

# Climate change, water and adaptation in agriculture

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Time to Adapt

Climate Change and the European Water Dimension

12th – 14th February, Berlin



# Policy questions (agriculture)

1

• **Impacts**

The risk to society

→

• **Avoiding**

→

• **Adaptation options:** options; implementation

→

• **Policy**  
among

The instruments to decrease risk

2

→

• **Econom**

→

• **Conflict resolution:** agriculture and other water users

• **Integrated approach:** role of agriculture and relationship with other sectors

3

• **Funding:** funding to support and encourage adaptation

→

• **Research**

The gaps in knowledge



# Analytical methods

**Risk =**

**Hazard X Vulnerability**

HAZARD = Probability of occurrence

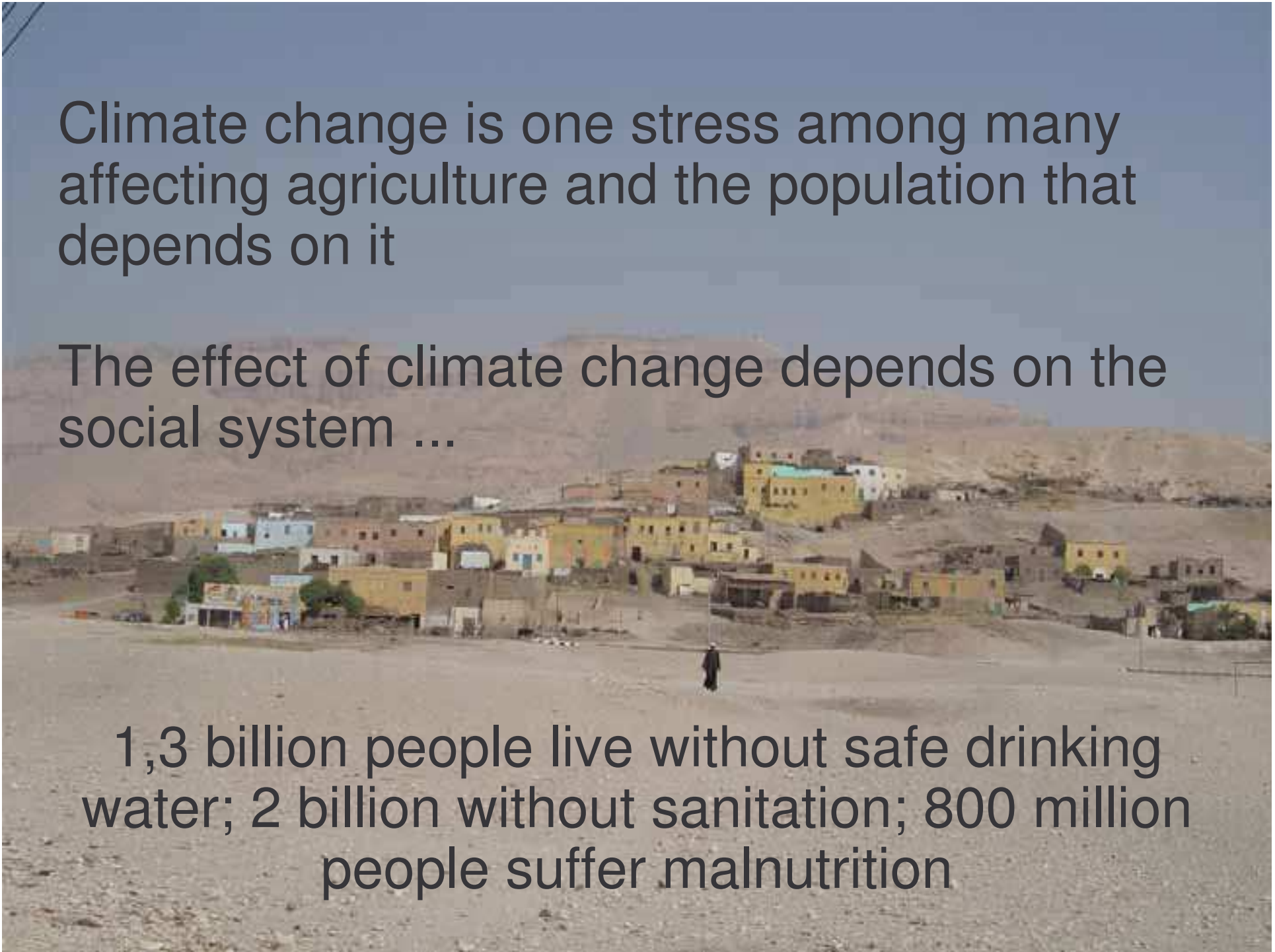
VULNERABILITY = Internal characteristics that define the ability to suffer from a hazard



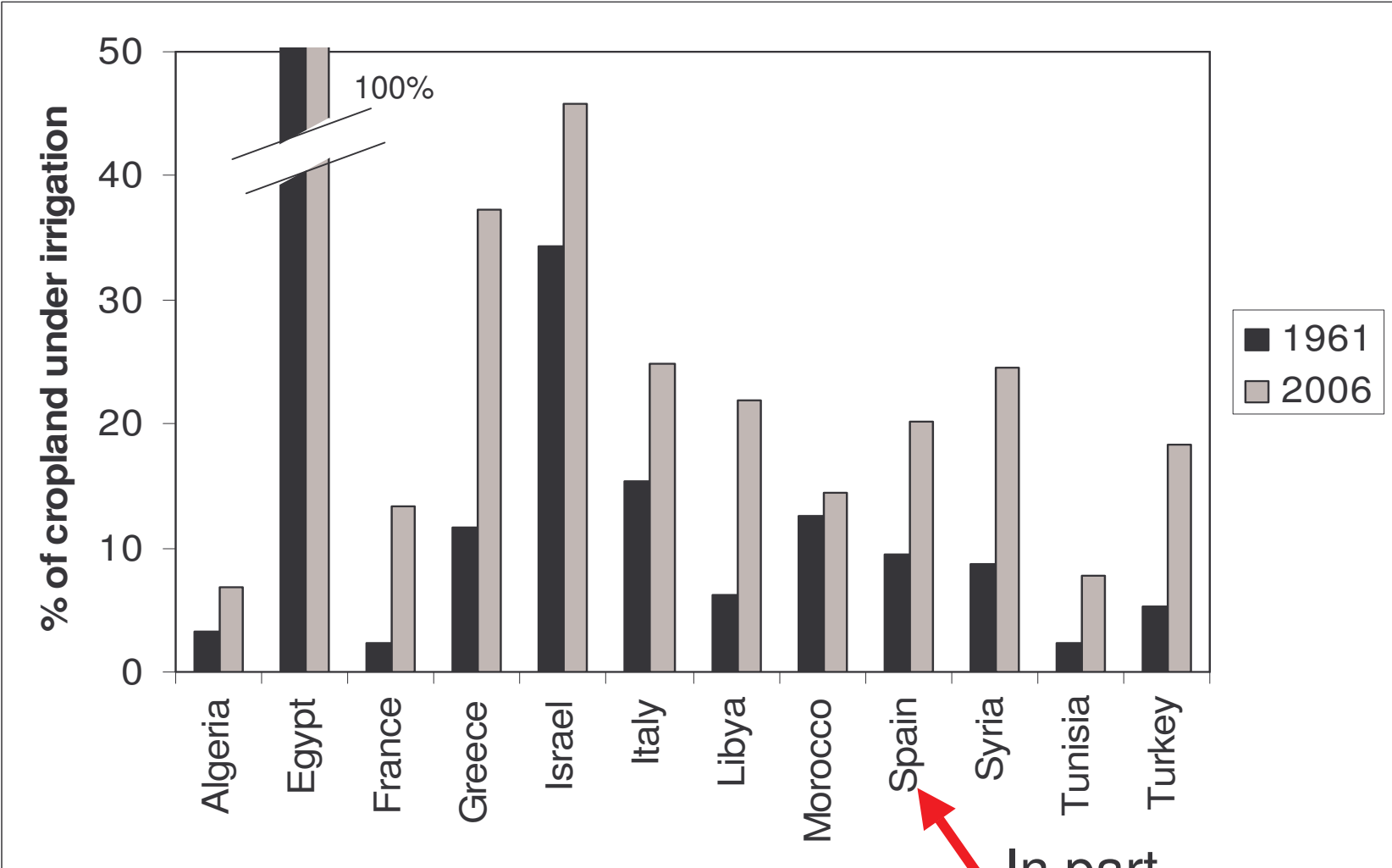
Climate change is one stress among many affecting agriculture and the population that depends on it

The effect of climate change depends on the social system ...

1,3 billion people live without safe drinking water; 2 billion without sanitation; 800 million people suffer malnutrition



# Irrigation



In part,  
EU policy-driven



# A range of phenomena

Water Scarcity Regime	Nature produced	Man induced
Temporary	Drought	Water shortage
Permanent	Aridity	Desertification

**Drought** Natural temporary imbalance of water availability (persistent lower-than-average precipitation).

**Water shortage** Man-induced temporary water imbalance.

**Aridity** Natural permanent imbalance in the water availability (low average annual precipitation).

**Desertification** Man-induced permanent imbalance in the availability of water (inappropriate land use).



# The PESETA project (JRC)

STEP 1. Spatial analysis

STEP 2. Process-based models

STEP 3. Yield/Irrigation functions

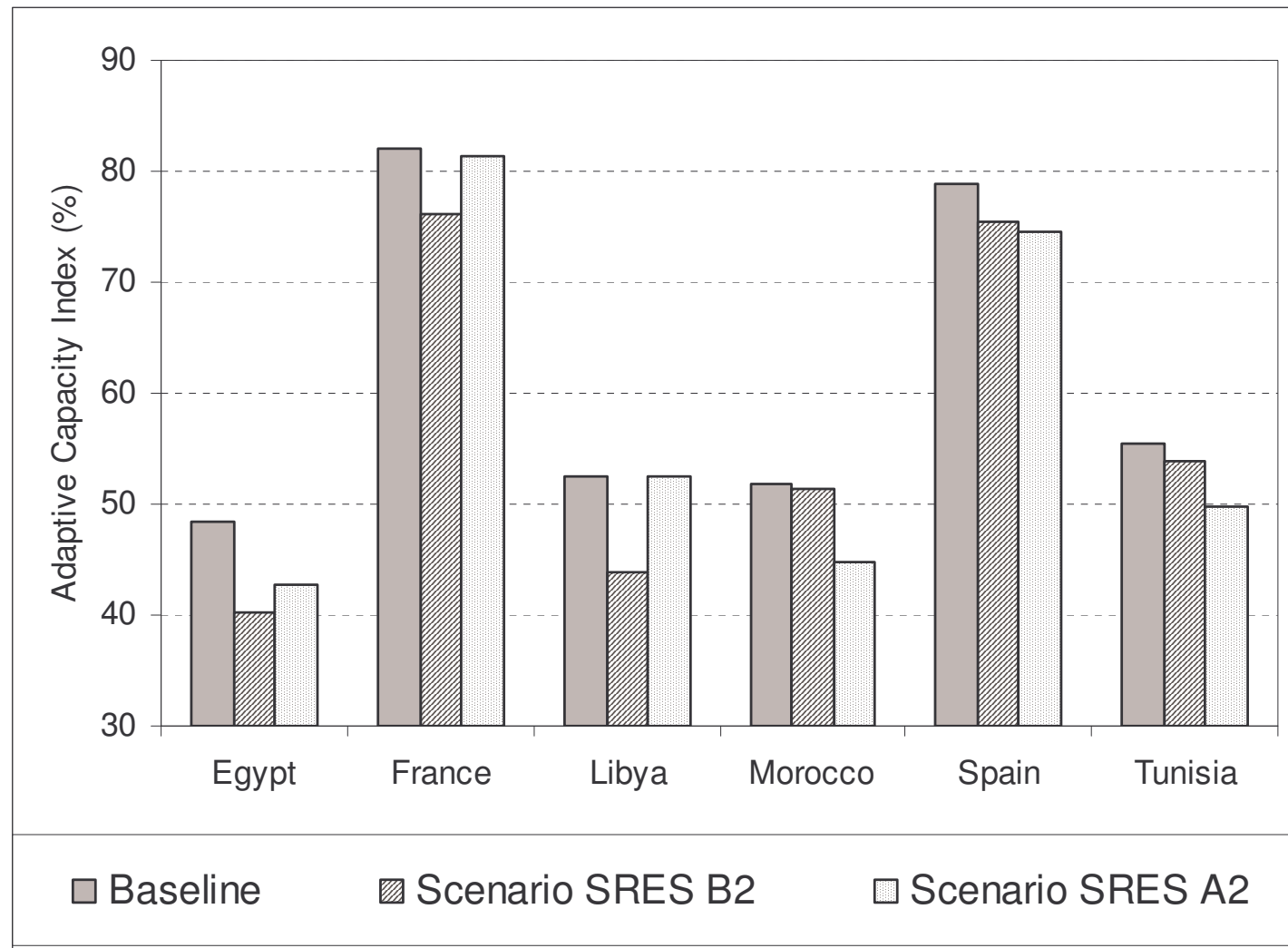
STEP 4. Application of  
Scenarios (Prudence A2, B2,  
Rosby A2), streamflow, clim var

## Improvements on previous estimates

- The yield changes include:
  - Explicit link to water availability scenarios
  - Rainfed and irrigated simulations
  - Changes in land use
  - Adaptive capacity (a measure of the internal vulnerability of the system)
  - Consistency of methods and assumptions with previous EU projects (Claire, Clivara, Accelerates, A Team, etc)



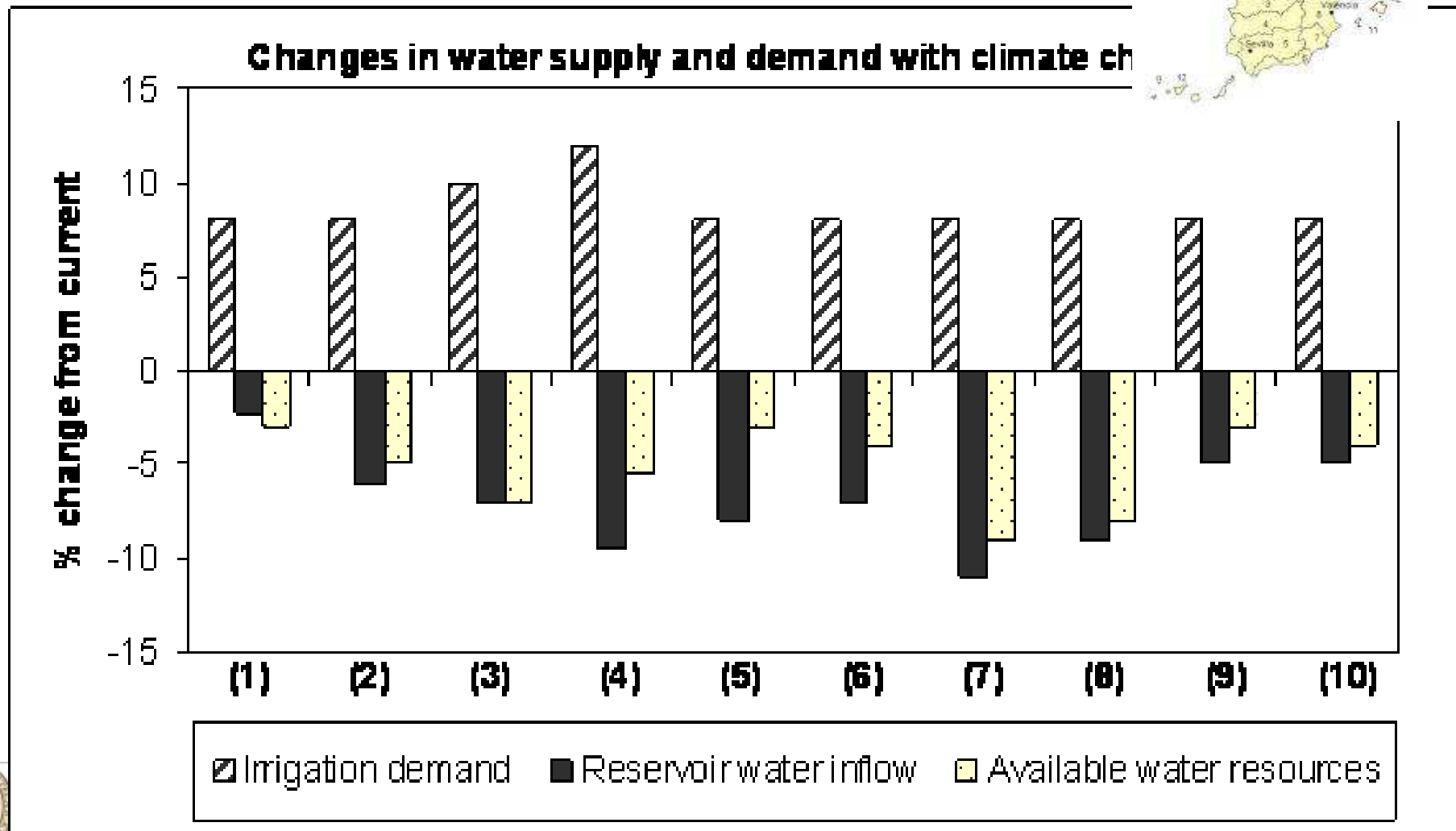
# Adaptive capacity of Euro-Mediterranean agriculture (Iglesias et al., 2007)



Iglesias, Time to adapt, Berlin 12-14 February 2007

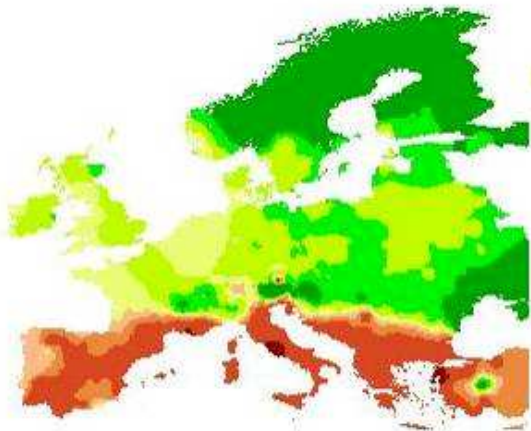


# Changes in water supply and demand with climate change in Spain (Source: Iglesias et al, 2007)

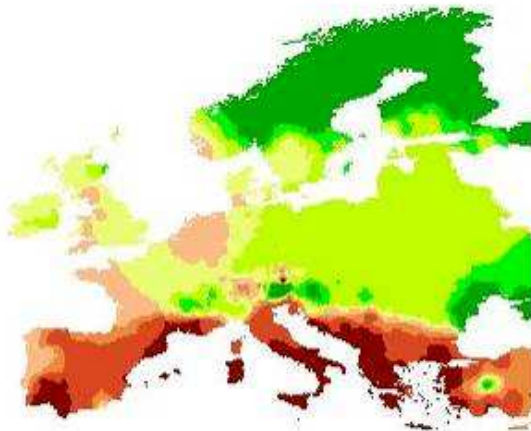


# Changes in crop yield

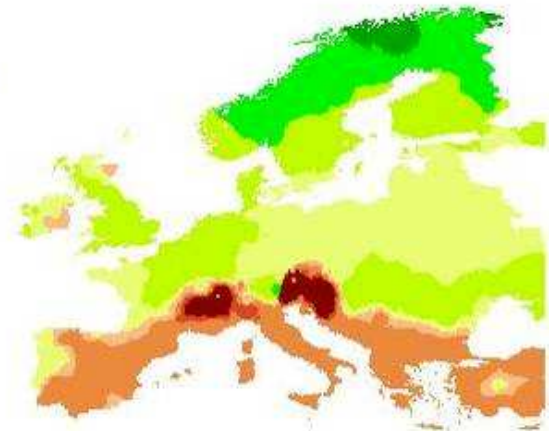
Prudence Hac CM3/Hiram/A2



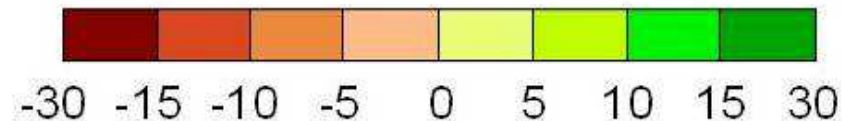
Prudence Hac CM3/Hiram/B2



Rosby ECHAM4/RCA3 A2



Scenario yield changes from baseline (%)



**Crop yield changes under the HadCM3/HIRHAM A2 and B2 scenarios for the 2080s and for the ECHAM4/ RCA3 A2 and B2 scenarios for the 2030s compared to baseline**



# Changes in crop yield

- **Regional differences**

- Although each scenario projects different results, all three scenarios are consistent in the spatial distribution of effects.
- Increase in vulnerability of marginal areas

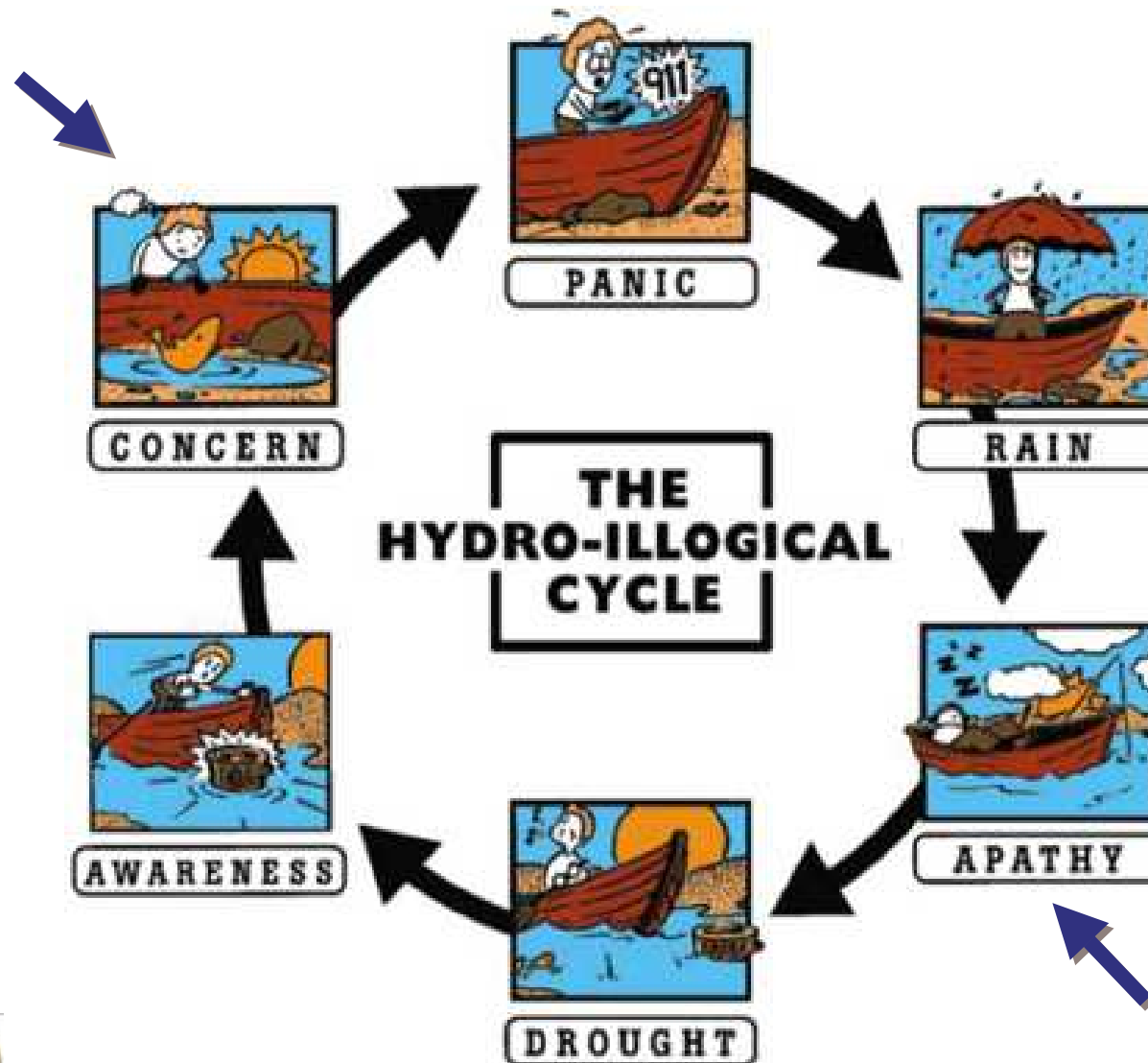
- **Results optimistic from the production point and pessimistic from the environmental point of view**

- It is very important to notice that the simulations considered no restrictions in water availability for irrigation due to changes in policy. In all cases, the simulations did not include restrictions in the application of nitrogen fertilizer.

- **Adaptation options limited**



# The instruments to decrease risk



From: I.R. Tannehill,  
Drought: Its Causes  
and Effects, Princeton  
University Press,  
Princeton, New  
Jersey, 1947

Source of image:  
<http://www.drought.unl.edu>



# Problems

- Water conflicts
- Extreme events
- Improving ecosystem services
- Social and rural development
- Regional effects

# Solutions

- Cultural change, awareness, cooperation
- Improved land and water management
  - Need public information
  - Need to include risk management
- Technology, infrastructure
- Adaptation needs policy assistance



# 1. Cultural change, awareness, cooperation actions

- Indirect, voluntary
- Non structural
- Directed to avoid worse situations
- Focus on communication



# Chi ama la vita non spreca l'acqua



Repubblica Italiana



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Chi ama la vita  
non spreca l'acqua

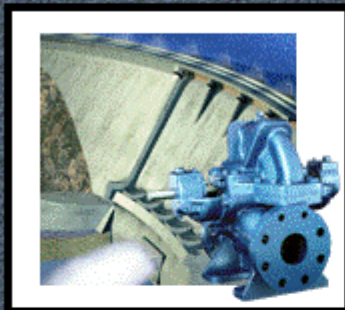


## 2. Improve land and water management

- Overcome impacts to avoid damage to society
- Examples:
  - Improve efficiency
  - Changes in management
  - Revision of current policies
  - Rights exchanges

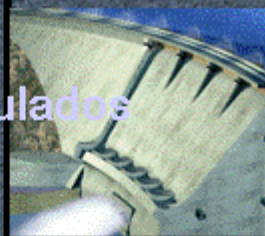


RECURSOS  
COMPLEMENTARIOS



RECURSOS ORDINARIOS

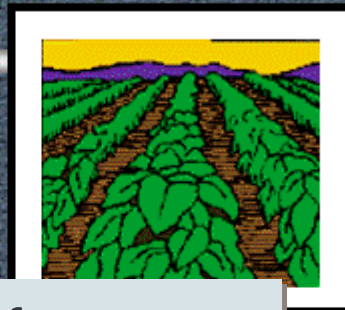
Regulados



No regulados



★  
INTERCAMBIO DE  
USOS



DEMANDA

Protocol for exchange of water rights that includes financial compensations (agriculture to urban)

EXCLUSIVOS

CONDICIONADOS

COMPARTIDOS

### **3. Technology and infrastructure**

- Improve adaptive capacity, minimise social vulnerability and damage



# Coordination of policies: Institutional analysis

	<b>Cyprus</b>	<b>Greece</b>	<b>Italy</b>	<b>Morocco</b>	<b>Tunisia</b>	<b>Spain</b>
<b>Institutional relations</b>	low	low	low	low	high	med
<b>Public part.</b>	low	med	high	low	low	high
<b>Basin management</b>	no	yes	yes	partial	partial	yes
<b>Monitoring</b>	partial	partial	yes/bas	yes/Nat	yes/Nat	yes/bas
<b>Drought in Water Law</b>	no	yes	yes	yes	yes	yes
<b>Contingency plan drought</b>	no	partial	yes/reg	partial	yes/Nat	yes/bas
<b>Groundwater ownership</b>	pub/priv	pub	pub	pub/priv	pub	pub/priv

Source of data: Iglesias and Moneo, 2005



# Limits to adaptation

- Technological limits (i.e., crop tolerance to water-logging or high temperature; water reutilization)
- Social and cultural limits (i.e., acceptance of biotechnology, water charges, infrastructure)
- Political limits (i.e., rural population stabilization may not be optimal land use planning)



# The gaps in knowledge

Case studies make science believable to policy makers



# Adaptation policy questions

- Key challenges and interactions to agriculture:
  - Development, health, human rights
  - Conflicts
  - Regional heterogeneity, vulnerable populations
  - Urbanization
  - Extreme events
  - Large public and private expenses in infrastructure
  - Environmental stress, cost of environmental protection
  - Economic pressures and globalization
- Policy instruments (CAP, WFD)
- CIRCE RL13 (Relevant society strategies)





*Thanks for your attention!*

Visit our projects on the web

<http://www.iamz.ciheam.org/medroplan>



<http://peseta.jrc.es/index.htm>

Circe, Piccmat, Swap (from Jan 2007)



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