



# Climate Change risks and adaptation for Mediterranean grapevine production

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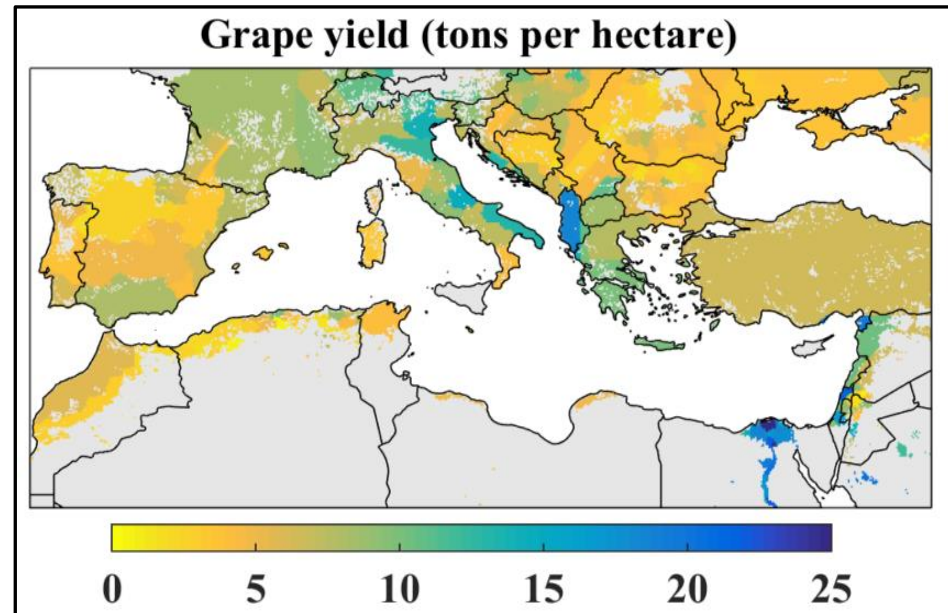


# Outline

1. Introduction
2. Data and approach
3. Results
4. Conclusions

# Introduction

- We wish to suggest **how climate change** will **transform vineyards**
- We **only** consider **changes in climate** variables as drivers and recognise the limitations of **excluding social and environmental** changes
- However, this assessment has **novel features** which are of interest for developing policies that may drive adaptation



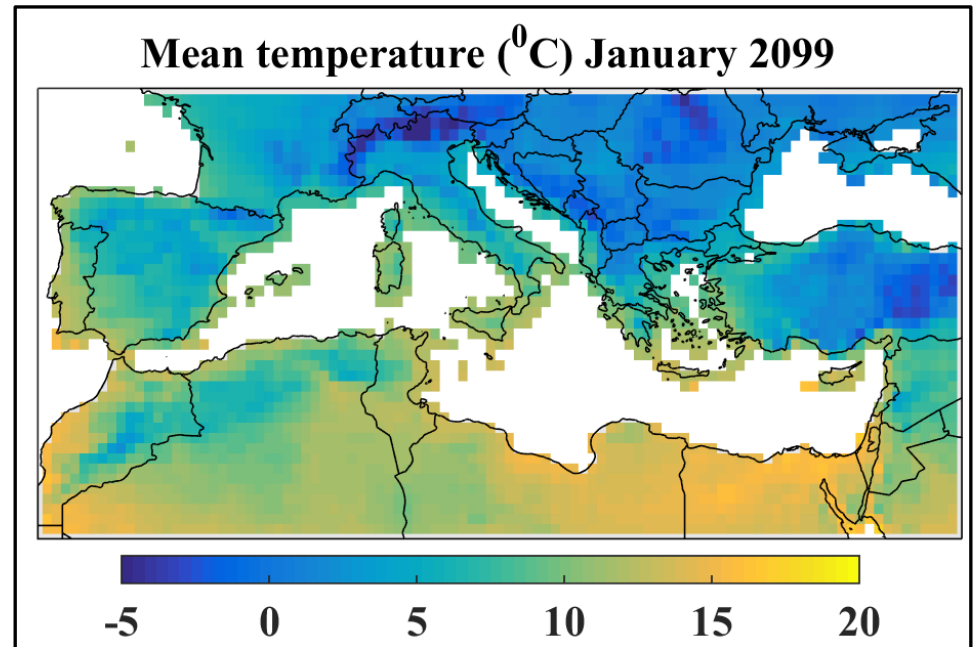
# Data: Climatic scenarios and grapevine data

## **CORDEX** and **ISIMIP** data

- Temperature (mean, max and min) and precipitation.
- Evapotranspiration (Thornthwaite's formula)
- Bias corrected
- Grid  $0.5^{\circ}$
- GFDL-ESM2M Model, Phase b. Forcing RCP60
- Daily time steps
- 1950 to 2099

## **EarthStat** database

- Grape yield tons/ha
- Grid of 5 minutes



# Approach

- We use **three impact indicators** that can be linked to adaptation choices:
  1. The **Huglin index** is a temperature suitability indicator that provides information on the **varieties** that could be used for quality wine
  2. The **Cool night index** is a temperature indicator that provides information about the **quality** of wine (aromatic compounds, etc)
  3. The **SPEI** is a **drought** indicator that provides insights to prepare for extreme drought events in probabilistic terms

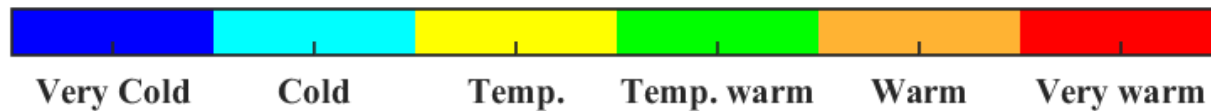
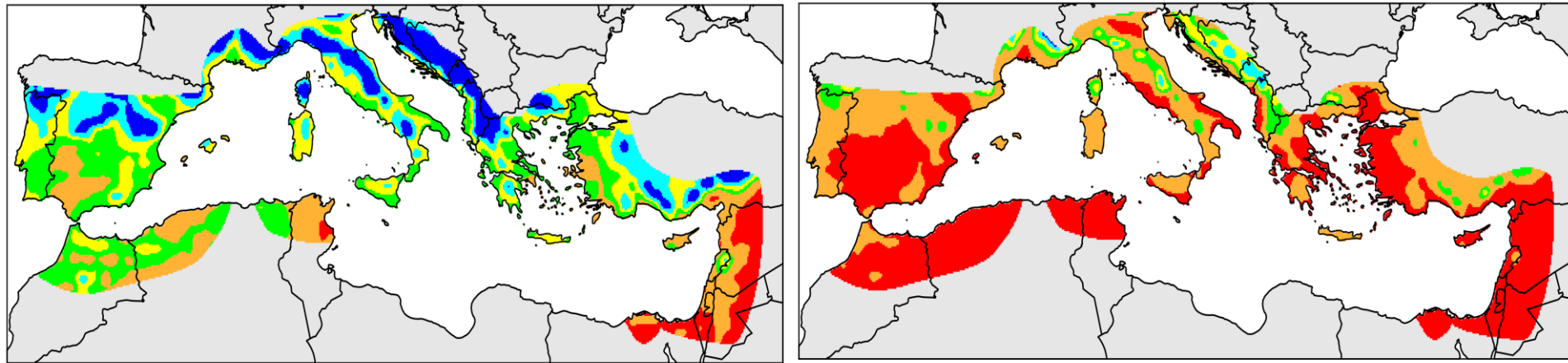
# Approach

- 1) We **compute the indices** at every grid element
- 2) We **detect trends** with the Mann-Kendal test
- 3) We estimate the **magnitude of the trend** with Sens' slope
- 4) We compute the values of the **indices in 1950 and 2099** with the adjusted **linear trend**
- 5) We **evaluate** changes and adaptation efforts

# Results: The Huglin index

1950

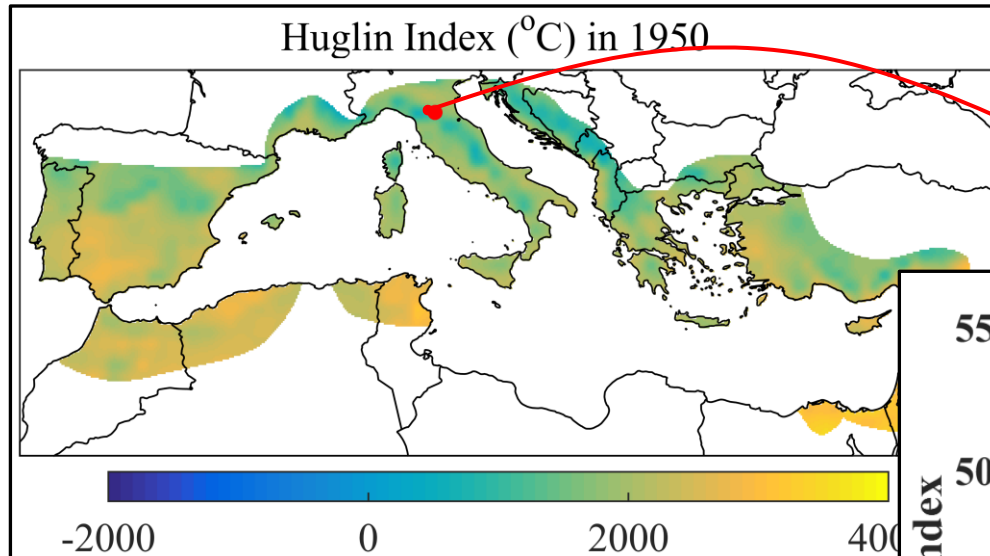
2099



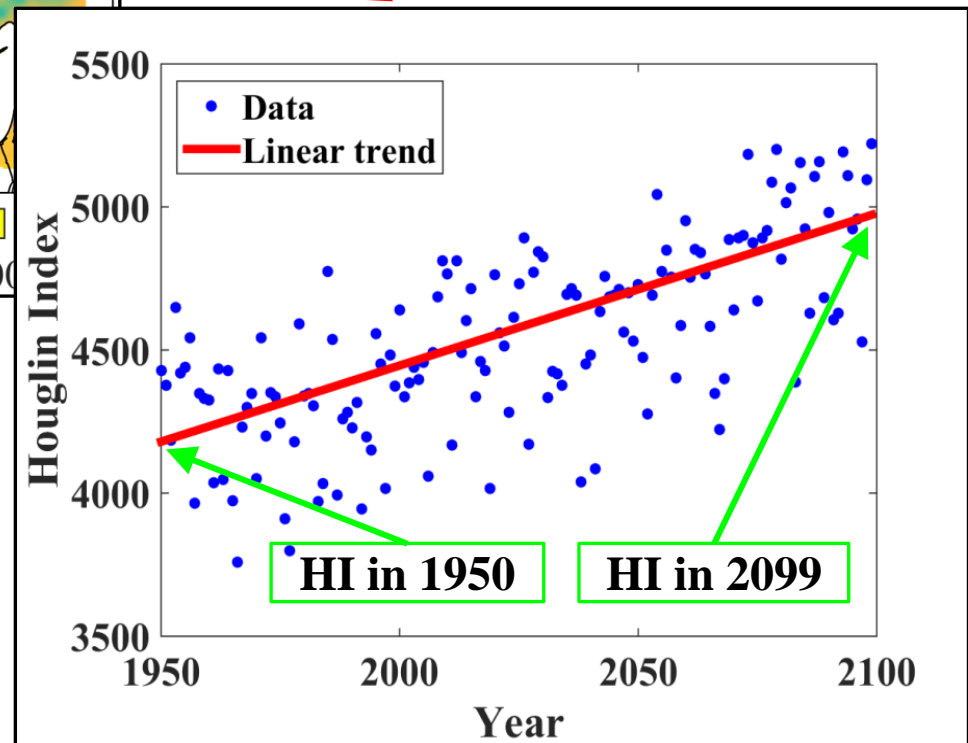
**Suitability** of premium grapevine have **the greatest** changes

# Results: Robustness of the index values at the temporal extremes (Huglin index)

## Huglin Index in 1950

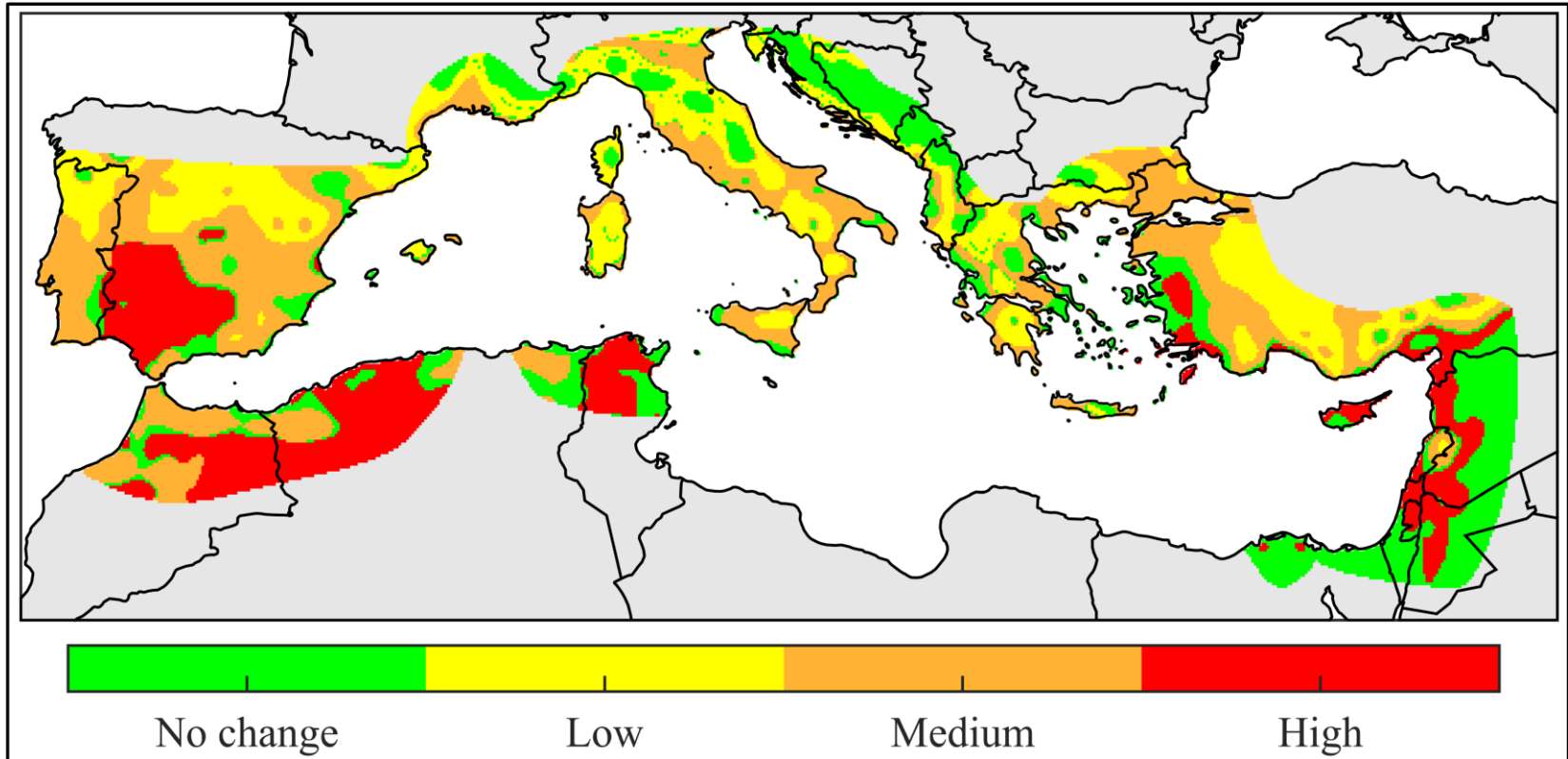


Sens' slope at the grid





# Huglin index: Adaptation needs

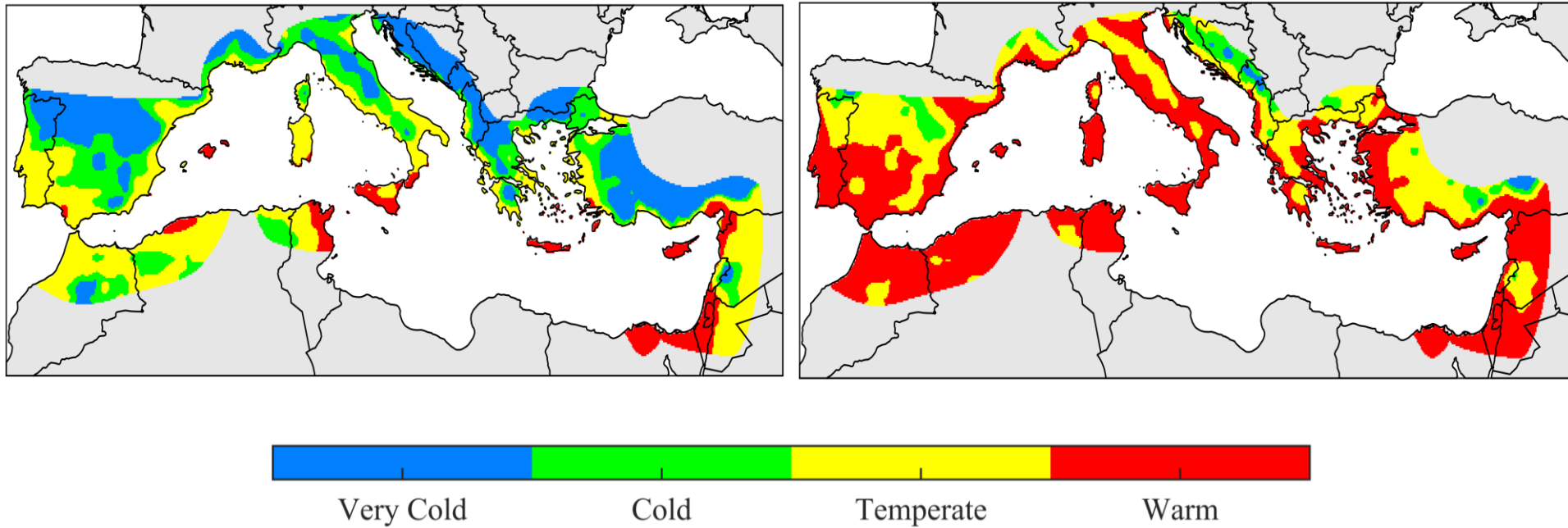


		Predicted climate (2099)					
		Very warm	Warm	Temp. Warm	Temperate	Cold	Very cold
Current climate (1950)	Very warm	No change					
	Warm	High	No change				
	Temp. Warm	High	Medium	No change			
	Temperate	High	Medium	Low	No change		
	Cold	High	Medium	Low	Low	No change	
	Very cold		High	Medium	Medium	No effort	No change

# Results: The Cool Night Index

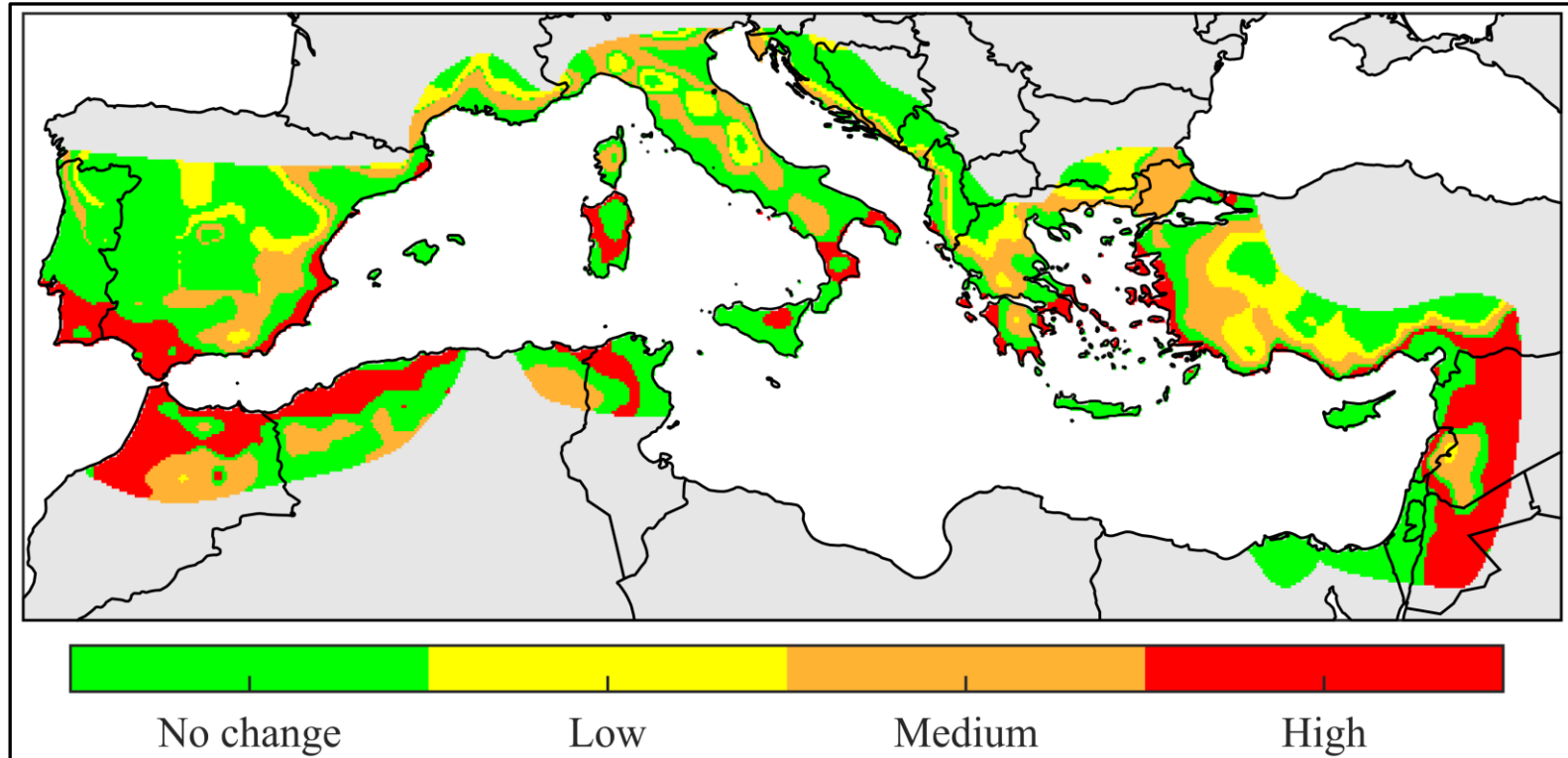
1950

2099



The possibility of **quality** wines **is not greatly altered** within the regions with adequate suitability

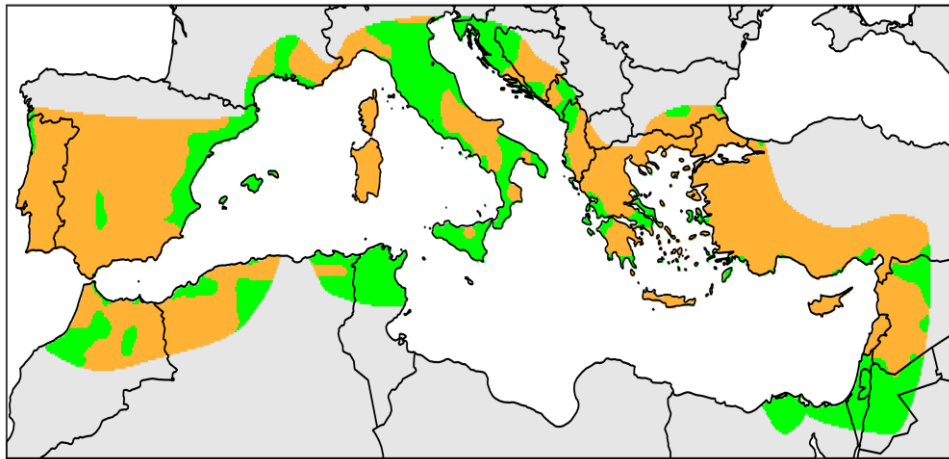
# Cool night index: Adaptation needs



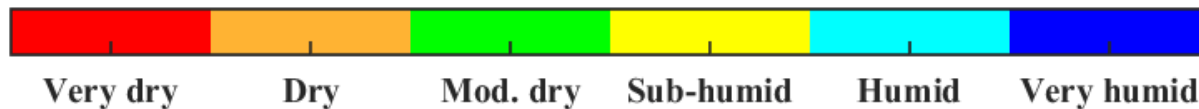
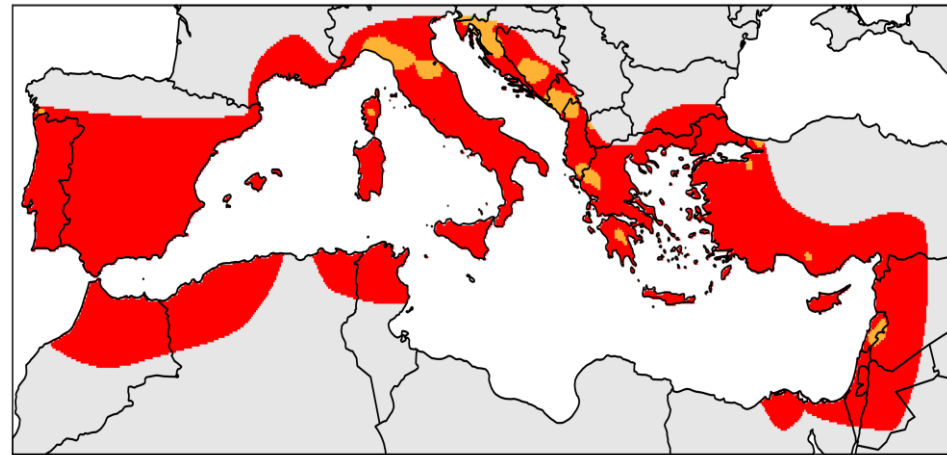
		Predicted climate (2099)			
		Warm	Temperate	Cold	Very cold
Current climate (1950)	Warm	No change			
	Temperate	High	No change		
	Cold	High	Medium	No change	
	Very cold	High	Medium	Low	No change

# Results: SPEI

1950

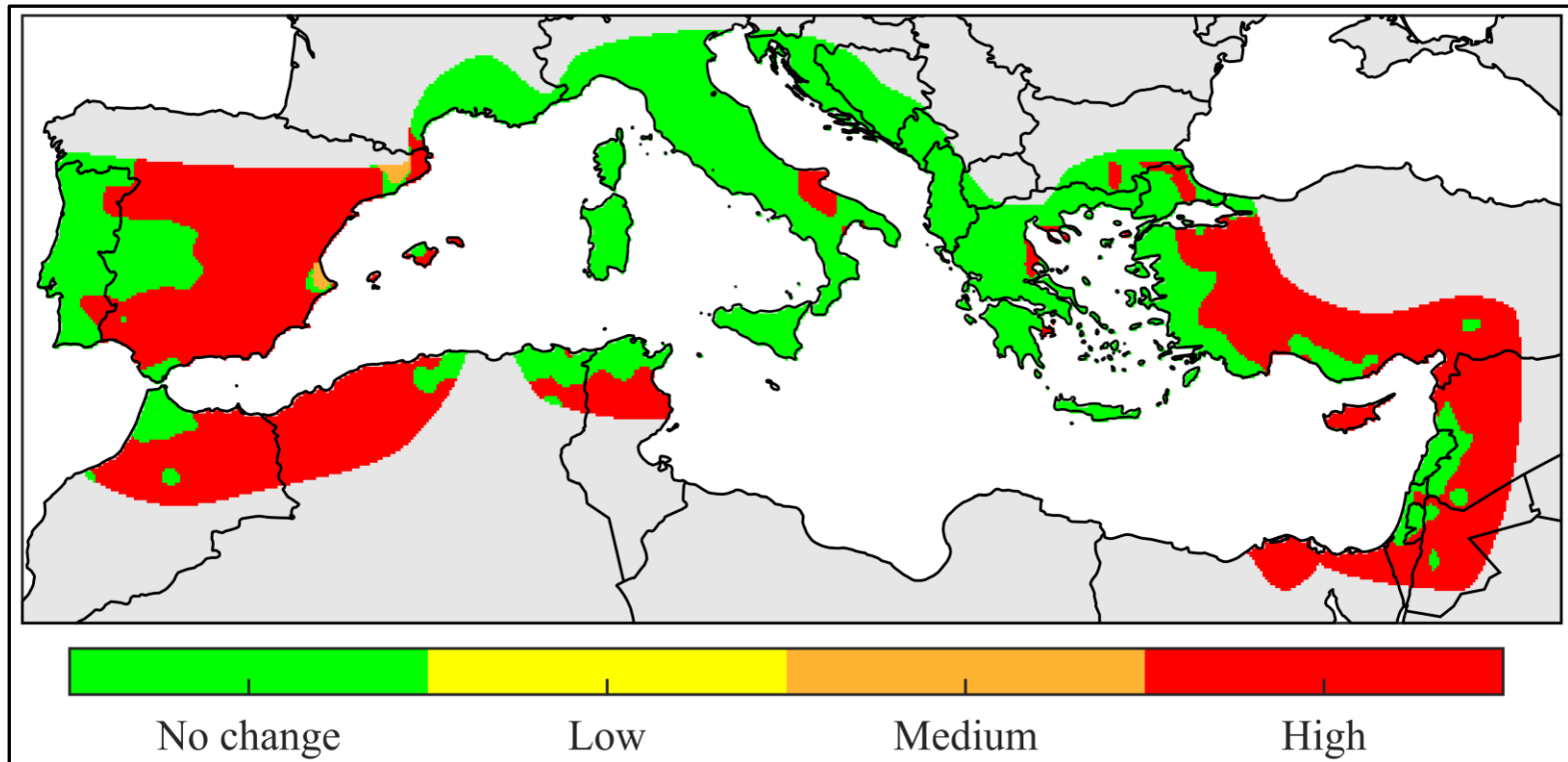


2099



All regions: **lack of water** to maintain current levels of production

# SPEI Index: Adaptation needs



		Predicted climate (2099)					
		Very dry	Dry	Mod. Dry	Sub-humid	Humid	Very humid
Current climate (1950)	Very dry	No change					
	Dry	High	No change				
	Mod. Dry	High	Medium	No change			
	Sub-humid	High	Medium	Low	No change		
	Humid	High	Medium	Low	Low	No change	
	Very humid		High	Medium	Low	No effort	No change

# Conclusions

- **Suitability** of premium grapevine have the **greatest changes** (accounting for over 50% of world production)
- The possibility of **quality** wines is **not greatly altered** within the regions with adequate suitability
- All regions: **lack of water** to maintain current levels of production
- The **Mediterranean** region requires **large adaptation efforts** (combination of indicators)
- **Normative** to maintain varieties **may limit adaptation choices**

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