SWAN Progress Meeting
University of Seville
June 12, 2014

Progress Report

National Institute of Geophysics Geodesy and Geography
Bulgarian Academy of Sciences
(NIGGG – BAS)

May 2013 – June 2014

National Institute of Geophysics
Geodesy and Geography

Content

1. Recruitment of perconnel
2. Research visits and events
3. Dissemination
4. Synergies to other groups/projects
5. Future plans
6. Scientific achievements

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Geodesy and Geography

Recruitment of perconnel

Tanya Trenkova
Research assistant
Department of Geography
NIGGG-BAS

PhD Thesis:

Web-based GIS applications supporting the integrated water management

Main Research Topics:

Climate change &water demand, Water governance issues, Integrative hydrological modeling under climate change, GIS

Project responsibilities

WP1 – Hydrologic modeling, Climate change models, water availability

WP3 – WFD

WP4 – Geospatial database

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Recruitment of perconel

Rositsa Yaneva
PhD Student
Department of Geography
NIGGG-BAS

PhD Thesis:

Landscape and ecosystem services in the Danube plain between rivers Timok and Iskar

Main Research Topics:

Ecosystem services supply and demand,
Public participation , GIS

Project responsibilities

WP1 – Water related ecosystem services

WP2 – Public participation in water management

Tucson Basin case study – Expert based ES assessment

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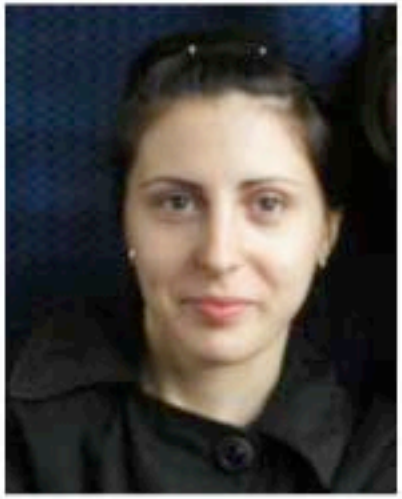
Recruitment of perconel

Sofia Kostadinova
Ms Student
Sofia University
Internship in
Department of Geography
NIGGG-BAS



Ms Thesis:

Spatial analysis of ecosystem services in Strumeshnitsa watershed

Main Research Topics:

Ecosystem services supply and demand, ES relation to WFD, GIS based tools for landscape assessment

Project responsibilities

WP1 – Water related ecosystem services,

WP4 – Land Cover classification, web mapping

TAMA case study – Ecosystem services assessment

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Research visits and events

Kremena Boyanova| Research visit January-May 2013

Study

- Development of trans-disciplinary approach addressing water management challenges and it's application in post normal science.
- Comparative analysis of the flood regulating ecosystem services in Bulgaria and Arizona by applying the VIC and KINEROS hydrological models.

Participation

- Weekly SWAN meetings

Classes at UA:

- Geographic Applications of Remote Sensing - Prof. Stuart Marsh
- Spatial Analysis and Modeling – Prof. Phillip Guertin

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Research visits and events

Tanya Trenkova| Research visit September-December 2013

Study: Web GIS: Principals & applications

- Start working on TAMA case study
- Join Wednesday meetings

Participation in: 3rd Progress Meeting of SWAN "New Scenarios for Water Management. Increasing Cooperation Between the Natural and Social Sciences" in October

- Attended the course: Systems Approach To Hydrologic Modeling of Prof. Hoshin Gupta
- Attended to Seminars & Symposiums:
  - Hydrology & Water Resources Seminars;
  - Research Insights in Semiarid Ecosystems (RISE) Symposium;
  - Mobile Matters Symposium: Innovation in action etc.

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Research visits and events

ROSITSA YANEVA | Research visit February-May 2014

Study - Expert based assessment of the provision of ecosystem services conducted through interviews

Step 1 - Online survey **"IMPORTANCE OF ECOSYSTEM SERVICES IN TUCSON ACTIVE MANAGEMENT AREA"**

Target groups: stakeholders from the UofA (Academia), SWAN members, UofA students

Assessment matrix – Capacity, Supply & Demand

Participation in "Water Resources & Policy Group", Udall center, University of Arizona. The collaboration of the students from this group significantly contributed to the survey results.

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Research visits and events

Regular NIGGG-BAS SWAN team meetings

2013 – 5 meetings, 5 students presentations 3 of them have already joined the project

2014 – 2 meetings, 2 students presentations

"Payment for Ecosystem Service" workshop in Bristol, September 13, 2013,

Chad Staddon, Lorraine de Souza - UWE

Stoyan Nedkov, Kremena Boyanowa - NIGGG

Chris Short, Mark Everard, Bendjamin Burkhard

Guest Researchers

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Dissemination

Publications

Nedkov, S., Boyanova, K., Burkhard, B., 2014. Quantifying, modelling and mapping ecosystem services in watershedsIn: Muller, F., Chicharo, L., Fohrer, N., Wolanski, E. (Eds.) Ecosystem services and river basin ecohydrology. Springer.

Boyanova, K., Nedkov, S., Burkhard, B., 2014. Quantification and mapping of flood regulating ecosystem services in different watersheds – case studies in Bulgaria and Arizona, USA. In: Bandrova, T., Konecny, M., Zlatanova, S. (eds). Thematic Cartography for the Society, Springer.

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Dissemination

Work papers

Deliverable 1.1: "Relative effect of Land Use - Land Cover Change and Climate Change on Extreme Precipitation Events in the Tucson-Phoenix urban corridor and associated Watersheds" (August 2013). Dominguez F., Yang Z., Boyanova K., Nedkov S. and Gupta H.

Deliverable 3.1: Key data and information requirements in the context of current debates on water management. Authors: María Fernanda Pita, Belén Pedregal, Nuria Hernández-Mora, Natalia Limones y Leandro del Moral (US). Substantial contribution: Stoyan Nedkov, Tanya Trenkova and Kremena Boyanova (BAS-NIGGG)

Deliverable 6.2: Analyzing New Challenges for Water Management: An outline for a trans-disciplinary approach, based on a review of existing conceptual frameworks. Authors: Serrat-Capdevila, A. (CNRS), Cabello V. (US), Boyanova, K. (NIGGG), Poupeau, F. (CNRS) Rodriguez, D. (USP/UA), Salmoral, G. (UAM), Segura, S. (US), and Yang, Z (UA).

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Dissemination

Conference presentations and posters

5th Annual ESP Conference "Ecosystem Services Come of Age: Linking Science, Policy, and Participation for sustainable Human Well-Being, August 2012. presentation by Stoyan Nedkov, poster by Kremena Boyanova.

6th Annual International ESP Conference "Linking Science, Policy and Practice" August 2013. Poster by Kremena Boyanova

IALE European Congress "Changing European Landscapes" September 2013 Presentations by Stoyan Nedkov and Kremena Boyanova

Workshop: National Stakeholder Consultations on Water: Supporting the Post-2015 Development Agenda (Sofia, Bulgaria, 18 March 2014) - T.Trenkova

Workshop: Integrated Drought Management in Central & Eastern Europe (Sofia, Bulgaria; 3 April 2014) – T.Trenkova

Some information for the SWAN project was included in a report of Ministry of

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Synergies to other groups/projects

Institute for Natural Resource Conservation, University of Kiel, Germany.
Common research and collaboration with Dr. Benjamin Burkhard, Research stay of Kremena Boyanova in 2012, Seminar by Benjamin Burkhard at UA, in 2013

Global Water Partnership – Bulgaria – workshops on sustainable water use, Integrated Drought Management etc. Participation in Stakeholders committee

OHMI project (leading partner – CNRS through UMI at UofA)

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Future plans

Rositsa's study - Expert based assessment of the provision of ecosystem services conducted through interviews

Step 2 of the investigation **"SUPPLY AND DEMAND OF ECOSYSTEM SERVICES IN TUCSON BASIN"**

Mapping ecosystem goods and services

To be accomplished by the end of 2014

Research Visit of Kremena Boyanova September – November 2014

Preparations already started

Study - Work on the quantification and mapping of the water-related ES in Tucson basin. Integration of the results in post-normal science concept. Collaboration with social scientists

Research Visits of Tanya Trenkova and Sofia Kostadinova

planned for January – May 2015

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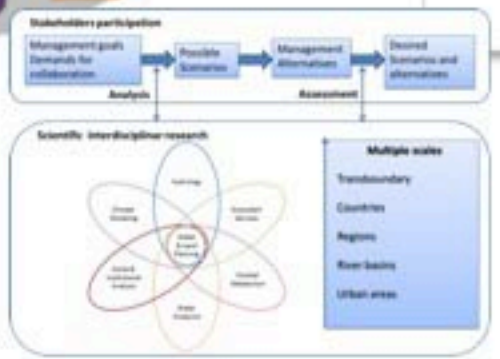
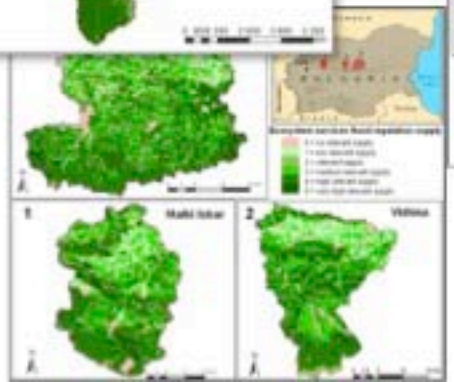
Scientific achievements

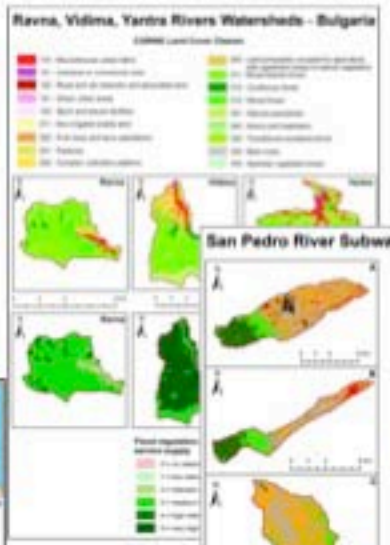
- Development of trans-disciplinary approach addressing water management challenges and it's application in post normal science (1)
- Comparative analysis of the flood regulating ecosystem services in Bulgaria and Arizona by applying the VIC and KINEROS hydrological models (2)
- Development of approach for integrating Water footprint concept and SWAT hydrological model for quantification of ecosystem services water provision and water purification (applied only for Bulgaria)

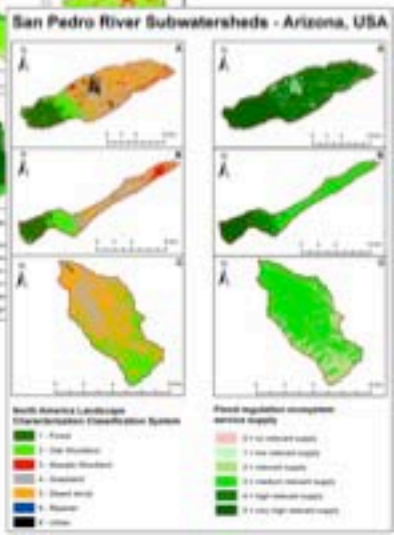
(1)



(2)







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Scientific achievements

Expert based assessment of the provision of ecosystem services conducted through interviews

Step 1 - Online survey "IMPORTANCE OF ECOSYSTEM SERVICES IN TUCSON ACTIVE MANAGEMENT AREA"

Target groups: stakeholders from the UofA (Academia), SWAN members, UofA students

Assessment matrix – Capacity, Supply & Demand

Regulating services												Provisioning services													Cultural services						
	Global climate regulation	Local climate regulation	Air quality regulation	Water flow regulation	Water purification	Nutrient regulation	Erosion regulation	Natural hazard regulation	Pollination	Pest and disease control	Regulation of waste		Crops	Biomass for energy	Fodder	Livestock (domestic)	Fibre	Timber	Wood Fuel	Fish, seafood & edible algae	Aquaculture	Wild foods & resources	Biochemicals & medicine	Freshwater	Mineral resources	Abiotic energy sources		Recreation & tourism	Landscape aesthetics & inspiration	Knowledge systems	Religious & spiritual experience	Cultural heritage & cultural diversity	Natural heritage & natural diversity
	0	0	0	0	0	0	2	0	1	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	2	2	2	1	0
	0	0	0	0	0	0	1	0	2	1	0		0	0	1	0	0	0	0	0	0	0	0	0	0	1		2	1	2	2	2	0

Which are the **most relevant** ecosystem services in the TAMA case study -
in scale from **0** to **5**?

- 0 = no relevance
- 1 = low relevance
- 2 = relevance
- 3 = medium relevance
- 4 = high relevance
- 5 = very high relevance

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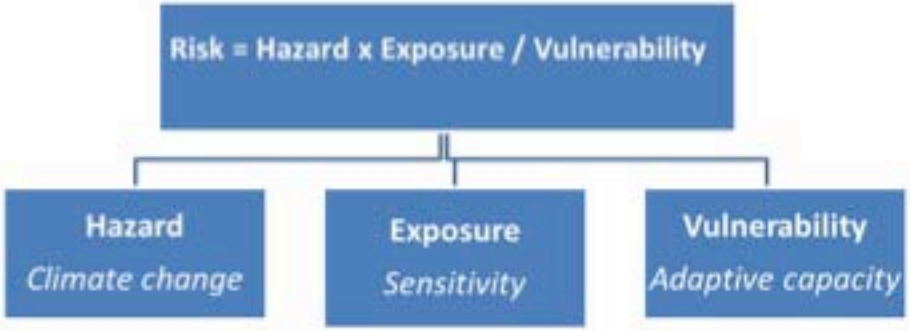
Scientific achievements

Climate Change Vulnerability Assessment



The level of vulnerability is estimated according the modified scale proposed from Garcia et al. (2012):

Vulnerability Index Value	Vulnerability
0.80 – 1.00	Extremely vulnerable
0.50 – 0.79	Very vulnerable
0.20 – 0.49	Moderately vulnerable
0.01 – 0.19	Vulnerable

Vulnerability in the context of the impact of climate change is measured by the ratio between the sensitivity and adaptive capacity of the exposed systems.

Vulnerability Index (VI):

$$VI = S/Ac$$

Where:

S – Sensitivity

S- Sensitivity = $\sum (\sum$ Sn max scores/ $\sum$ Sn scores)/n

n – number of climate change indicators

Ac – Adaptive capacity

1 - Insufficient adaptive capacity - no action is taken to address the risk of climate change;

2 - Sufficient adaptive capacity - partly implemented directives , strategies and programs for adaptation and mitigation of climate change ;

3 - High adaptive capacity - executed directives , strategies and programs for adaptation and mitigation of climate change.

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Scientific achievements

Climate change impact and sensitivity assessment (2081-2100)

Indicator	IPCC AR5	RCP (2081-2100)			Expected impact: positive (+); neutral (0) or negative (-)			Sensitivity: Low -1 Moderate – 2 High - 3			Ac: 1-Low 2-Medium 3-High
	RCP Scenario	ΔT°C	ΔP%↓,↑	Ex↓,↑	ΔT°C	ΔP%	ΔEx	ΔT°C	ΔP%	ΔEx	
Water Temperature	RCP 2.6 RCP 4.5 RCP 6 RCP 8.5										
Water quality	RCP 2.6 RCP 4.5 RCP 6 RCP 8.5										
Ecosystems services	RCP 2.6 RCP 4.5 RCP 6 RCP 8.5										

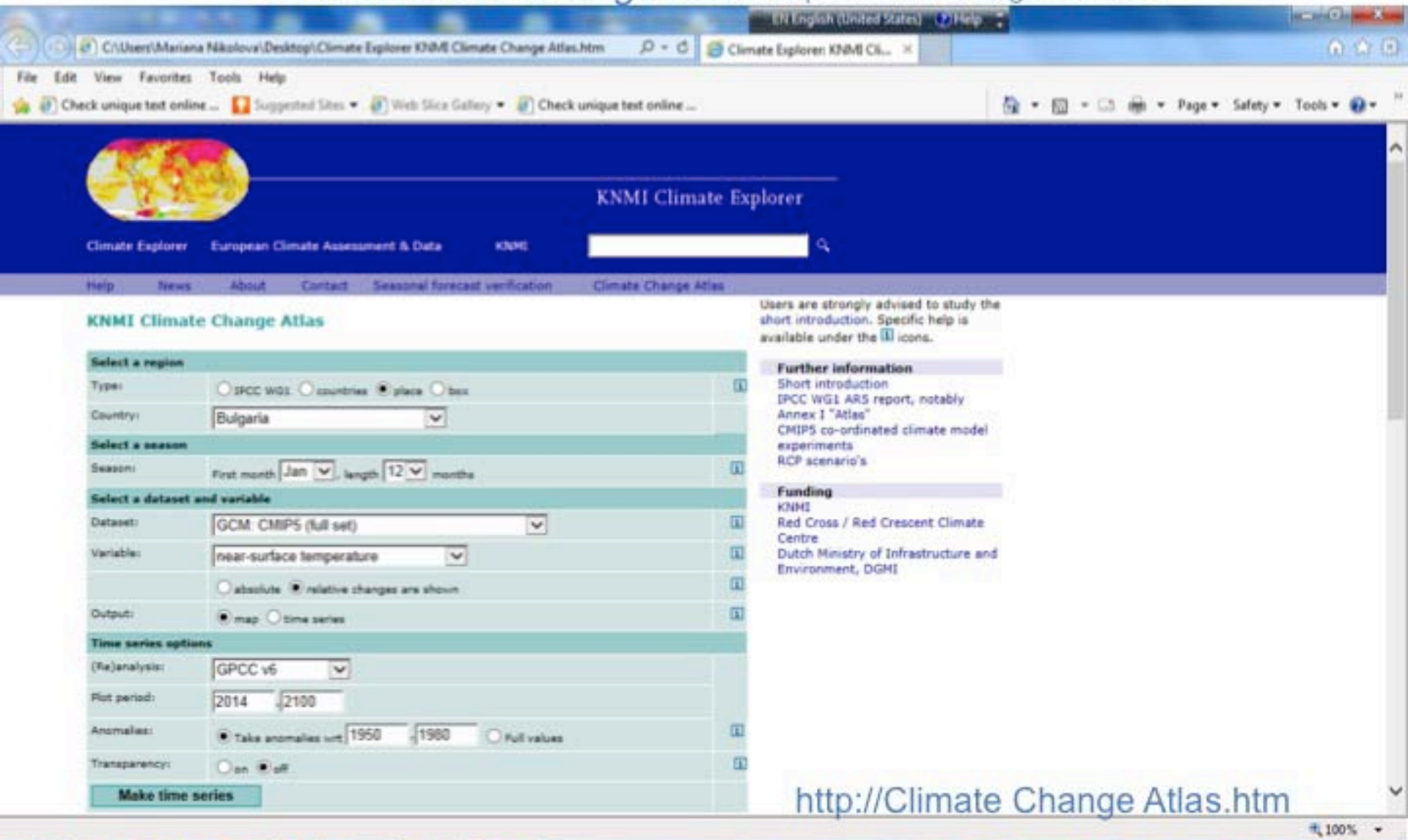
IPCC AR5 ICP's Scenarios

RCP	Radiation pressure	CO_2 eq. (ppm)	Median of temperature anomaly (°C)	Trend	Equivalent to the SRES scenarios
RCP 8.5	8.5 W/m^2 in 2100 r.	1370	4.9	Increase	SRES A1F1
RCP 6.0	6 W/m^2 in 2100 r.	850	3.0	Stable	SRES B2
RCP 4.5	4.5 W/m^2 after 2100	650	2.4	Stable	SRES B1
RCP 2.6	3 W/m^2 before 2100 r., to 2.6 W/m^2 in 2100 r.	490	1.5	Increase	No equvalent

Source: Assesment of risk…, MOEW, 2014

Data

KNMI Climate Change Atlas http://Climate Change Atlas.htm

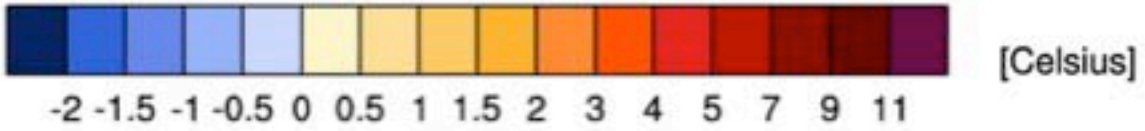


http://Climate Change Atlas.htm

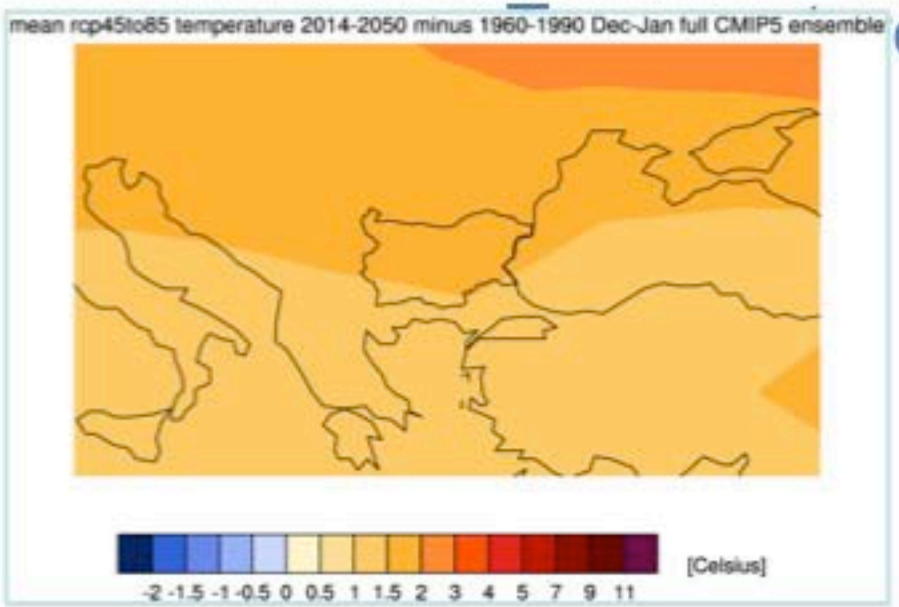
Climate change projections IPCC AR5

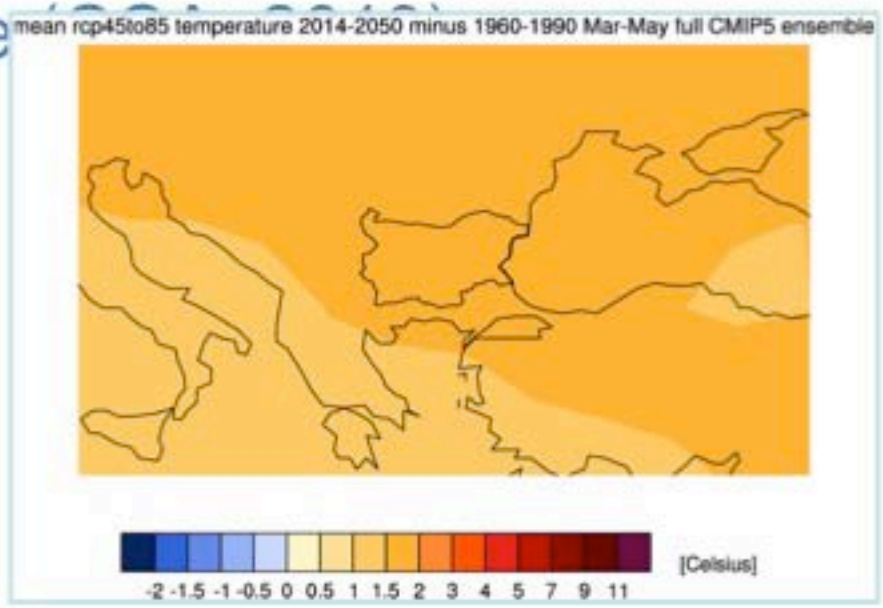
Temperature

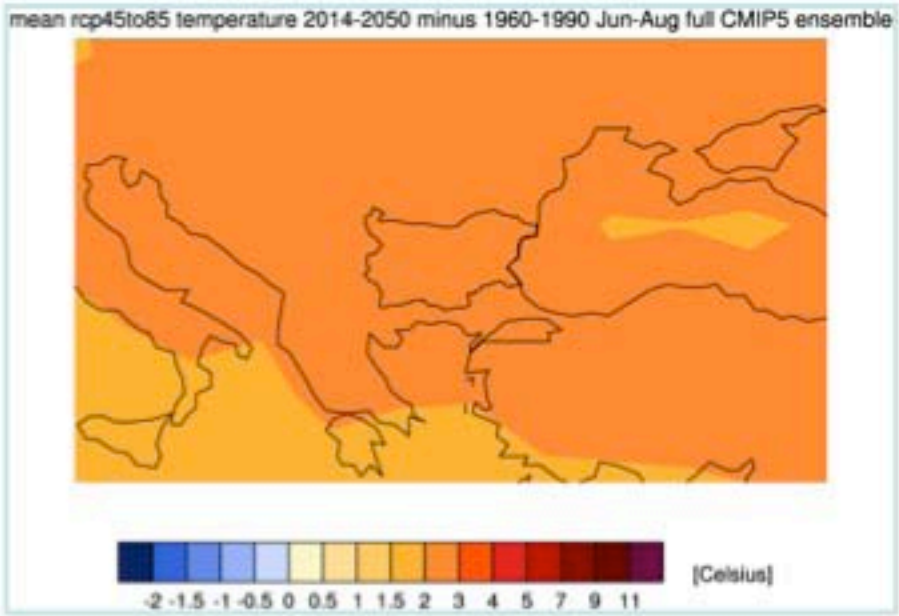
mean rcp45to85 temperature 2014-2100 minus 1961-1990 Jan-Dec full CMIP5 ensemble

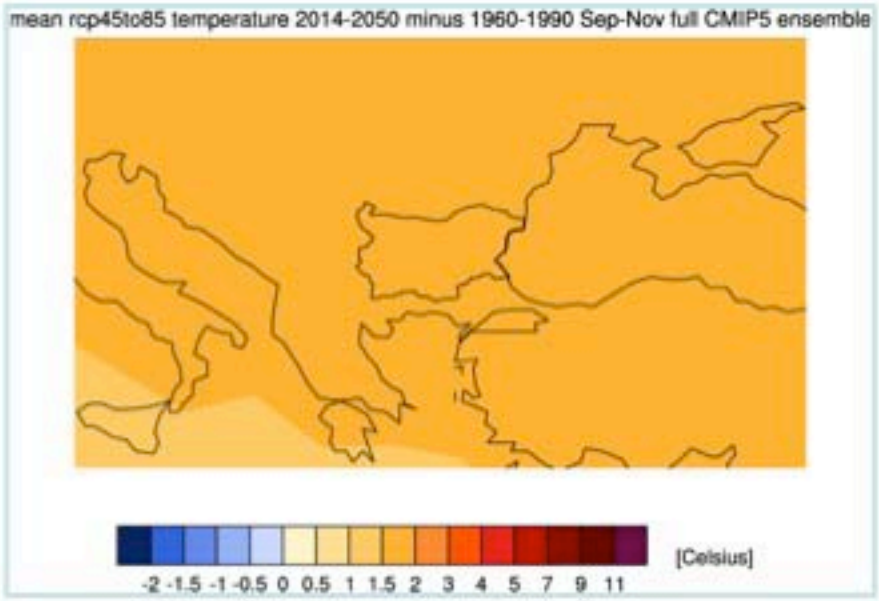


Climate change projections IPCC AR5

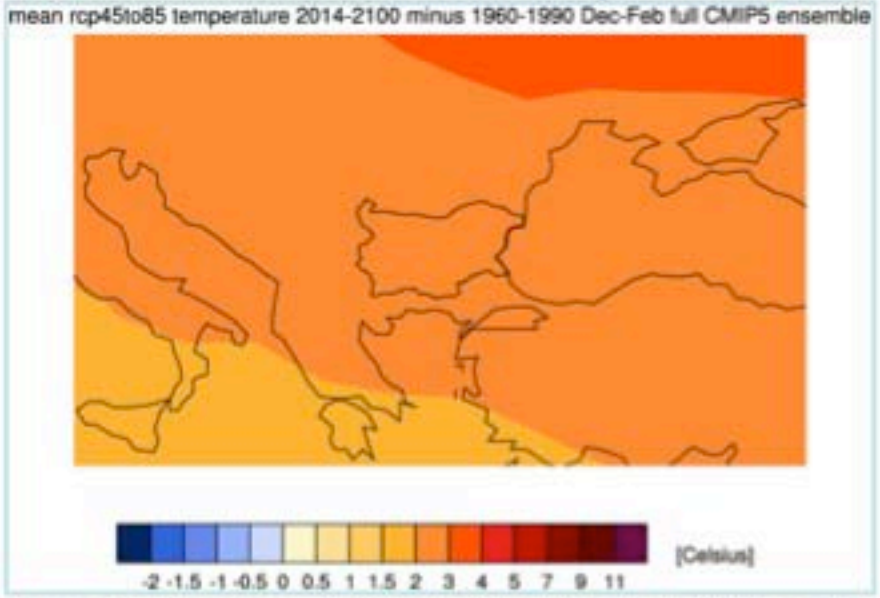


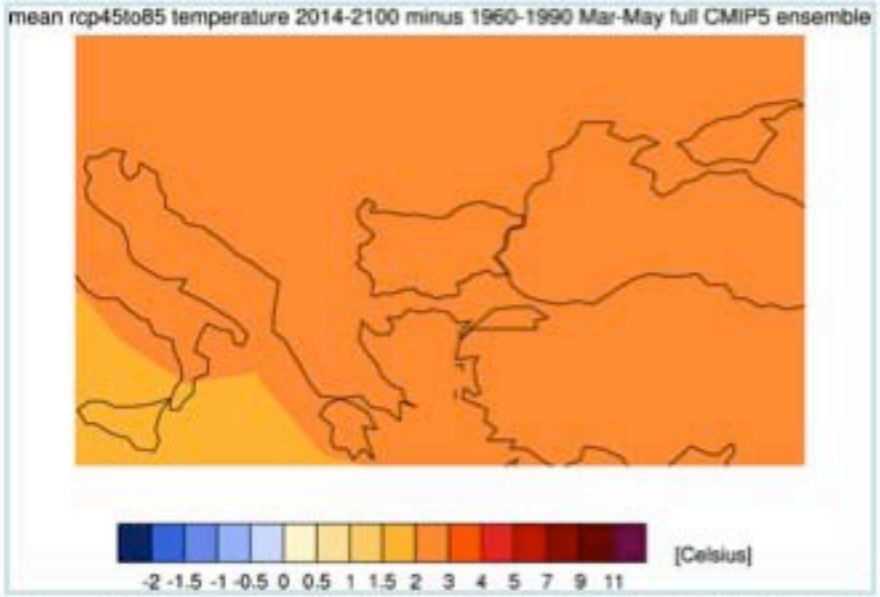


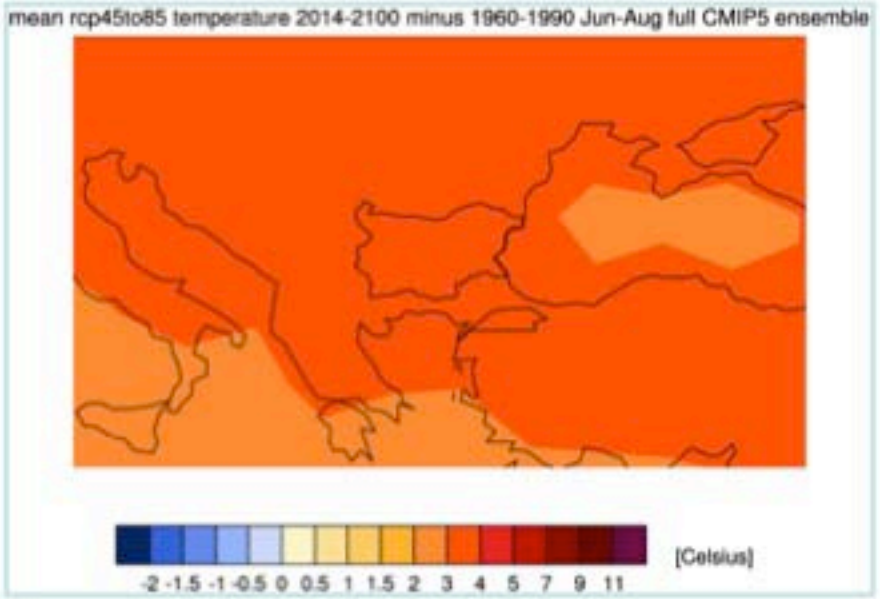


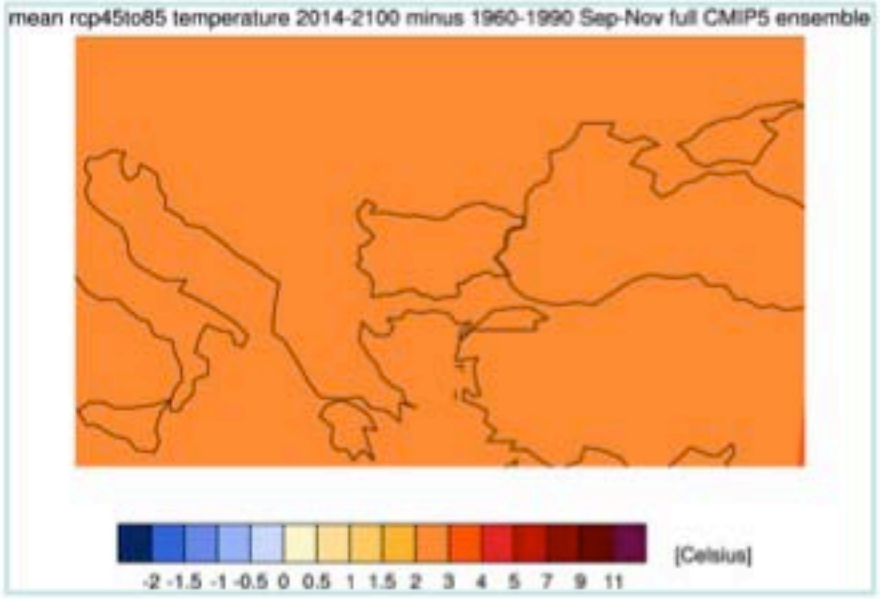


Climate change projections IPCC AR5 Temperature (CCA, 2013)



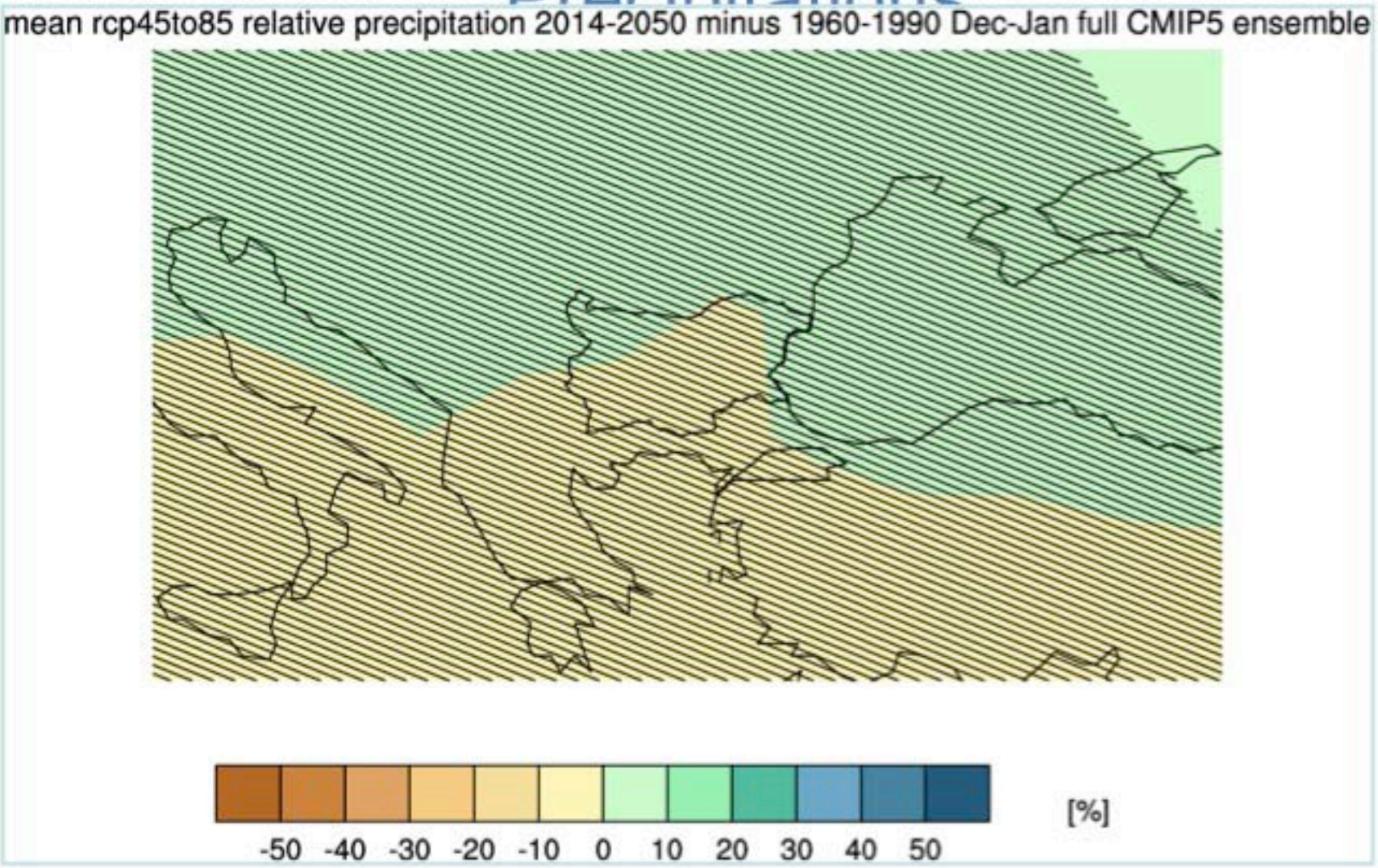






Climate change projections IPCC AR5

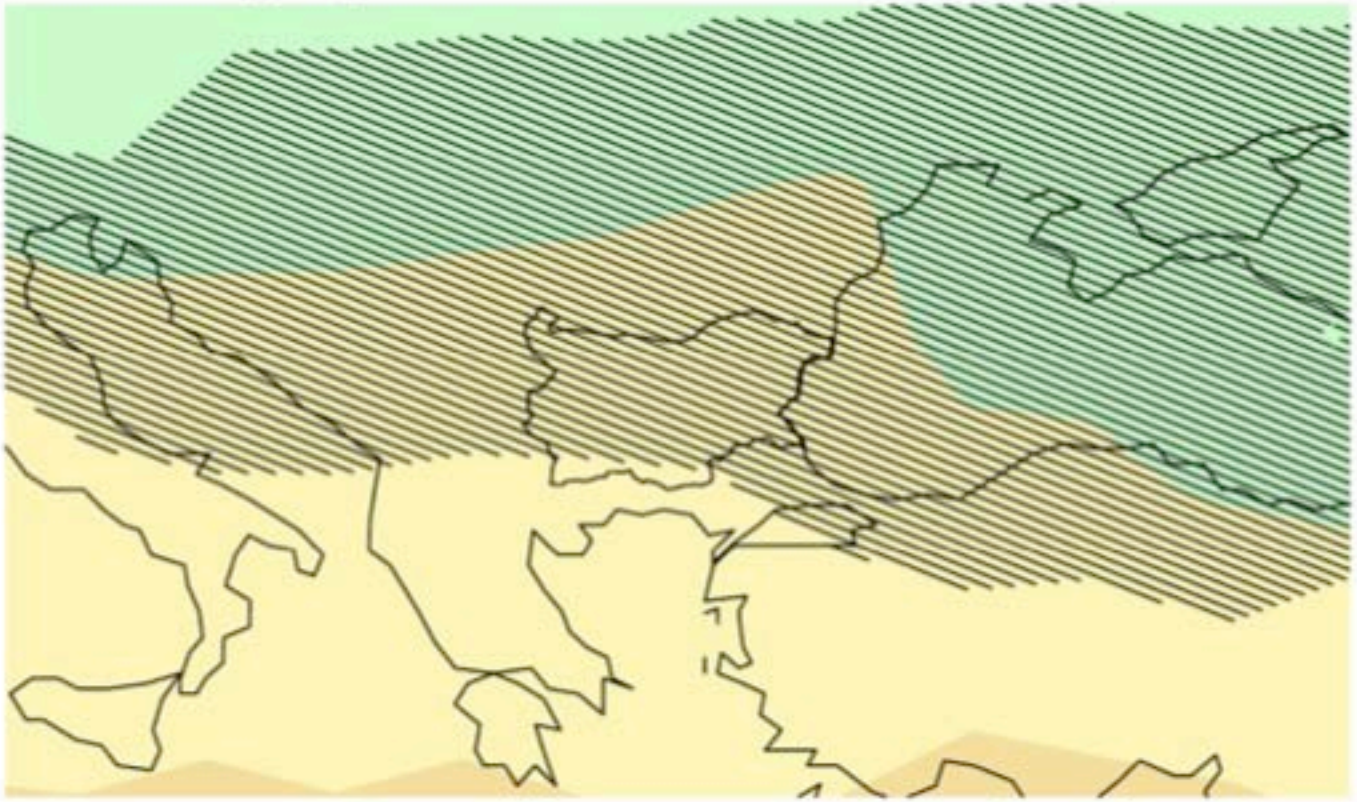
Precipitations



Climate change projections IPCC AR5

Precipitations

mean rcp45to85 relative precipitation 2014-2100 minus 1961-1990 Jan-Dec full CMIP5 ensemble



Climate change impact and sensitivity assessment (2081-2100)

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	RCP Scenario	ΔT°C	ΔP%↓,↑	ΔEx↓,↑ No of dry spill days	ΔT°C	ΔP%	ΔEx	ΔT°C	ΔP%	ΔEx	
Water temperature	RCP 2.6	1,5-2,0	0,0-10↓	2-4	-	0	0	3	1	1	1
	RCP 4.5	2,0-3,0	0,0-10↓	2-8	-	-	-	3	1	3	1
	RCP 6	3,0-4,0	0,0-10↓	2-8	-	-	-	3	1	3	1
	RCP 8.5	4,0-5,0	10-20↓	8-10	-	-	-	3	3	3	1
Water quality	RCP 2.6	1,5-2,0	0,0-10↓	2-4	-	0	0	1	1	1	1
	RCP 4.5	2,0-3,0	0,0-10↓	2-8	-	-	-	2	1	3	1
	RCP 6	3,0-4,0	0,0-10↓	2-8	-	-	-	3	1	3	1
	RCP 8.5	4,0-5,0	10-20↓	8-10	-	-	-	3	2	3	1
Ecosystems services		1,5-2,0	0,0-10↓	2-4	-	0	-	2	1	1	1

Results

Climate change vulnerability assessment

Vulnerability Index VI=S/Ak

S- Sensitivity = ∑ (∑ Sn max scores/ ∑ Sn scores)/n

Indicator	Sum	ΔT°C	ΔP%	ΔEx	n	S	Ak	Vulnerability Index
Water temperature	S Max	12	3	9				
	S sc.	12	6	10				
	S	1	0,5	0,9	3	0,8	1	**0,8 – Extremely vulnerable**
Water Quality	S Max	6	2	9				
	S sc.	9	5	10				
	S	0,6	0,4	0,9	3	0,65	1	**0,65 – Very vulnerable**
Ecosystem services	S Max	9	2	9				
	S sc.	11	3	10				
	S	0,81	0,66	0,9	3	0,79	1	**0,79 - Very vulnerable**


Thank you for your attention!