Cres-Lošinj Water – Wastewater Project: A Climate Change Adaptation Case Study

JASPERS Networking Platform Event

Climate Change Adaptation: Vulnerability and Risk Assessment and the Resilience of Major Infrastructure Projects

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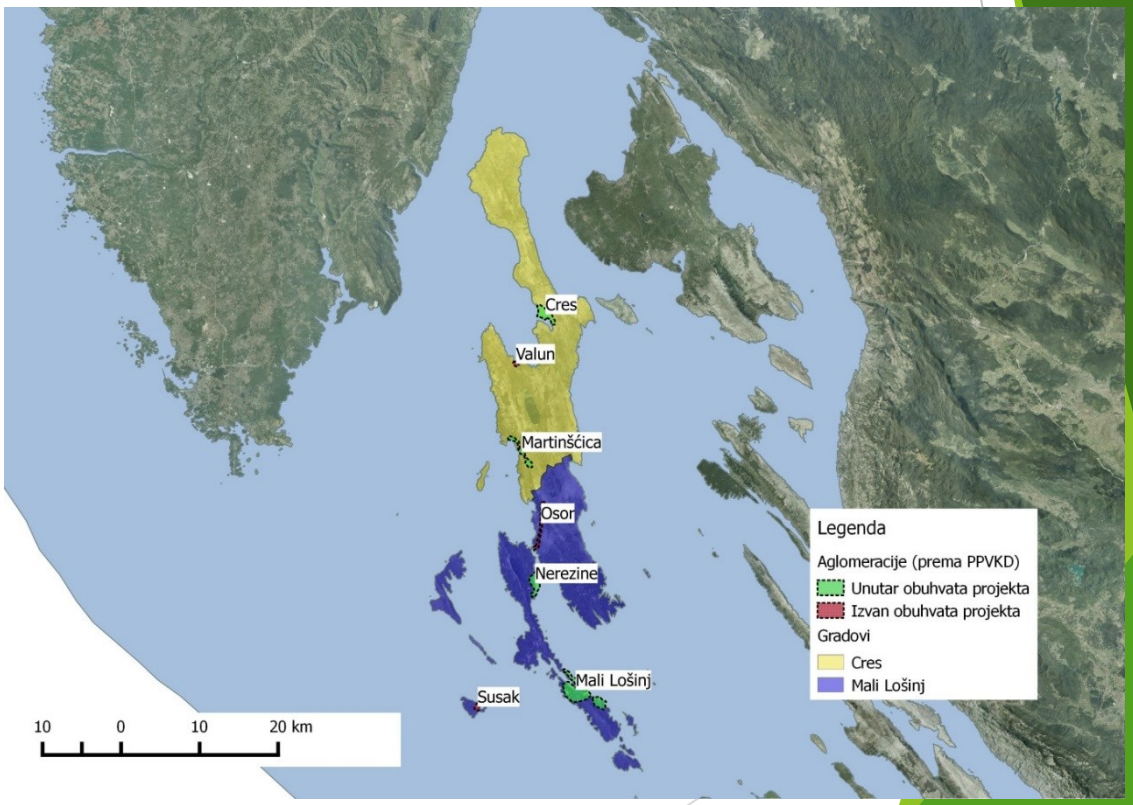
Project Area

- Islands Cres and Lošinj, Primorje-Goran County in Croatia
- Project scope - 5 agglomerations:
  - Cres
  - Martinšćica
  - Nerezine
  - Mali Lošinj
  - Veli Lošinj



Base Data

Agglomeration	Cres	Martinšćica	Nerezine	Mali Lošinj / Veli Lošinj
Population (2031.)	2.199	161	471	6.876
Tour. overnights (2031.)	585.760	218.980	535.640	1.705.240
Tourism seasonality	July+August: 66%	July+August: 66%	July+August: 64%	July+August: 64%
WWTP winter load (PE)	2.400	200	600	7.800
WWTP peak load (PE)	12.700	4.200	7.400	31.500
Seasonality ratio	**5,3**	**21,0**	**12,3**	**4,0**
Recipient	normal	normal	normal	normal
Treatment level required	secondary	appropriate	appropriate	secondary
UWWTD deadline	2020.	2023.	2023.	2020.

Methodology

- Methodology derived by A. Dekker in 2015 based on „Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient“

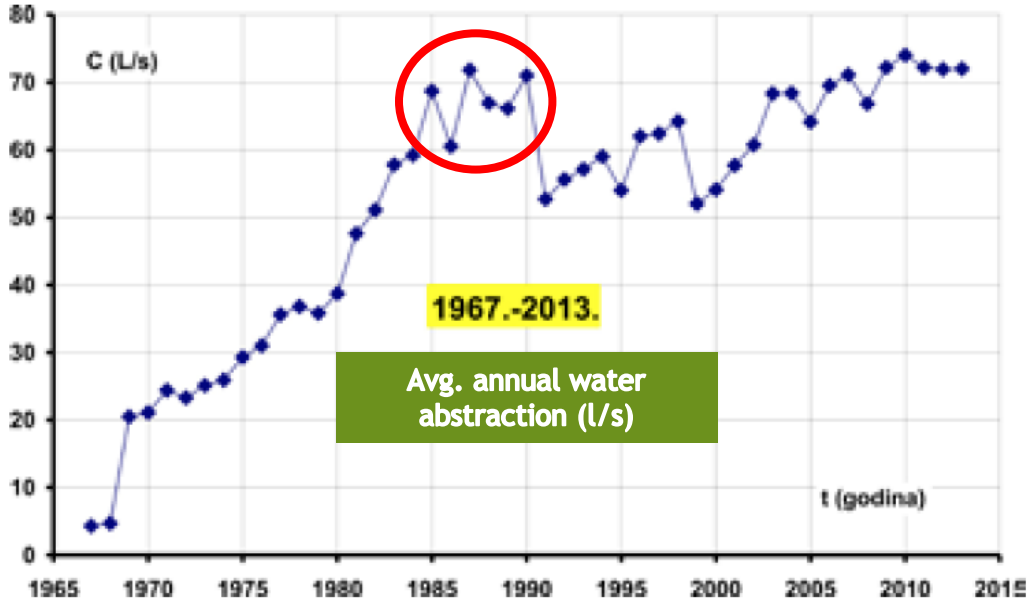
1. Identify climate sensitivity of the project
2. Evaluate exposure of the project
3. Assess vulnerability

   $$Vulnerability = Sensitivity * Exposure$$

4. Assess risk
5. Identify adaptation options
6. Appraise adaptation options
7. Integrate adaptation plan

Water Supply Base Data

	2012	2013	2014
Water abstracted (m^3)	2.258.865	2.299.874	2.182.791
Invoiced water (m^3)	1.392.983	1.351.555	1.383.509
NRW (m^3)	865.882	948.317	799.282
NRW (%)	38,3%	41,2%	36,6%

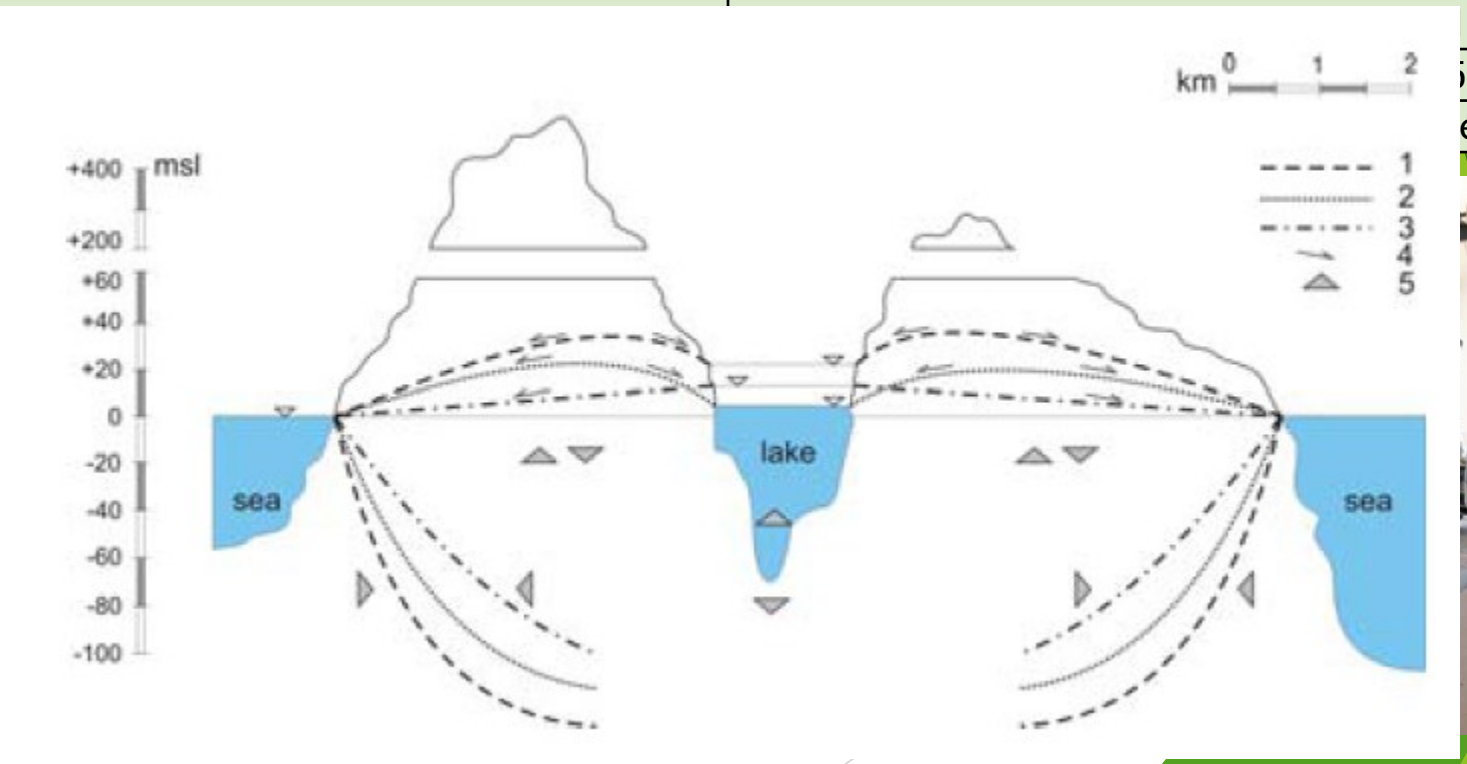


Source: Bonacci, O. (2014.): Analiza varijacije razine vode jezera Vrana na otoku Cresu. Hrvatske vode, 22(2014), 337-346.

Lake Vrana

- Karstic environment
- The only water intake for islands Cres and Lošinj

Location	Island Cres
Area	5,8 km²
Volume	200 mio. m³
Bottom level	-61,5 masl
Avg. water level (long-term)	14 masl
Max. v	,5 km
Max. l	,5 km
Type	ession

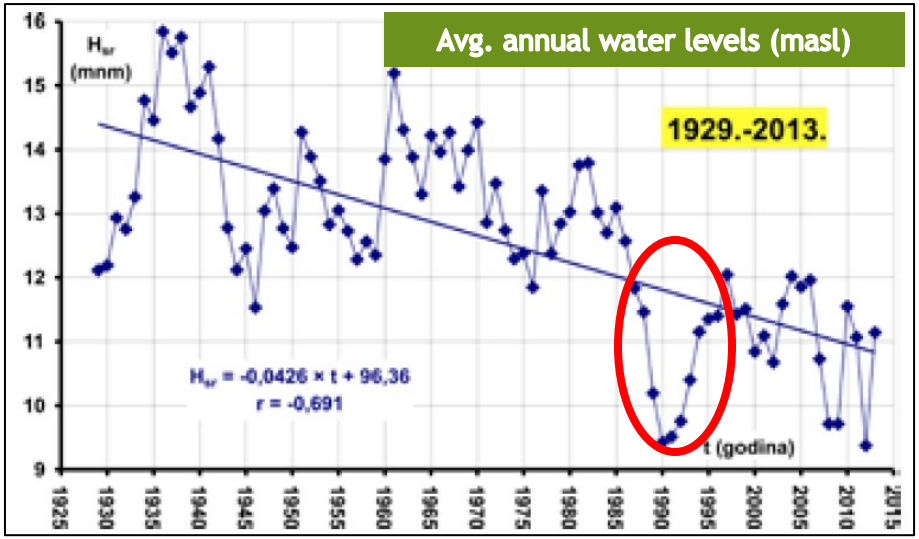


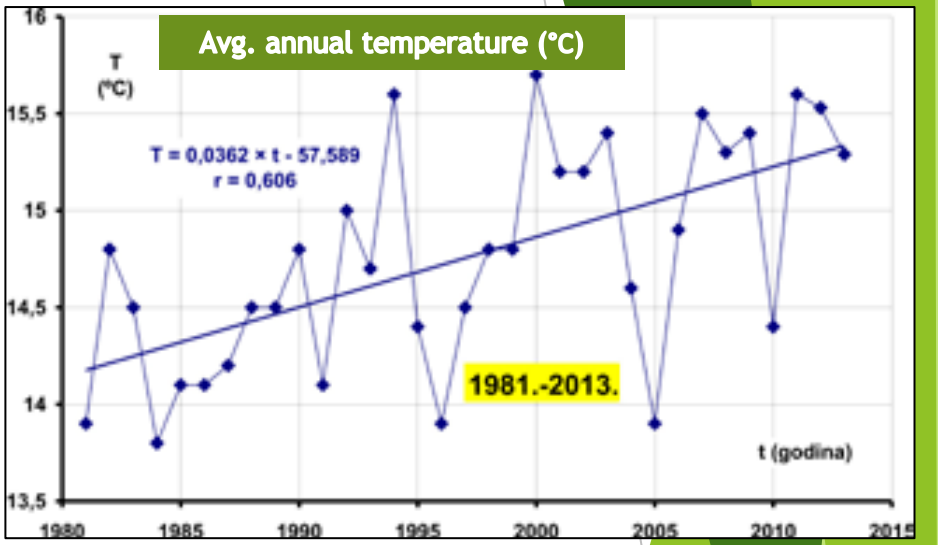
Lake Vrana

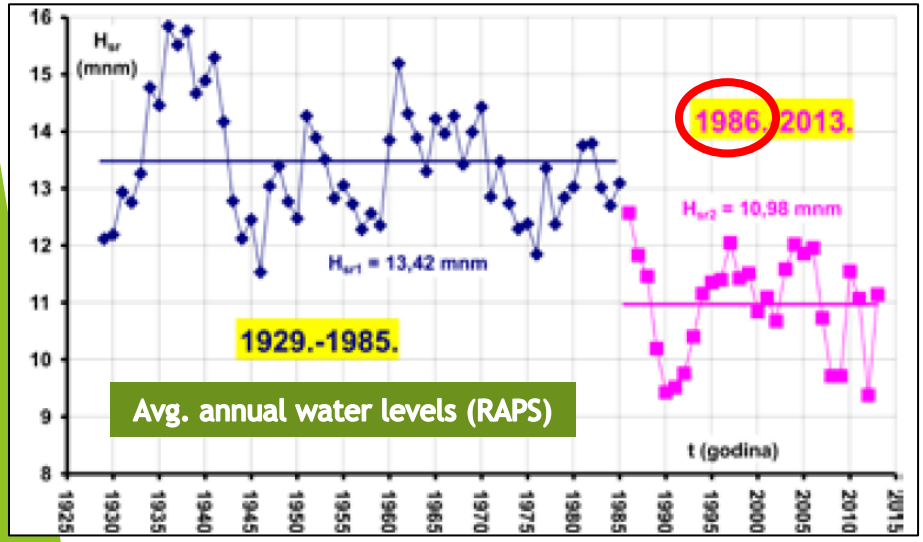
- Water availability governed by three main parameters: a) precipitation, b) temperature and irradiation and c) water abstraction.
- Late 1980s extremely low water levels recorded → question arose: *„Is it possible to continue the abstraction trend without seawater intrusion?”*
- A number of scientific projects started → still no clear answer due to the system complexity
- GCM results show that in 2071 – 2100 a 30% reduction in water recharge is to be expected
- Authors Katalinić, Rubinić, Bušelić in a paper in 2007 conclude (based on hydrological monitoring data and results from occasional monitoring of water conductivity and salinity):

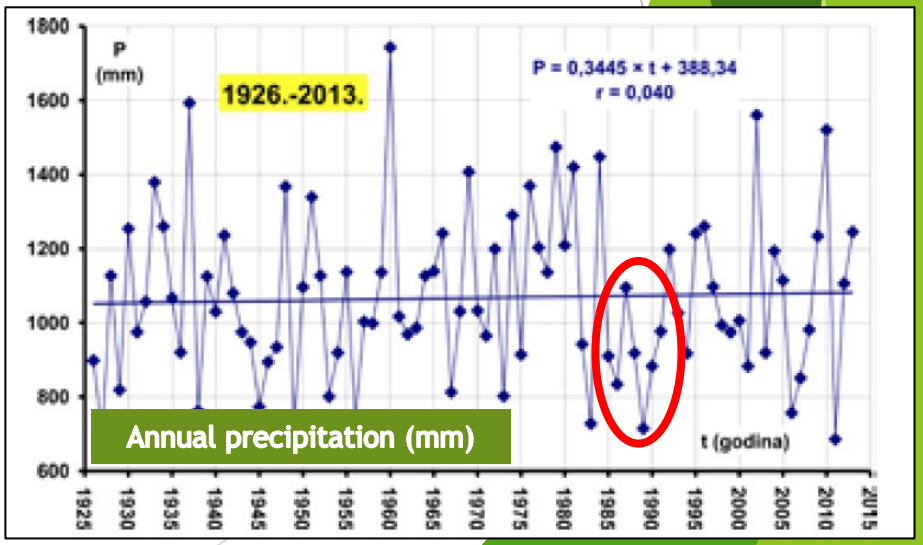
„…if the excessive pumping would significantly decrease the average water level of Vrana lake, the lake would suffer the freshwater-saltwater equilibrium disruptance and even face the risk of seawater intrusion in the until now freshwater karst system.”

Hydrological Trends









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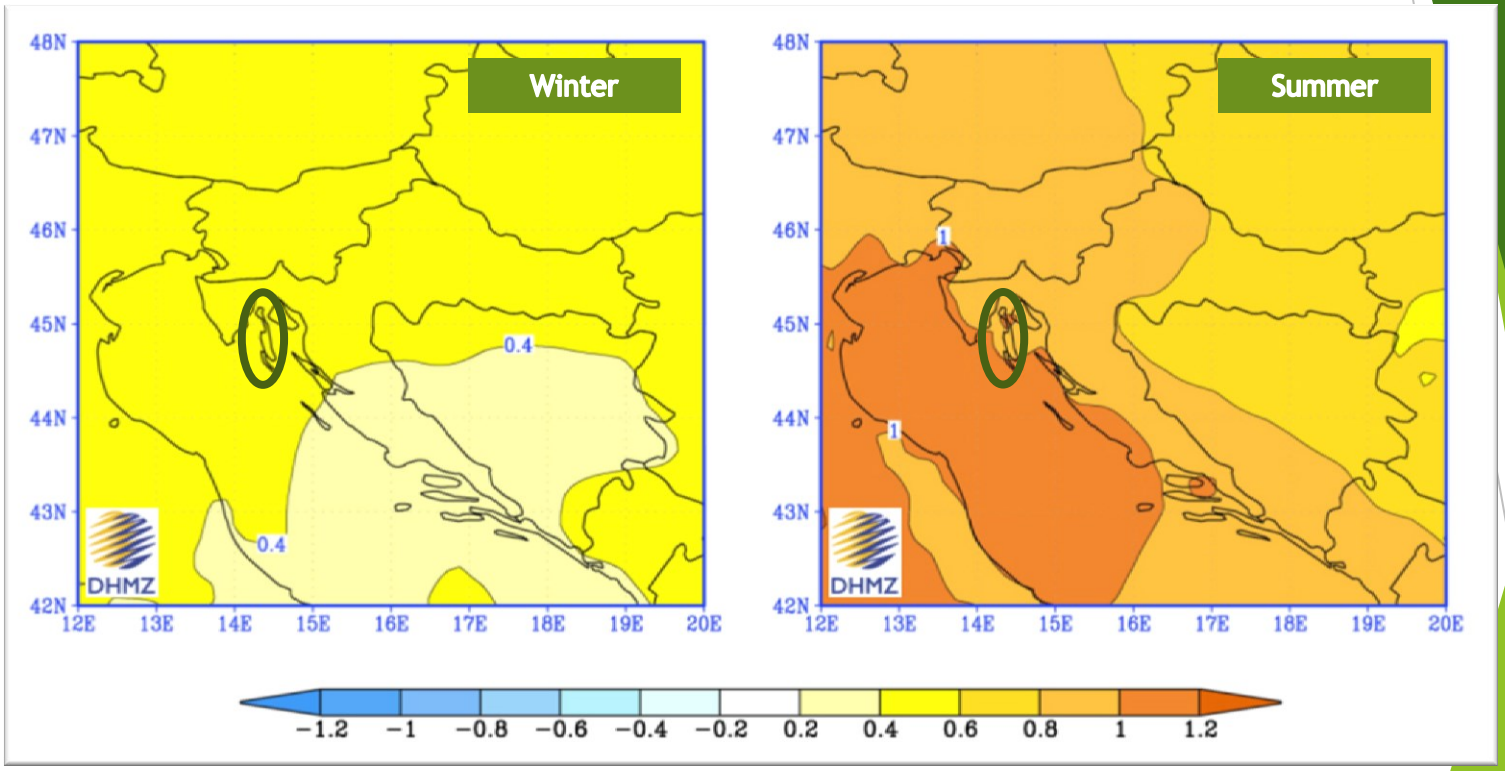
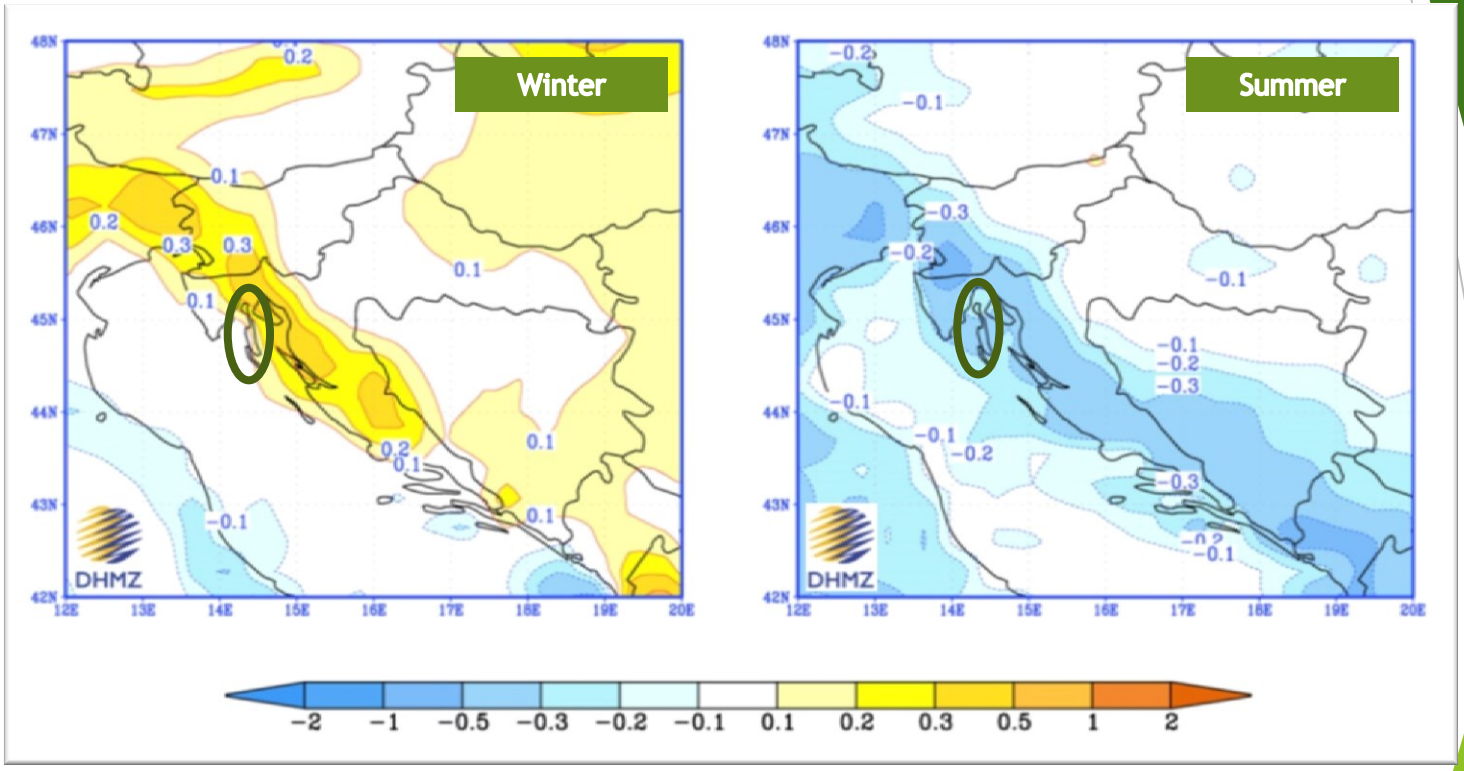
Climate Change Prospects (1)



- Temperature increase
- Hotter summers
- Increase in number of hot days

Climate Change Prospects (2)



- Precipitation decrease
- Largest decrease in coastal area

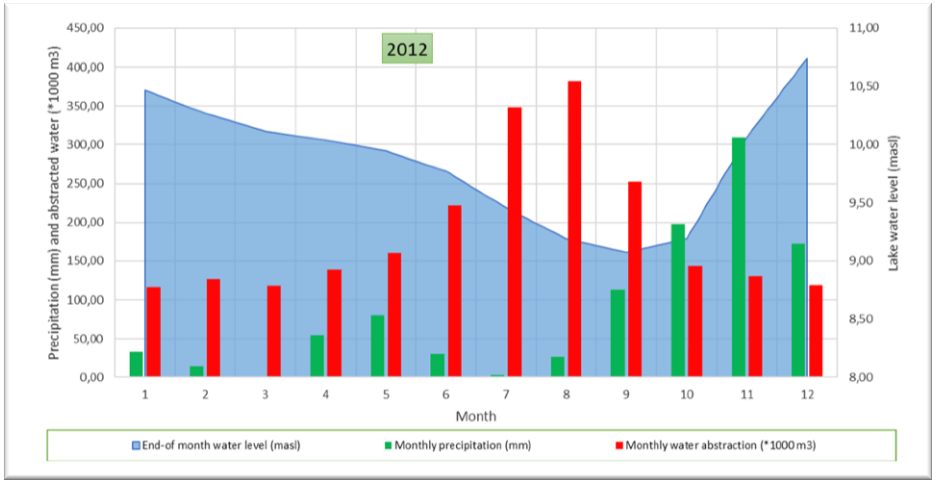
Mediterranean region

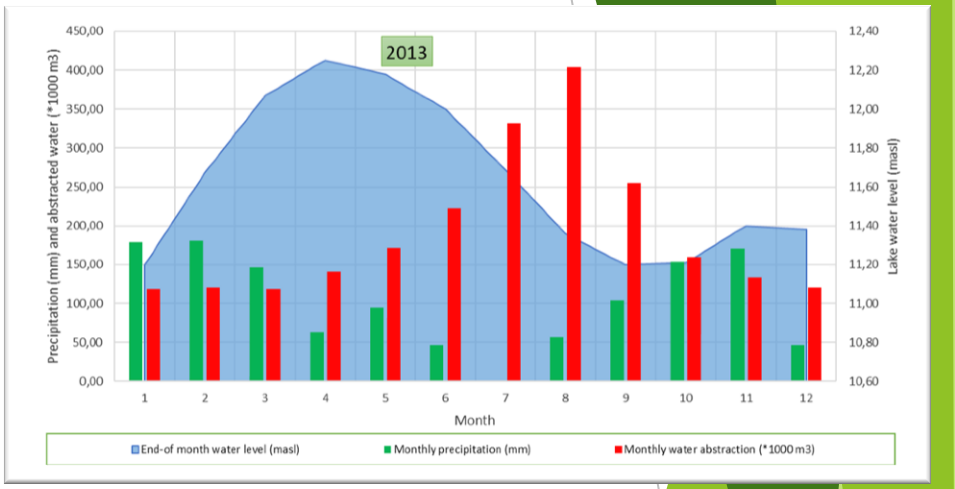
Temperature rise larger than European average
Decrease in annual precipitation
Decrease in annual river flow
Increasing risk of biodiversity loss
Increasing risk of desertification

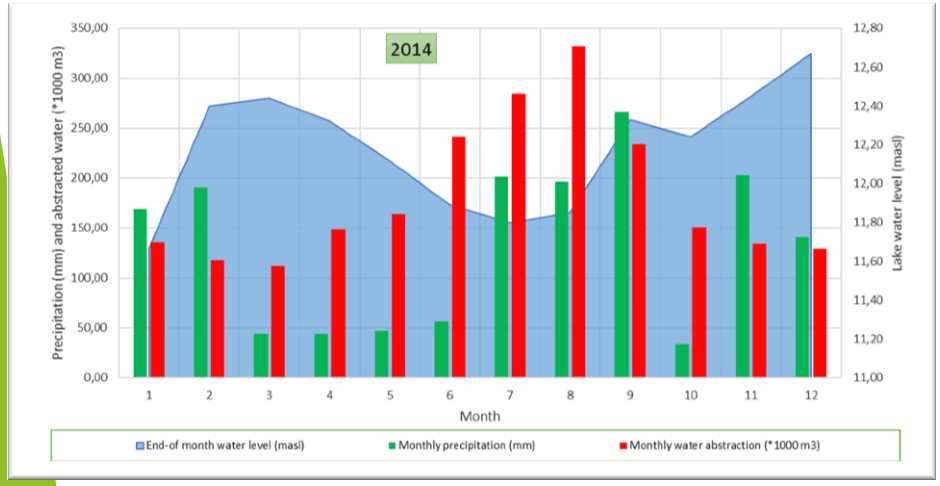
Increasing water demand for agriculture
Decrease in crop yields
Increasing risk of forest fire
Increase in mortality from heat waves

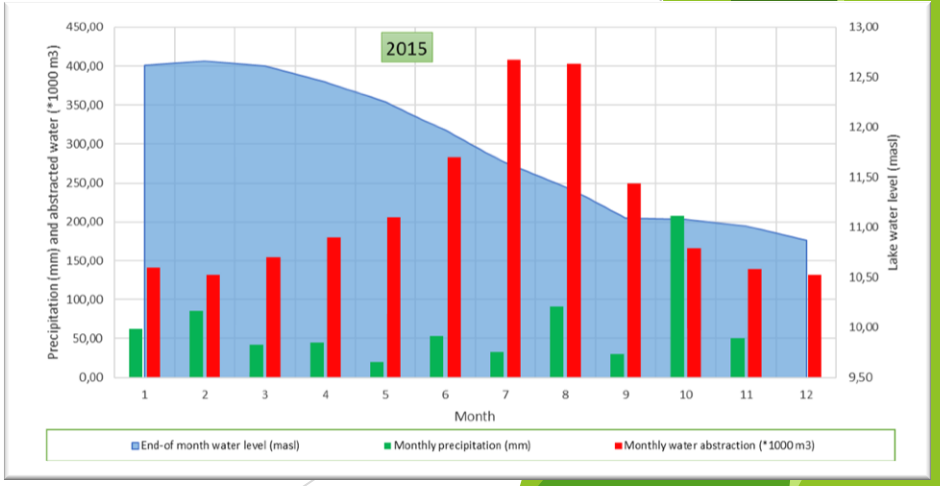
Expansion of habitats for southern disease vectors
Decrease in hydropower potential
Decrease in summer tourism and potential increase in other seasons

Lake Vrana Hydrology - Present Status









Project Risks Identified

Vulnerability	Exposure	Sensitivity
Increase in mean temperatures	Increase in mean annual temperature of 1,8°C in winter and 2°C during summer.	HIGH
Decrease of precipitation	Decrease of avg. precipitation in winter (0,3-0,5 mm/day), but increase of precipitation during summer. Long-term (2040.-2070.g.): further decrease of annual precipitation by 45-65 mm.	
Increase in dry spells	Increase in no. of sunny days and temperature rise lead to dry spell increase.	
Water availability	Water balance of the lake is likely to change based on temperature and precipitation trends which could have a strong negative impact on water availability (albeit average abstraction is still ~100 times less than average lake volume).	

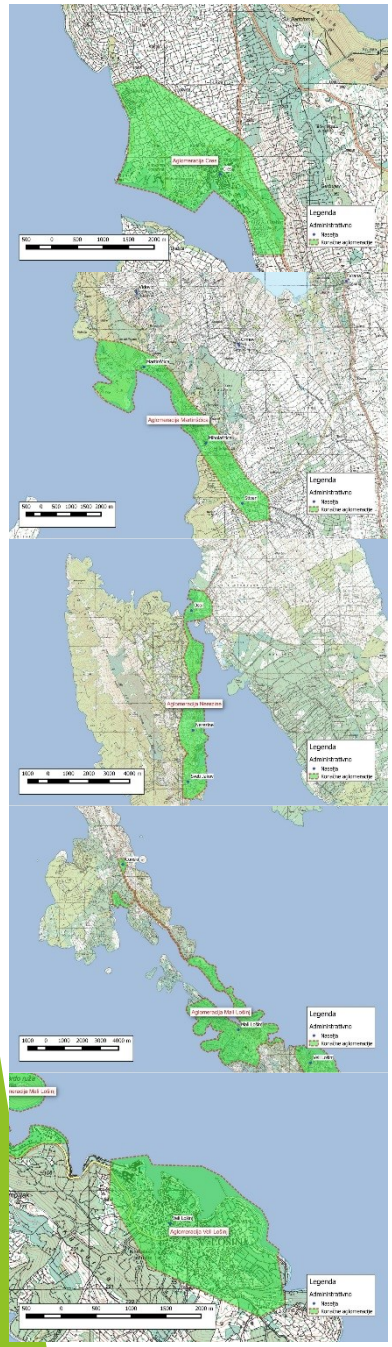
Resilience and Adaptation Measures

- Short-term:
  - Urgent reconstruction of the most damaged section of the water main (approx. 4 km) to reduce leakage
  - Supply of leak detection equipment and personnel training
  - TA contract: Measurement campaign / Hydraulic modelling / Leak management plan / Integration of GIS, invoicing, hydrological monitoring and hydraulic modelling into a DSS
- Continuous / Long-term:
  - Continuous hydrological monitoring of Vrana lake
  - Further investments into pressure optimization and NRW reduction
  - Investigation of potential alternative water sources (mainland connection, desalinization, combination thereof etc.)

Lessons Learned

- Climate change is a powerful justification „tool”.
- Historical data is of utmost importance to determine trends in conjunction with climate change estimates.
- Risk can often not be quantified → expert judgement crucial.

Other than „standard” project drivers (Directive compliance etc.) – can climate change be considered a project driver?



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VODOOPSKRBA I ODVODNJA CRES LOŠINJ D.O.O. CRES




For info or further questions on this seminar and the activities of the JASPERS Networking Platform, please contact:

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