Resilience @ JRC

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Outline

- Resilience as a compass for EU policy making: EU resilience monitoring dashboard- beyond economy

- CAP Performance monitoring and evaluation framework (PMEF) resilience indicator- work in progress

- Prepare for the future.

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Bringing resilience thinking into policies

"Resilience is the ability not only to withstand and cope with challenges, but also to undergo transitions, in sustainable, fair and democratic manner."
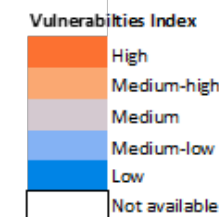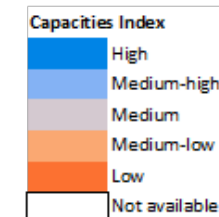
- Focus on societal wellbeing

- Beyond aggregate policies

- Beyond single policy areas

- Beyond stability

- Linked to strategic foresight

- Linked to sustainability

Monitoring resilience using the Resilience Dashboards

- Ability to make progress: vulnerabilities and resilience capacities

- Forward-looking indicators

- Holistic perspective

- Focus on transitions

- Inform the resilience analysis in the 2023 Country Reports (Annex 5)
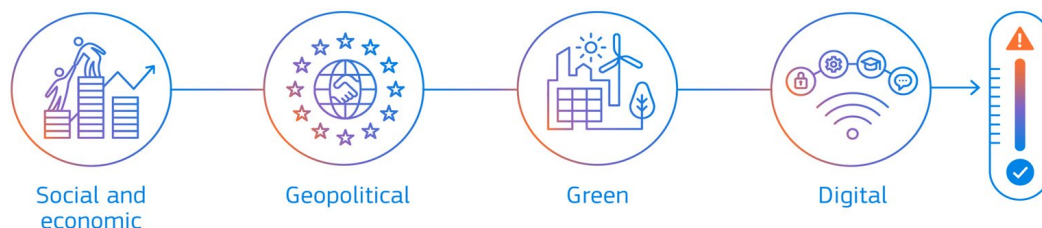
Dimension/Area	Vulnerabilities		Capacities	
	FI	EU-27	FI	EU-27
Social and economic				
Inequalities and social impact of the transitions				
Health, education and work				
Economic & financial stability and sustainability				
Green				
Climate change mitigation & adaptation				
Sustainable use of resources				
Ecosystems, biodiversity, sustainable agriculture				
Digital				
Digital for personal space				
Digital for industry				
Digital for public space				
Cybersecurity				
Geopolitical				
Raw material and energy supply				
Value chains and trade				
Financial globalisation				
Security and demography				

Capacities Index
High
Medium-high
Medium
Medium-low
Low
Not available

Vulnerabilties Index
High
Medium-high
Medium
Medium-low
Low
Not available

Social and economic

Geopolitical

Green

Digital

Agricultural sector climate resilience indicator

- The EU Adaptation strategy recommends developing metrics for resilience

- CAP objectives: "Contribute to climate change mitigation and adaptation, as well as sustainable energy"

- Member States reflect their adaptation needs in their CAP Strategic Plans

- Initial analysis of CAP SP indicates that MS needs to strengthen approaches to climate adaptation- in particular 'risk management tools'

- *Composite impact indicator of climate resilience of EU agricultural sector in CAP monitoring framework (PMEF)*
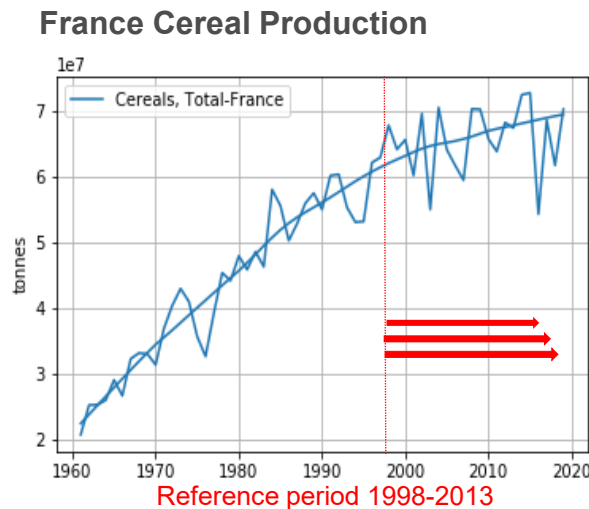
Objective of composite resilience indicator:

- Resilience to climate change: robustness- adaptation- transformation
- 4 dimensions of resilience:
  financial, social/innovation, governance and climate-environmental.
- Use available datasets/indicators: CMEF, Eurostat, EEA, JRC, MS data
- Work in progress: Harmonized analysis, dashboard approach, simple summary score on MS level
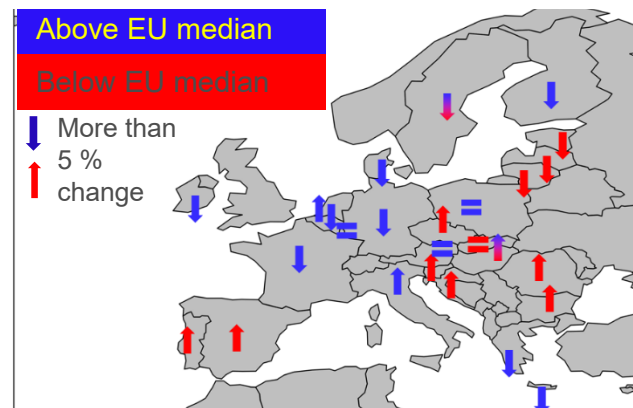- Initial analysis: 4 indicators

Areas of progress:
- Currently expanding analysis on financial resilience
- Foreseen crop diversity analysis
- Risk management tools?

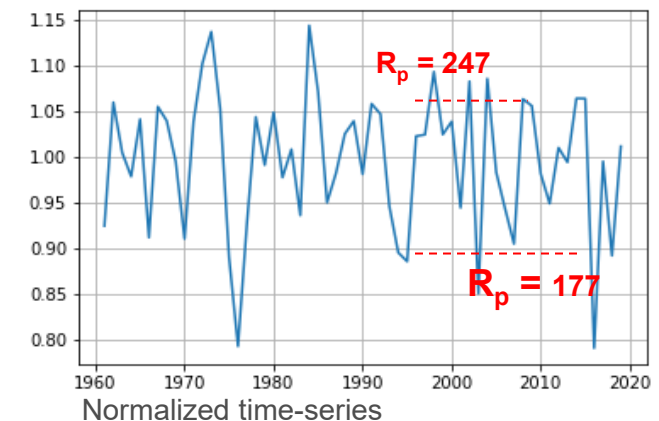# Example 1: Annual Cereal Production Resilience

- Normalized long term national production (Eurostat) with climate change impacts

- We consider periods of 10-15 years to account for climate variability versus change

- Production resilience is dependent on climatic and environmental properties, agro-management, crop choices, diversity of cropping system

France Cereal Production

Reference period 1998-2013

Resilience change wrt reference period

Above EU median
Below EU median

More than 5 % change

French Cereals

$R_p = 247$

$R_p = 177$

Normalized time-series

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Example 2: Agricultural factor income

Factor Income Resilience status change wrt reference period

Above EU median
Below EU median
More than 5 % change
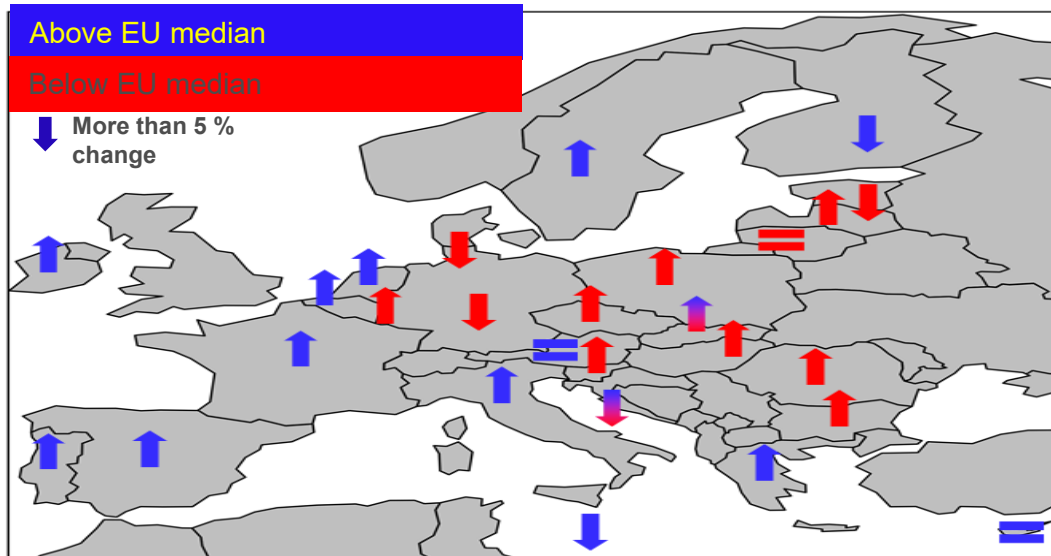
- A similar approach to crop production.
- Overall since 2001 financial resilience has gone up
- Change in Factor Income and variability reflects much more than climate change
- Currently enriched with analysis from FADN

Example 3: Soil Organic Matter (C.39)

- Improvement of soil properties is relevant for climate mitigation.
- Composite of normalized Soil Organic Carbon **stock** (I.11) and **stock change**
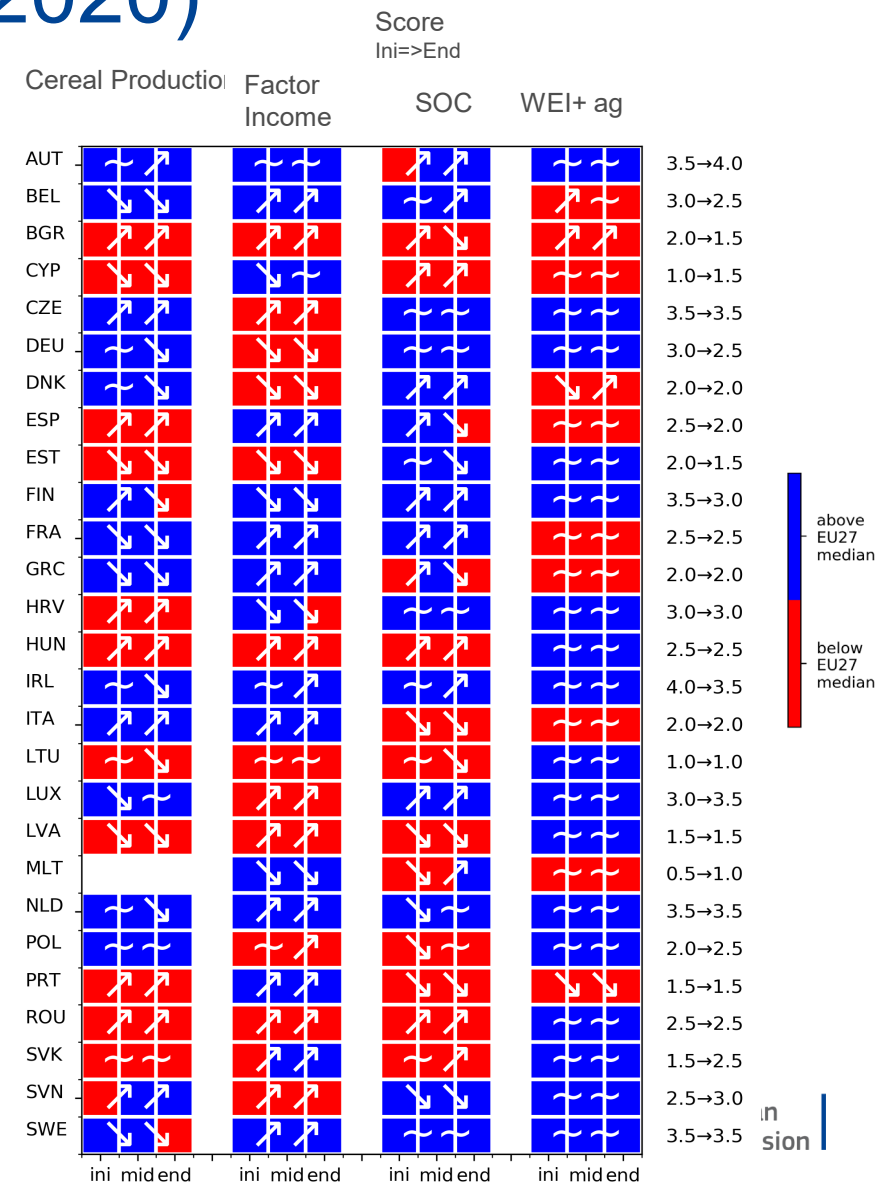- DayCent biogeochemical model at 1x1 km for 1990-2020; calibrated with LUCAS survey data

Soil Stock

>85 ton/ha: resilient

x 0.7

SOC resilience (2007-2020)

<-0.1 %/year: not-resilient

>0.1 %/year: resilient

x 0.3

Soil Stock Change

	0.00 - 0.20
	0.21 - 0.40
	0.41 - 0.60
	0.61 - 0.80
	0.81 - 1.00
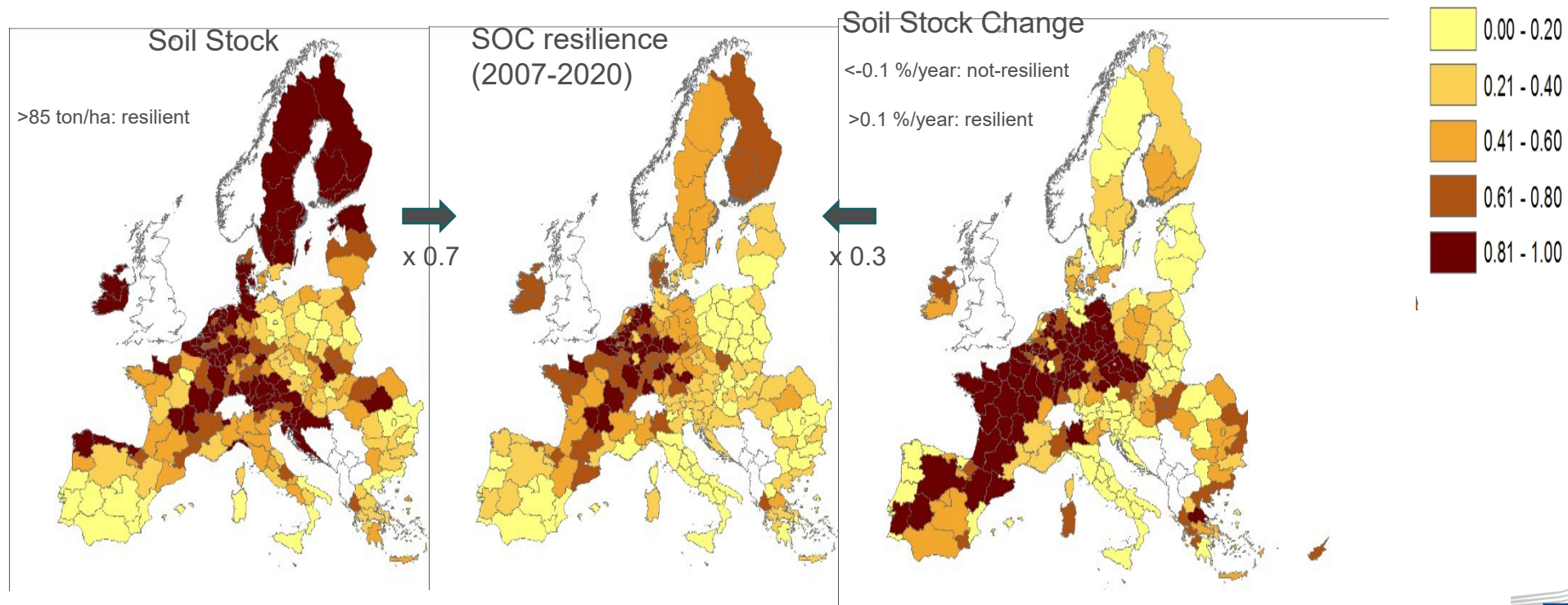
I.09– Agricultural sector resilience dashboard (prototype using data of CAP 2014-2020)
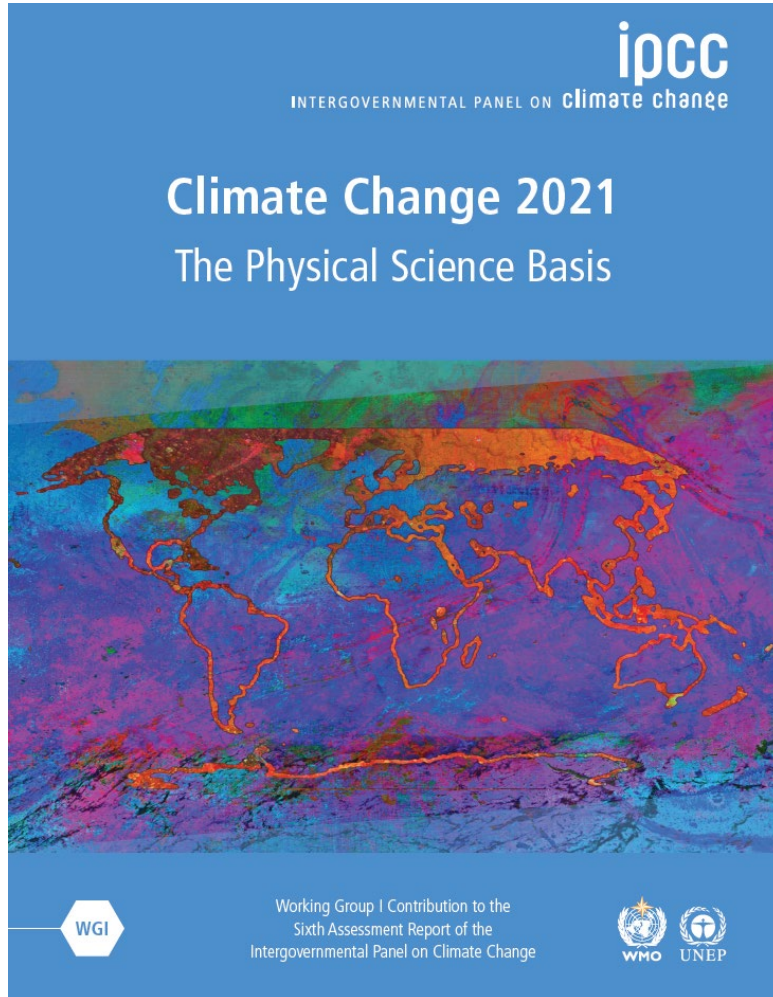
Goal:
a quick inspection of overall resilience of farming sector, inviting to look into the details

- Resilience score counts status and progress of individual indicators compared to reference period
- Colors are relative to the EU27 median (normalized).
- Should not be used for comparing MS

Changes wrt reference period are >5 % (Production, Income) or >1 % (SOC; WEI+ag).

Preparing for the future, climate change and other drivers

Climate Change 2021
The Physical Science Basis

Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

What do we know about the next decades?

- Intergovernmental Panel on Climate Change (IPCC)

- Working groups on climate change, adaptation and mitigation

- Research builds on IPCC scenarios and concepts.

- System approach: Resilience to climate change depends on ability to adapt and transform.

- Projections not predictions.

Temperature

Observed change per **1°C** global warming

+1°C

Change (°C) — Warmer
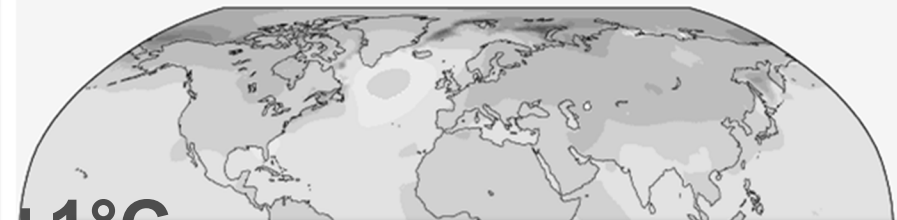0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7
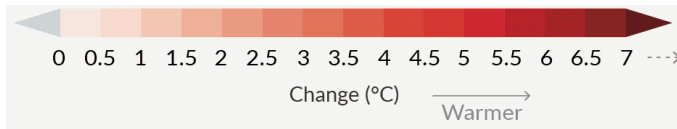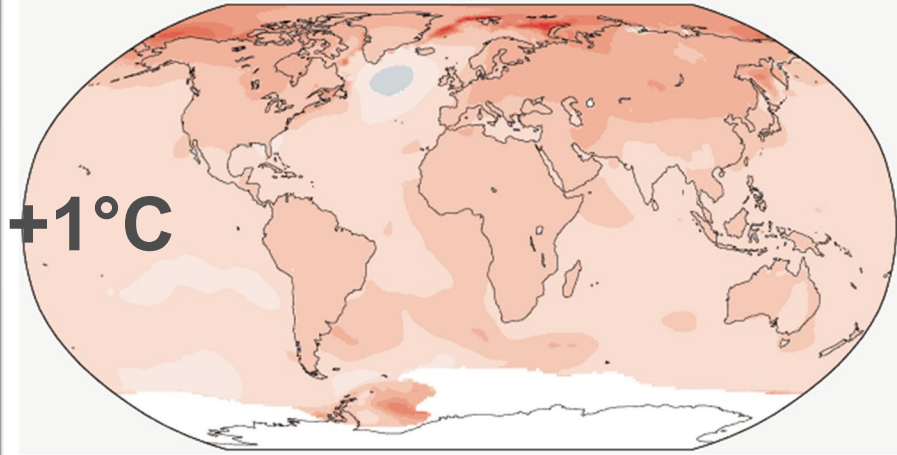
Climate Change scenarios

- We are now at 1.2 °C global warming
- Europe's warming is about double the global average
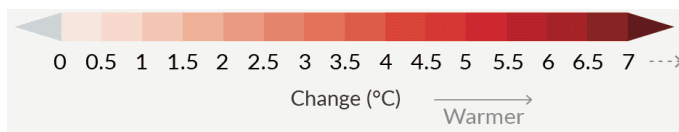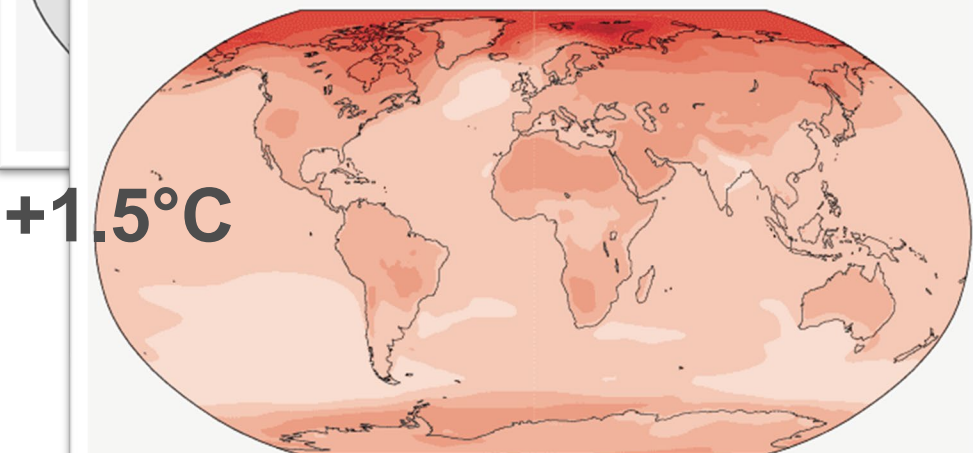- 2023 set to be warmest year on record (WMO)

Temperature

Observed change per **1°C** global warming

+1°C

Simulated change at **1.5°C** global warming

+1.5°C

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 --->

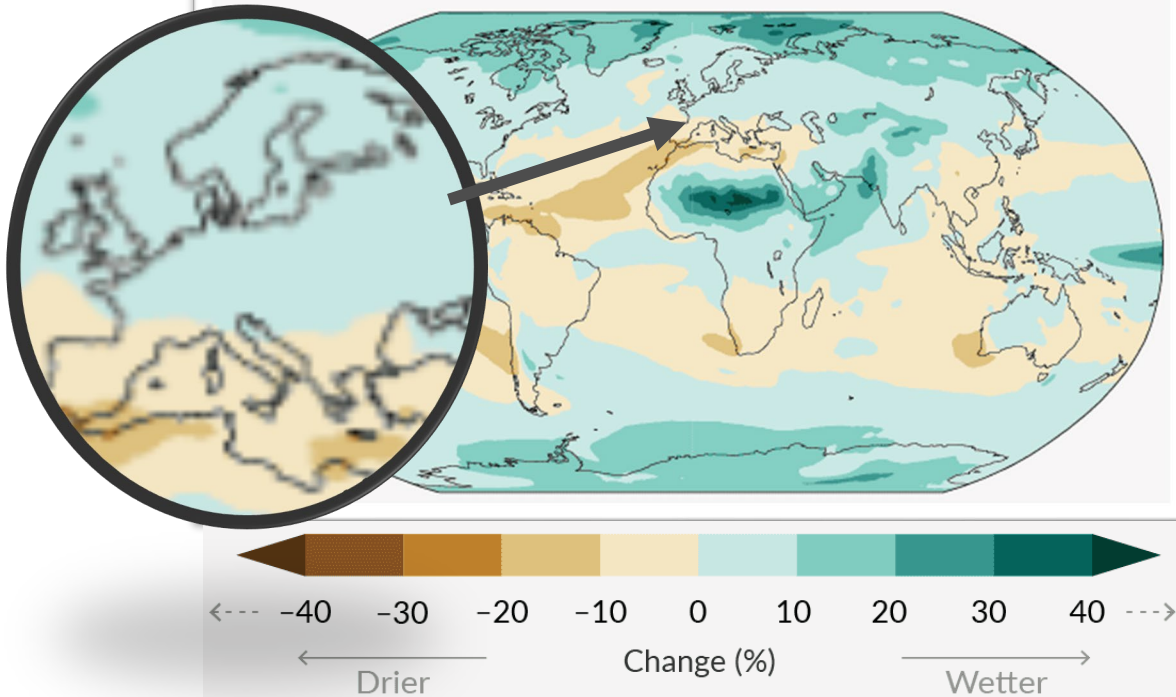Change (°C)   Warmer

Climate Change scenarios

1.5 °C global warming:

- Paris agreement ambitious goal- but current global commitments to mitigate emissions are insufficient.

- all the signs are that we are getting at 1.5 °C beginning of the 2030s

- The next CAP!

- Possibly reaching 2 °C only 3 CAPs ahead. (2040-2060).

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IPCC, SPM, 2022

Climate Change scenarios: hydrological cycle at **+1.5°C**

Precipitation

Simulated change at **1.5°C** global warming

−40 −30 −20 −10 0 10 20 30 40

Change (%)

←— Drier   Wetter —→

Soil Moisture

Simulated change at **1.5°C** glob[al]

−1.5 −1.0 −0.5 0 0.5 1.0 1.5

Change (standard deviation of interannual variability)

←— Drier   Wetter —→
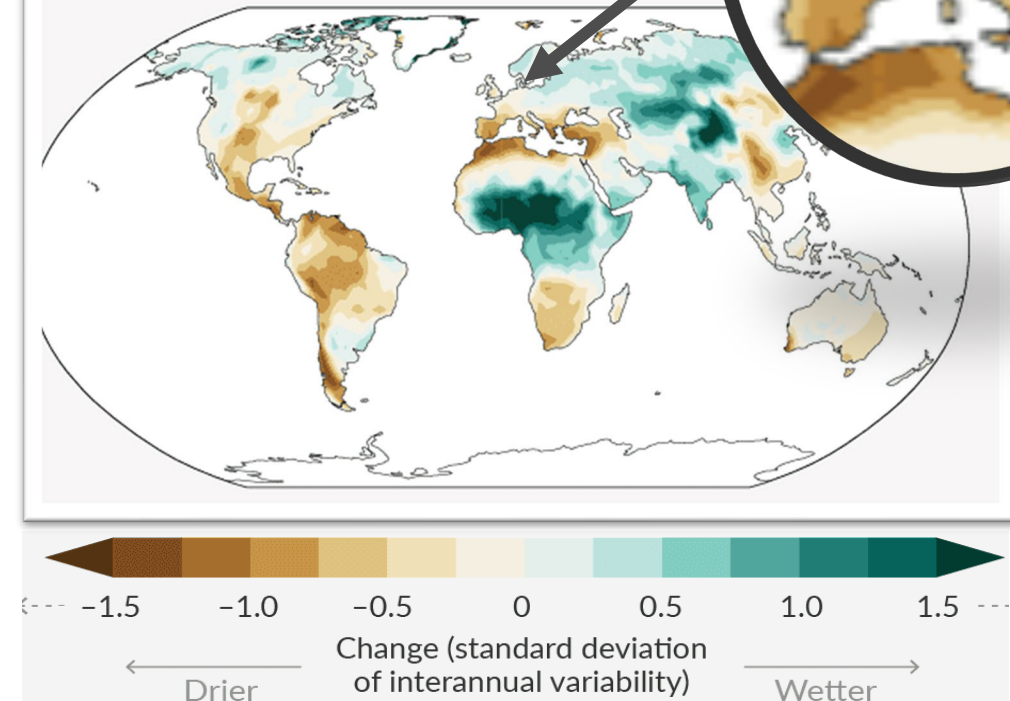
- More difficult and models are more diverse. Median of many models

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IPCC report: regional maize yield changes in Europe at 1.7 °C

(a) Yield changes for current production systems — -10 % to -30 %

(b) Yield increase with crop irrigation — -20 % to +20 %

(c) Irrigated yield increases from new varieties — +10 % to +20 %

(d) Water demand for irrigation

Maize

Relative yield change (%)
-100 % -50 % 0 50 % 100 %

Irrigation water use (mm yr⁻¹)
300 400 500 600 700
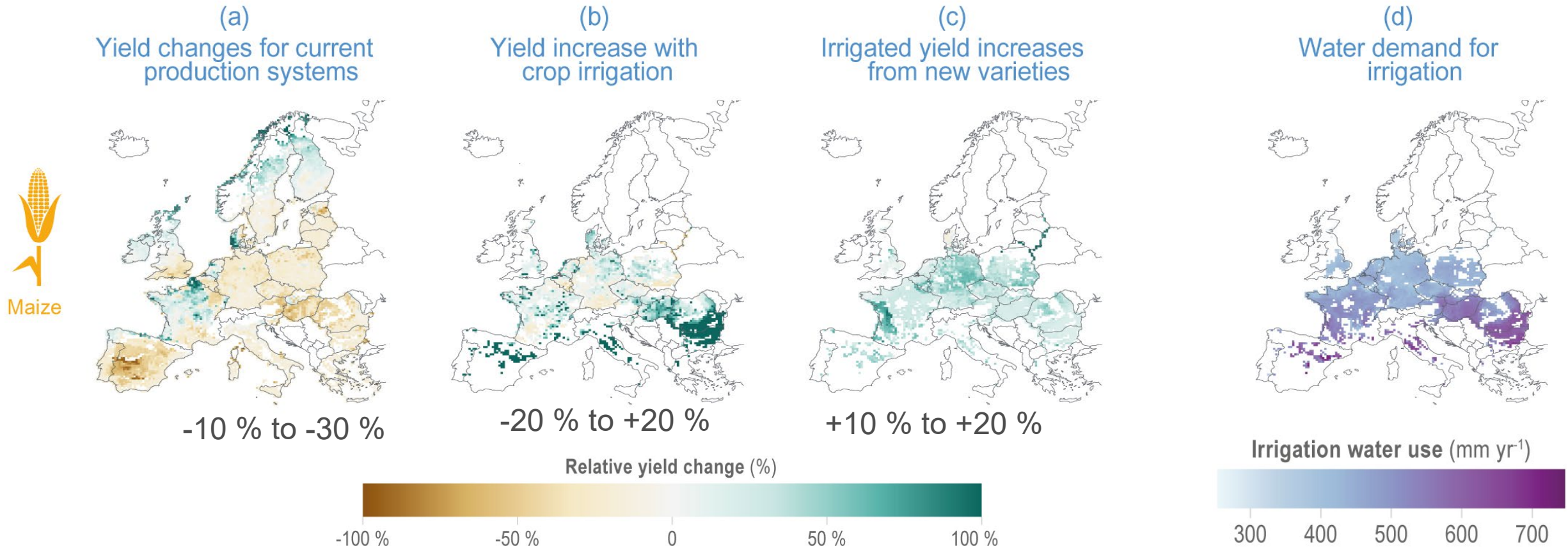
- Large declines in maize yields using current production systems
- More irrigation can improve yields- but water demand exacerbates
- New crop varieties may have (limited) positive effect on yields. But variability increases.

IPCC AR6; WG2 Figure 13.15

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Agriculture - wheat drought risk

Warming Level +2.0 °C

CL = Current Losses
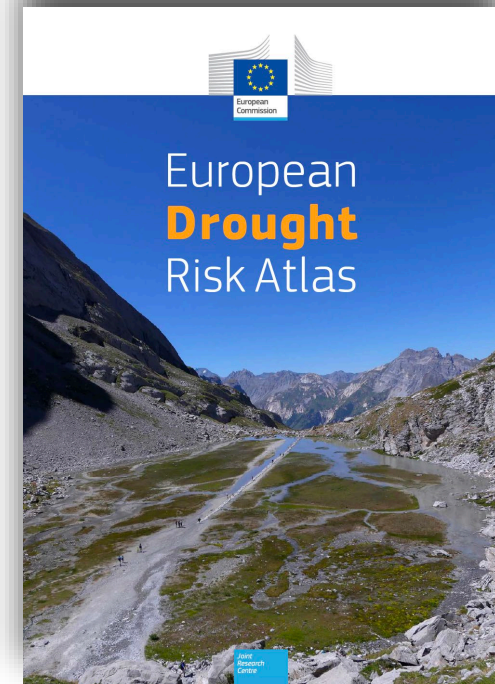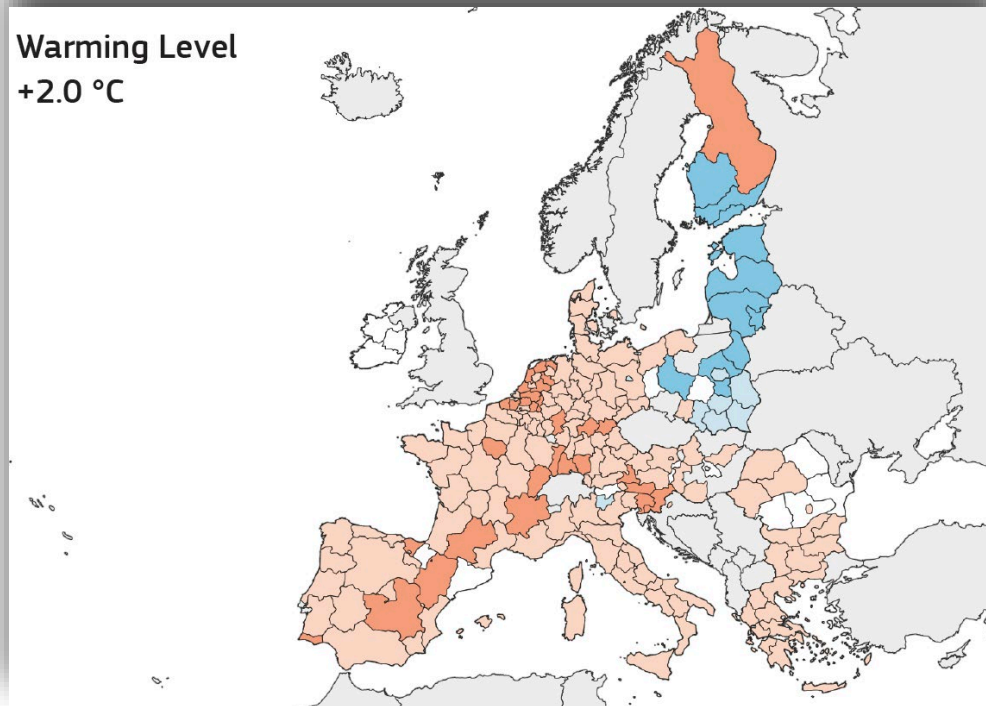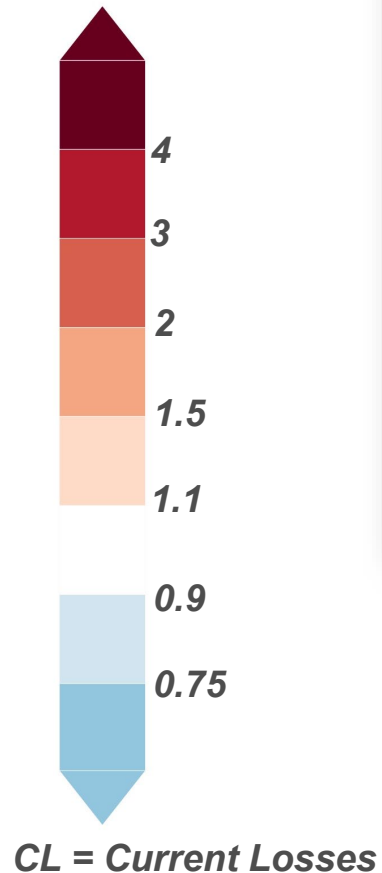
- Drought risk alone increase wheat losses by a factor 1.5-2 across most of Europe (machine learning approaches using past yield variabilities)
- Overall more positive effects for wheat than maize, in particular when irrigated (water demand not sustainable in large regions).

https://publications.jrc.ec.europa.eu/repository/handle/JRC135215

A glimpse in the future?
The summer 2022 drought and heat severely affected summer crop production in Europe

Source: JRC Mars Bulletin, 2022

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JRC Risk Data Hub

https://drmkc.jrc.ec.europa.eu/risk-data-hub

A data hub for pan-European risk and loss data

- Host and share disaster risk and loss data at pan-European level

- Host data and results from research EU funded and JRC projects

A platform to share information on risk and loss

- Share insights on losses, hazard, exposure and vulnerability

- Compute probabilistic risk for Europe

- Provide information regarding methodologies for risk calculation

- Support the new EU strategy on adaptation to climate change

Agriculture: exposure to coastal and river floods (municipality) and modelled losses (NUTS3).

European Climate Risk Assessment (EUCRA)

- Led by EEA, commissioned by CLIMA- scheduled for spring 2024
- Intends to inform the incoming commission on climate adaptation priorities.
- Across sectors. Chapters on food security, droughts, supply chains disruption,etc
- Agriculture a key-sector.
- Differentiated for macro regions

- Watch this space!.

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Wrap up

- **A better understanding of the resilience of EU agriculture is needed.** Monitoring agricultural sector resilience within CAP needs further improvement

- *Resilience is the ability not only to withstand and cope with challenges, but also to undergo transitions, in sustainable, fair and democratic manner*

- Characterized by **preparedness, capacities, vulnerability**. Soil moisture conservation, irrigation, agroforestry, farm and landscape level diversification in agriculture, nature based solutions are often mentioned a beneficial for resilience.

- **Loss of crop production is a key risk for northern and Southern Europe**,

- Need to **address the future risks and preparedness** of the agricultural sector. The droughts of 2022 (and 2018) as a glimpse **into the future**?

- **Climate services** can **play an important role in informing farmers and mitigating negative effects**. The performance of services and our understanding of how to use them is increasing. Higher yields can also mean more variability.

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Thank you

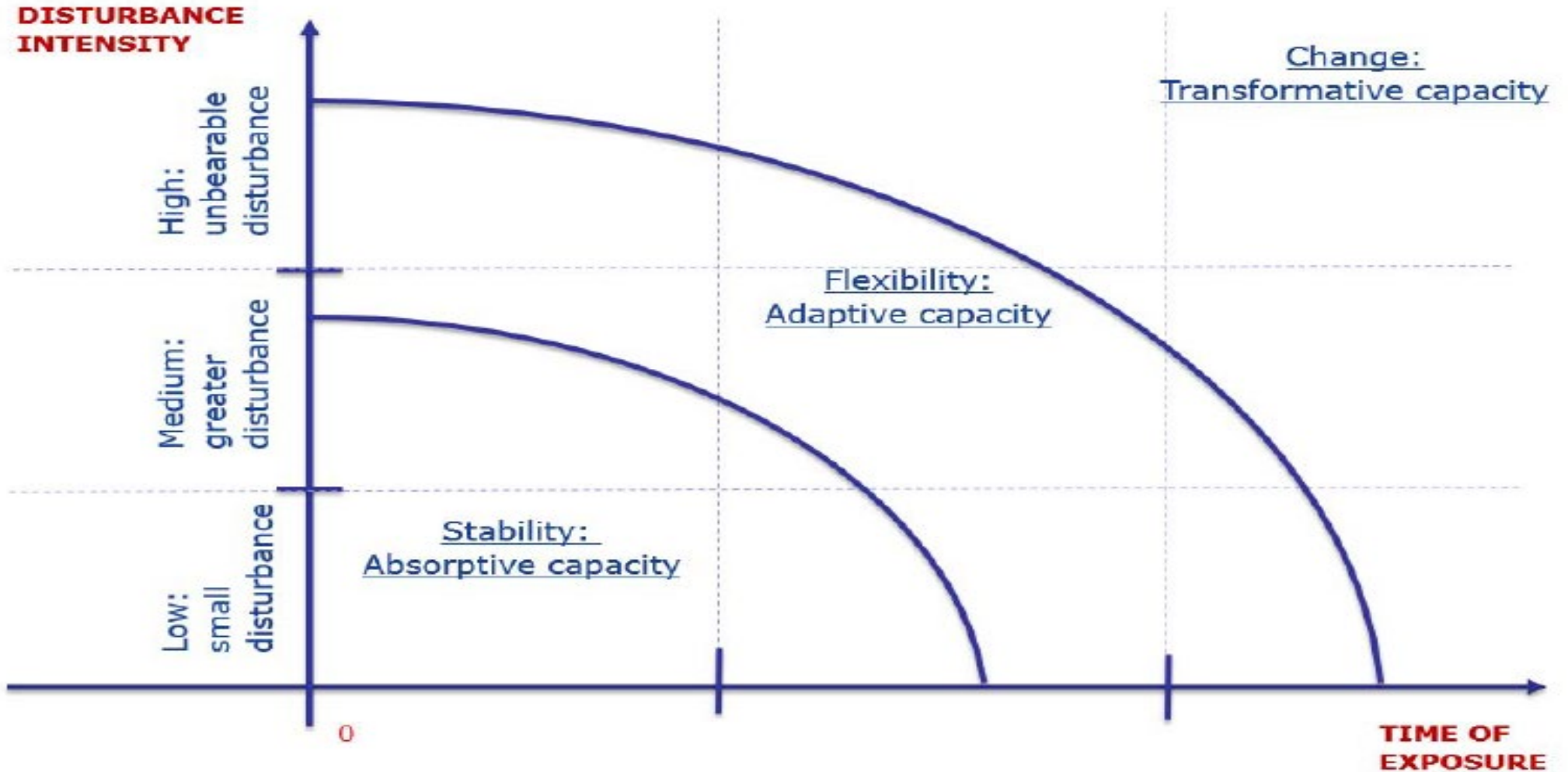frank.dentener@ec.europa.eu
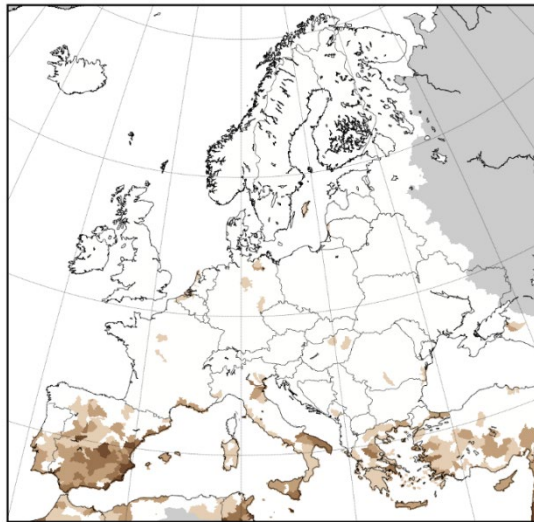
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Extra's

# Resilience: stability; adaptation; transformation

WEI+: under current and 2-degrees climate

- JRC-LISFLOOD hydrological model
- WEI+ ratio of the total water net consumption divided by the available freshwater resources in a region, including upstream inflowing water. Warning level for WEI+=0.2

WEI+ current climate (1990-2018)

Change in WEI+ in 2 degrees climate (22 Euro-Cordex scenarios)
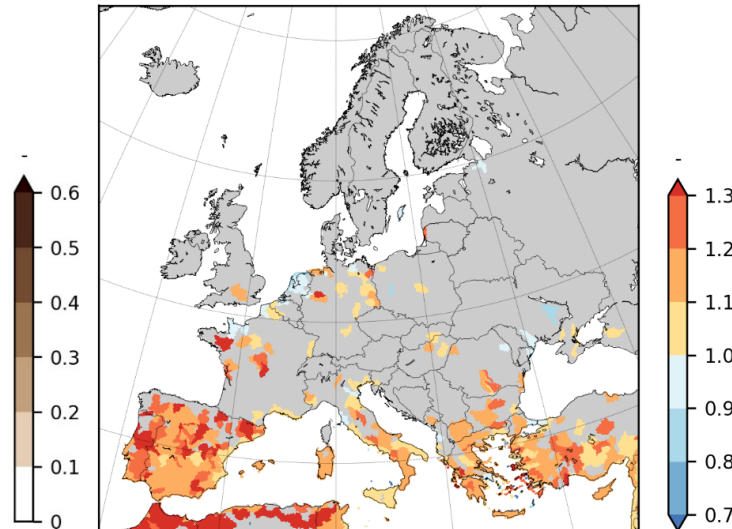
Do CAP SP's recognize reduced water availability for irrigation caused by climate change?

(reduced rainfall, increased evaporative demand)

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