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Climate change and droughts in the Danube region

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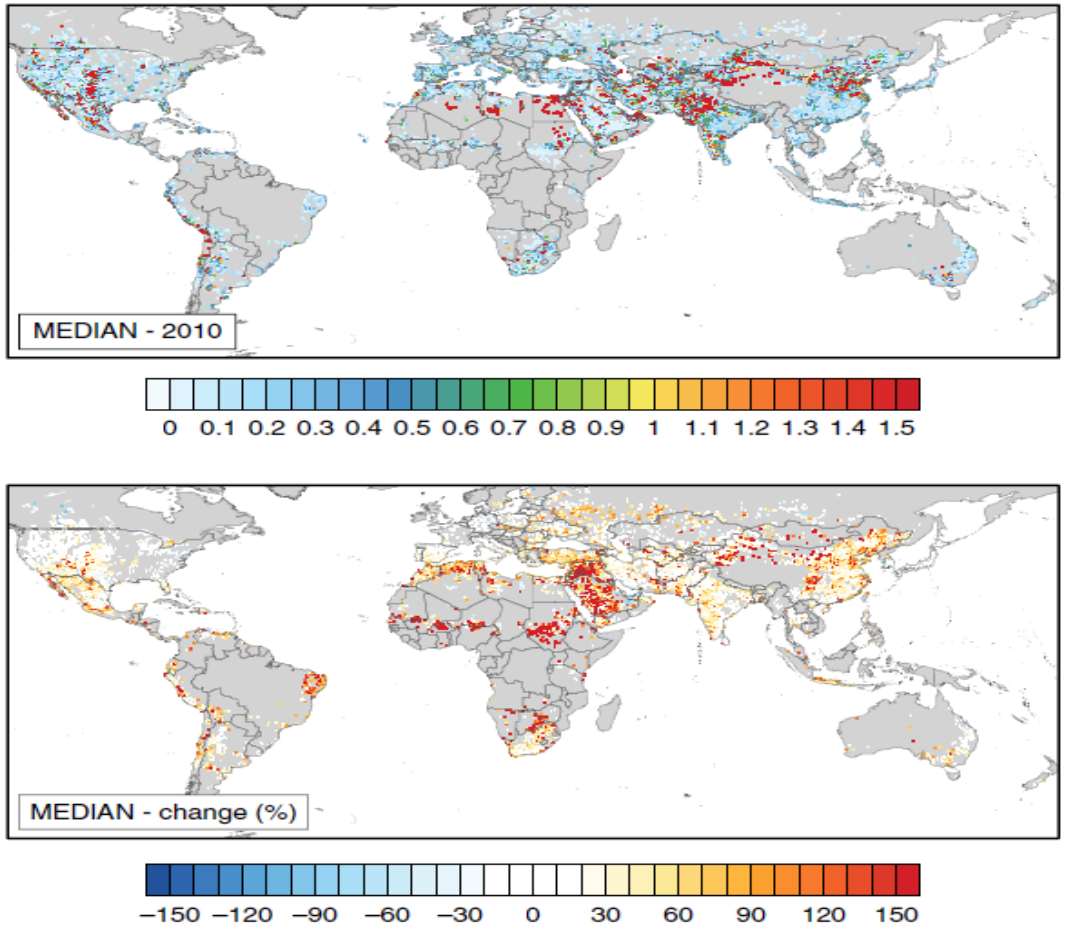
All results shown in this presentation are the outcomes of the Eastern Europe and Central Asia water security assessment project led by IIASA in partnership with Hydrophil and InterSuS, funded by the World Bank.

2024 Danube Water Forum
Setting the scene: the sector's challenge in a new climate reality
30 May 2024, Brasov, Romania

Water scarcity (imbalance between supply and demand): expected to further exacerbate in the future, becoming a widespread problem in many regions around the world (including areas never experienced water scarcity)

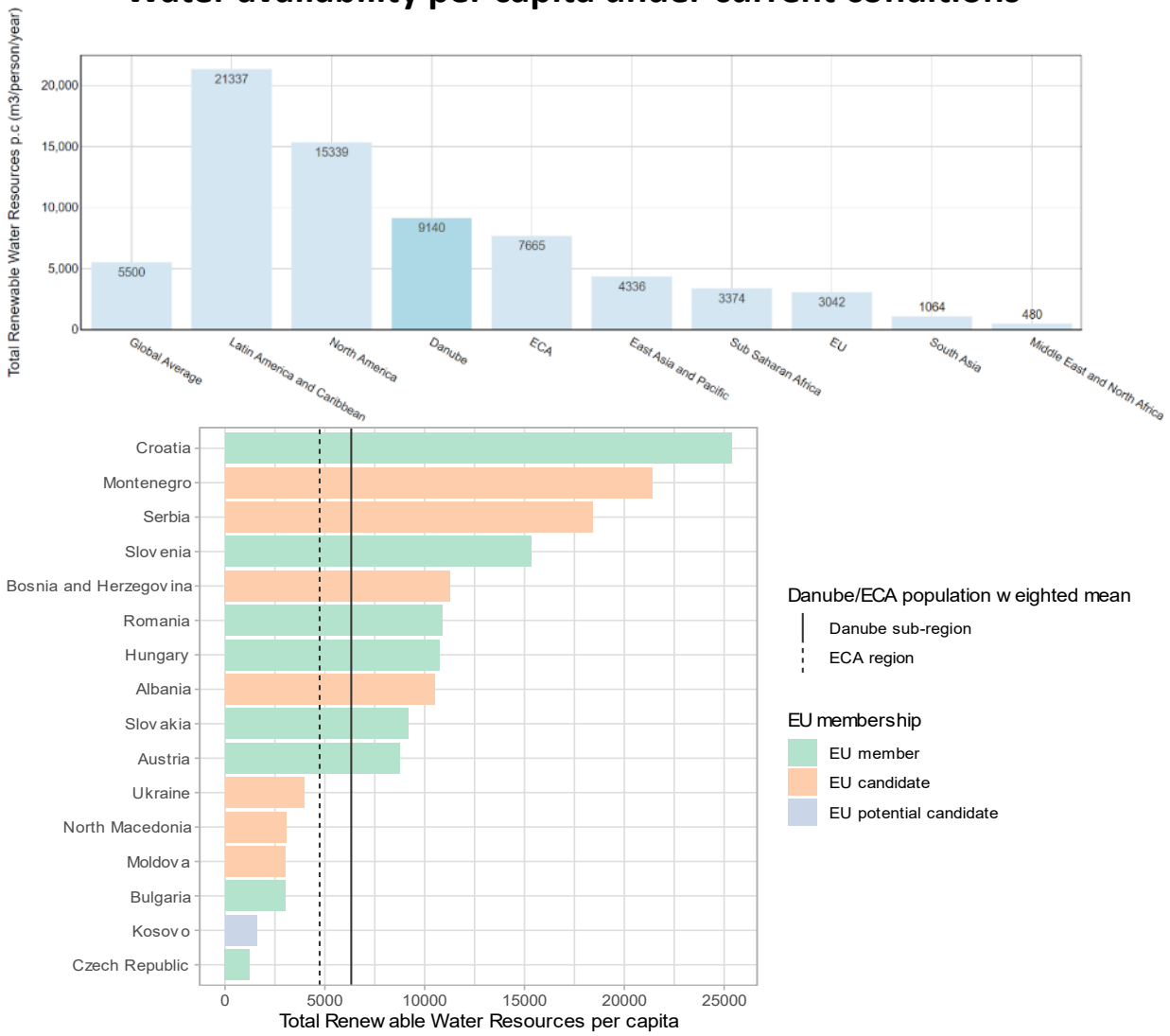


- Water scarcity could reduce GDP growth rates in some regions by 6% by 2050, as a result of losses in agriculture, health, income and property – sending them into sustained negative growth (World Bank, 2016)
- Water scarcity could also cause several environmental problems such reduction of environmental flows and degradation of water-dependent ecosystems sustaining the livelihood of millions of people

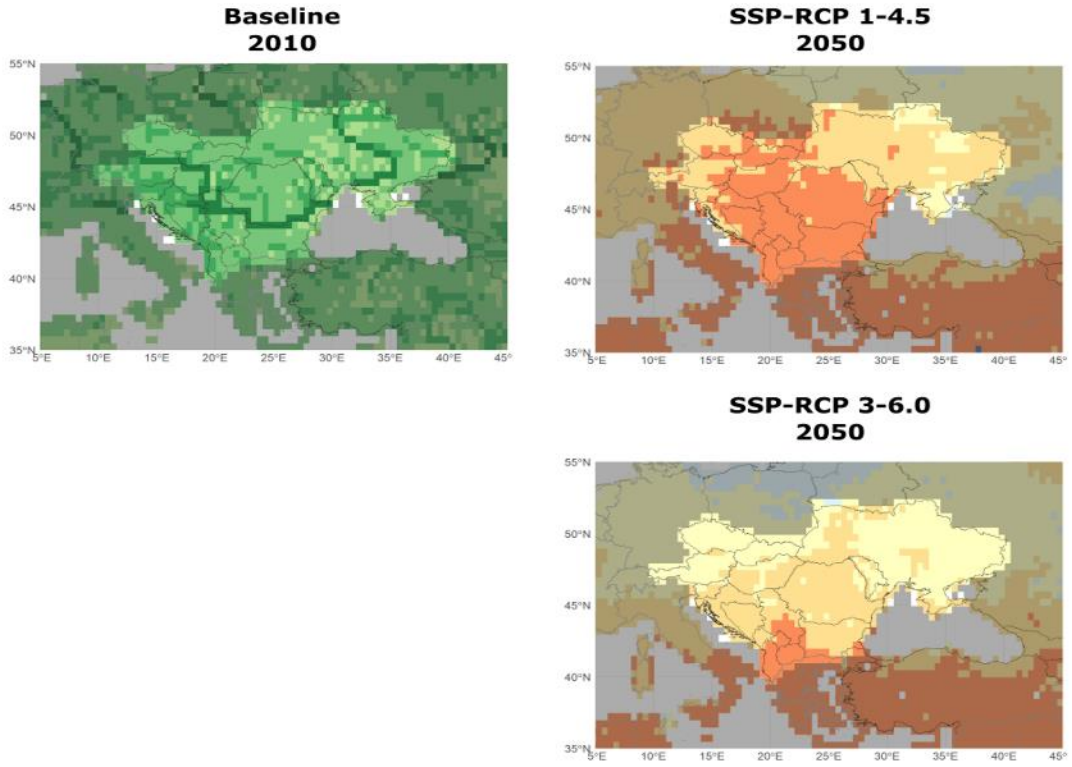
Greve et al. Nature Sust. 2018

Water availability is currently high in the Danube region, but climate change is expected to affect it mostly negatively (up to -20% by 2050 in some areas under certain scenarios)

Water availability per capita under current conditions



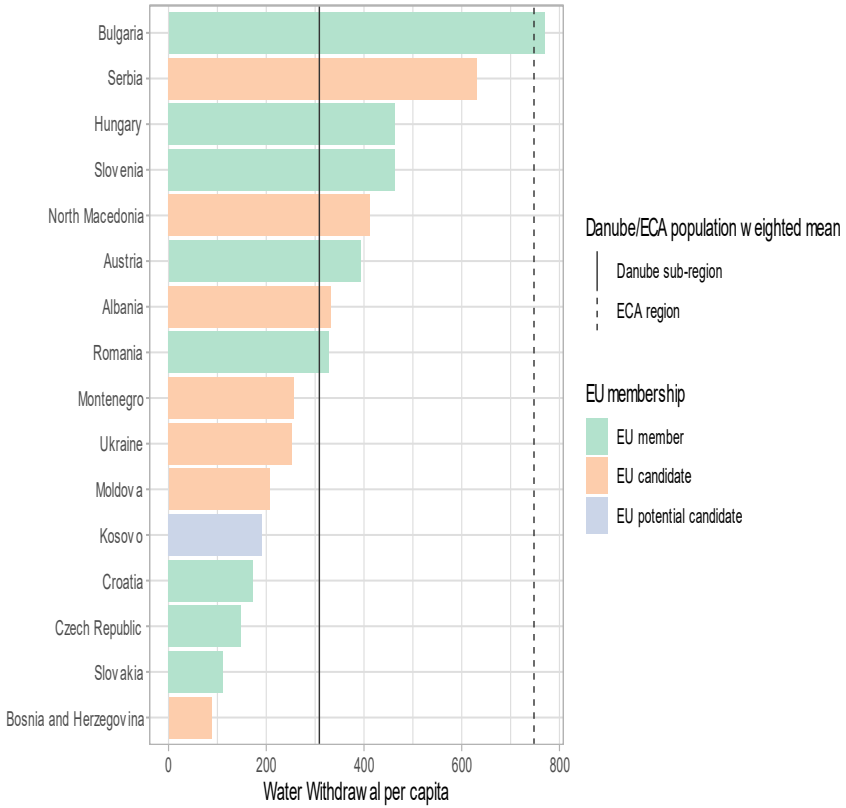
Projected climate change impacts by 2050



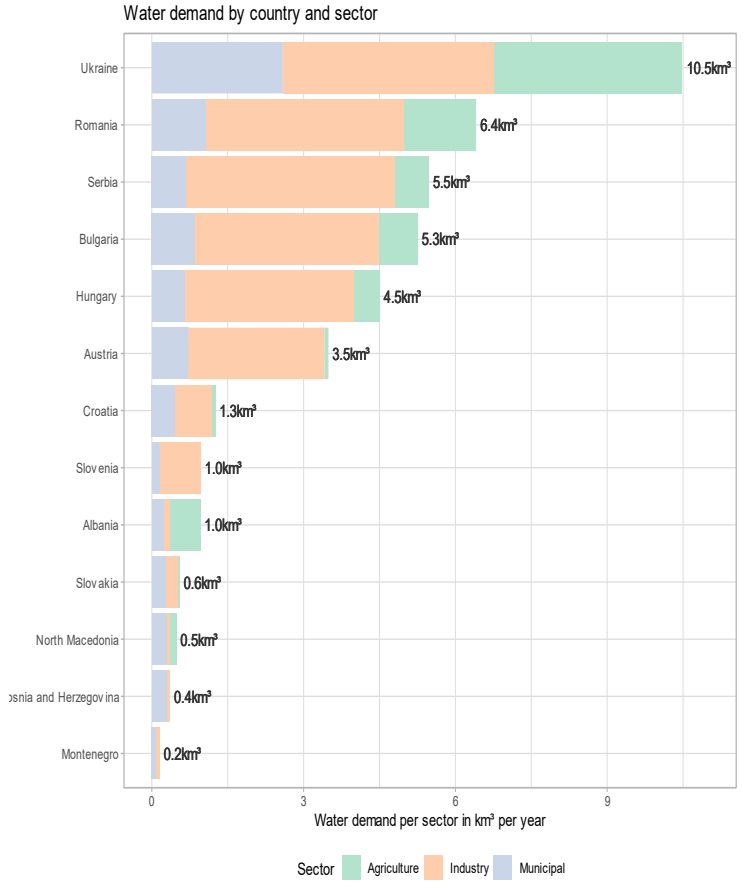
Satoh et al. Earth's Future 2017

Water demand is currently low in the Danube region, but projected to further increase in the coming decades driven by mostly by the growing domestic and industrial sectors (up to 50% by 2050 in some areas under certain scenarios)

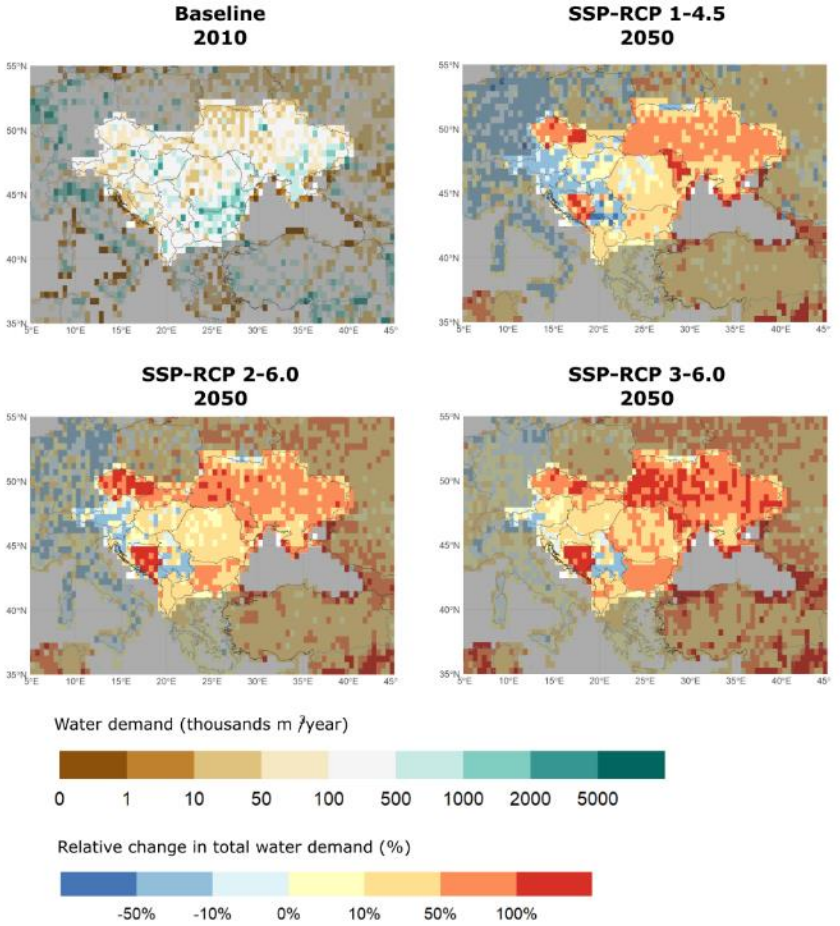
Water demand per capita under current conditions



Water demand by sector under current conditions



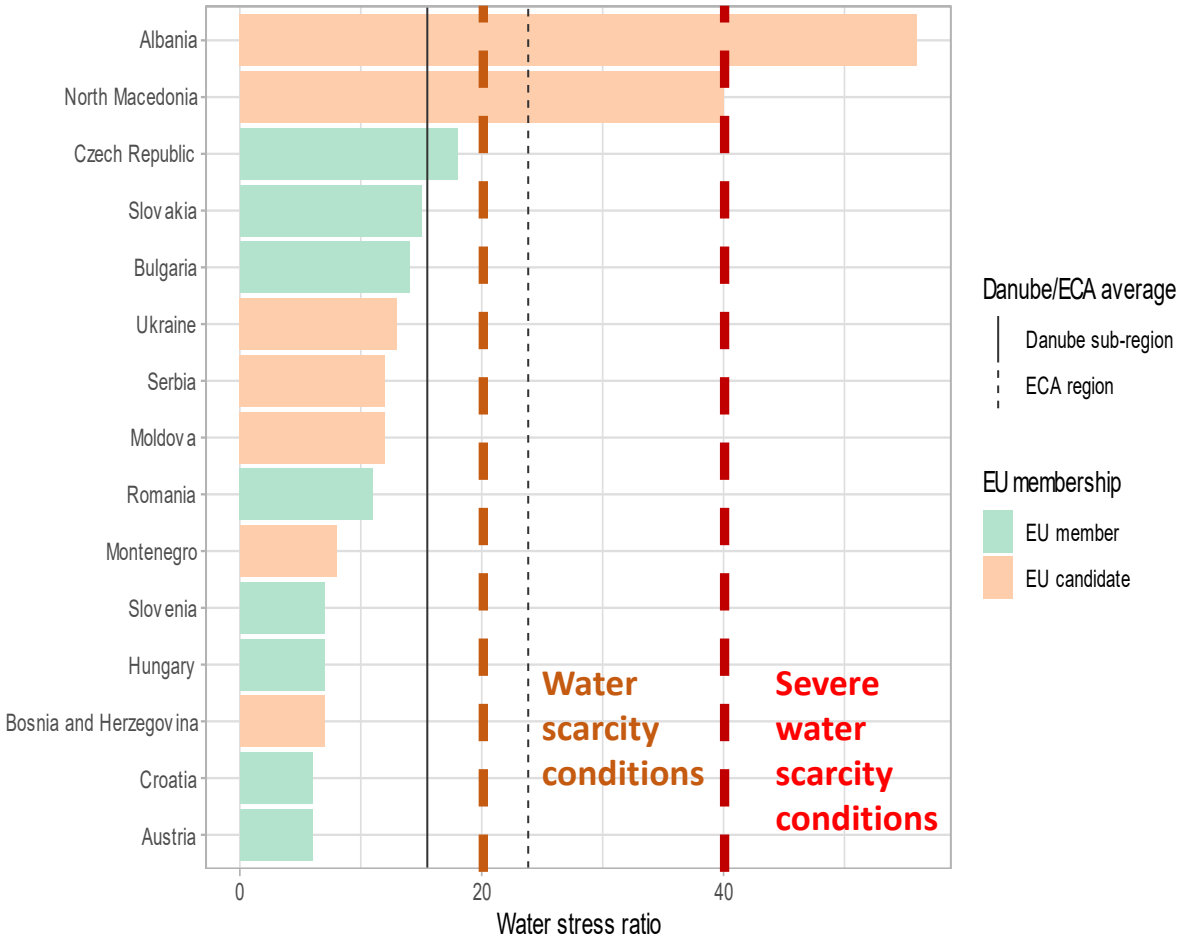
Projected change in water demand by 2050



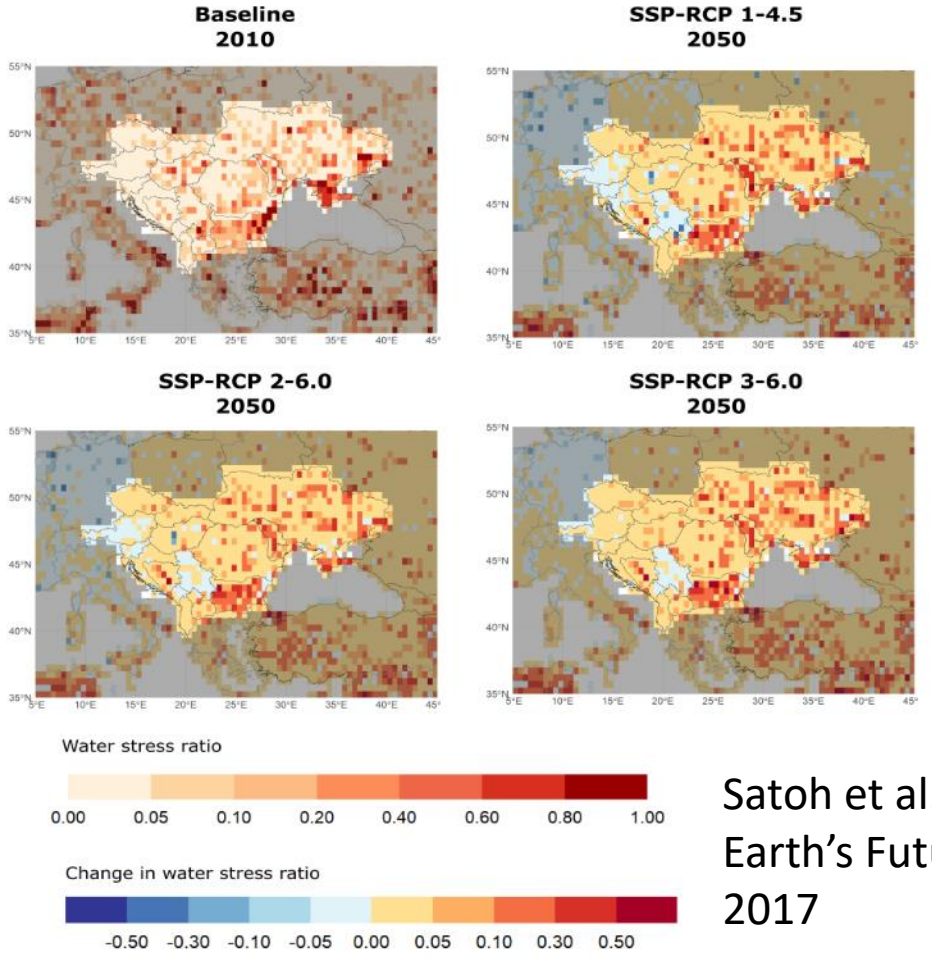
Satoh et al. Earth's Future 2017

Water stress (withdrawal to availability ratio) is currently low in the Danube region, with the share of population living in highly water-stressed areas is 15%, but it is expected to exacerbate, particularly in the eastern and southeastern parts

Water stress ratio under current conditions



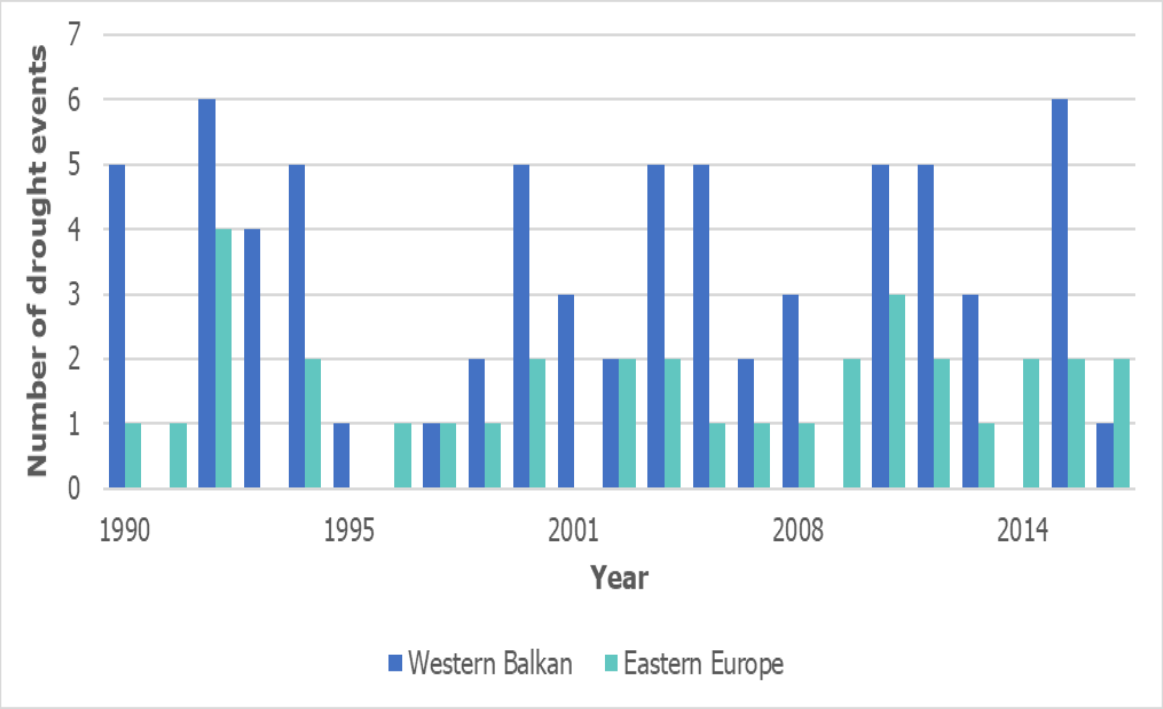
Projected change in water stress by 2050



Satoh et al. Earth's Future 2017

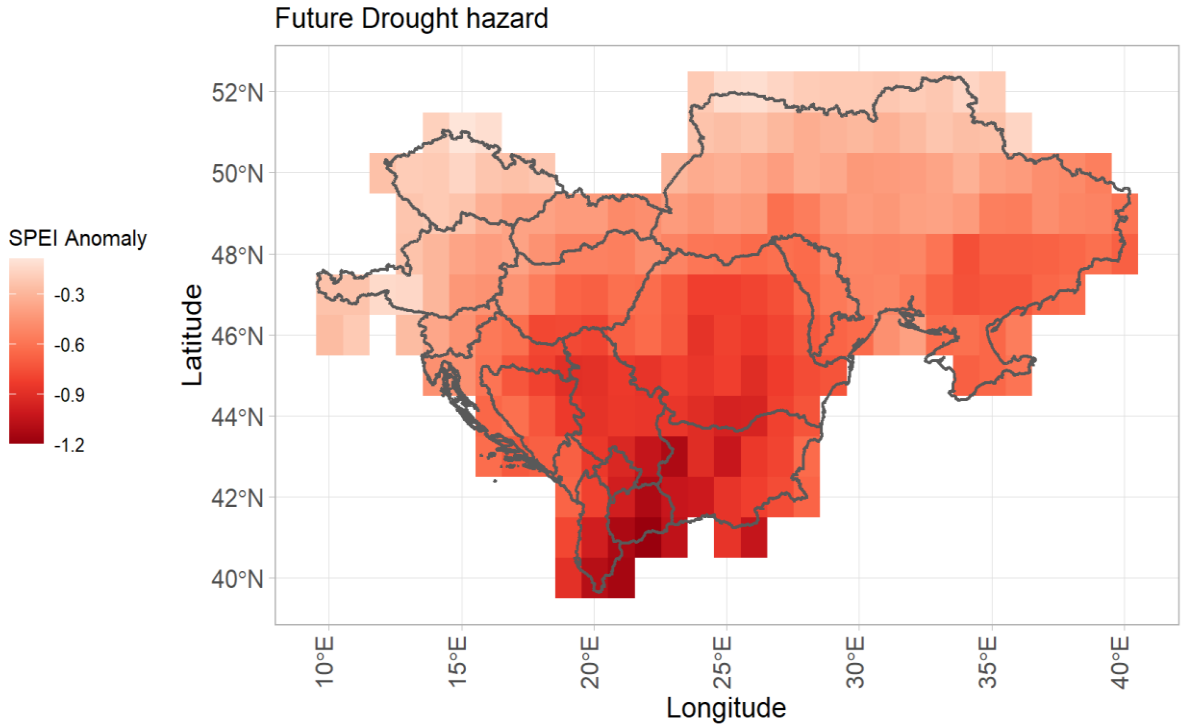
Drought hazards are projected to intensify in the Danube region, further exacerbating the water stress conditions and creating risks to economic sectors and environmental assets

Number of drought events per year in the Western Balkan and Eastern Europe



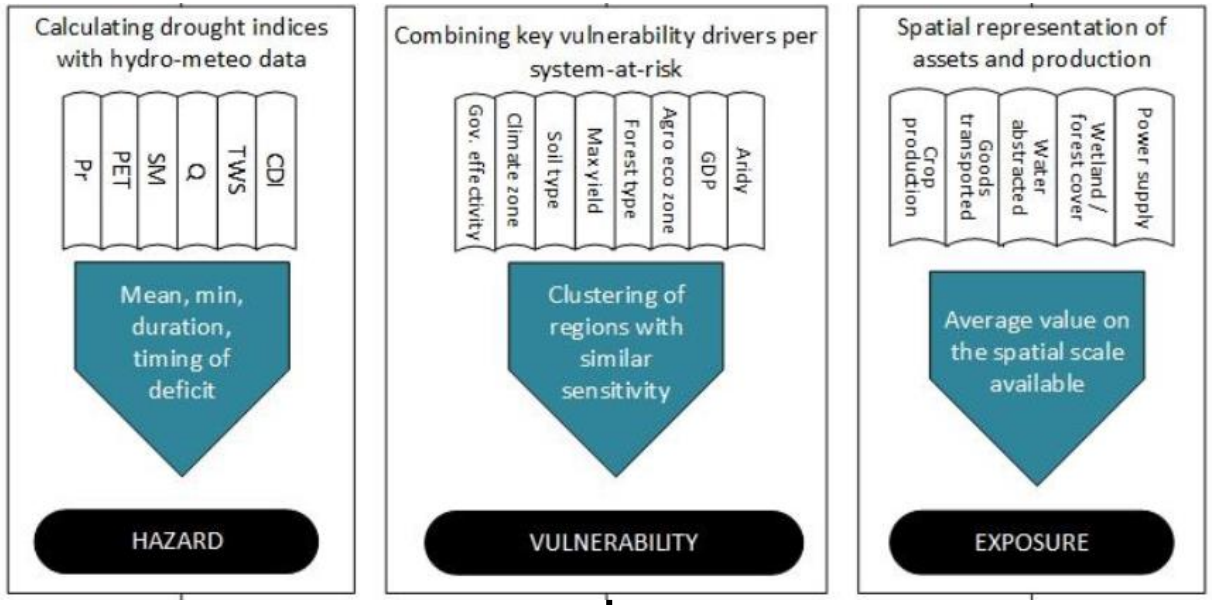
69 drought events in the Western Balkan in 1990-2016
34 droughts events in Eastern Europe in 1990-2016

Future drought hazards by 2050 under a pessimistic climate scenario



Drought hazards is measured by the CMIP5 multi-model ensemble standardized precipitation evapotranspiration index (SPEI).

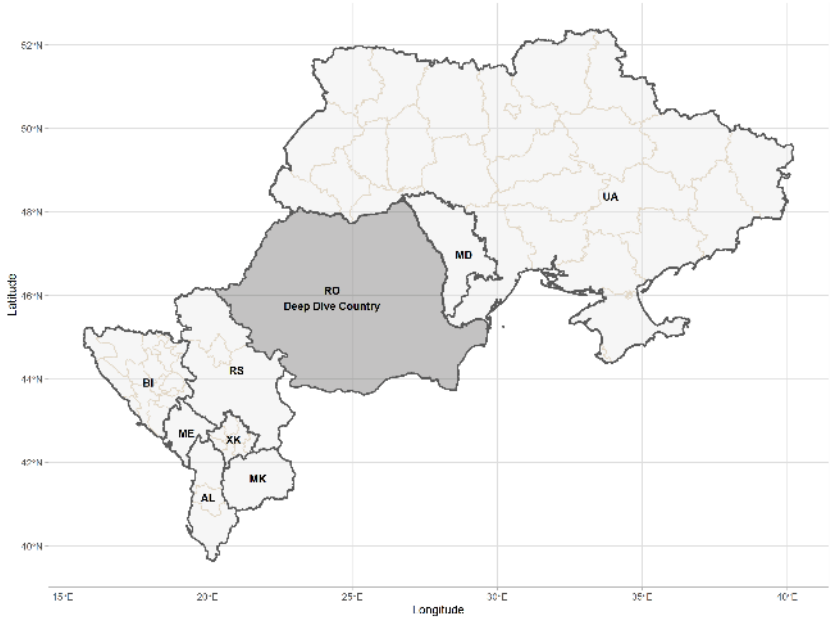
Methods for sector drought impact assessment in the Western Balkan and Eastern Europe (the EDORA project approach)



Machine learning (Random Forest)

Sectoral drought risk per NUTS

Sectoral, NUT-specific likelihood of impactful drought event (Expected annual damage, probably maximum loss)



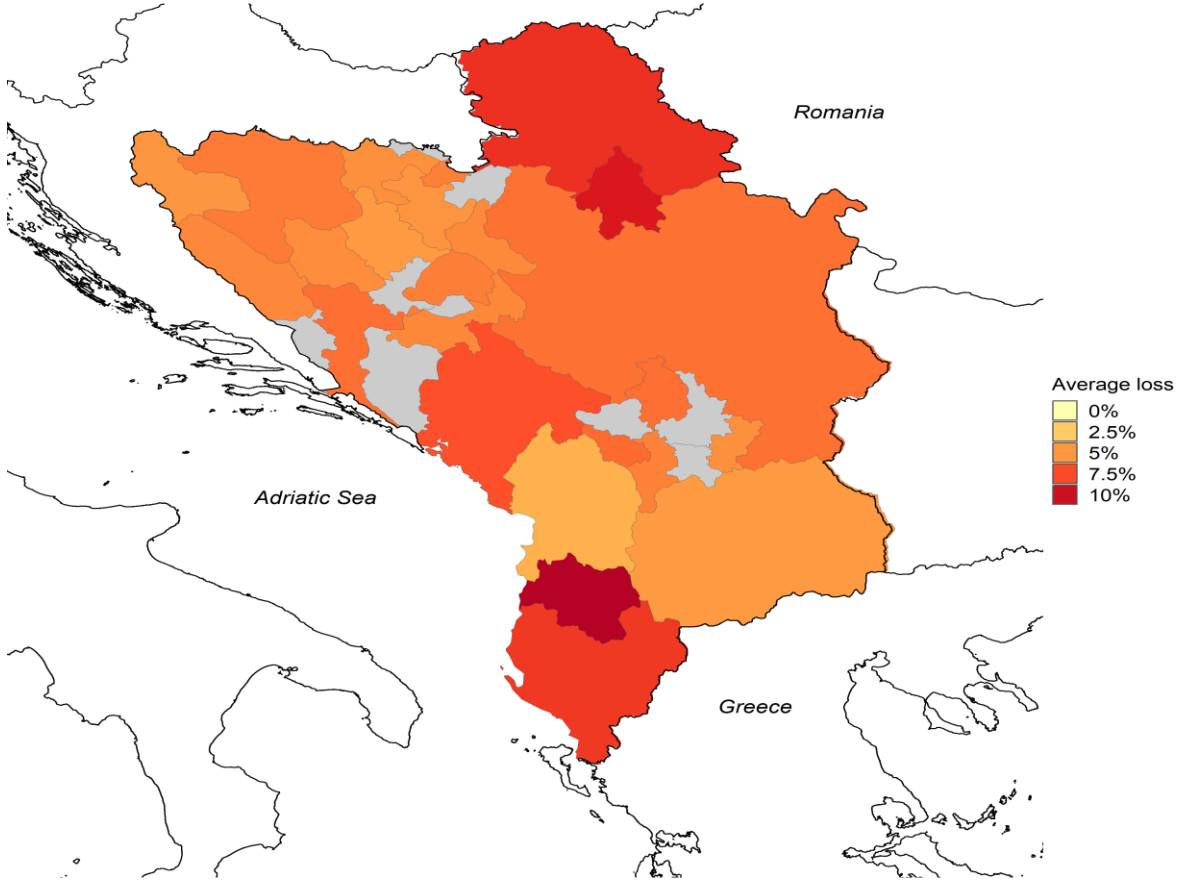
Extending the EDORA-EU assessment to include the Western Balkan, and Ukraine and Moldova (Eight countries).

Systems-at-risk & data

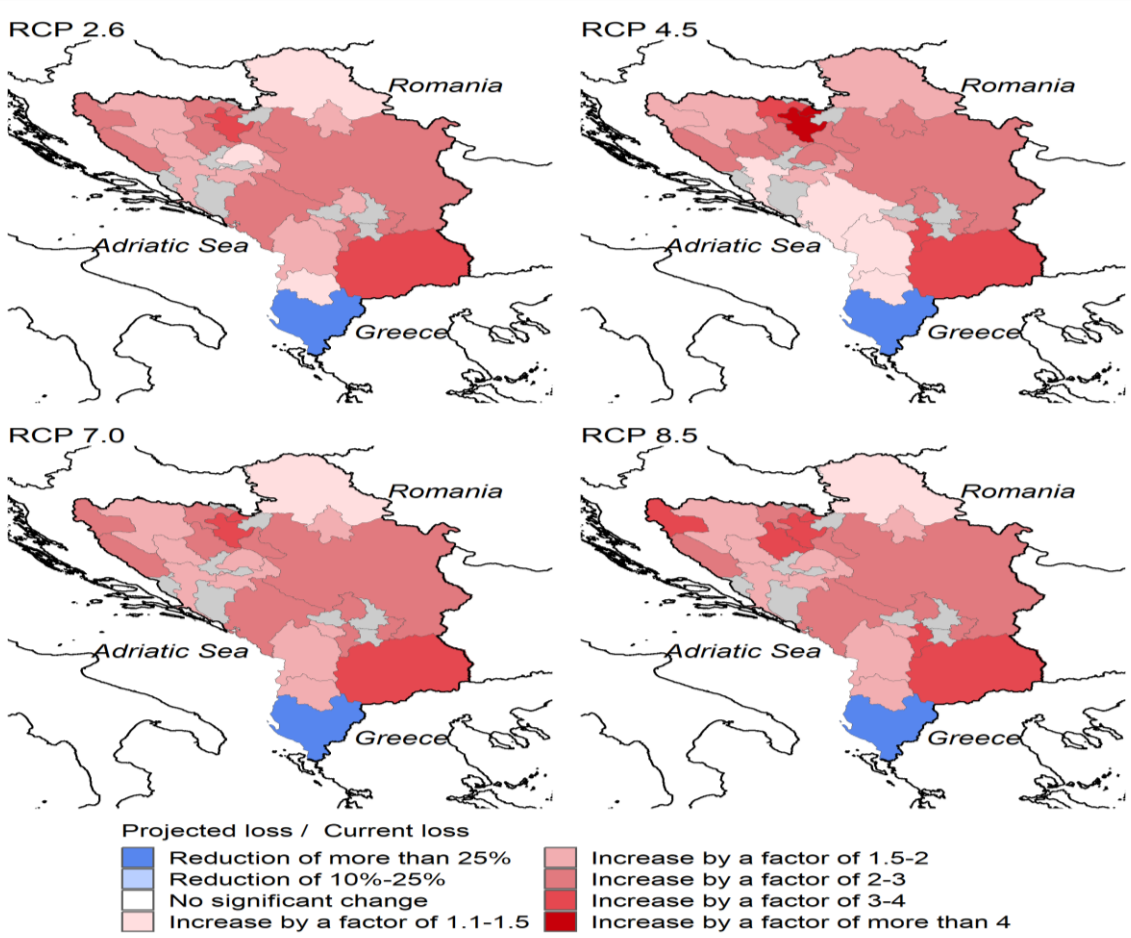
System-at-risk	Impact proxy	Data source & coverage
Agriculture – crops	Yield of wheat and maize	Lizumi and Sakai, 2020 0.5°, 1982 -2016
Water Supply	Water withdrawal	Global CWatM 0.5°, 1990 -2019
Energy supply – hydroelectricity	Hydroelectricity generation	Country Statistics, IEA National, 1990 -2020
Inland water transport	Goods transported	UNECE Statistical database National, 1980 -2021
Ecosystem – terrestrial	Forest Net Primary Productivity (NPP)	MODIS Net Primary Productivity & MODIS landcover type (annual) 500 meter, 2001 -2022
Ecosystem – freshwater	Wetland Net Primary Productivity (NPP)	

Climate change-induced droughts are expected to result in major losses in crop production in many parts of the Danube region (more than doubling), because of no or inefficient irrigation and low water storage capacity

Average annual yield loss (AAL) for maize associated with droughts under the present conditions in the Western Balkan

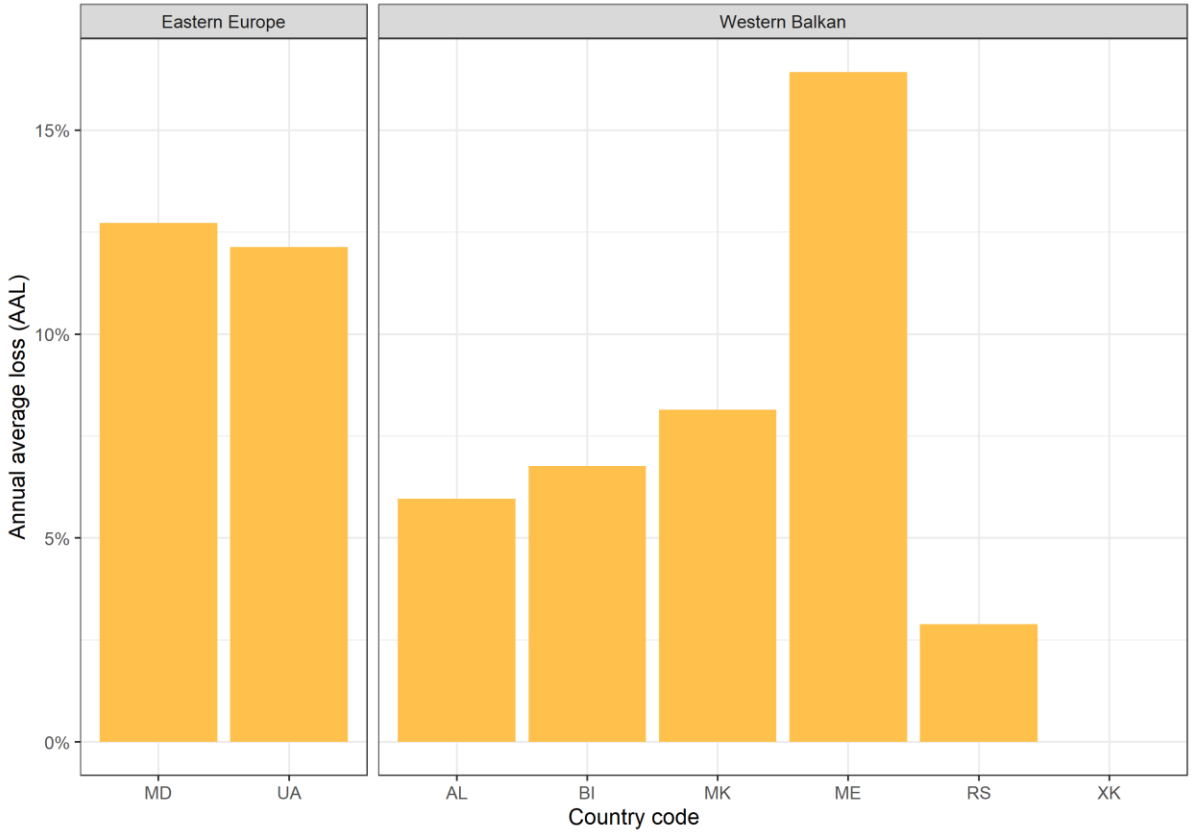


Change in drought-related AAL of maize because of climate change

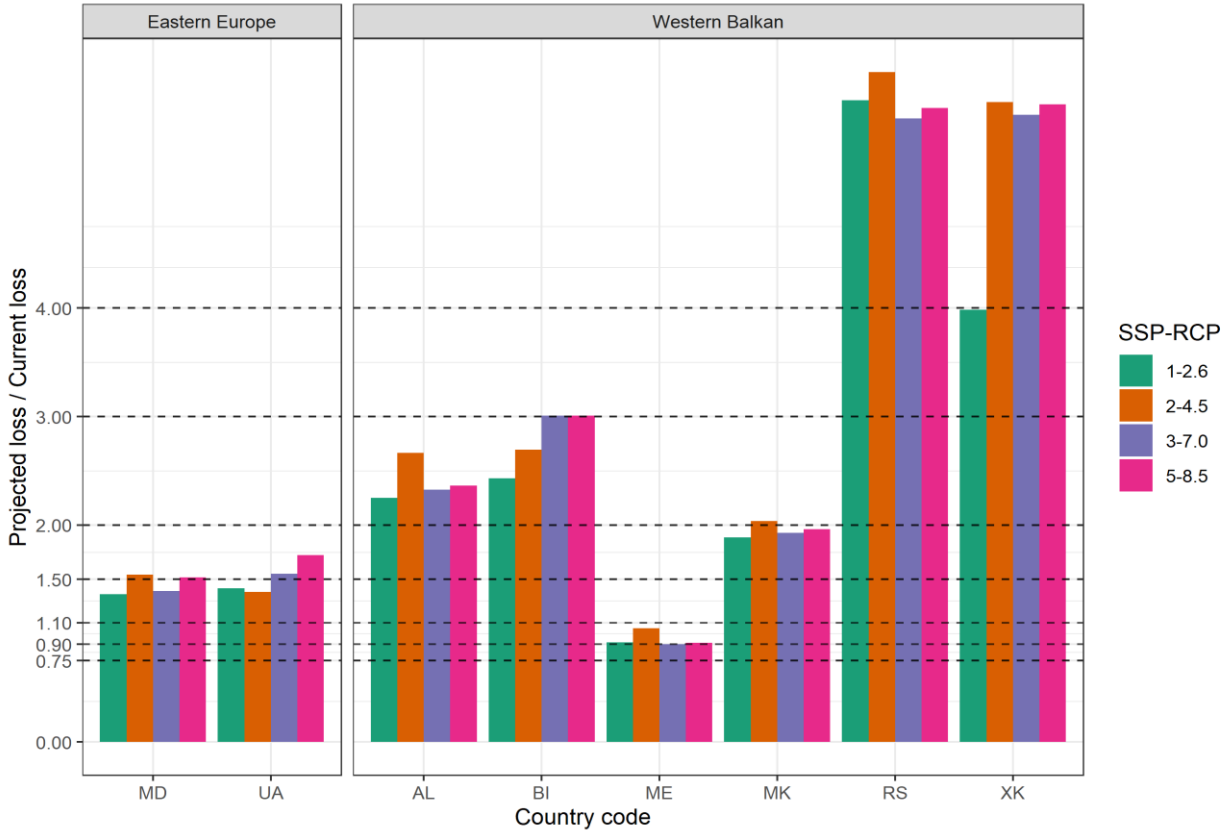


Hydropower production could be impacted substantially by climate-change inducted droughts (up to 4 times increase), with cascading impacts on energy prices due to hydropower over-specialization in many countries in the Danube region

Average annual loss (AAL) for hydropower production associated with droughts under the present conditions in the Western Balkan and Eastern Europe



Change in drought-related AAL of hydropower production because of climate change

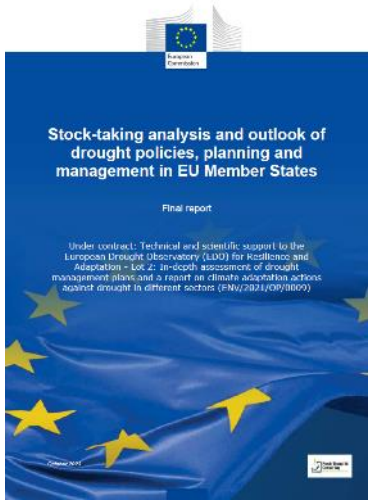


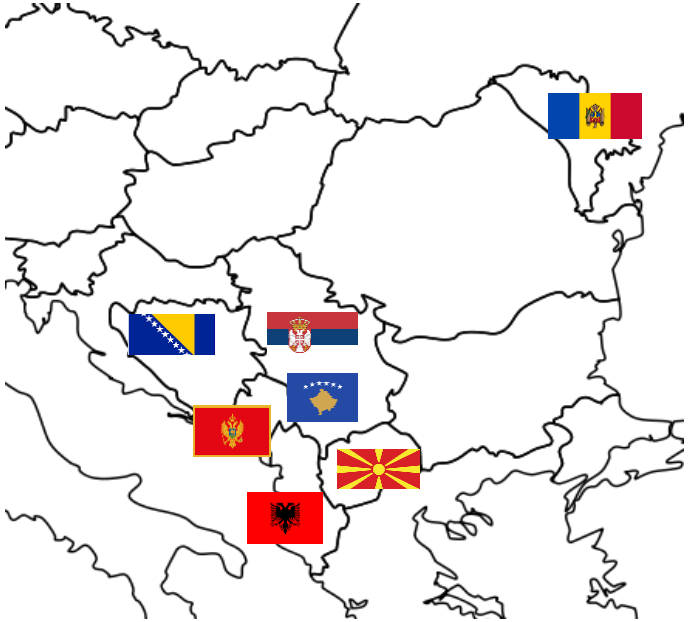
Drought preparedness Assessment

- Drought hazards and impacts increasing, but country preparedness not yet

- An Ad-hoc Task Group on Water Scarcity and Droughts was established by the EC to take stock across EU countries. Report for EU countries

- The DWP aimed at completing this assessment for non-EU countries of the Danube. Target countries:
  - Albania
  - Bosnia and Herzegovina
  - Kosovo
  - Moldova
  - Montenegro
  - North Macedonia
  - Serbia

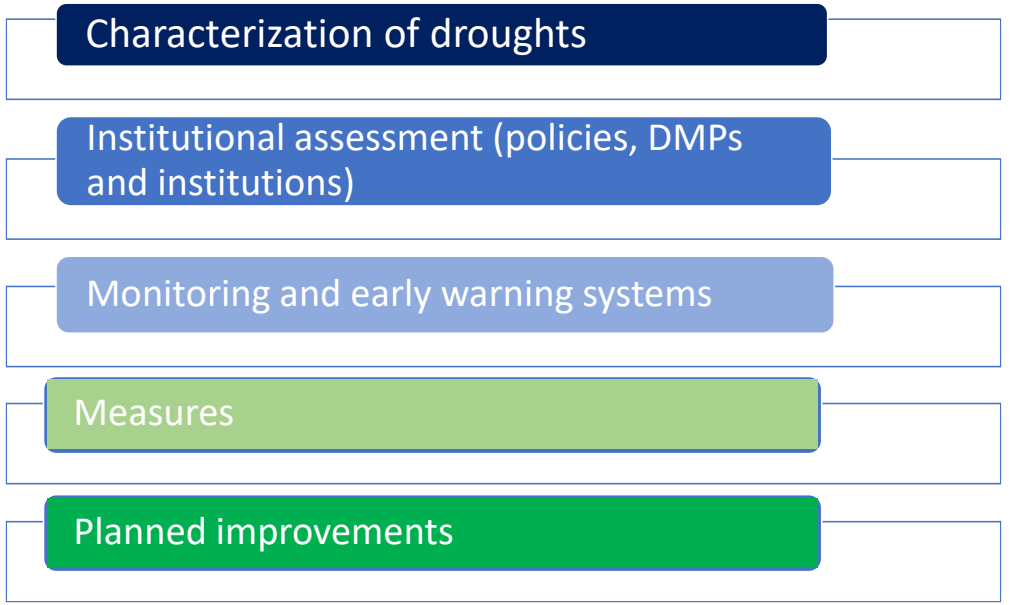




Methodology drought preparedness Assessment

- In-depth review of relevant national and sub-national policy documents
- 2-4 interviews per country with relevant institutional levels (20 interviews in total). Semi-structured interviews dealing with
- Report summarizing main findings: taking stock of preparedness, and outlining priority actions
  - Regulatory framework
  - Roles and responsabilities
  - Management instruments
  - Adaptation measures
  - Good practices and next steps

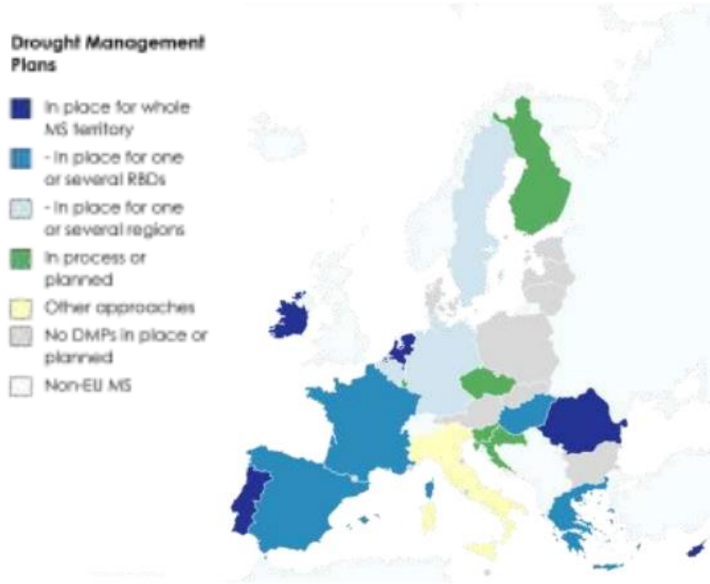
Focus of the interviews



EU Drought Assessment

- **Legislation**
  - In 8/27 EU States there is no specific legislation on droughts
  - Drought legislation where present (10/27) is being updated recently
  - No standard definition of droughts and associated risks

- **Management** 13/27 EU States have DMPs in place at different levels (region, basin, country). Not all contain the key three elements required:
  - No harmonized (& comparable) indicators
  - No specific measures to deal with droughts
  - Different or even absent organizational framework to develop and update DMPs



- **Governance** largely applies a subsidiary approach across EU States
  - *Policy* drafted at national level (often Ministry of Environment and/or Agriculture).
  - Drought *planning* either integrated with policy or decentralized at local level
  - Drought *Management* is spread across local, national and basin (depending on the scale of the DMPs)

Non-EU Danube countries Drought Assessment

- **Legislation**
  - In 3/7 national legislation on droughts is in place but not fully developed
  - In the remaining countries, droughts is recognized as a risk to be managed but without specific normative development
  - Like in many EU countries, no standard definition of droughts and associated risks

- **Management**
  - Development and adoption of DMPs is very limited.
    - National: MKD, MNE, SRB (pending of approval)
    - Basin level, only one plan adopted (MDA)
    - Al local level XK, MNE (pending of approval)
    - No harmonized (& comparable) indicators
  - No guidance documents to draft DMPs

- **Governance** largely applies a subsidiary approach
  - *Policy* drafted at national level is fragmented across different ministries (Environment, Agriculture, Infrastructure)
  - Drought *planning* largely national level (BiH at basin)
  - Drought *Management* is spread across national and basin ALB, BIH, XK)

Non-EU Danube countries Drought Assessment

Monitoring

- Basic indicator networks in place but limited coverage or non continuous series
- Monitoring is focused on other risks, less on droughts
- No standard indicator framework, every countries uses different ones

Management

- Reactive approach instead of proactive
- Strong focus on water management for socioeconomic uses, limited for environment
- Measures are primarily operational

Allocation measures

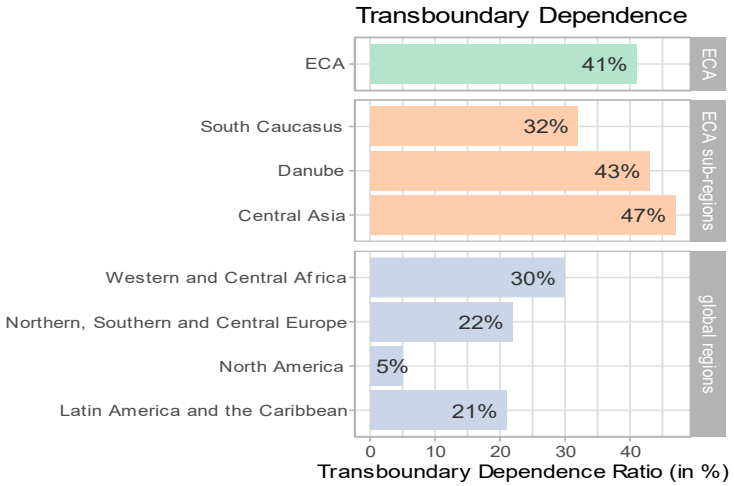
- 5/7 countries have allocation mechanisms in place but facing implementation challenges
- Allocation priorities during droughts differ, but drinking water prevails as a first priority and the environment as a low priority

Planned improvements

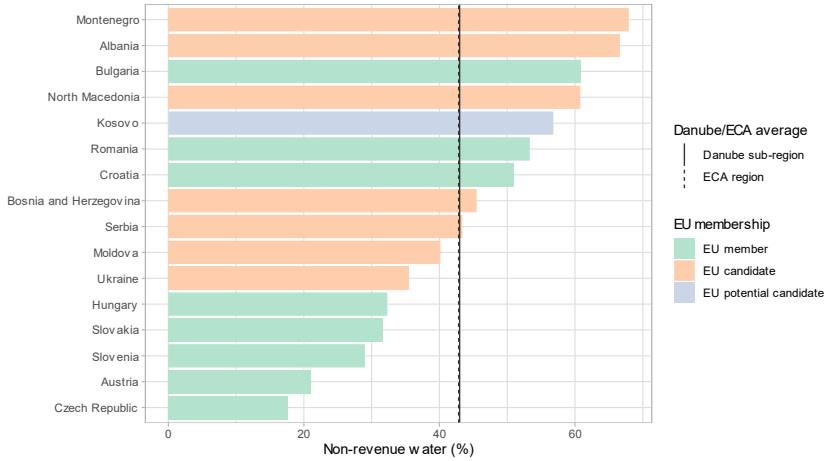
- Improve indicators & spatial and temporal resolution
- Develop scenarios
- Expand stakeholder engagement
- Transboundary cooperation

Key opportunities for enhancing resilience to climate change and achieving/maintaining water security in the Danube region

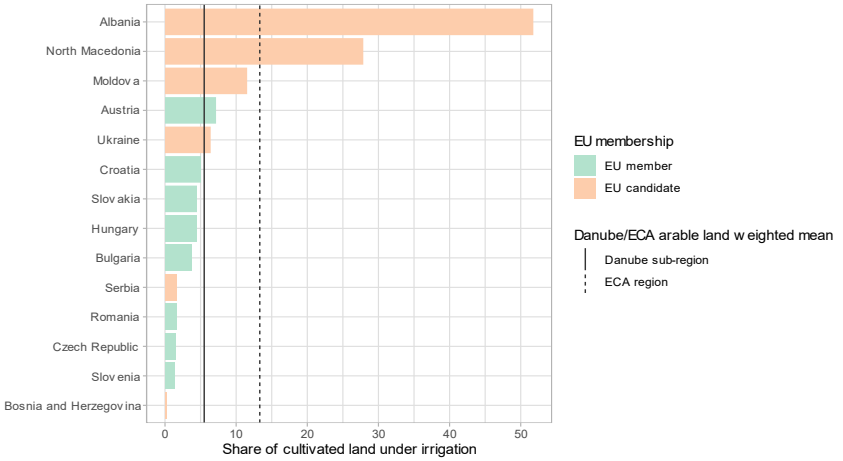
Strengthen transboundary cooperation



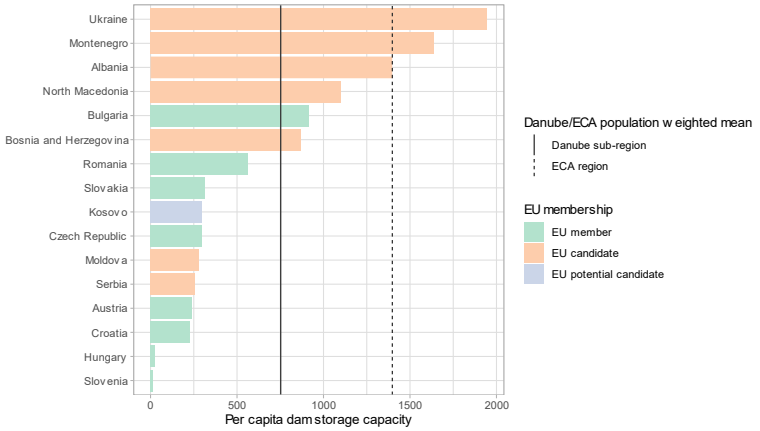
Reduce water losses and improve water efficiency



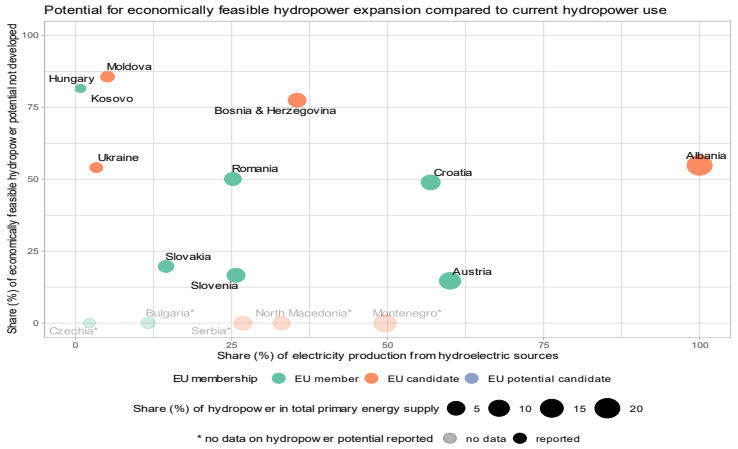
Expand and modernize irrigation



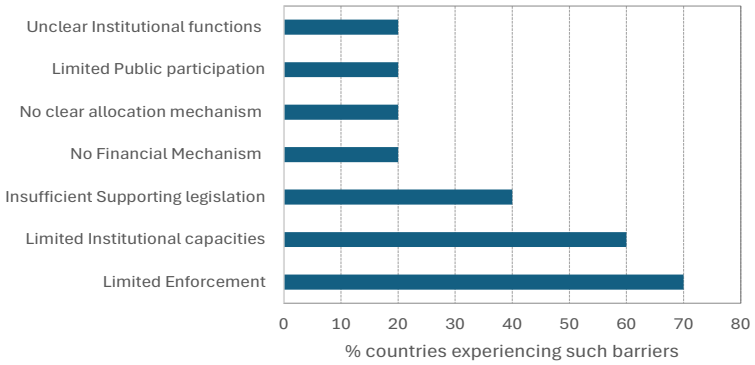
Enhance storage capacity



Diversify electricity supply



Strengthen institutions and management capacities



Thank you very much for your attention

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