Drought early warning and management:

Some thoughts from my work in the Mediterranean and Africa

Ana Iglesias

Department of Agricultural Economics and Social Sciences,
Universidad Politécnica de Madrid, Spain

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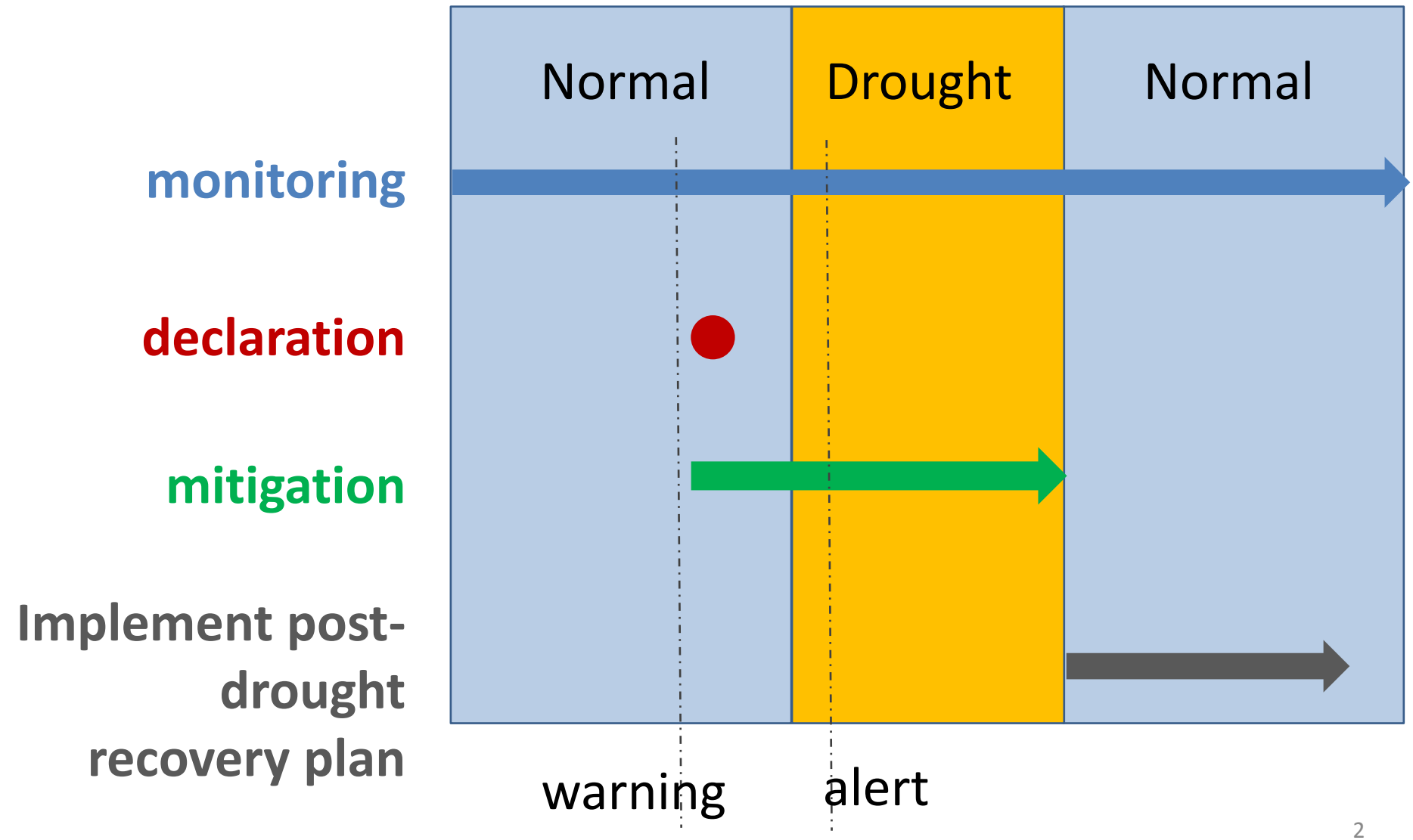
DEWFORA


Normal
Drought
Normal
monitoring
declaration
mitigation
Implement post-drought recovery plan
warning
alert

Imagine you have a forecast

- What to do?
- How to do it?

CIHEAM
Centre International de Hautes Études Agronomiques Méditerranéennes

Universidad Politécnica de Madrid (Spain)

University of Cyprus

NTUA
National Technical University of Athens (Greece)

Università degli Studi di Catania (Italy)

Institut Agronomique et Vétérinaire Hassan II (Morocco)

Ministère de l'Agriculture et des Ressources Hydrauliques (Tunisia)

Ministerio de Medio Ambiente Confederación Hidrográfica del Tajo (Spain)

Canal de Isabel II
Canal de Isabel II (Spain)

Fundación Ecología y Desarrollo (Spain)

European Commission - EuropeAid Co-operation Office
Euro-Mediterranean Regional Programme For Local Water Management (MEDA Water)
Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN)

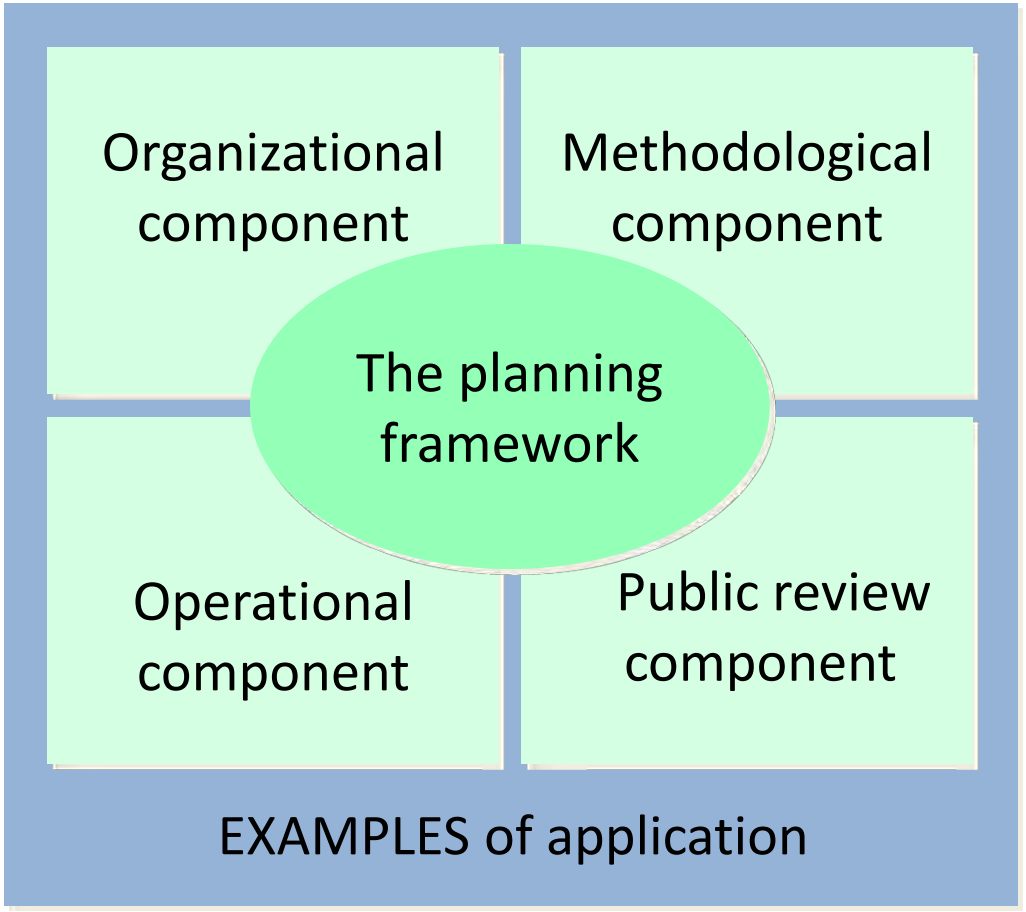
Drought Management Guidelines

Editors:
A. Iglesias, A. Cancelliere, D. Gabiña, A. López-Francos, M. Moneo, G. Rossi

Authors:
A. Iglesias, T. Ameziane,
S. Benbeniste, M. Bergaoui, B. Bonaccorso, A. Cancelliere,
M. Casado, T. Christofides, F. Cubillo, L. Euchi, M. Fernández,
F. Flores, D. Gabiña, A. Garrido, L. Garrote, S. Hajispyrou, E. Keravnou-Papailiou,
P. Laban, A. Lapeña, F. Lebdi, G. Liebana, A. López-Francos,
M.H. Louati, M. Mathlouthi, H.J. Mellouli, M. Moneo,
A. Ouassou, D. Pangalou, P. Pashardes, S. Quiroga, G. Rossi,
N. Rostandi, D. Saracoglu, M. Soriano, D. Tigkas, G. Tsakiris,
N. Tsiourtis, C. Vangelis, V. Viñuales

MEDROPLAN

MEDA Water



The guidelines are translated into Arabic, English, Farsi, French, Greek, Italian, Spanish

Controversy on drought declaration

- Removing the welfare component from the policy and providing support to those in need through the general social welfare system
- Moving away from drought declarations and providing ongoing support to improve farmers' risk management skills
- This would mean the end of the exceptional circumstances program and the associated problems of arriving at agreed definitions

Linda Botterill, 2010

- We need to develop a policy approach that is realistic about the climate and supports people in adapting to ongoing change
- (Adapted from L. Botterill, 2010)

Institutional analysis (example)

TRIGGERS social unrest, sings of damage, Regional Governments warning

1

INSTITUTIONS
M. MARM, M. Finance (tax abatement; subsidies)

1

INSTITUTIONS
Finance Ministry
Approval of budget

INSTITUTIONS
RBAs , CCAAs,
Actions related to water policy

5

6

Permanent Office for Drought
President,
Committee

3

DECISION PROCESS
- Analysis of situation and risk

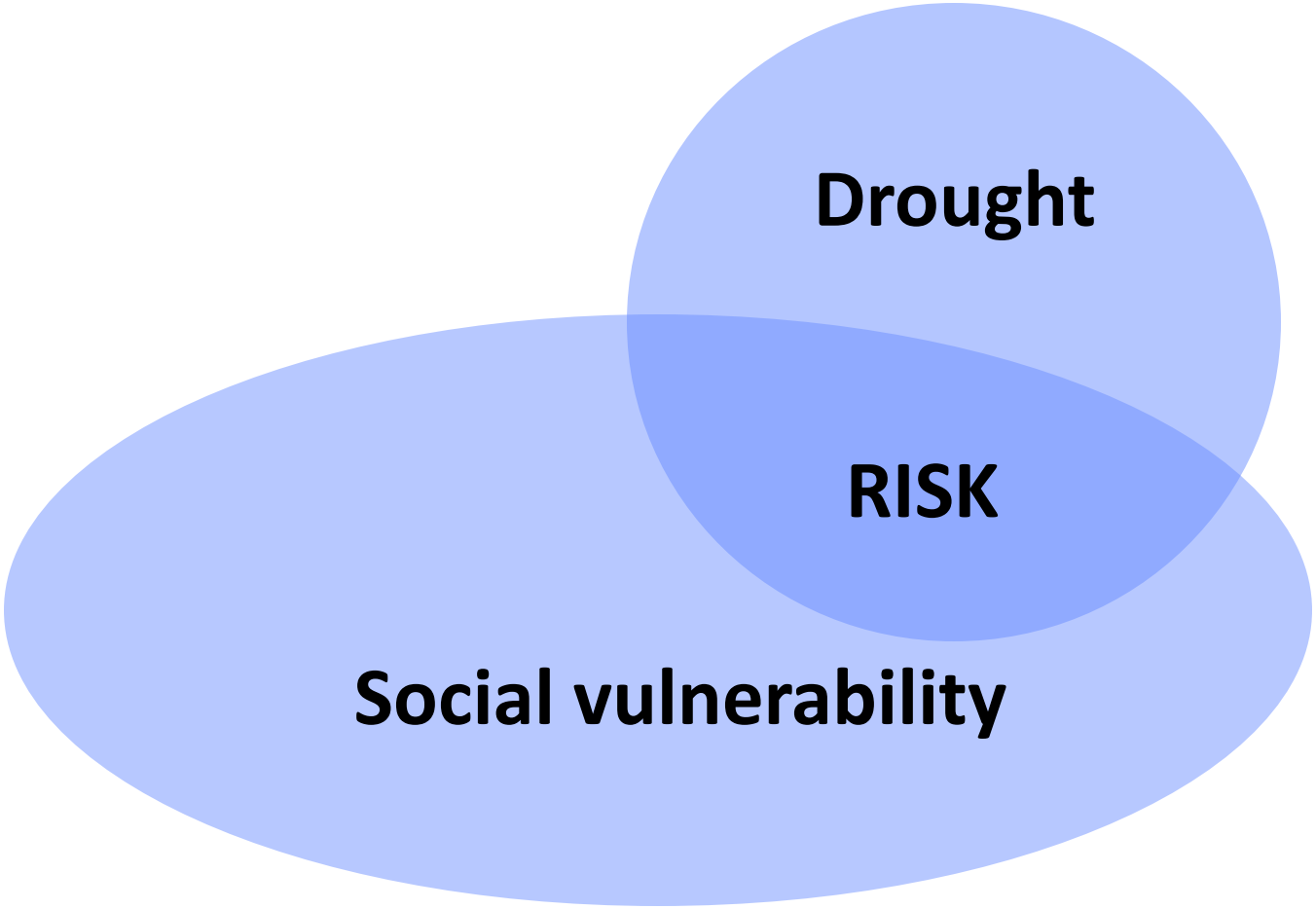
4

PROPOSED ACTIONS
1.Finance
2.Related to water

APPROVED ACTIONS

1. Tax policy: lower land taxes, lower Social Security contributions
2. Agricultural Policy: Advancement of CAP Payments, insurance
3. Water Policy: Funding for drilling wells for animal drinking

Analytical methods: linking science to society



Surveys and interviews

- Allow the direct input of stakeholders (bottom-up approach is emphasized)
- Provide expert judgment in a rigorous way

The possibility of drought determines agricultural choices …

Farmer

Before

- Choice of crop
- Sowing density
- Inputs

During

- Irrigation
- Application of agro-chemicals

After

- Markets
- Storage

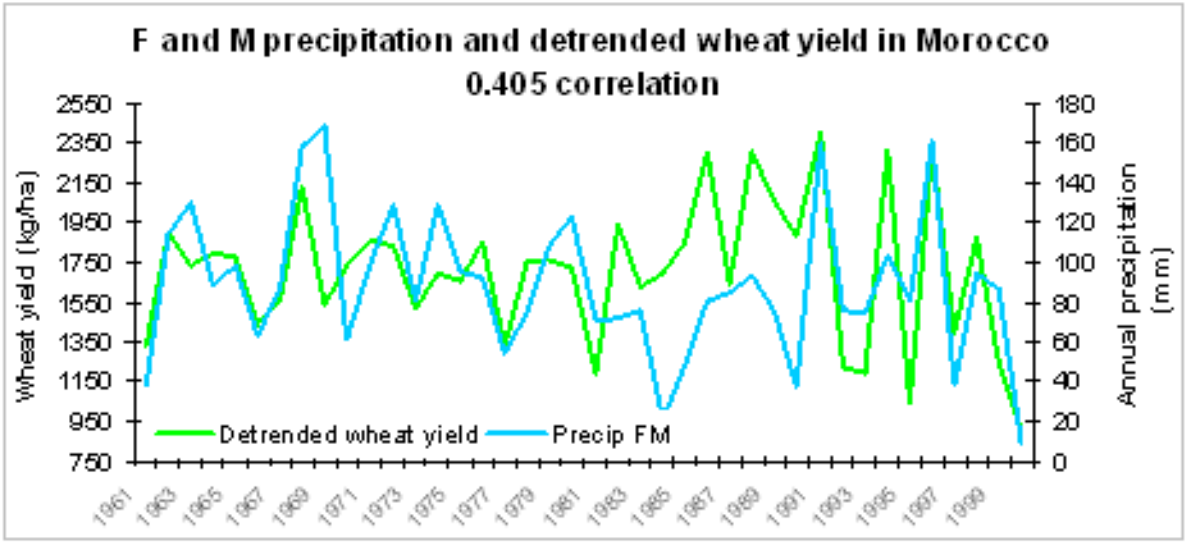
Industry

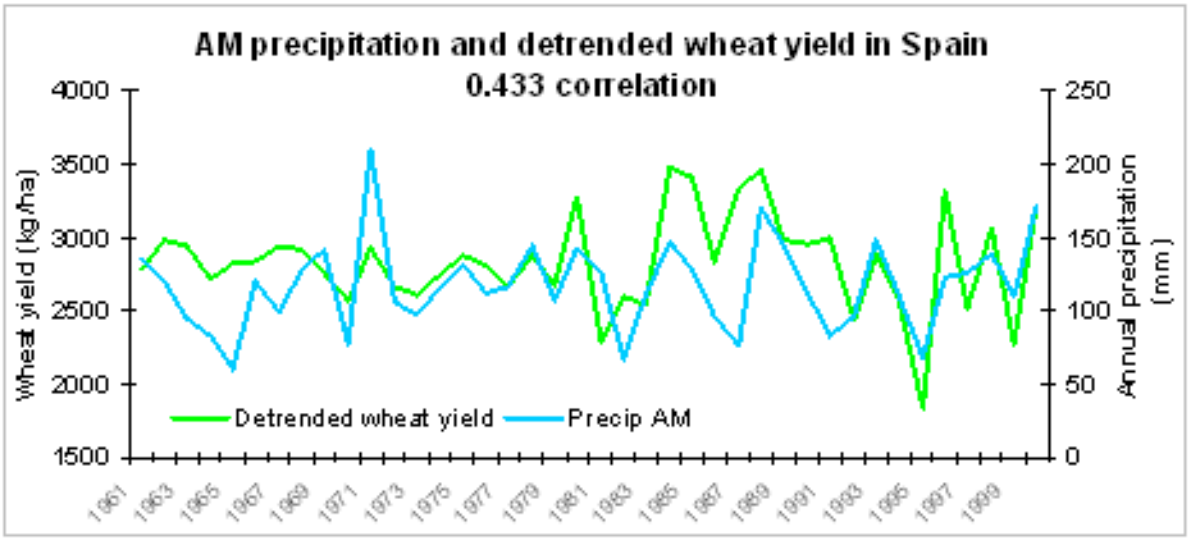
- Production of agro-chemicals
- Credit
- Transport
- Insurance

Resource management

- Water
- Emergency plans

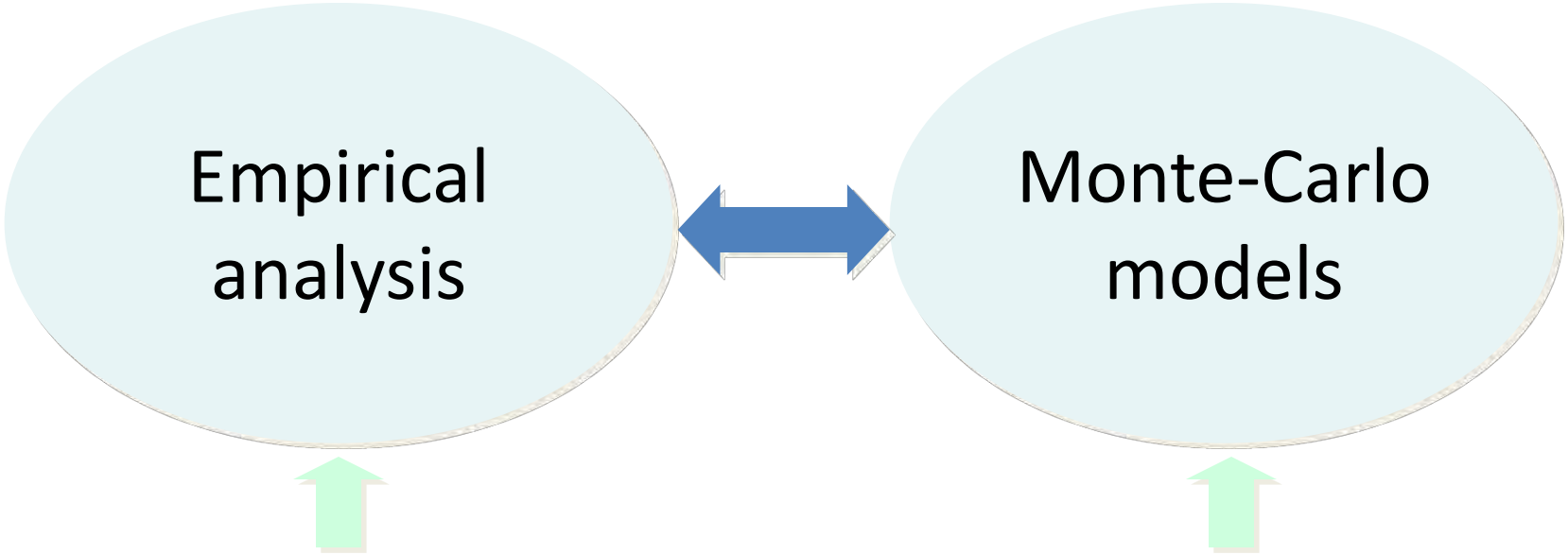
Empirical evidence

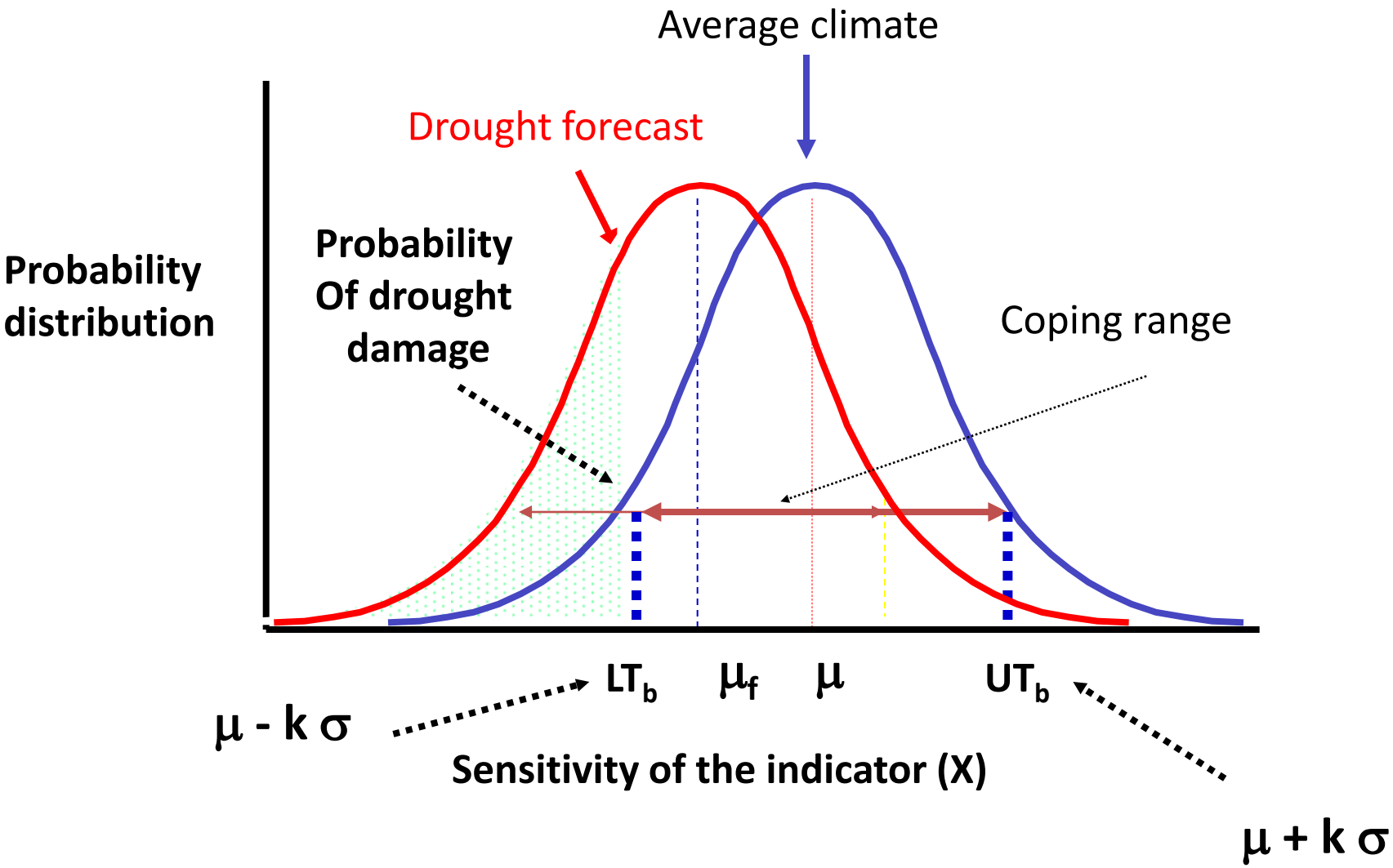




Source: Moneo and Iglesias 2005

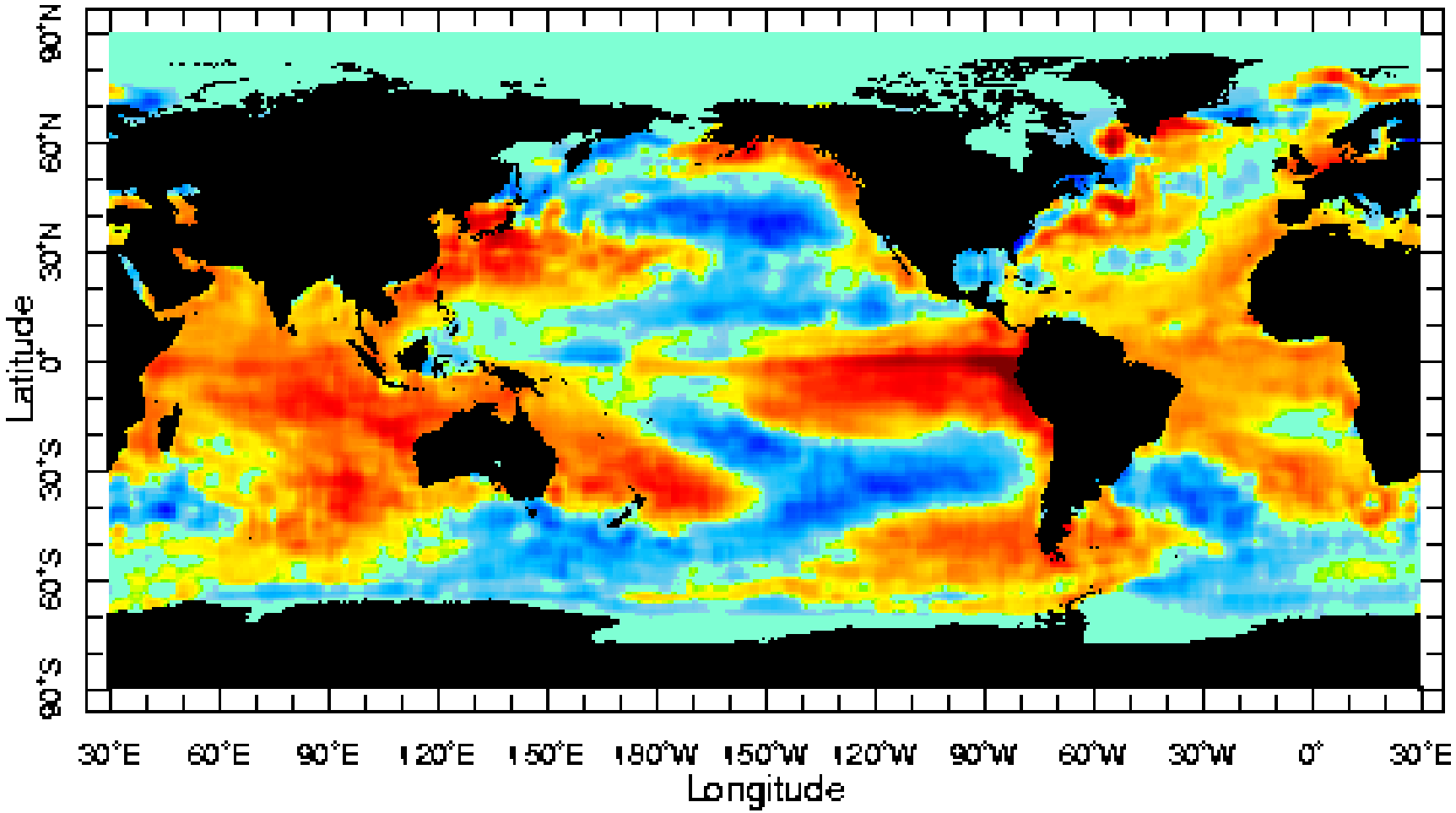
Risk assessment in agriculture




Average climate
Drought forecast
Probability
Of drought
damage
Probability
distribution
Coping range
LT_b
μ_f
μ
UT_b
$\mu - k\sigma$
Sensitivity of the indicator (X)
$\mu + k\sigma$

Steps in the evaluation of risk

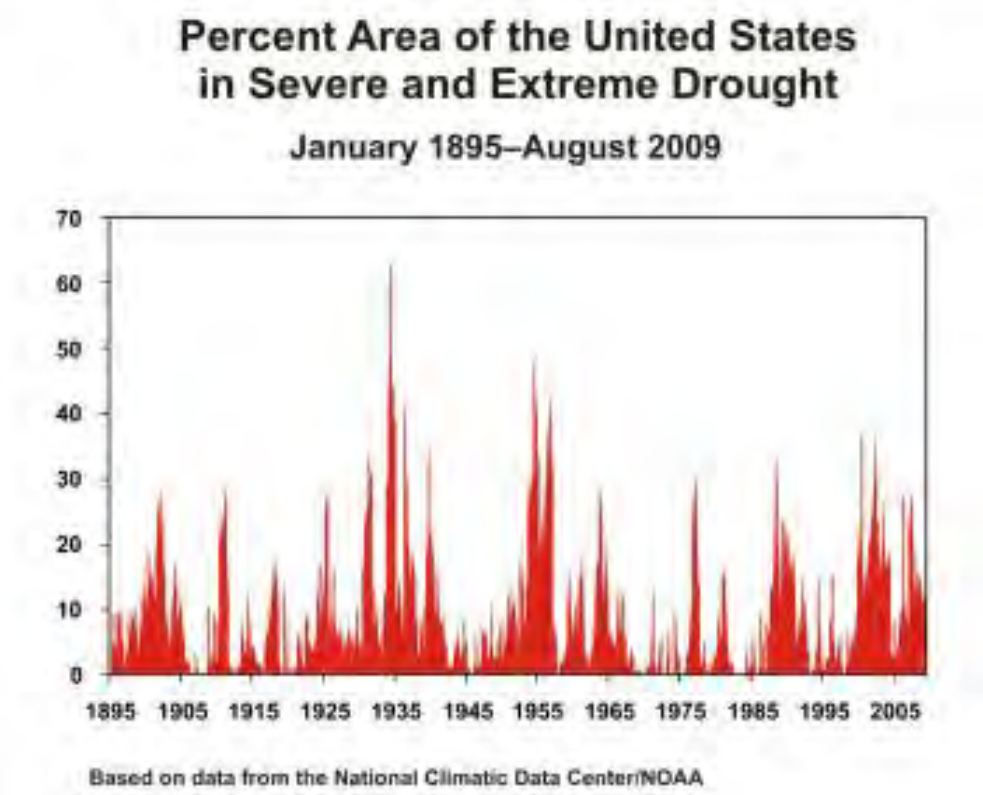
1. Establish the **objectives** and context
2. Define the **concepts** to ensure communication
3. Evaluate **potential risks** (i.e., surveys)
4. Analyse **risks** (i.e., determine probabilities)
5. Evaluate **management alternatives** to decrease potential damage
6. **Review** process



IRI INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE PREDICTION

- “In a book I published … argued that the word ‘drought’ should be removed from the Australian language as it is emotionally charged and value laden. “ “The report to the government on the social impact of drought in 2008 made a similar call, arguing that we should be talking about coping with dryness. “

Linda Botterill, 2010



Source: Wilhite 2010

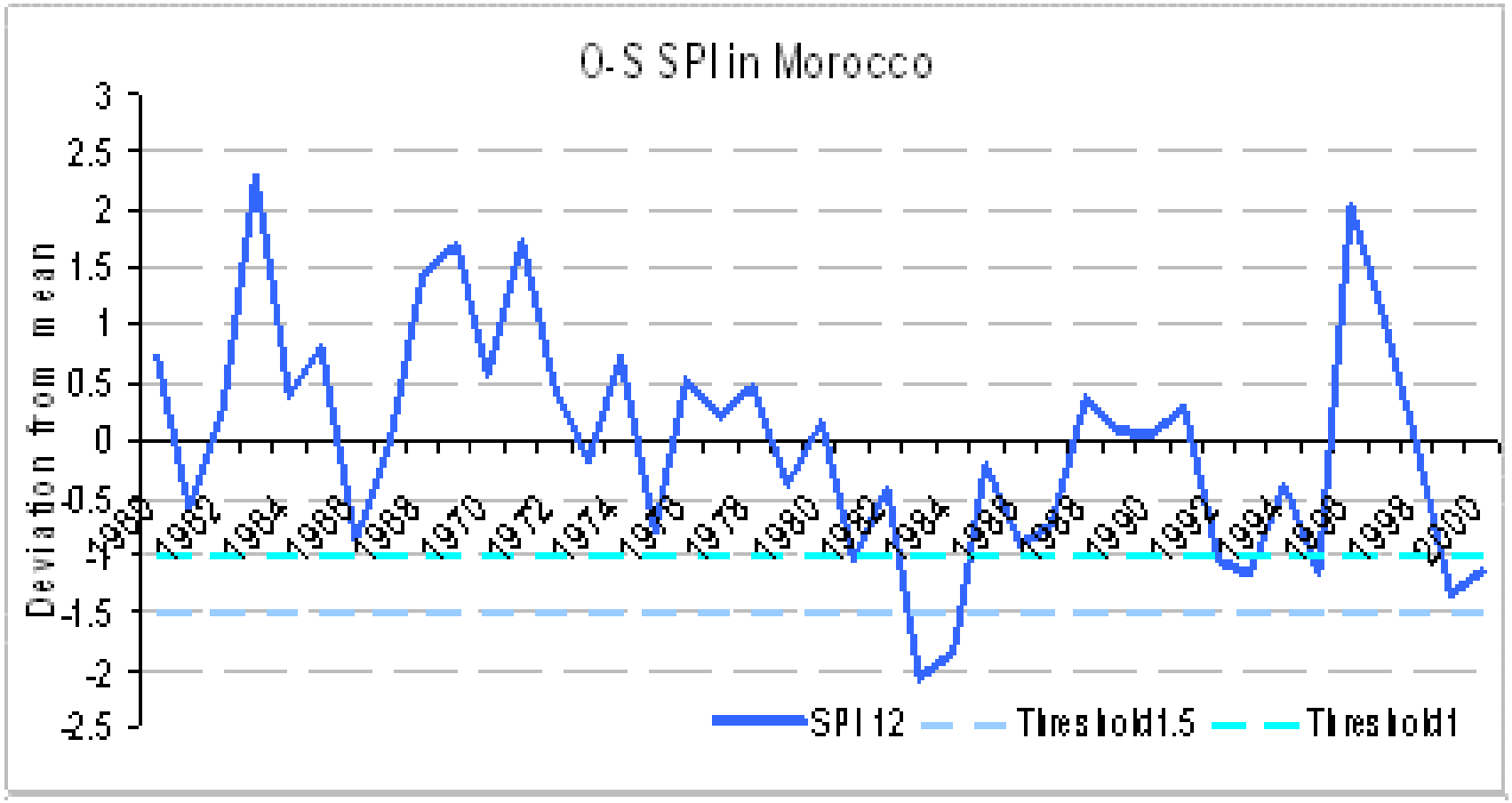
National Drought Mitigation Center

Breaking the hydro-illogical cycle :

1. Accepting drought as a normal part of climate
2. Adopting a pro-active approach
3. Including social vulnerability indicators as part of monitoring

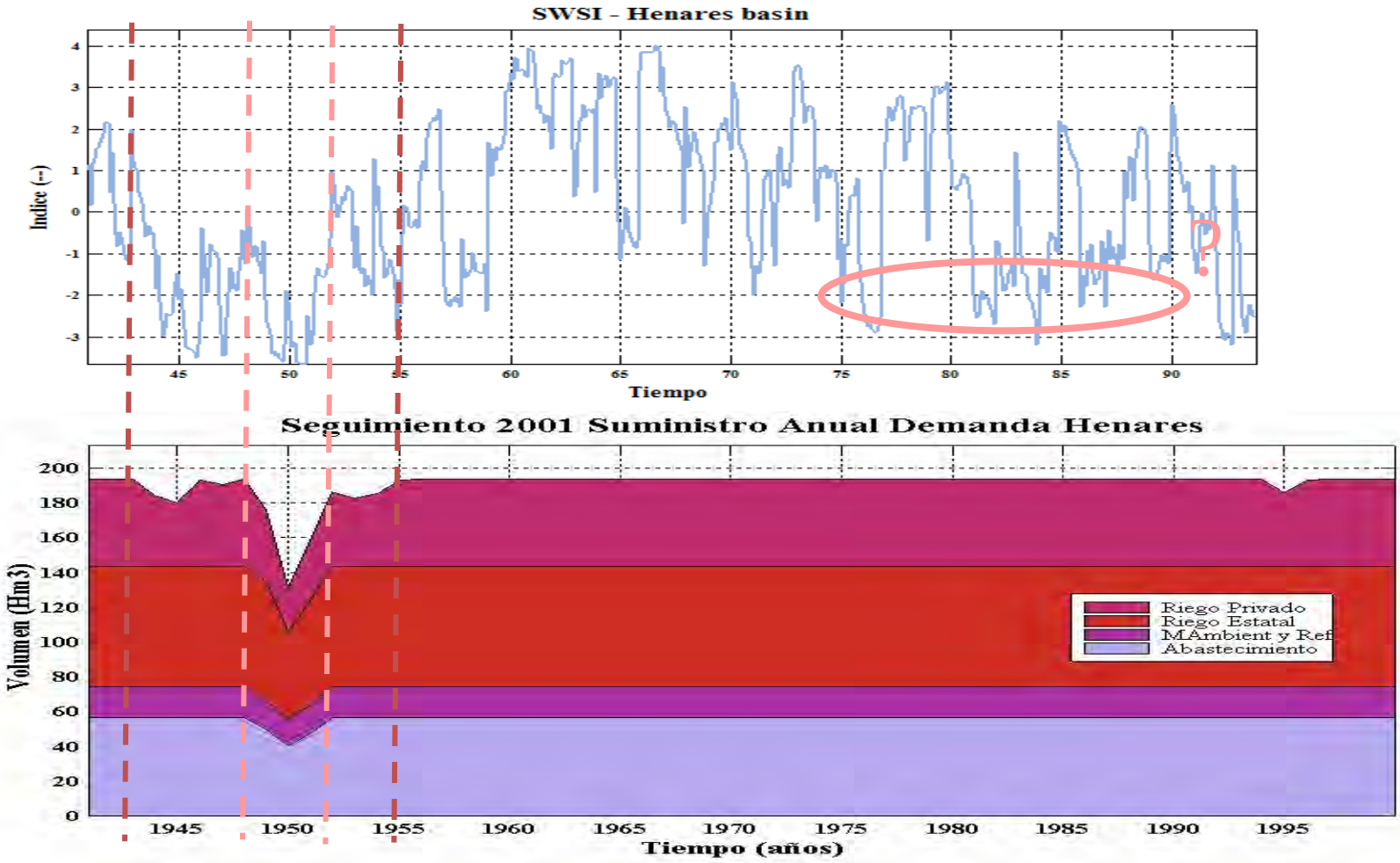
(Wilhite, 2010)

SPI (12 month) Settat, Morocco



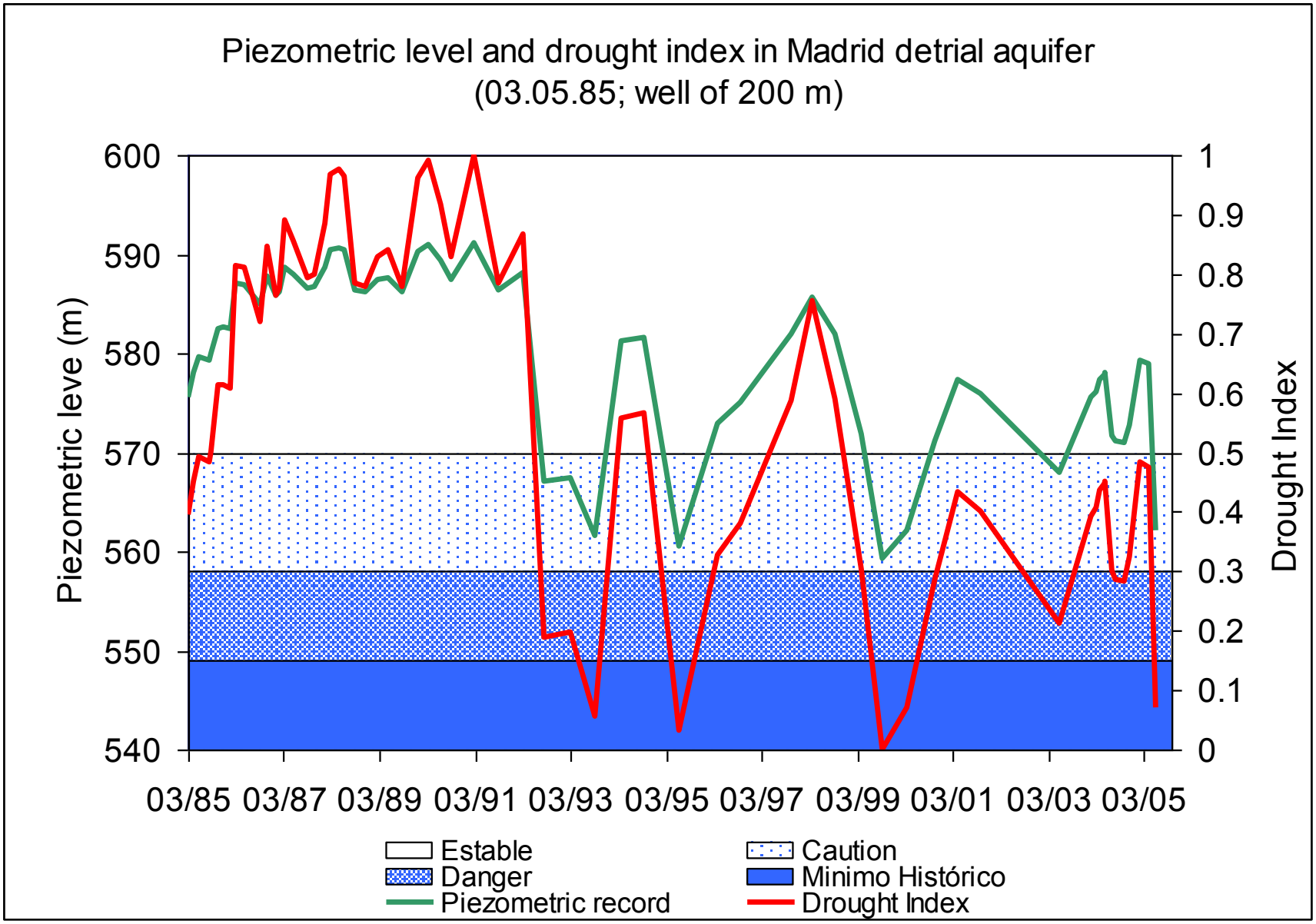
Source: Moneo, Iglesias 2004

SWSI and demand supply in Henares basin



Source: Garrote et al., 2008

Strategic groundwater (Source: Flores et al. 2005)

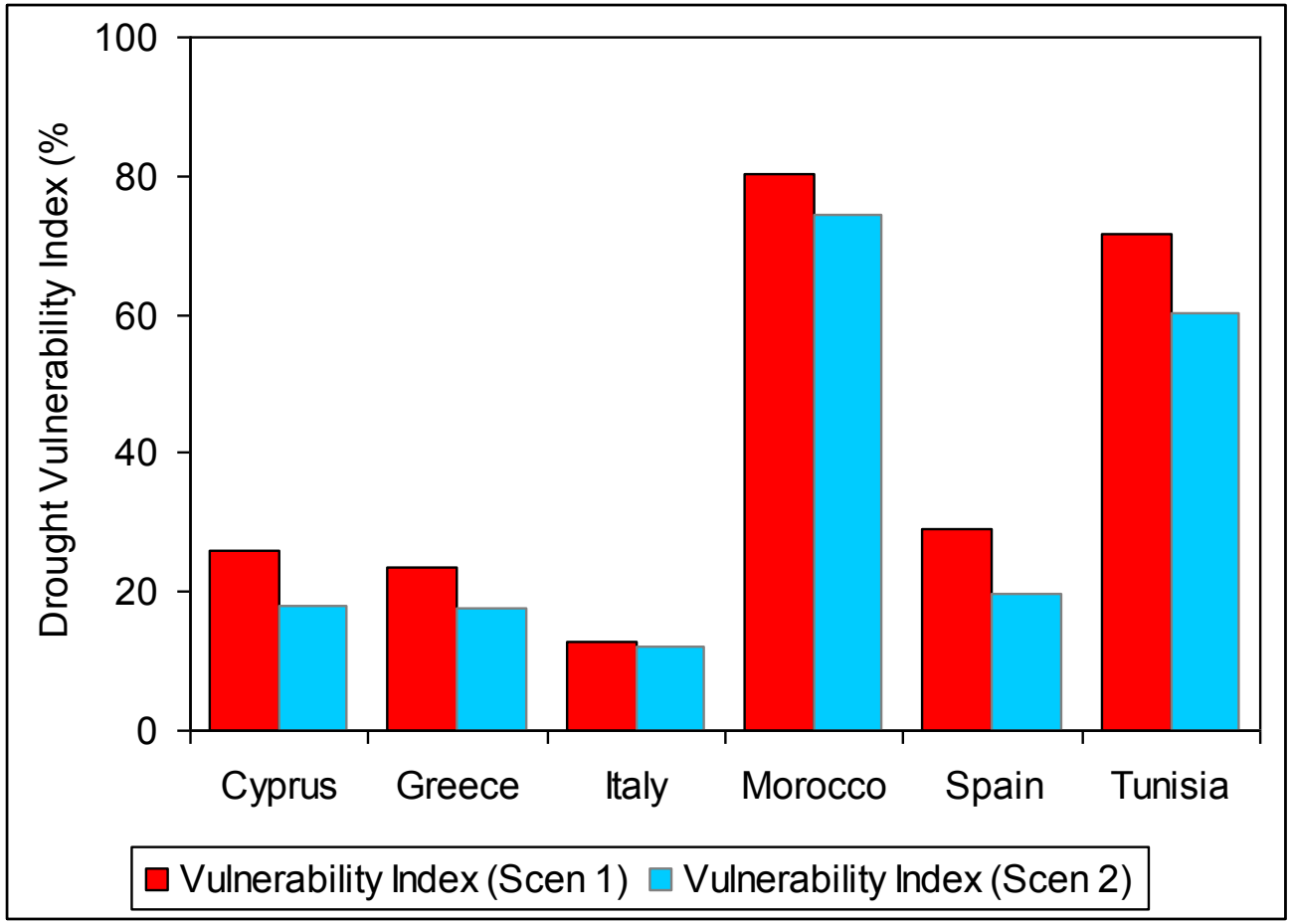


Drought Vulnerability Index

Source: Iglesias et al., 2009

Component	Indicators
Human capital	literacy rate; Population with level of education; Rural population
Economic development	% of GDP from agriculture/GDP per capita, Life expectancy at birth % Access to drinkable water
Mechanisms of risk sharing	Insurance, Agricultural policies
Institutional response	Drought regulations; Drought management plans; Institutional drought agencies; Access to financial services
Environmental aspects	Soil degradation
Agricultural Aspects	Cultivation techniques; Crop varieties

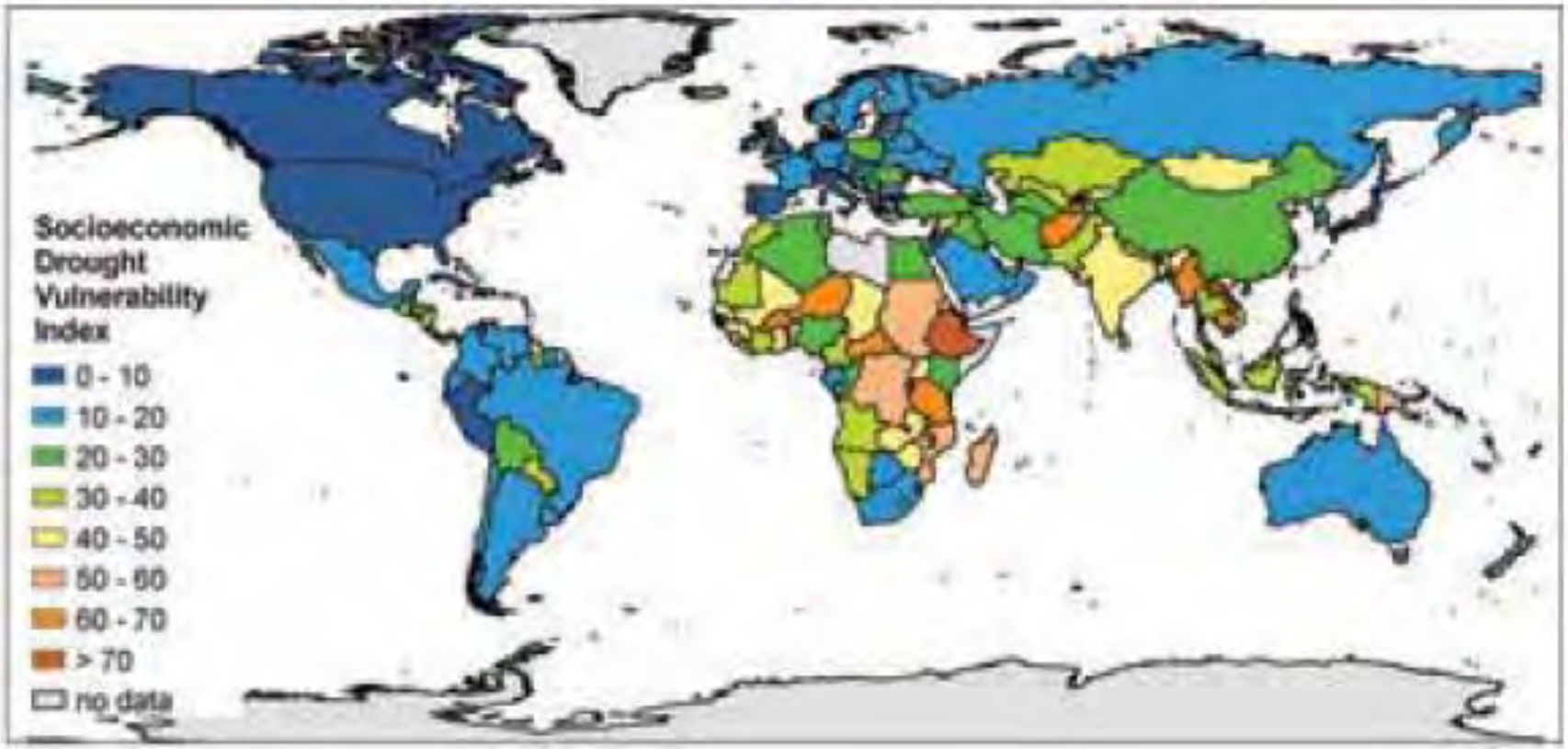
Drought Vulnerability Index

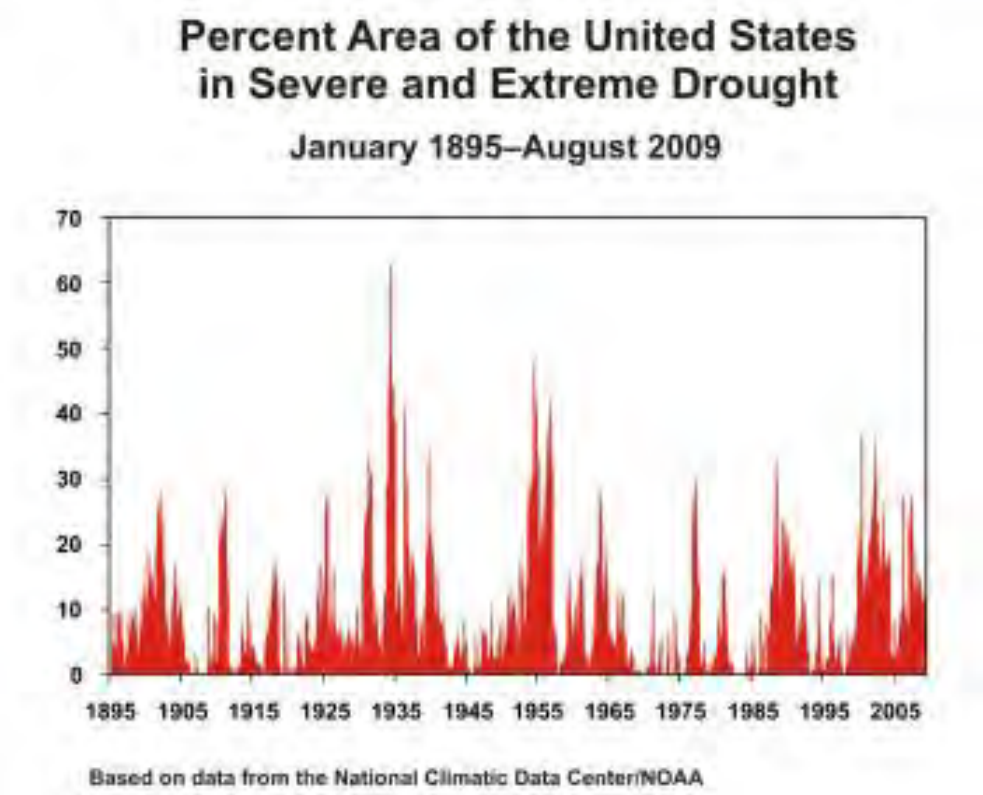


Scen 1 All components weighted equally

Scen 2 Human and civic resources more important

Socioeconomic Drought Vulnerability Index - IWMI





Source: Wilhite 2010

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Breaking the hydro-illogical cycle :

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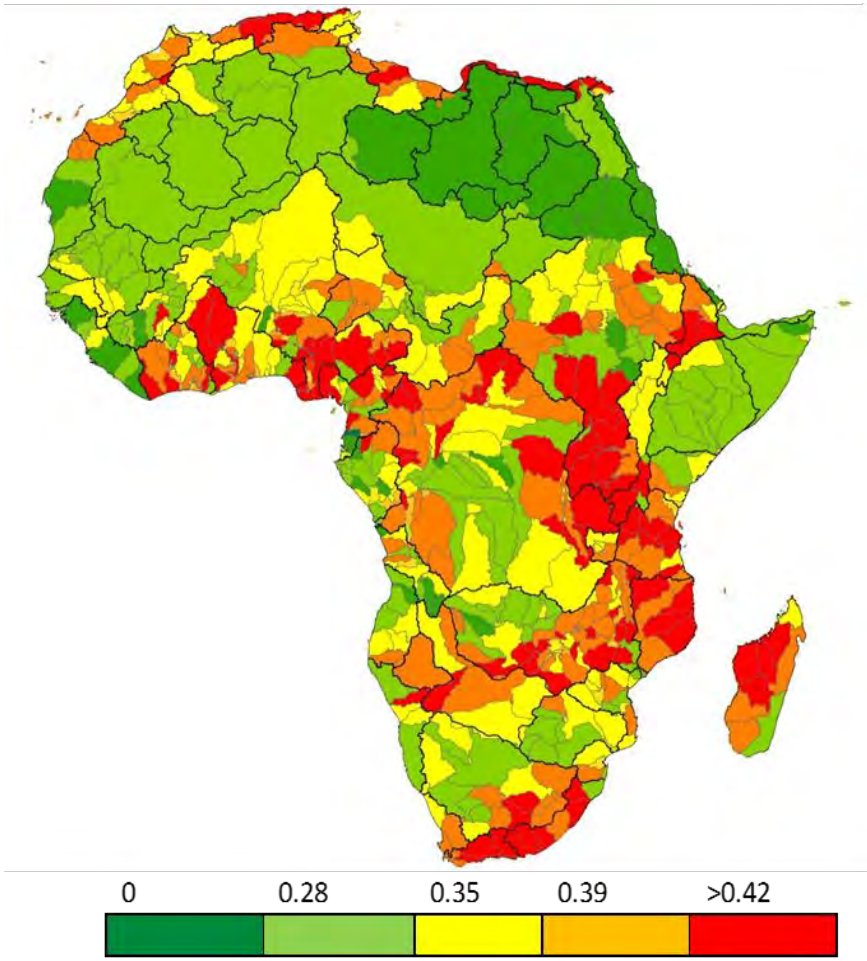
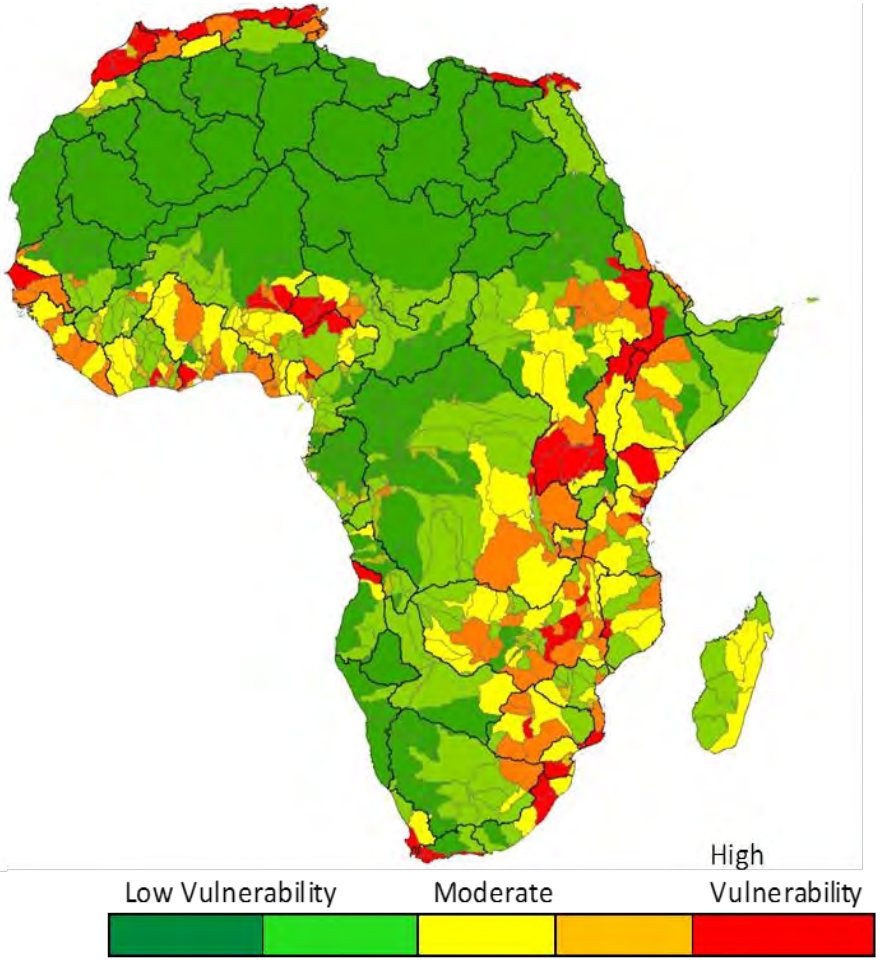
(Wilhite, 2010)

Drought hazard (DHI)



Agricultural vulnerability

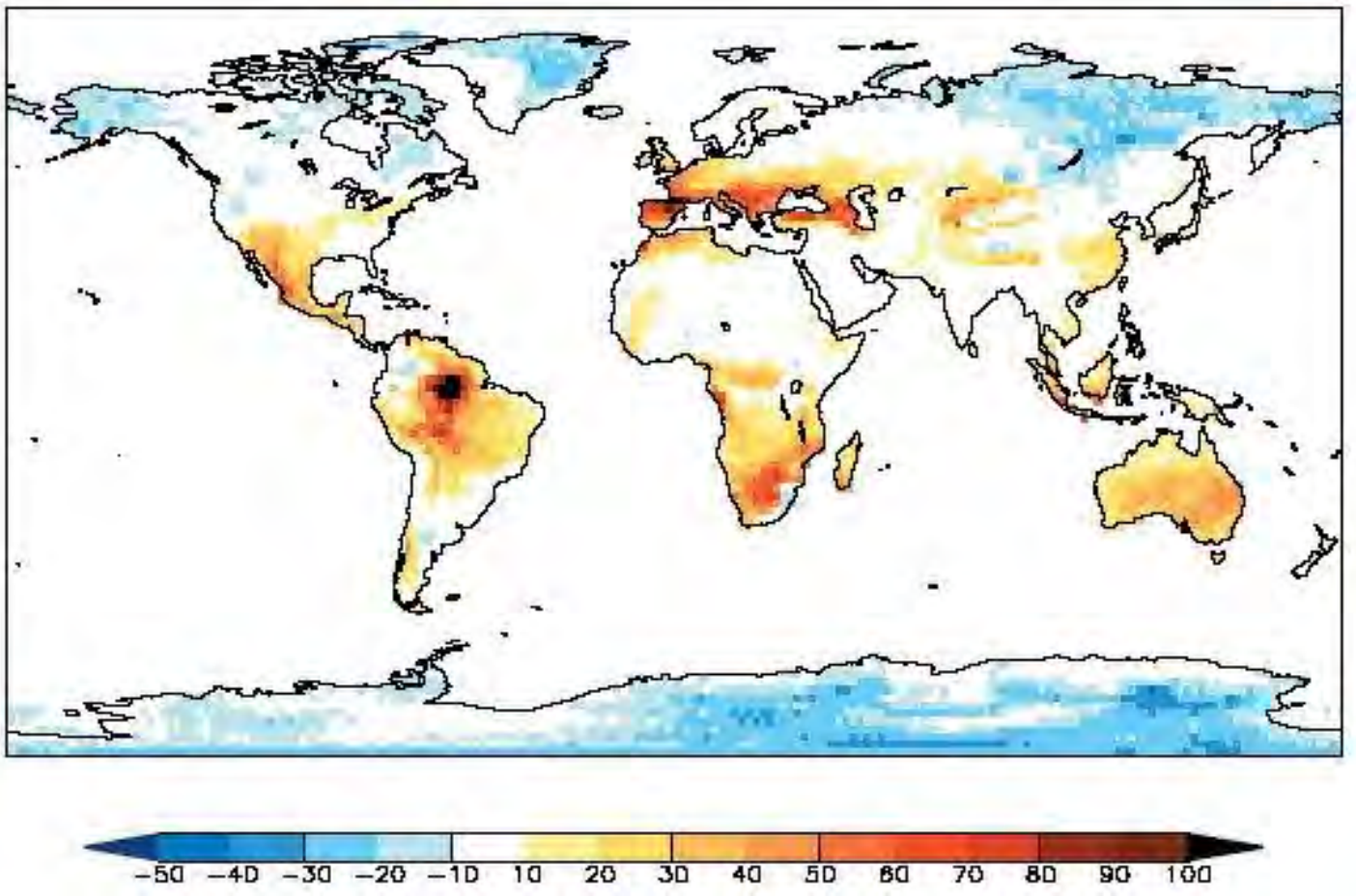


Drought—a vision of the future

- Increased frequency and severity of meteorological droughts
- Increased impacts associated with increased vulnerability
- Combination of the two—increasing risk because of greater frequency of meteorological drought and increased vulnerability and greater impacts

Future: more extreme events

Projected changes in drought risk (%)
under the A1B MPI 2070-2100 scenario



1 key issue can drought science provide insights for the policy development?

2 assertions

- Understanding and reducing vulnerability does not demand accurate predictions of the impacts of drought
- It is politically difficult to justify vulnerability reduction only on economic grounds

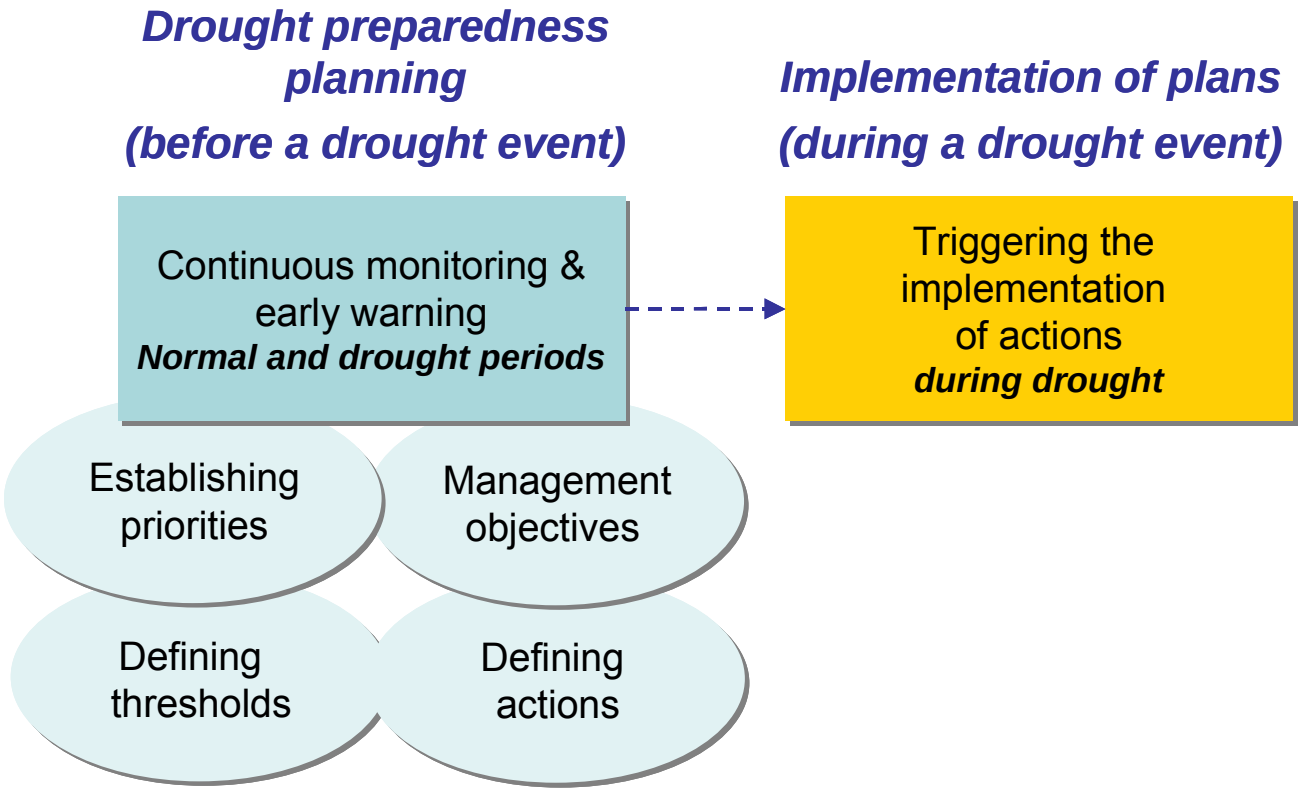
(an academic of view)

Managing the unavoidable



Operational component

According to a proactive approach, operational component includes planning and implementation of the long and short term measures to reduce drought vulnerability and to mitigate drought impacts.



PERMANENT MEASURES

- Improve the situation (reduce vulnerability of the system)
- Examples:
  - Monitoring and early warning systems
  - Technology (water re-use)
  - Aquifer management
  - Increment supply
  - Agricultural insurance
  - Cooperation in policy development

Preparedness and early warning (permanent measures)

- Preparedness and early warning is the key for later operational management and determines the success of the overall drought management plan since:
  1. Establish the drought master plan
  2. Reduce social vulnerability
  3. Define the actions to be taken upon drought
  4. Identify alert mechanisms
  5. Establish the links between drought, water and development policies

INDICATORS (permanent monitoring, forecast)
meteorological, hydrological, environmental, socio-economic

PRE-ALERT	ALERT	EMERGENCY
Initial stage of danger	Drought will have impacts	Impacts have occurred and supply is not guaranteed

ACTIONS (taken in response to drought)
should be triggered by indicators

PRE-ALERT	ALERT	EMERGENCY
Voluntary, focus on raising awareness	Mandatory, non structural, directed to limit water use	Restrictive, structural or new abstractions

Implementation of drought policy

- Australia: One level (Exceptional Circumstances)
- Spain: 3 levels
- USA: from 2 to 5 levels

Selecting the actions

1. Establishing priorities
2. Management objectives
3. Defining thresholds
4. Defining actions

Long term measures (to reduce drought vulnerability)

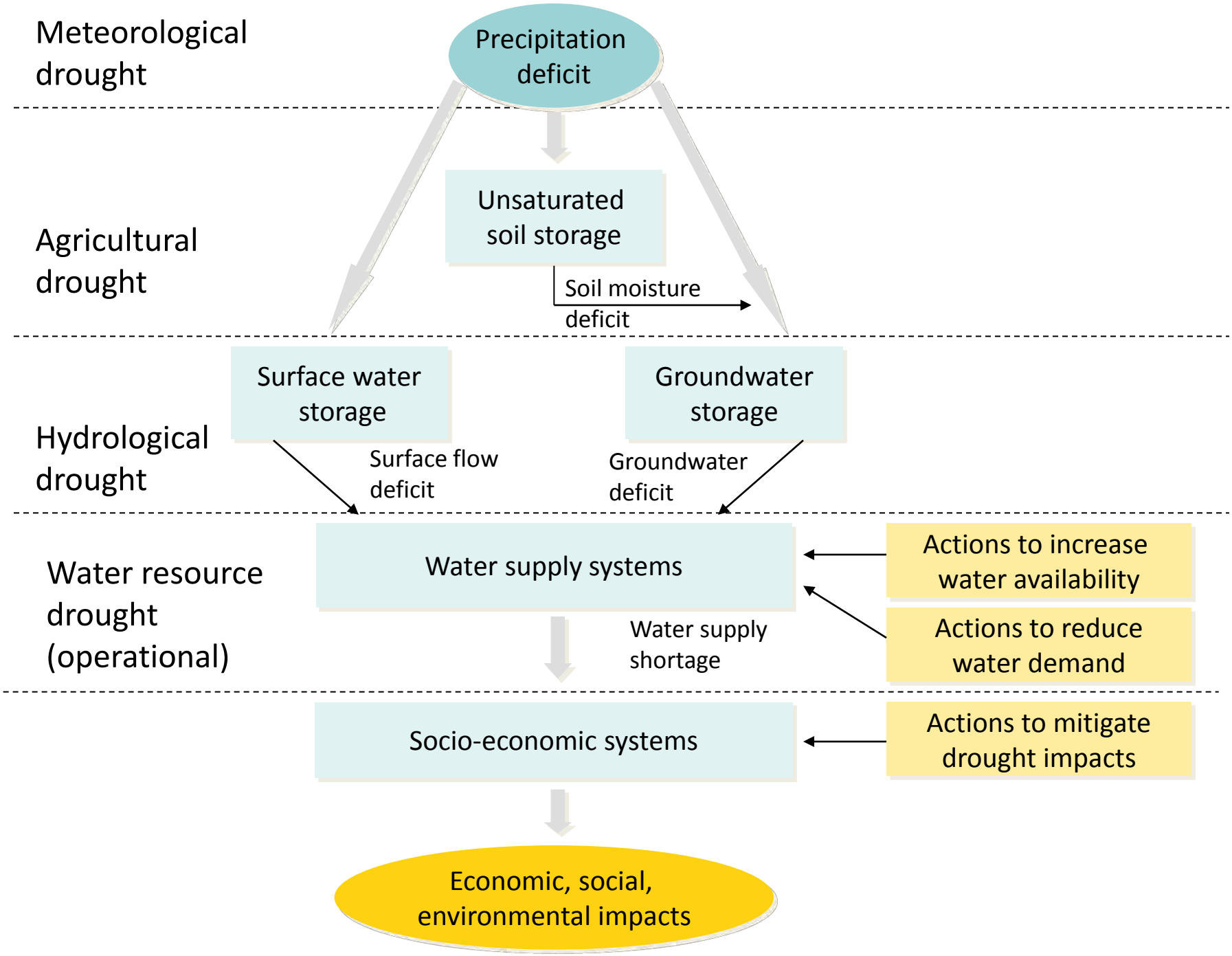
Category	Type of actions	Affected sectors			
Demand reduction	Economic incentives for water saving	U	A	I	R/E
	Agronomic techniques for reducing water consumption		A		
	Dry crops in place of irrigated crops		A		
	Dual distribution network for urban use	U			
	Water recycling in industries			I	
Water supply increase	Conveyance networks for bi-directional exchanges	U	A	I	
	Reuse of treated wastewater		A	I	R
	Inter-basin and within-basin water transfers	U	A	I	R
	Construction of new reservoirs or increase of storage volume of existing reservoirs	U	A	I	
	Construction of farm ponds		A		
	Desalination of brackish or saline waters	U	A		R
	Control of seepage and evaporation losses	U	A	I	
Impacts minimization	Education activities for improving drought preparedness and/or permanent water saving	U	A	I	
	Reallocation of water resources based on water quality requirements	U	A	I	R
	Development of early warning systems	U	A	I	R
	Implementation of a Drought Management Plan	U	A	I	R
	Insurance programmes		A	I	

U= urban; A= agricultural; I=industrial; R=recreational; E=environmental

Short term measures
(to mitigate drought impacts)

Category	Type of actions	Affected sectors			
Demand reduction	Public information campaign for water saving	U	A	I	R
	Restriction in some urban water uses (e.g. car washing, gardening, etc.)	U			
	Restriction of irrigation of annual crops		A		
	Pricing	U	A	I	R
	Mandatory rationing	U	A	I	R
Water supply increase	Improvement of existing water systems efficiency (leak detection programmes, new operating rules, etc.)	U	A	I	
	Use of additional sources of low quality or high exploitation cost	U	A	I	R
	Over-exploitation of aquifers or use of groundwater reserves	U	A	I	
	Increased diversion by relaxing ecological or recreational use constraints	U	A	I	R
Impacts minimization	Temporary reallocation of water resources	U	A	I	R
	Public aids to compensate income losses	U	A	I	
	Tax reduction or delay of payment deadline	U	A	I	
	Public aids for crops insurance		A		

U= urban; A= agricultural; I=industrial; R=recreational


Meteorological drought
Precipitation deficit
Agricultural drought
Unsaturated soil storage
Soil moisture deficit
Hydrological drought
Surface water storage
Groundwater storage
Surface flow deficit
Groundwater deficit
Water resource drought (operational)
Water supply systems
Actions to increase water availability
Actions to reduce water demand
Water supply shortage
Socio-economic systems
Actions to mitigate drought impacts
Economic, social, environmental impacts

Type of policy	Quantify the results of policy
Supply management policies	Water allocation for environmental and consumptive uses
	Reuse of urban water
	Reduction of water allocation
	Increase water supply
	Increase supply efficiency
Demand management policies	Reduction of per-capita or per-hectare water use
	Water rights exchange programs
	Increase resource efficiency

Prioritizing the actions

- Cost/benefit ratios?
- Accepted by general public?
- Sensitive to the local environment?
- Directly addressing causes and reducing impact?
- Addressing short-term and long-term solutions?
- Representing the needs of affected individuals and groups?

Water rights

- First priority: Ensure adequate supplies of domestic water are available for public health, safety and welfare
- Second priority: Minimize adverse drought effects on the economy, environment, and social well-being

Evaluation of management options

1. Tactical advice crop calendar
2. Tactical advice water needs
3. Improve cash return for water and land units
4. Management of risk in water
5. Investment
6. Integrated resource management for water and land
7. Education
8. Private sector participation
9. Alternatives for the use of natural resources and infrastructure
10. Crop residue incorporation
11. Access to fertilizer
12. Extension services
13. Indigenous knowledge
14. Short-duration varieties
15. Crop diversification
16. New crop varieties
17. New crops
18. Agroforestry
19. Food storage
20. Agrometeorological advice
21. Construction of a dam
22. Irrigation (new scheme)
23. Irrigation (improved system)
24. Water harvesting
25. Water desalination / reutilization
26. Cease activity

Drought Preparedness

GOAL:

To help nations build greater institutional capacity to cope with drought by promoting risk management and sharing lessons learned on drought monitoring, mitigation, and preparedness.

Building Regional and Global Partnerships

Challenges

- Science:
  - Sharing data
  - Going beyond uncertainty
- Institutional
  - Limitations on assimilate scientific output
  - Willingness to act based on science (trust in science)

Critical Issues for ISDR

- Develop and disseminate risk and vulnerability assessment tools
- Disseminate drought planning methodologies
- Integrate local or indigenous coping mechanisms as a part of drought risk reduction
- Create drought impact reduction strategies as an integral part of drought preparedness plans
- Develop drought policies at the regional and national level

Critical Issues for ISDR

- Assess availability of skilled human resources needed for drought preparedness planning
- Educate policy makers and the public on the need for improved drought preparedness as an integral part of water resources management

Revising and reviewing

Why is it necessary to test the drought management plan?

- Singularity of drought events
- New collection of knowledge and previous experiences
- Dynamic drought, climate, institutions, society

thank you

ana.iglesias@upm.es

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