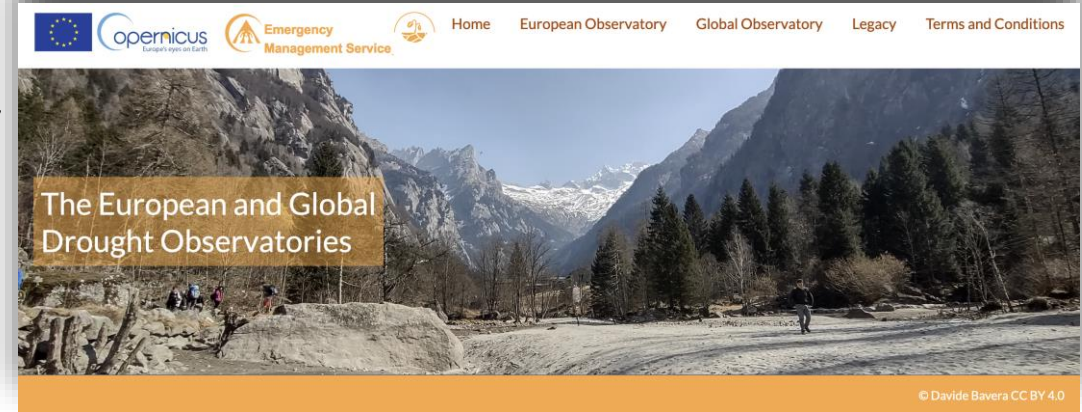
Date	System	Description	Severity	Status
01/07/2018 - 31/07/2018	Ecosystems - terrestrial	slight increase of significantly damaged trees, about 3% to a share of 29%. A distinct increase of the damage level was ...	1	●
01/06/2018 - 30/06/2018	Ecosystems - terrestrial	The secondary growth of spruces stopped between mid-june and mid-july....	1	●
01/07/2018 - 31/07/2018	Ecosystems - terrestrial	from july on, the decolouring and early dropping of leaves started due to the drought stress....	2	●
01/07/2018 - 31/07/2018	Ecosystems - terrestrial	reduced secondary growth, tue to the hot and dry summer. At the end of october there had been an estimated growth reduct...	1	●

**Map:** Europe map showing impact locations. Legend: Red intensifies with overlapping records. No hazard event selected.

**EDID**

<http://edid-test.eu>








# EDORA doesn't end today

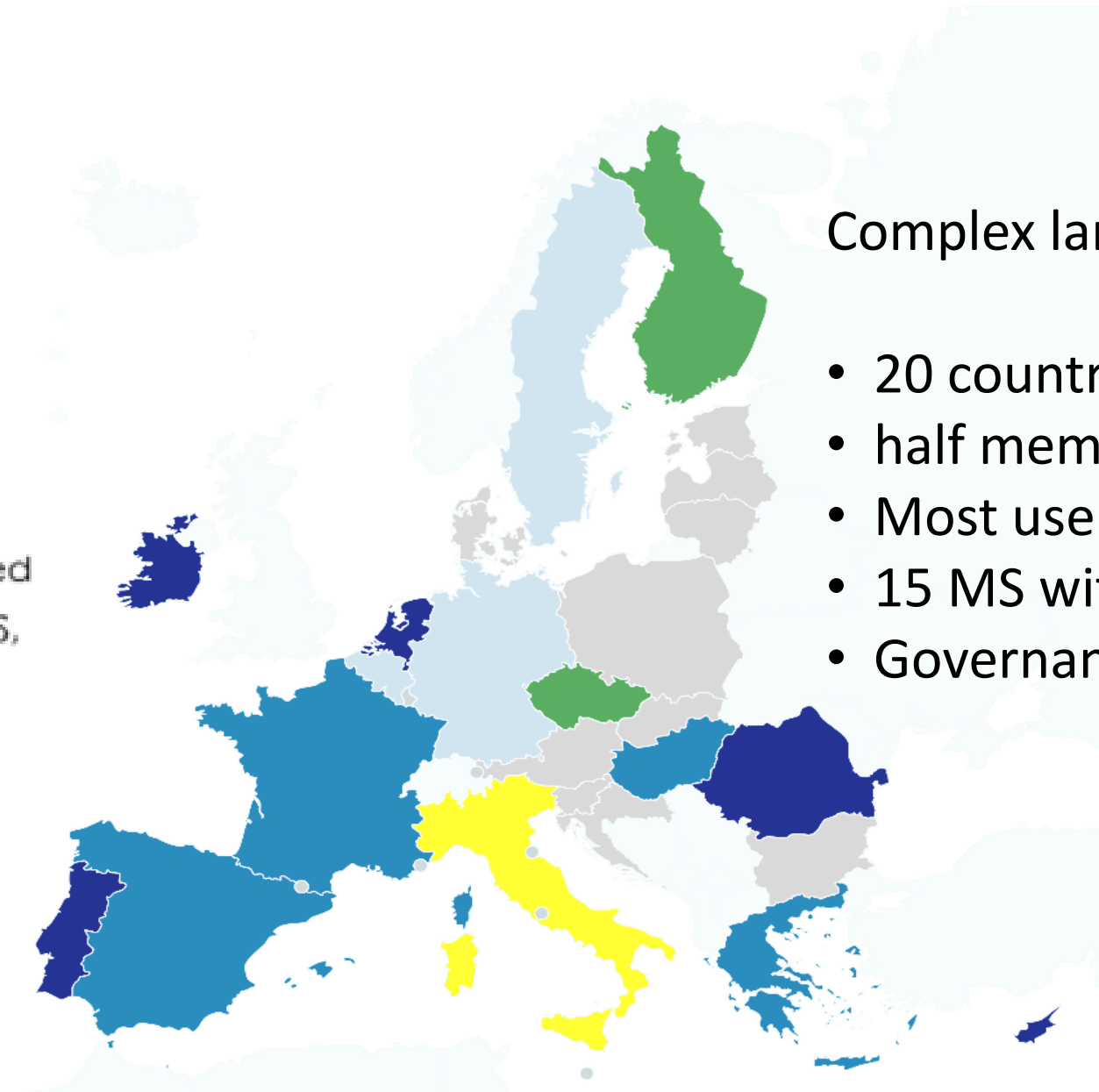


- *Integration into the Copernicus EMS European Drought Observatory*
- *Mobilise the EDO Drought Network & EU ATG Water Scarcity and Drought for impact collection*
- *Enhance cooperation + data and expertise sharing*
- *Expand to other sectors and improve the ones already analysed*
- *Methodological advancement + adaptation*
- *From hazard-focused drought EWS to **risk-focused drought EWS***

# EU Drought Management Plans

## Drought Management Plans

-  In place for whole MS territory
-  In place for one or several RBDs
-  In place for one or several regions
-  In process or planned
-  Other approaches
-  No DMPs in place or planned
-  Note: For some of the EU MS, several of the categories apply; the largest has been indicated in the map



Complex landscape:

- 20 countries with legislation
- half member states DMP
- Most use drought indicators
- 15 MS with allocation
- Governance?



# A good DMP

- 1) Indicators and thresholds** defining a severe drought
- 2) Actions** to take during drought for prevention and mitigation
- 3) An organizational framework** to deal with drought (and update of DMP)

In the EU, many country/basin specific challenges...

# Current adaptation measures - review

- Effective **low-cost soft** adaptation options
- **Nature based solutions** (green options) provide **multiple co-benefits**
- **Investment-intensive** grey options (desalination, recycling, efficiency) should be measured.
- Risk of **maladaptation** if rebound effect is not managed.
- **Measures dealing with the drivers/root causes are better**
- Major constraints: lack of the **right governance arrangements** and institutions and financial.
- Level of **ambition** at the European level

# Thank you



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