

# Carpathian Region: From a Strategic Agenda on Adaptation to Climate Change to practical improvements

# Content

- The strategic agenda on climate change in the Carpathians
- Development of projects to adapt and mitigate climate change
- Recommendations how mountain areas in general can better adapt and mitigate climate change

# History and main objective

- 7 State Parties
- Adoption: 22 May 2003 in Kyiv, Ukraine
- Entry into force: 4 January 2006
- 4 Meetings of the COP: 2006, 2008, 2011, 2014
- Current presidency: Czech Republic

## **Main objective:**

- Protection and Sustainable Development of the Carpathian region

# Policy Responses towards a Climate Proofed Carpathian Economy

- Public policy
- Mainstreaming of adaptation objectives
- Ecosystem management
- Increase transnational cooperation
- Ecoregional approach
- Action in framework of Carpathian Convention and of the EUSDR

# Potential Priority Climate Change Adaptation Actions

- Capacity building programme which draws on, and enhances the connectivity of the Region
- Information management and awareness rising
- Climate-proofing of infrastructure, investments and climate-cross compliance
- Development of forestry measures for climate change adaptation
- Making biodiversity management more dynamic
- Evaluation of Carpathian ecosystem services
- Capacity-building on proposal-writing for adaptation funding
- Permanent Working Group on Climate Change

# The Convention as an institution



**Conference of the Parties**

**Carpathian Convention  
Implementation Committee  
CCIC**



**WG  
Biodiversity**

**WG Spatial  
Development**

**WG  
SARD**

**WG Forest  
Management**

**WG Industry,  
Energy,  
Transport,  
Infrastructure**

**WG Tourism**

**WG Cultural  
Heritage and  
Traditional  
Knowledge**

**WG  
Climate  
Change**

**Carpathian  
Network of  
Protected  
Areas  
(CNPA)  
Steering  
Committee**

# Climate Change adaptation WG at Carpathian Convention

- Decision COP3/15 on Climate change of the COP 3 of the Carpathian Convention: a Working Group on Adaptation to Climate Change under the Carpathian Convention has been established

# Workplan

- Preparation of strategic agenda on adaptation in the Carpathians
- Planning of adaptation measures
- Realization of a clearing house for the Carpathians in the wider EU context



# Eger Group

- Workshop on sharing of experiences on adaptation to climate change in mountain areas, Eger, Hungary, 22 October 2012
- Participation of representatives from Pyrenees, Alps, Carpathians, Balkans, Caucasus, Central Asia
- Main outcome: establishment of a platform for exchange of information and know-how and development of possible common activities
- On Facebook: Eger Working Group

# Potential Priority Climate Change Adaptation Actions

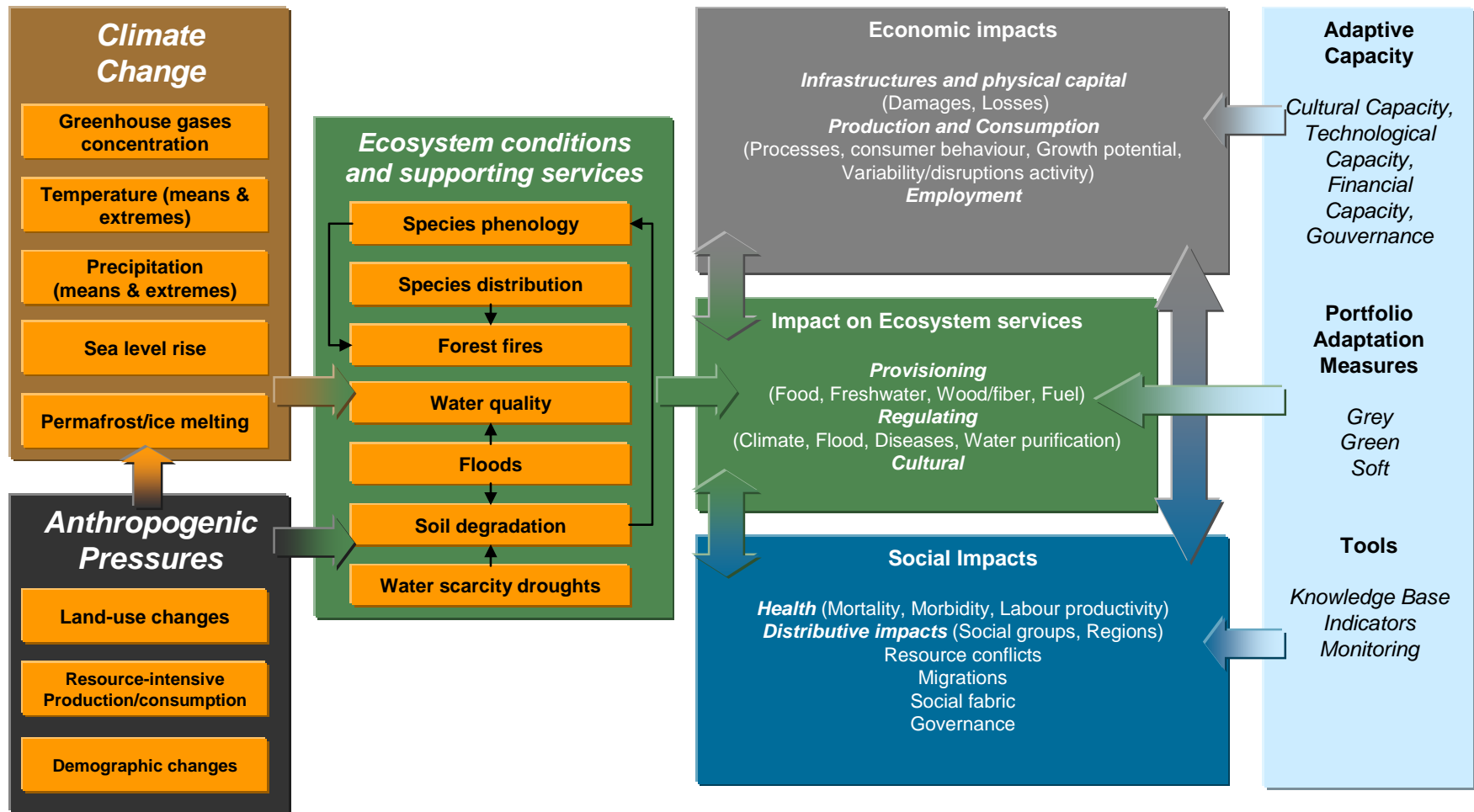
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# Strategic Agenda, content

1. Introduction
2. Background
3. Impacts of climate change in the Carpathians
4. Policy responses to create a Path to a Climate-Proofed Carpathian Economy
5. Institutional and organisational responses
6. Cross-Cutting Opportunities
7. Opportunity for the EU Funds from 2014-2020:
8. Steer the Region's Development Towards a Climate-Proofed Carpathian Space
9. Potential Priority Climate Change Adaptation Actions

# Environmental pathway of vulnerability and adaptation

Jacques Delsalle, Evdokia Achilleos, DG Environment, Unit D1 – Protection of Water Resources



# Publication of the three Carpathian projects

- Climate of the Carpathian region (CARPATCLIM)
- Integrated assessment of vulnerability of environmental resources and ecosystem-based adaptation measures (Service contract CARPIVIA)
- In-depth assessment of vulnerability of environmental resources and ecosystem-based adaptation measures (Framework contract CarpathCC)

# Preparatory actions

- Three projects:
  - Climate of the Carpathian region
  - Integrated assessment of vulnerability of environmental resources and ecosystem-based adaptation measures (Service contract CARPIVIA)
  - In-depth assessment of vulnerability of environmental resources and ecosystem-based adaptation measures (Framework contract CarpathCC)



- \* led by the Hungarian Meteorological Service
- \* harmonized historic climate data (1961–2010)
- \* main aim: to improve climate data to investigate how the regional climate has changed over this period
- \* produced a high-resolution database which is freely available: [www.carpatclim-eu.org](http://www.carpatclim-eu.org)



- \* Carpathian Integrated Assessment of Vulnerability to Climate Change and Ecosystem-based Adaptation Measures (CARPIVIA)
- \* assessed the vulnerability to climate change of the Carpathian region's main ecosystems
- \* produced an inventory of climate change effects and ecosystem-based adaptation measures.
- \* further information: [www.carpivia.eu](http://www.carpivia.eu)



- \* Climate change in the Carpathian Region (CarpathCC)
- \* examined the vulnerability of water, soil, forests, ecosystems and related production systems
- \* proposed concrete ecosystem-based adaptation measures
- \* assessed the costs and benefits of adaptation measures
- \* further information: [www.carpathcc.eu](http://www.carpathcc.eu)

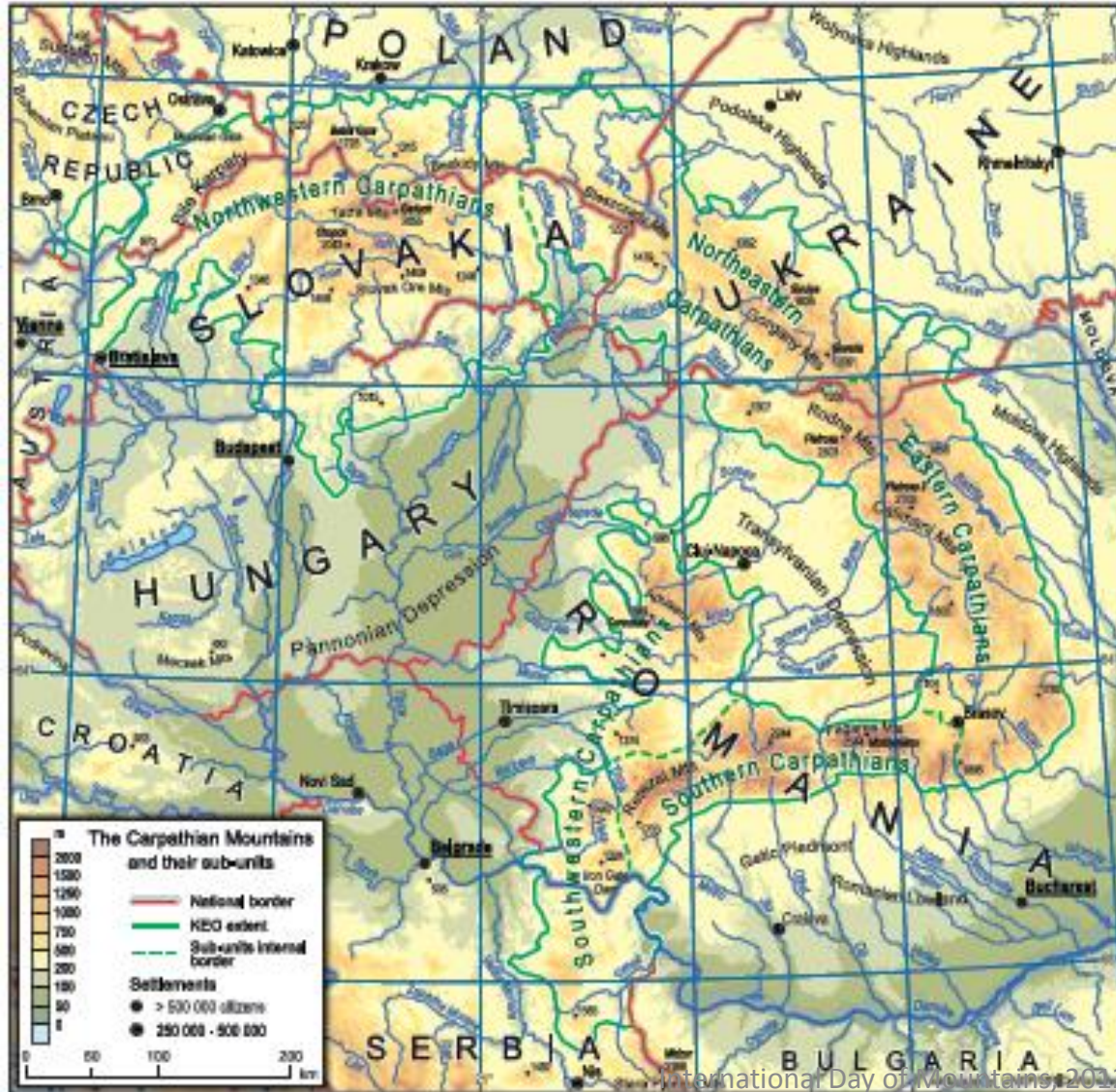
# CARPATCLIM results

- High-resolution (10 km\*10 km) freely available databases
- Data availability on monthly and daily level
- Time frame: 1961-2010
- [www.carpatclim-eu.org](http://www.carpatclim-eu.org)

# Philosophy of CARPATCLIM

- No common database of raw data
- Each country provide the same work (hope for the availability of most possible data)
- Common softwares
- National and international consistency
- Near border data exchange (minimum number of data exchanged on equal basis)

# Map of the Greater Carpathian Region

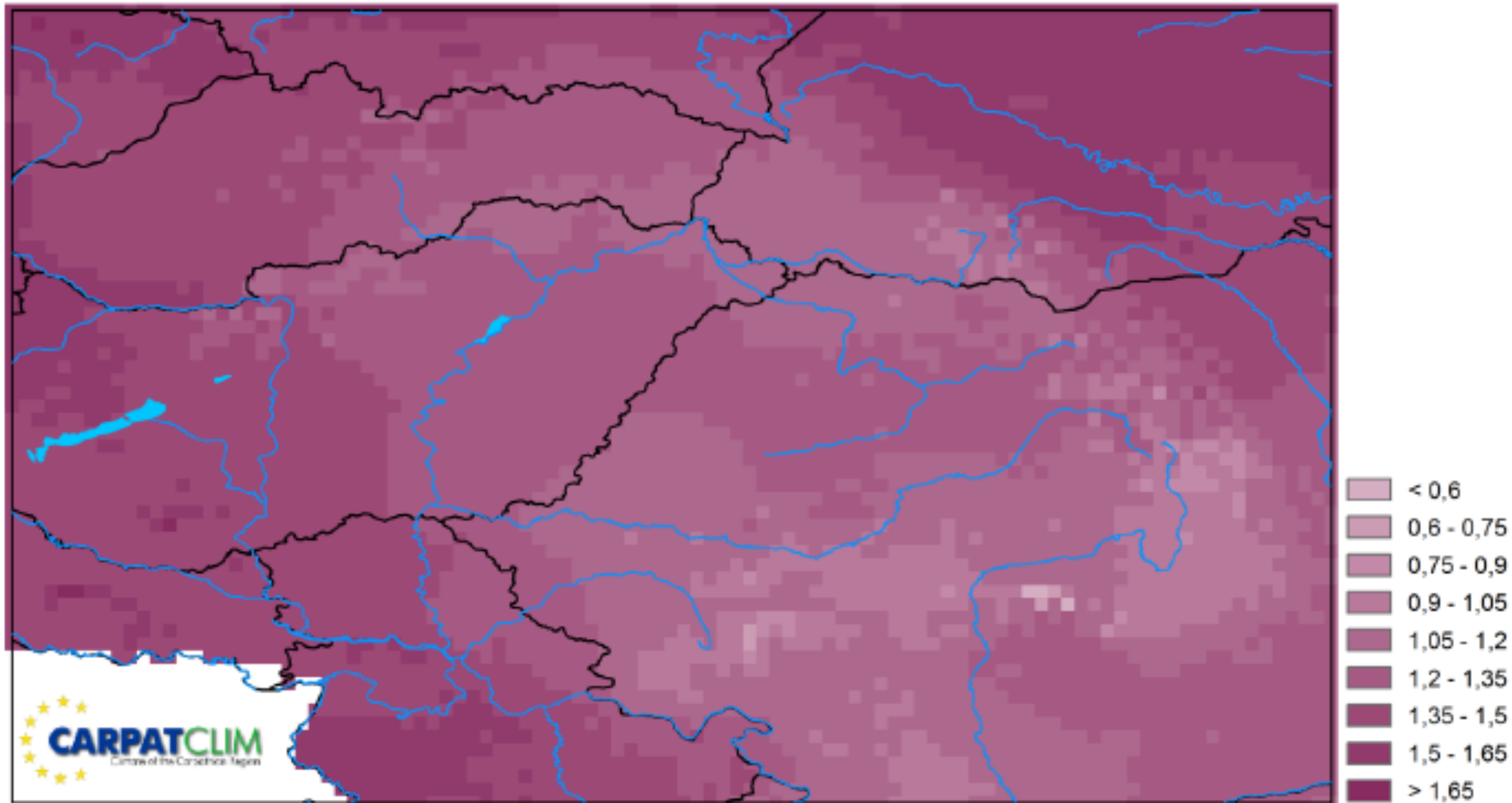


Area of the square around is about 500000 km<sup>2</sup> (appr. the territory of Spain), the Territory of the Carpathian Region is about 200000 km<sup>2</sup>

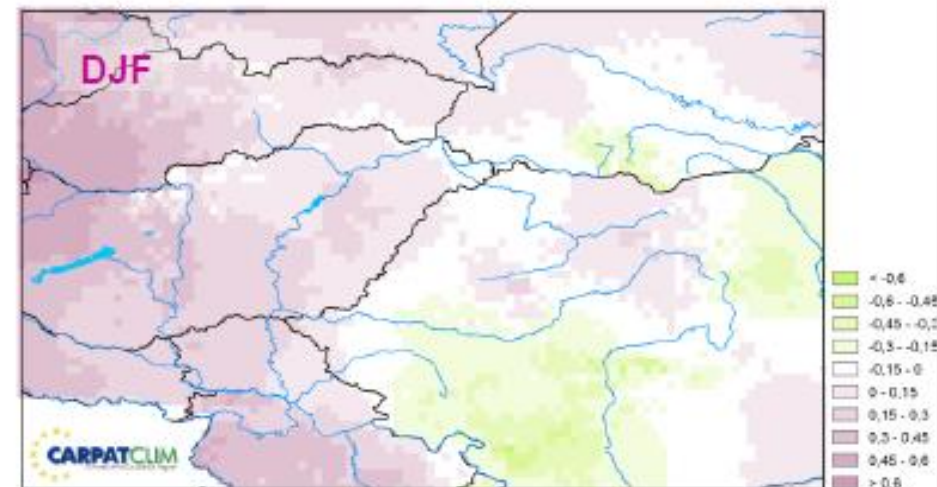
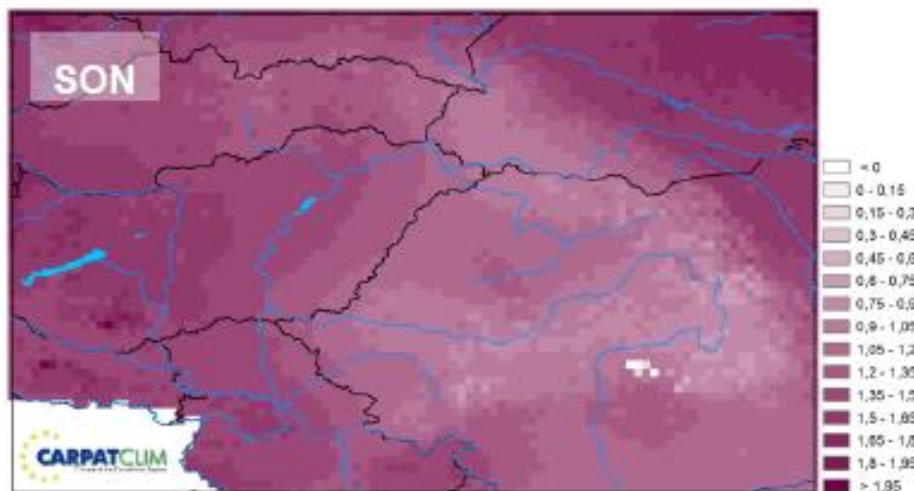
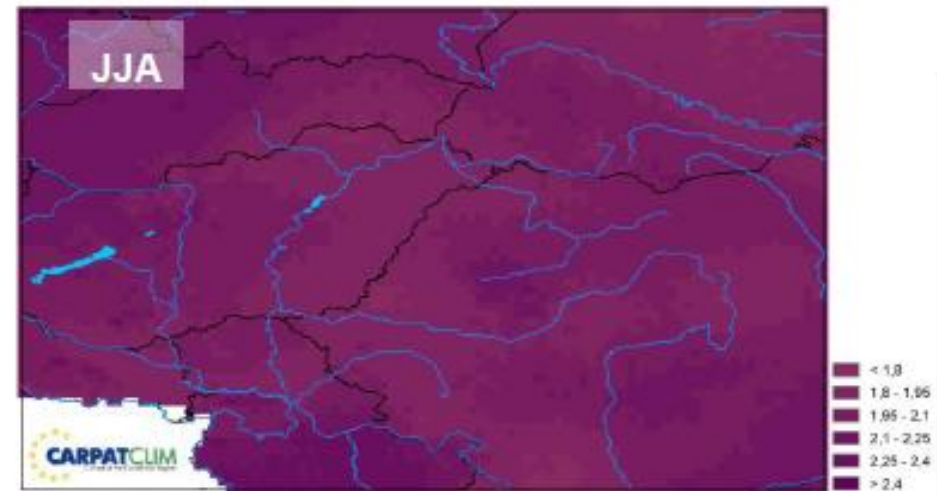
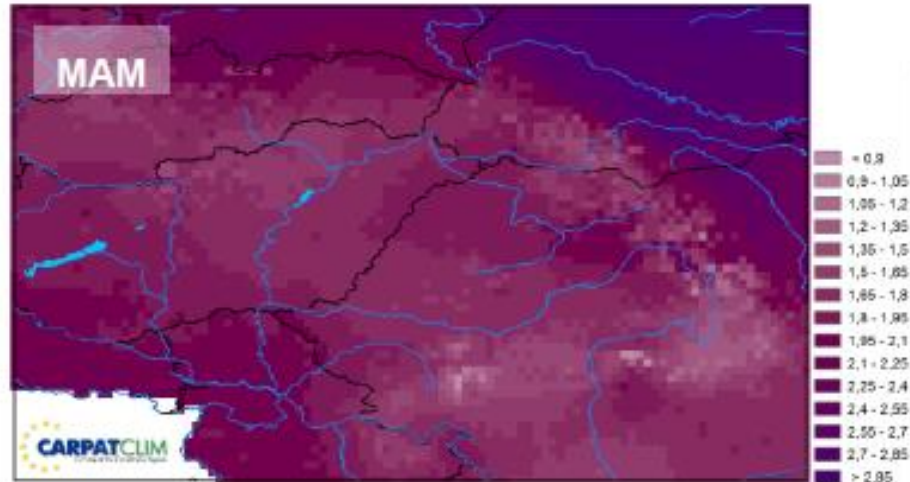
# Structure

- Module 1: Data rescue, quality control, and data homogenisation by the use of MASH. (Leader: SHMU)
- Module 2: Data harmonisation and gridded datasets by the use of MISH. (Leader: OMSZ)
- Module 3: Climate Atlas, publicly accessible dedicated web site, gridded climatological datasets and searchable metadata catalogue (Leader: RHMSS)

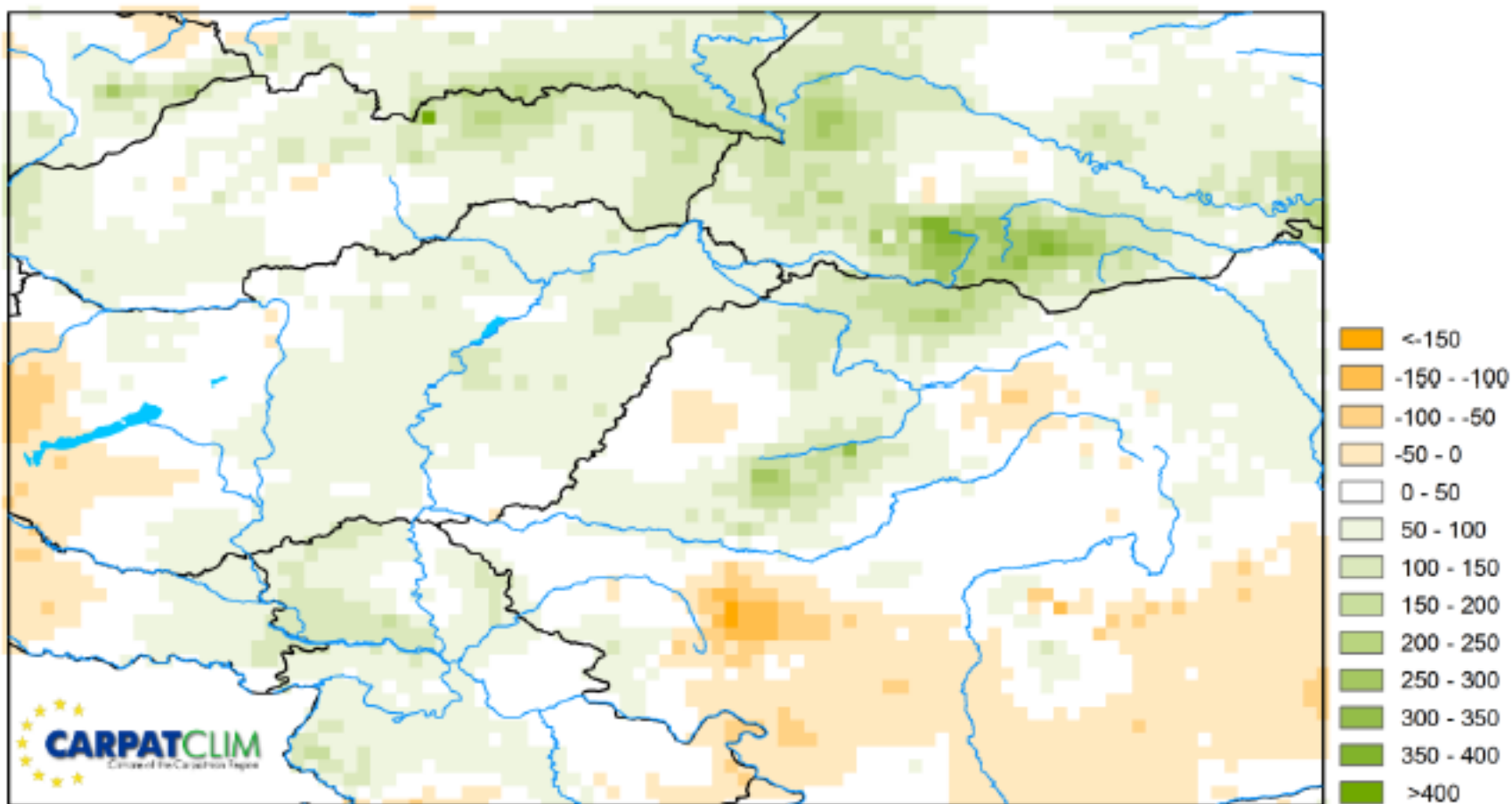
# Temperature changes, 1961-2010



# Seasonal temperature changes, 1961-2010



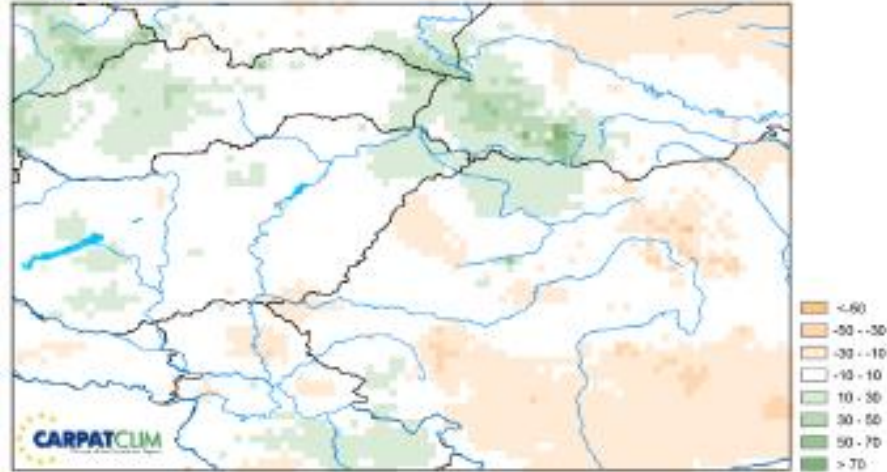
# Change of the annual precipitation sum 1961-2010



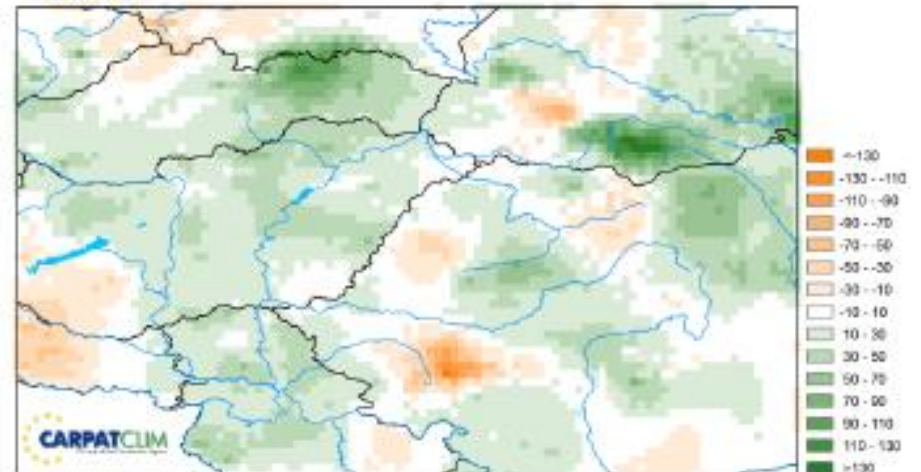


# Change of the seasonal precipitation sums 1961-2010

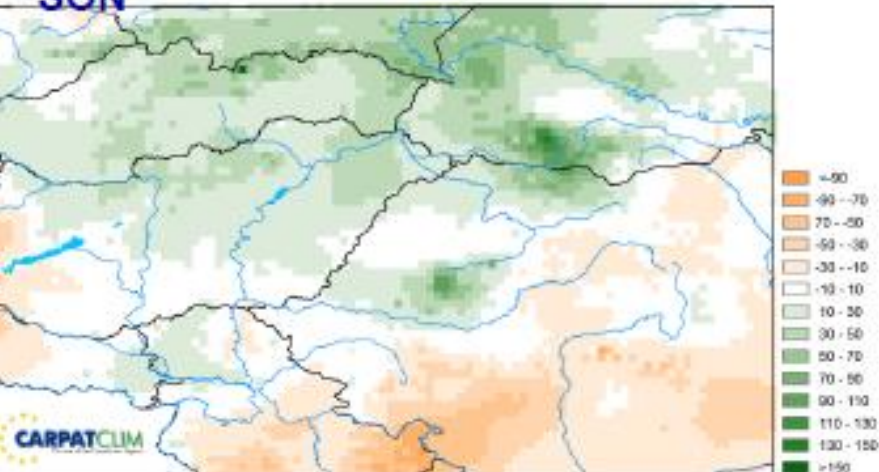
MAM



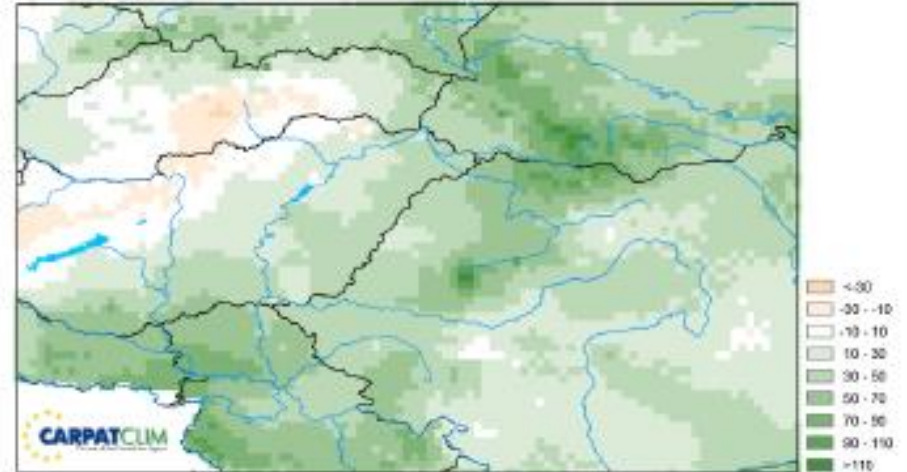
JJA



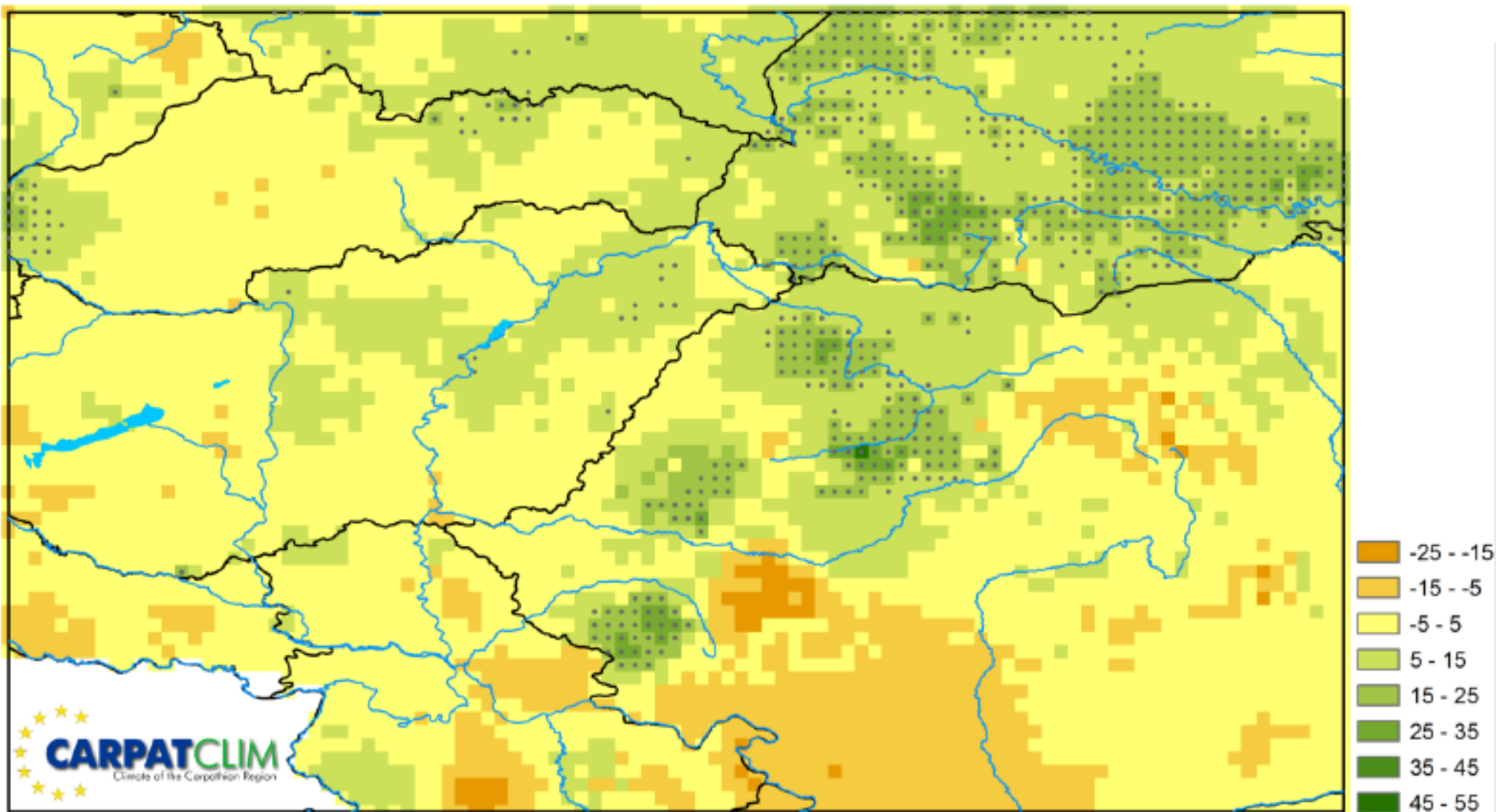
SON



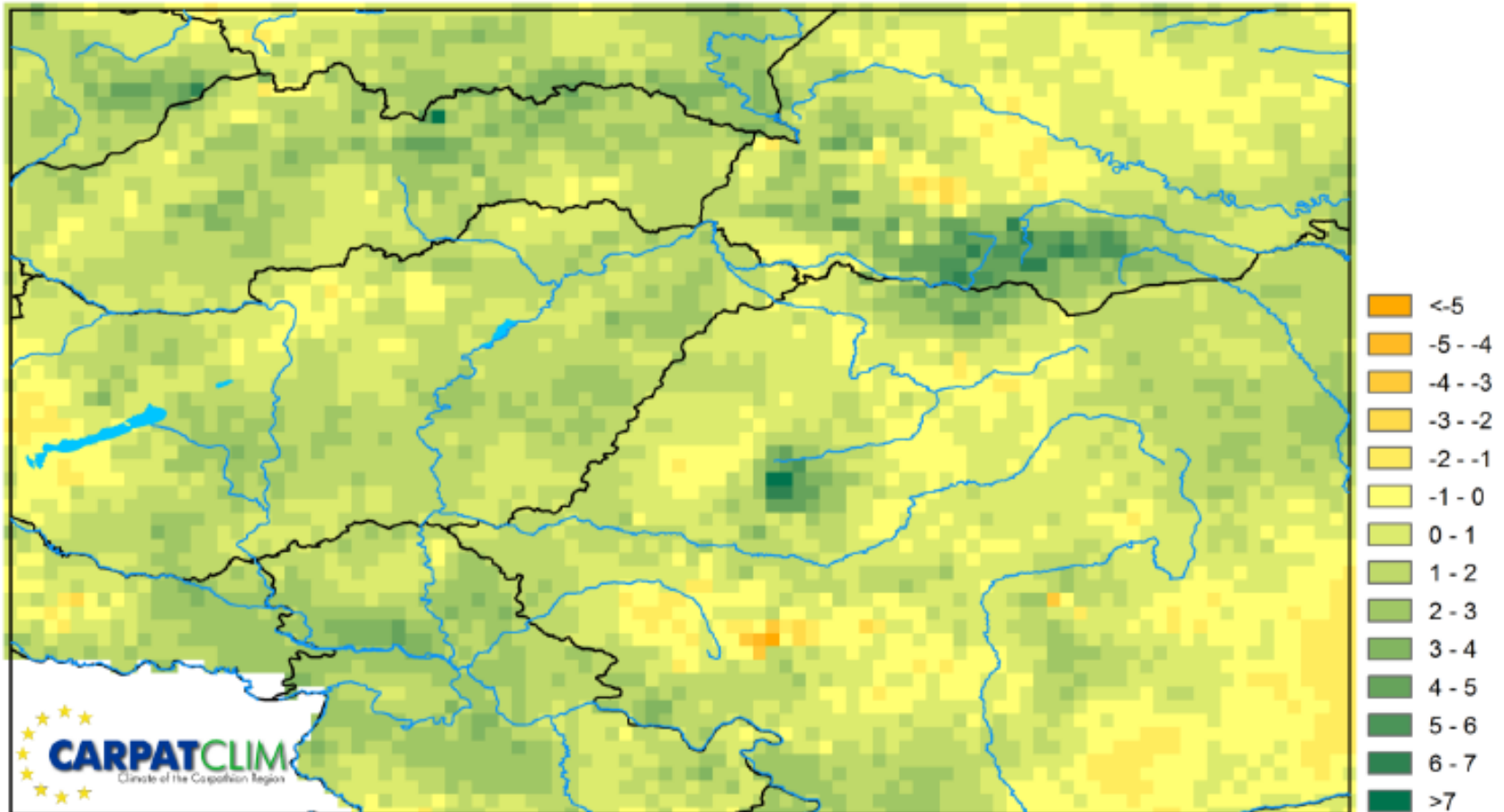
DJF



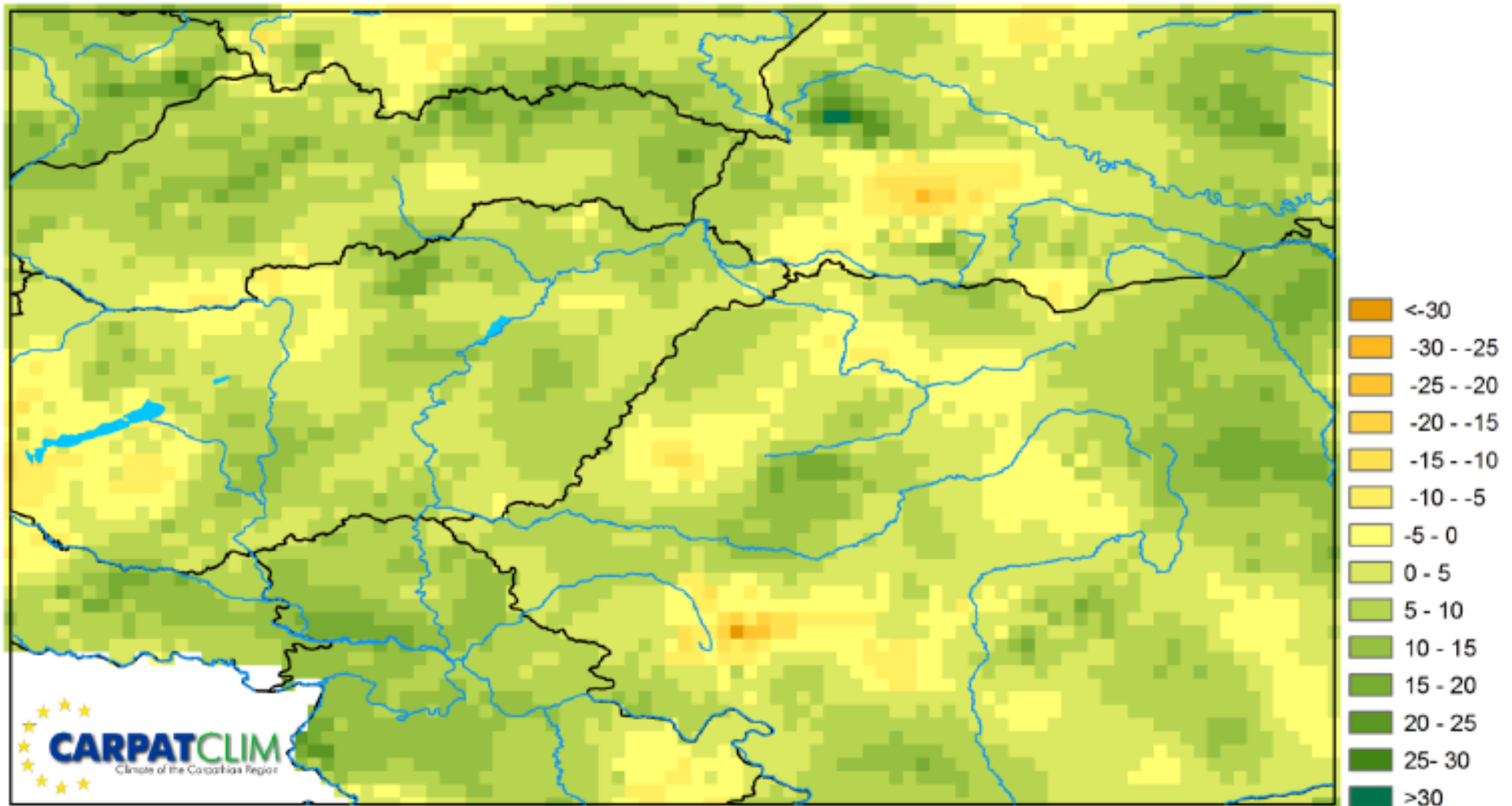
# Change in the number of wet days 1961-2010



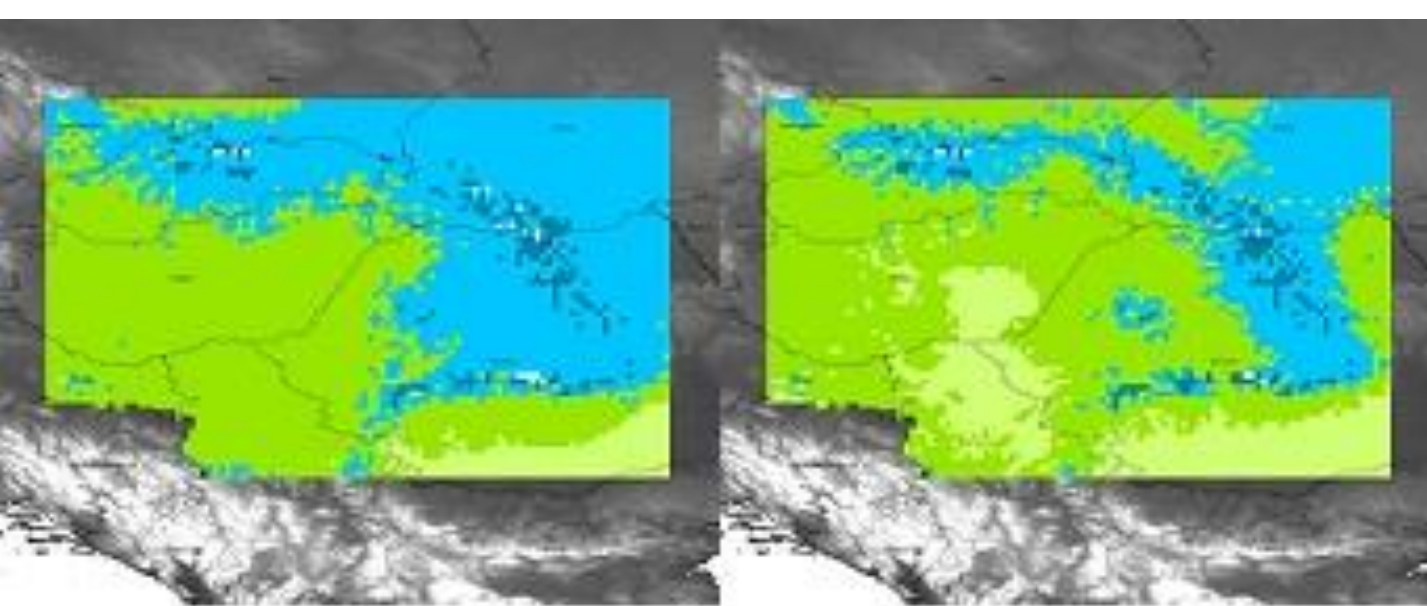
# Change in the number of days with precipitation above 20 mm, 1961-2010



# Change in the maximum daily precipitation sum, 1961-2010



# 1961-90 versus 1981-2010 Köppen-Geiger's climate maps



KG 61-90

KG 81-10

KG classification
H_Alpine
Cfa_Subtropical
Cfb_Oceanic
Dfb_Hemiboreal
Dfc_Taiga

# Vulnerabilities of six important sectors 1/6

## Water resources

- \* Reduced snow cover
- \* Sudden&heavy rainfalls
- \* Changes in precipitation pattern → increase: the risk of floods, erosion, landslide risk
- \* Declining river water levels → drought events
- \* Declining groundwater level → availability&quaility of drinking water



[Source: Sakda Wamern]

## Adaptation measures 1/6

### Water resources

- \* Adjusting permits for water use or pollution discharge
- \* Introducing smart irrigation systems
- \* Planting forests and combating illegal logging in catchment areas in order to reduce nutrient loading and soil erosion
- \* Restoring floodplains near rivers and streams to buffer extreme runoff and reduce flows of nutrients
- \* Ensuring legal frameworks are in place to support planning and implementation of adaptation measures

# Vulnerabilities of six important sectors 2/6

## Forests and forestry

- \* The way climate change affects forests: depend on forest structure, species composition, natural conditions, applied management, air pollution
- \* Drought, windstorms → can trigger the pest outbreaks (bark beetles, defoliating species) and moving in of new species (Romania)
- \* Forest decline → affects wood production, biodiversity and other ecosystem services



(Source: sciencedaily.com)



## Adaptation measures 2/6

### Forests and forestry

- \* Promote&encourage sustainable forest management
- \* Supporting and harmonizing regional and European forest monitoring schemes, including those tracking newly emerging pests and pathogens
- \* Increasing awareness about the role of forests in integrated watershed management
  - particularly in biodiversity maintenance, water regulation and erosion control

## Vulnerabilities of six important sectors 3/6

### Wetlands

- \* Increased temperature → dry out wetlands
- \* Wetland loss → reduces habitat for plant & animal species, habitat fragmentation → threatened: migratory birds and amphibians
- \* The most vulnerable wetland habitats: peatlands



(Source: wildlifetrust.org)

## Adaptation measures 3/6 Wetlands

- \* Developing monitoring systems for aquatic ecosystems in the region
- \* Integrating wetland protection with flood control practices
- \* Supporting programmes aimed at wetland and peatland restoration, floodplain rehabilitation
- \* Creating new wetlands and lakes to enhance local water retention capacity and support biodiversity

# Vulnerabilities of six important sectors 4/6

## Grasslands

- \* Increase in temperature, extreme events, tree line shifting upward, agricultural intensification → reduce the quality and coverage of grasslands → habitat fragmentation & species loss
- \* Increased nutrient input (mulching & use of fertilizers) → increase the presence of invasive species & affect water quality → not suitable for grassland management



(Source: Barbara Scabo)

## Adaptation measures 4/6 Grasslands

- \* Implementing agro-environment measures and the EU nature & biodiversity Natura2000 management plans
- \* Diversifying species and breeds of crops and animals
- \* Managing through (extensive) grazing and mowing
- \* Avoiding the abandonment of land or mulching or fertilizing techniques
- \* Avoiding overgrazing

# Vulnerabilities of six important sectors 5/6

## Agriculture

- \* Maize and wheat yields will decline (become feasible at higher altitudes)
- \* Sunflower, soya and winter wheat yields might increase (due to higher temperature & migration of the northern limit of these crops)
- \* Pest threaten is predicted to rise → productivity loss
- \* Traditional mixed agro-ecosystems may disappear (due to land abandonment and land use change)



(Source: network.hu)

## Adaptation measures 5/6 Agriculture

- \* Supporting small-scale traditional farms as important economic activities delivering multiple ecosystem services
- \* Supporting agro-environment programmes
  - to maintain&enhance biodiversity and viability of semi- natural grasslands&mixed agro-ecosystems

# Vulnerabilities of six important sectors 6/6

## Tourism

### Positive effects from CC

- \* Rising temperature in summer  
→ bring additional tourists to the mountains

### Negative effects from CC

- \* Decline in snow depth&duration  
→ limited winter sport possibilities



(Source: Andreas Beckman)



## Adaptation measures 6/6

### Tourism

- \* Develop year-round, resilient destinations with good accommodations (e.g. wellness&conference hotels)
- \* Develop ecotourism, health and active tourism
- \* Evaluate investments in tourism infrastructure in the light of projected snow and water availability
- \* Develop climate-friendly winter sport projects, relaxation and entertainment activities
- \* Continue to diversify resorts and markets

# Publications



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## Foreword

The Carpathian region, forming an integrative part of the wider Danube region, is a mountainous area of outstanding natural and cultural heritage shared by seven Carpathian countries, the majority of them being members of the European Union.

Like many other mountain regions in Europe and around the globe, the Carpathian mountain region provides a multitude of essential ecosystem goods and services such as water provision, food and agriculture products, forest products, tourism and energy provision that are important not only for local people, but also for downstream communities. But these ecosystem services – as well as the mountain communities that are their custodians and beneficiaries – are particularly vulnerable to the impacts of climate change.

Regional climate change projections suggest more irregular rainfall and a warmer climate in the Carpathian basin. According to recent findings, the Carpathian mountains will experience an increase between 3.0°C and 4.5°C during this century. Precipitation patterns will also change, leading to profound consequences on the environment, on the economy and on

human well-being. It is important to strengthen the sustainable use of natural resources in the mountain areas and adopt integrated, multi-sectoral ecosystem management approaches including climate change adaptation which will benefit not only mountain communities but also people downstream. Building on a sound scientific basis, a strategic approach to climate change adaptation across different sectors and levels of governance – in line with the EU Strategy on adaptation to climate change, adopted by the European Commission in April 2013 – is necessary.

Following an initiative by the European Parliament and funded by the European Union, important research by several teams of experts has been undertaken in the recent years in order to investigate more into climate change and adaptation in the Carpathians: from climate change projections to in-depth assessments of the vulnerability to climate change of ecosystems and their services in the Carpathian region. This has led to the establishment of a diversified portfolio of sustainable adaptation measures with the active and valuable cooperation of international environmental experts. At the intergovern-

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This report presents the major findings and outcomes of the three conducted EU projects – CARPIMA, CarpathOC and CARPATCUM – funded under the preparatory action "Climate of the Carpathian Basin" approved by the European Parliament. Results are being integrated to the European Climate Adaptation Platform (Climate-ADAPT). With this report we hope to further raise awareness about the Carpathian region – a unique region in the heart of Europe which faces the challenge of the impacts of climate change. We also hope to stimulate further debate on climate change and adaptation in the Carpathians leading to concrete follow-up actions that may also serve as inspiration for other mountain regions in Europe and beyond.

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**HE János Áder**  
President of Hungary  
Former member of the European Parliament

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**HE Peter Žiga**  
Minister of Environment of Slovakia  
(Current presidency of Carpathian Convention)

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**Janez Potočnik**  
European Commissioner for the Environment

An aerial photograph of a mountain valley. In the foreground, a small village with red-roofed houses is nestled in a valley. To the left, there is a green field. The middle ground shows a dense forest with some trees in autumn colors. In the background, a range of mountains with snow-capped peaks rises above a layer of low clouds or fog. The sky is clear and blue.

# **FUTURE IMPERFECT**

**CLIMATE CHANGE AND ADAPTATION IN THE CARPATHIANS**

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# International co-operation

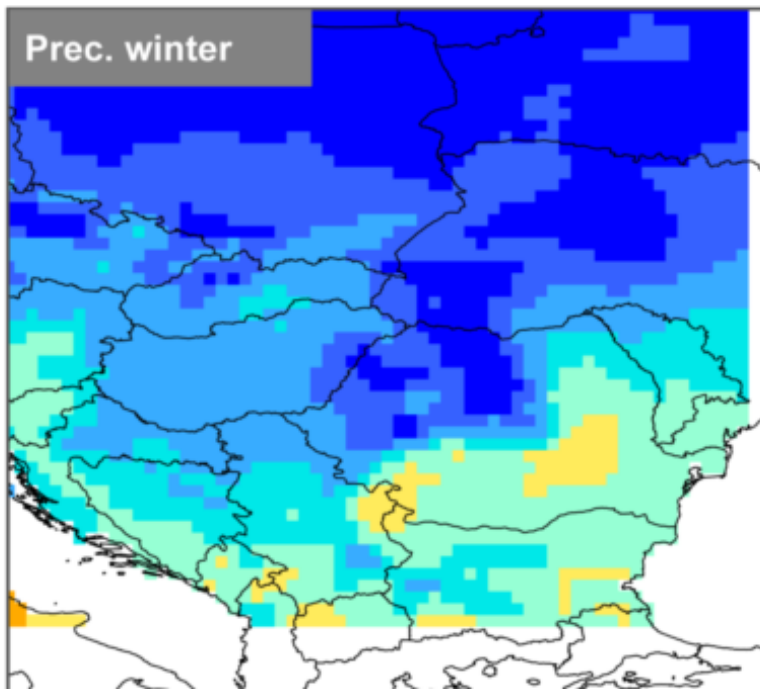
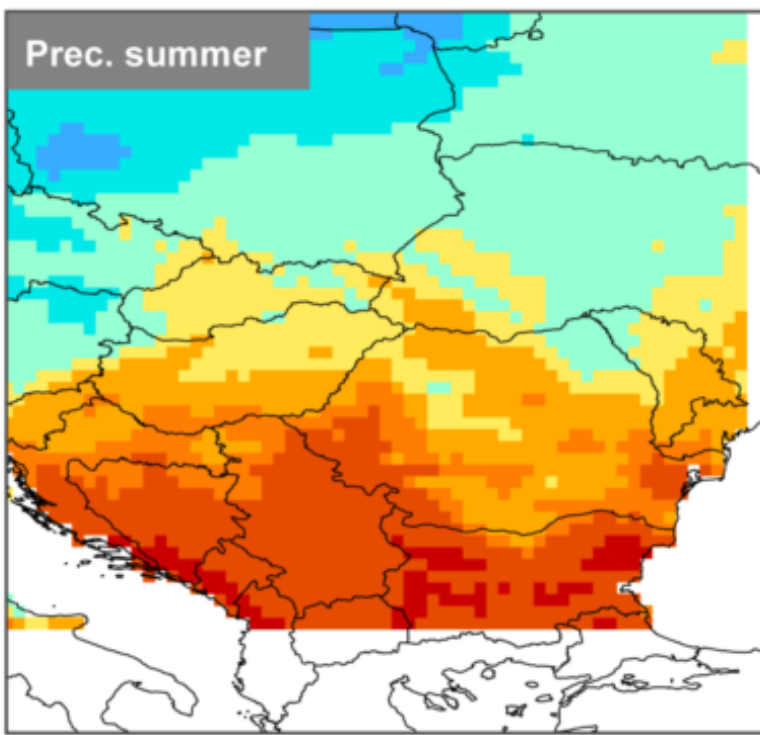
- Alpine convention
- EU Strategy on Danube River
- Pyrenees Working Community
- Baltic Sea Region

**Thank you for your attention!**

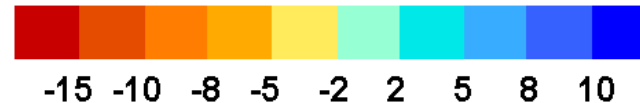


# PROJECTED TRENDS FOR NEXT 50 YEARS PRECIPITATION (%)

*2021-2050 REL. TO 1971-2000*



- annual increase in the NW and decrease for rest of region having the maximum decrease in the Southern part of the Carpathians
- decreasing spring, summer and autumn values and significantly increasing winter precipitation
- increase in daily maximum precipitation and in number of days with at least 20 mm precipitation can be expected.



# Adaptation to higher discharge patterns

## Improving water retention capacities

- Constructing new reservoirs (careful!)
- Rainwater harvesting on slopes

### Microstructures for the rainwater harvesting on land

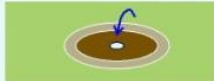
Contoured barrages



Terraces



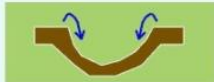
Eyebrow terraces



Pits



Vallerani-type microcatchments



Semicircular bunds



Triangular bunds



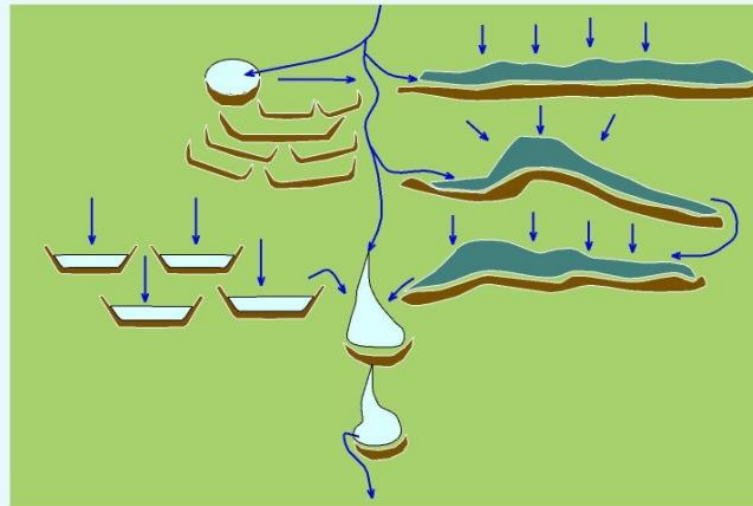
Meskat



Negarim



### Combination of different rainwater harvesting technologies



absorption area  
earthen levee  
runoff of water



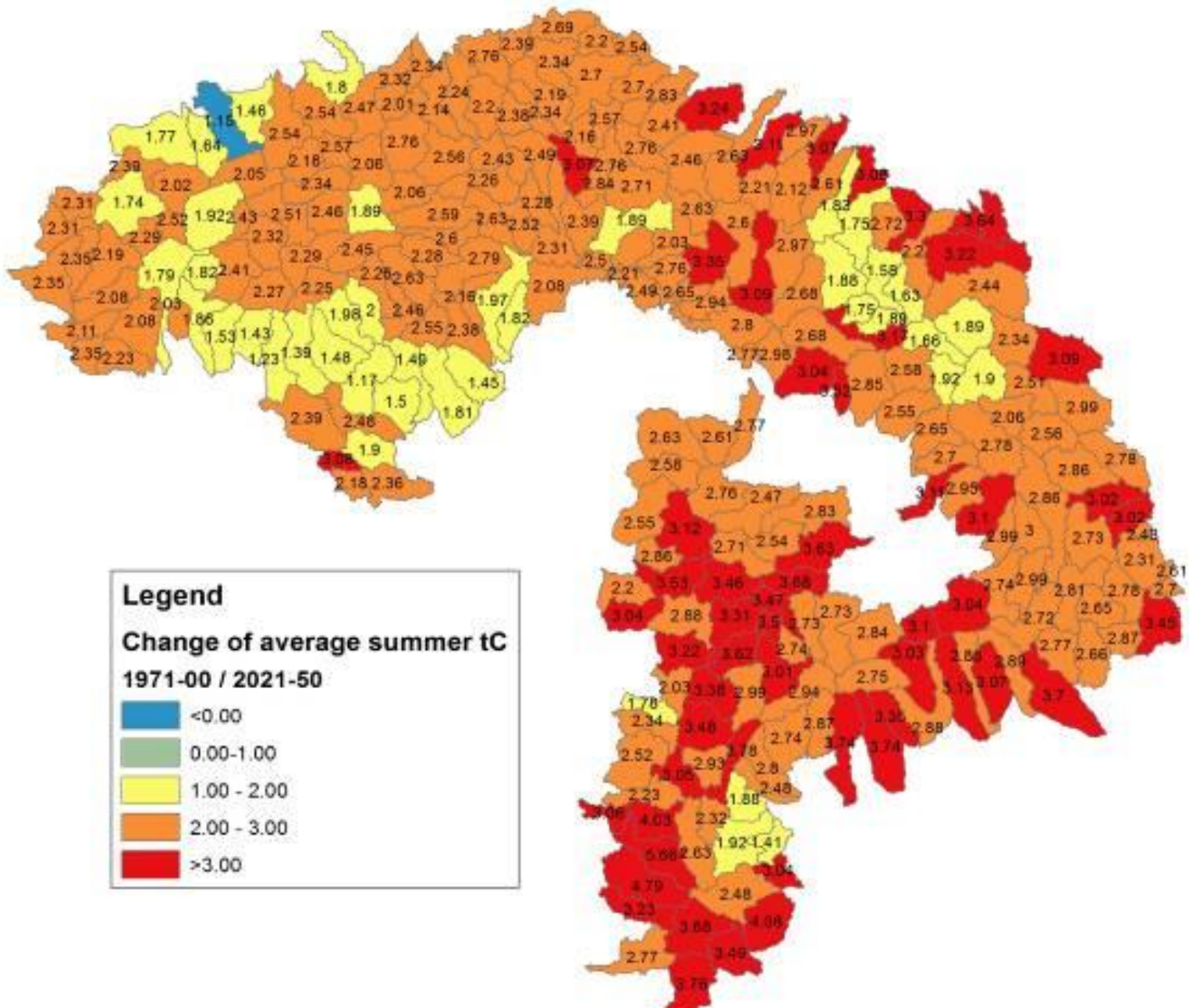
(Kravčík et al., 2008)

# SNOW COVER CHANGES

- the period with snow form precipitation will be shortened and the snow melting time will start earlier
- the amount of the snow and the number of days with snow cover will decrease in the area. The 100 day snow cover boundary is currently at the elevation of 1,250 to 1,350 m that is forecasted to rise up to 1,350 to 1,450 m by 2050
- winter precipitation will be stored in snow form for a shorter time and will melt as water runoff



# Changes in summer temperature of surface water



# Impacts on ecosystems and ecosystem-based production systems

- Forests / forestry
- Wetlands
- Grasslands (natural and semi-natural)
- Agriculture
- Tourism
- (water resources)

## Key impacts- forests / Forestry

- Impact depends on diverse factors, such as tree species, forest structure, elevation
- Lower elevation forests, mainly in south SVK, HUN, ROM, SRB are especially prone to drought and temperature rise
- Increase in extreme rainfall events & deforestation may increase risk of landslides
- Intensifying droughts and windstorms followed by outbreaks of bark beetles and defoliating insect are the main risks; +potential influx of new pest species (e.g. Northern spruce bark beetle throughout ROM)
- Treeline moving upward, changes in composition



# Forests – vulnerability

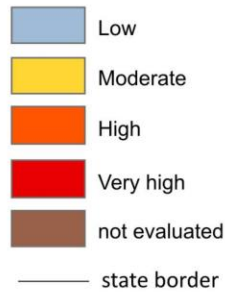
Secondary spruce forest, pests, former air pollution

Good forest structure, lower exposure, moderate AdCap

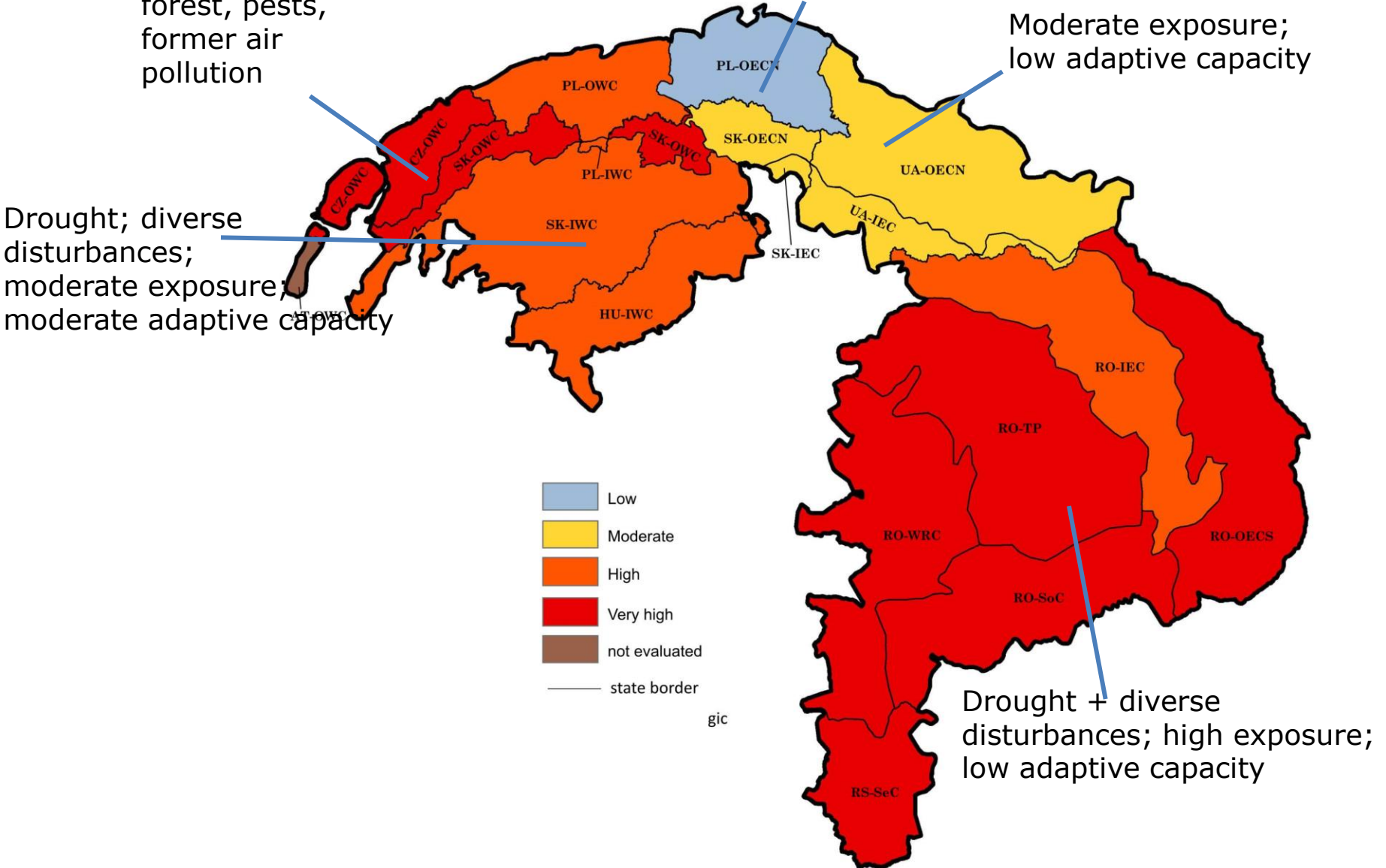
Moderate exposure; low adaptive capacity

Drought; diverse disturbances; moderate exposure; moderate adaptive capacity

Drought + diverse disturbances; high exposure; low adaptive capacity



gic



## Key impacts-Agriculture

- Agriculture becomes feasible at higher altitudes
- In parts of the Carpathians maize and wheat yields are projected to decline, whilst sunflower and soya yields might increase due to higher temperatures and migration of these crops' northern limit
- Shift spring planting towards winter crops possible (winter wheat)
- Pest incidence expected to rise
- Productivity losses due to drought, groundwater depletion, and extreme weather events





# Agriculture - adaptation

- Small-scale traditional farms, which are an important economic activity in the Carpathian region, deliver multiple ecosystem services and should be supported.
- Agro-environment programmes are critical to maintain and enhance biodiversity and viability of semi-natural grasslands and mixed agro-ecosystems.
- Adaptation plans have to be integrated into wider planning for promoting sustainable development of the Carpathians with a specific focus on strengthening resilience of farming communities to climate change and other economic and social stressors

# Key impacts - Tourism

- Positive and negative impacts from climate change. Ecotourism, summer tourism, health tourism and vocational tourism can be positively influenced by climate change. Rising temperatures can bring more tourists to the mountains. On the other hand, the possibilities of winter sport will become more limited.

Climate change can bring 60-75.000 additional tourists  
per year with 9,6-12 million EUR additional revenue for  
the region



Tourism – recommended adaptation

- Continue diversification of resorts and tourist offers
- Diversify the market
- Focus on the development of ecotourism, health tourism active tourism with cycling and hiking
- Supporting tourism information networks in region among accommodations, suppliers and tourism organizations; up to date information about current touristic

# Summary – outputs

- A wealth of climate related information of the Carpathians
- Strategic Agenda on Adaptation for Carpathian Convention
- Booklet summarizing outcomes to be widely distributed
- Websites
- Information system (for discussion how to sustain)

**Thank you ! Further information**

**[www.carpatclim-eu.org](http://www.carpatclim-eu.org)**

**[www.carpivia.eu](http://www.carpivia.eu)**

**[www.carpathcc.eu](http://www.carpathcc.eu)**

**Information system**

**Reports +**

**New booklet on climate change and**

# Discussion

- *what is the biggest impediment or barrier to sustainable development in the Carpathians*
- *What would be the first priority of the climate change working group*
- *Is the organisational or governance structure strong enough to address the multiple challenges of sustainable development of the Carpathians*
- *If not; what should be changed?*
- *what do I value in the Carpathian region*
- *what is the impact on this value of climate change?*