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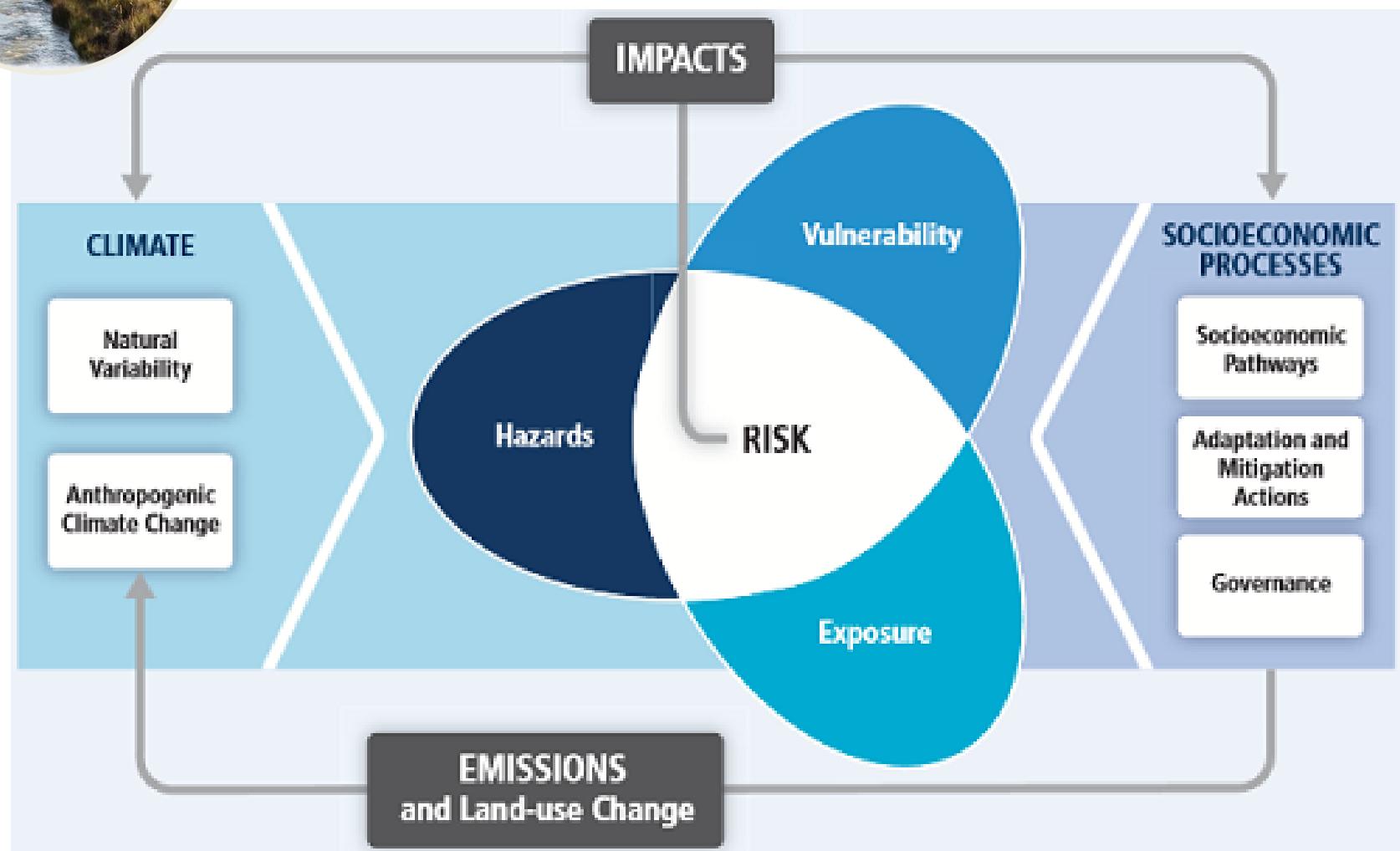
UNIVERSITY OF  
BIRMINGHAM

# Developing the Drought Vulnerability Map of Chile

**Koen Verbist and Froukje Kuijk**  
Hydrological Systems and Water Scarcity Section  
International Hydrological Programme (IHP)  
UNESCO



# Vulnerability in its context





# Two perspectives on Vulnerability assessment

Methodological Approach Considering Different Factors Influencing Vulnerability - Pan-European Scale(De Stefano *et al.*, 2015)

## Disaster Risk Reduction

## Climate Change Adaptation

<b>Goal</b>	To highlight means for risk reduction of shocks	To find the most efficient way to adapt to CC
<b>Vulnerability Assessment</b>	It is considered as a step/part of a risk assessment process, together with hazard exposure evaluation	It is considered as the expected outcome of the process
<b>Responses to</b>	Emergencies	Gradual incremental changes
<b>Risk</b>	Probability of loss. The threat (not only climate related) posed by natural hazards to vulnerable societies	The threat posed by CC (frequently refer as impacts)
<b>Hazard</b>	Primarily perceived as an external factor. Natural and man-made hazards	Usually incorporated within vulnerability, as exposure. Climate hazard
<b>Exposure</b>	Exposed assets; elements at risk (people, infrastructure, goods, economic activities etc.).	Relate to the magnitude and frequency of potential hazard. It is a component of Vulnerability
<b>Sensitivity</b>	Susceptibility or fragility. Sometimes it is equated to vulnerability	Sensitivity
<b>Capacities</b>	Encompasses coping and adaptive capacities. Also might include resilience	Mainly refers to adaptive capacity



# Case Study Mexico (PRONACOSE)

## Programa Nacional Contra la Sequía (PRONACOSE)

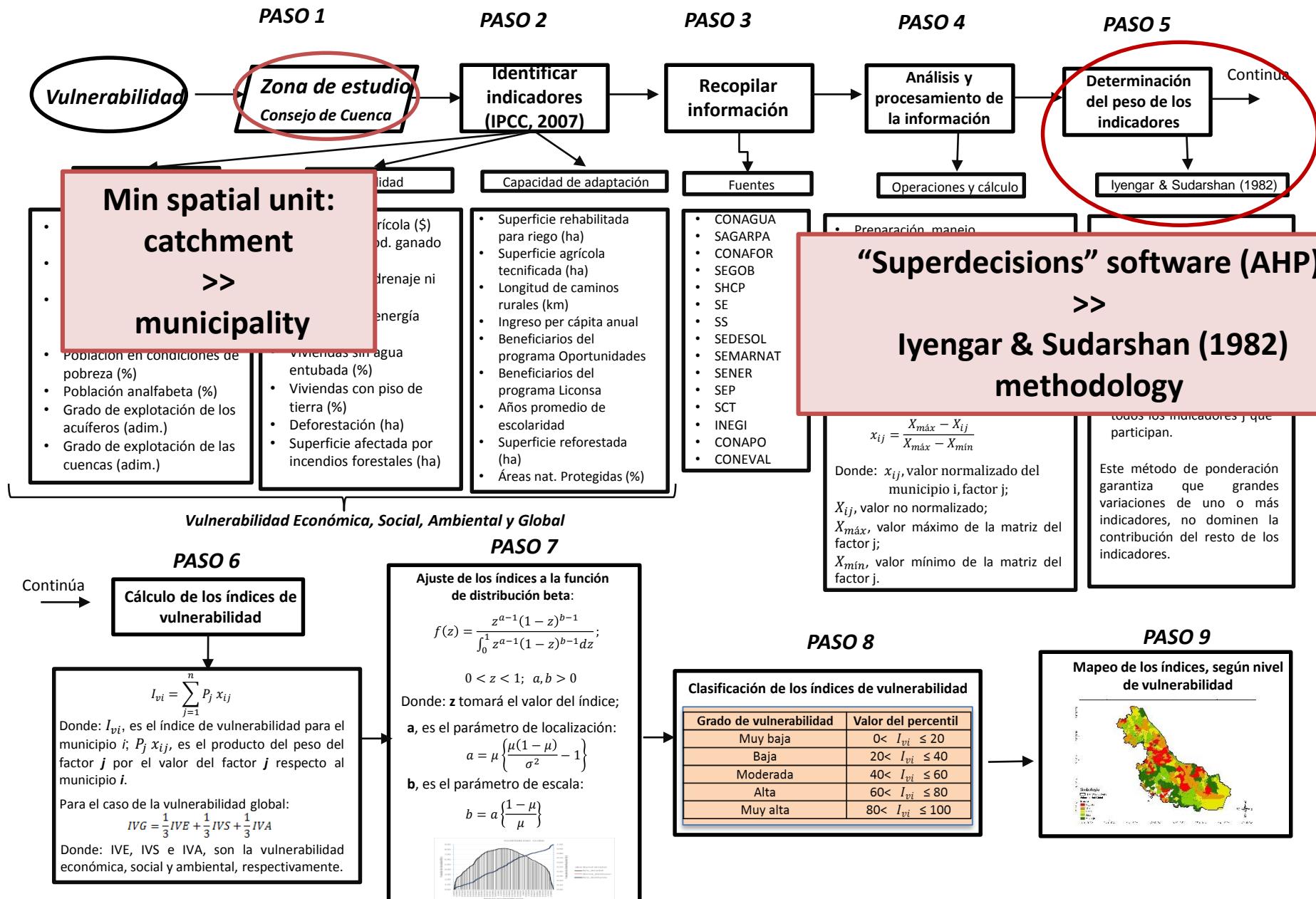
Representative indicators clustered in Grade of Exposure (Ge), Sensitivity (S) and Adaptation Capacity (Ca)

Global Vulnerability

- Economic Vulnerability
- Social Vulnerability
- Environmental Vulnerability

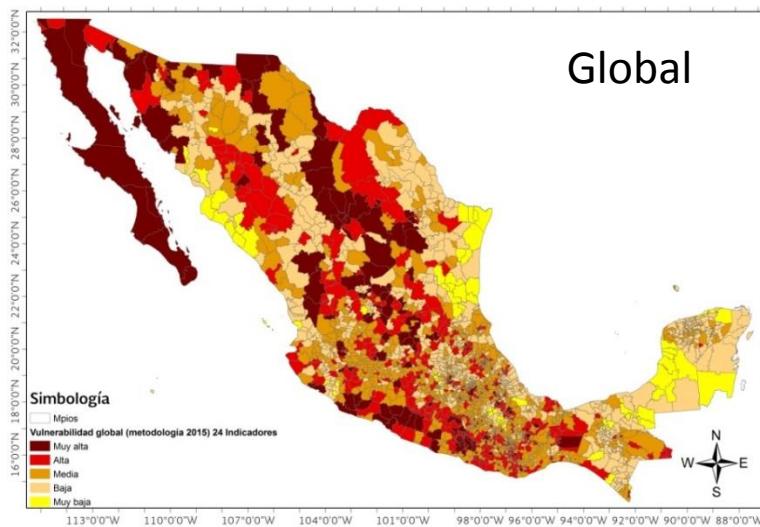


# Proposed methodology (IMTA, 2015)

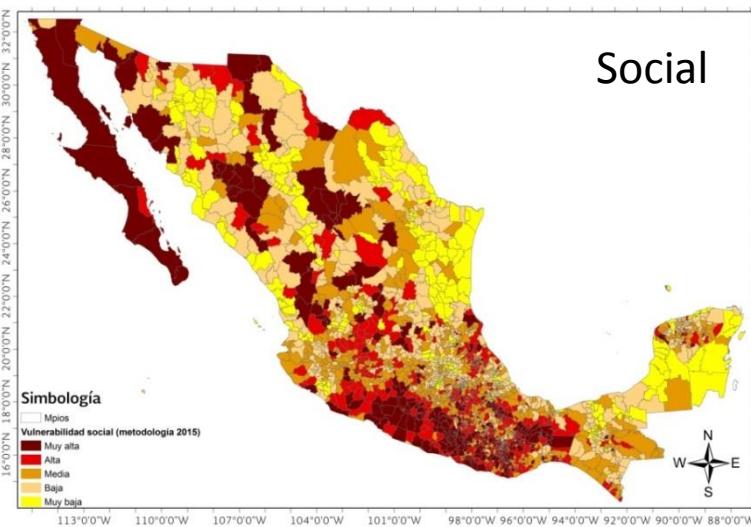




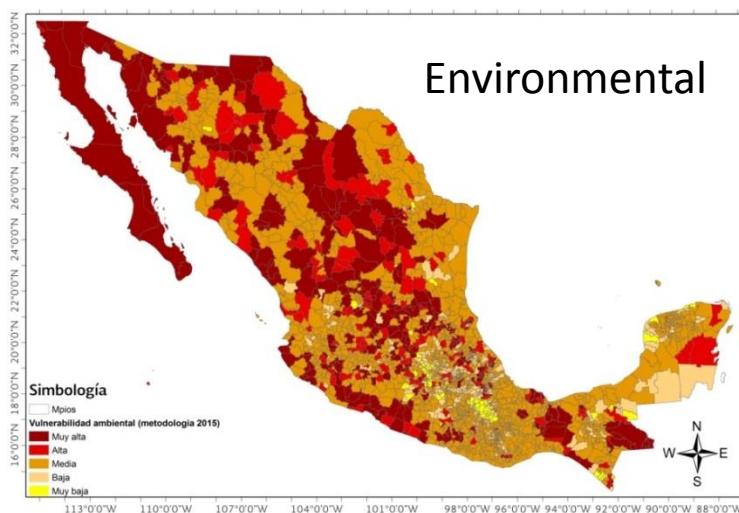
# Case Study Mexico (PRONACOSE)



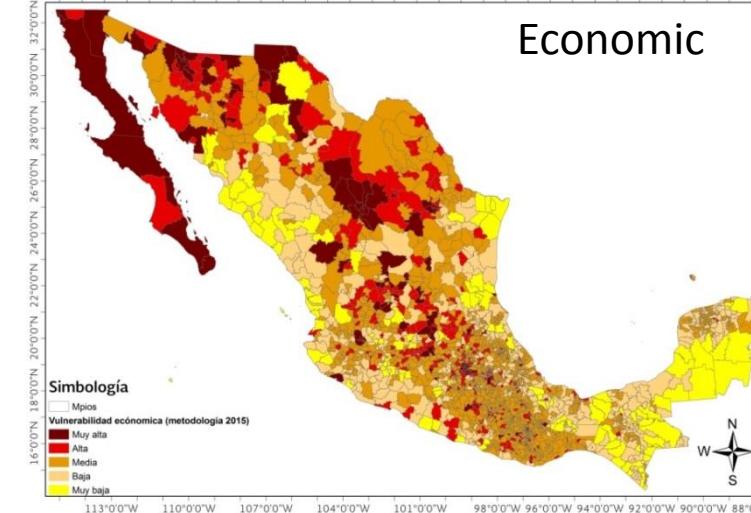
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# Vulnerability study in Chile

## - Objectives/ specific target group

- including agricultural factors

## - Selected Indicators

- ✓ Data available
- ✓ Measurable
- ✓ Representative or proxy of a specific aspect of the problem
- ✓ Nonredundant
- ✓ Available at high spatial resolution
- ✓ Updated 'regularly' (every 5-10 years)

Economic Vulnerability  
Social Vulnerability  
Environmental Vulnerability  
**Agricultural Vulnerability**

Vulnerability	Grade of Exposure	Sensitivity	Adaptation Capacity
	Indicators		
Global	Economic	<ul style="list-style-type: none"> <li>✓ Population density</li> <li>✓ Unemployed economically active population</li> </ul>	<ul style="list-style-type: none"> <li>✓ GVA of agricultural production under irrigation</li> <li>✓ GVA of livestock production</li> </ul>
	Social	<ul style="list-style-type: none"> <li>✓ Population in conditions of poverty</li> <li>✓ Population without medical assistance</li> </ul>	<ul style="list-style-type: none"> <li>✓ Household living quality (tap water, electric energy, sanitary system, basic services, status of the house)</li> </ul>
	Environmental	<ul style="list-style-type: none"> <li>✓ Exploitation grade of water resources (rivers, aquifers,...)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Deforestation</li> <li>✓ Area affected by forest fires</li> </ul>
	Agricultural	<ul style="list-style-type: none"> <li>✓ Probability of seasonal crop moisture deficiency</li> <li>✓ Soil root zone water holding capacity</li> </ul>	<ul style="list-style-type: none"> <li>✓ Fragmentation of land tenure</li> </ul>
	Institutional		

- Water rights
- Water use per sector (%) [Agriculture greater user, but less input into economy]
- Subsidies (access to)
- Vulnerability of the irrigation system
- Water costs
- Pollution (environmental indicator)
- Population/inhabitants – increase = higher vulnerability?
- Agriculture monoculture
- Access to early warning/information
- Environmental minimum flows

Vulnerability	Grade of Exposure	Sensitivity	Adaptation Capacity	
			Indicators	
Global	Economic	<ul style="list-style-type: none"> <li>✓ Population density</li> <li>✓ Unemployed economically active population</li> <li>✓ Population density (affects water access)</li> </ul>	<ul style="list-style-type: none"> <li>✓ GVA of agricultural production under irrigation</li> <li>✓ GVA of livestock production</li> </ul>	<ul style="list-style-type: none"> <li>✓ Commitment of private and public sector in R&amp;D</li> <li>✓ Water Resources Development and Infrastructure (Dam storage capacity, Contribution of desalination and contribution of waste water recycling)</li> <li>✓ Energy use</li> </ul>
	Social	<ul style="list-style-type: none"> <li>✓ Population in conditions of poverty</li> <li>✓ Population without medical assistance</li> <li>✓ Rural population</li> <li>✓ Access to water</li> </ul>	<ul style="list-style-type: none"> <li>✓ Household living quality (tap water, electric energy, sanitary system, basic services, status of the house)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Annual income per capita (GDP), taking into account the Gini-coefficient</li> <li>✓ Average years of schooling above age of 24 + population literacy</li> <li>✓ Education level</li> </ul>
	Environmental	<ul style="list-style-type: none"> <li>✓ Exploitation grade of water resources (rivers, aquifers,...)</li> <li>✓ Average precipitation</li> </ul>	<ul style="list-style-type: none"> <li>✓ Deforestation</li> <li>✓ Area affected by forest fires</li> <li>✓ Average precipitation</li> </ul>	<ul style="list-style-type: none"> <li>✓ Reforested area</li> <li>✓ Protected natural areas</li> </ul>
	Agricultural	<ul style="list-style-type: none"> <li>✓ Probability of seasonal crop moisture deficiency</li> <li>✓ Soil root zone water holding capacity</li> </ul>	<ul style="list-style-type: none"> <li>✓ Fragmentation of land tenure</li> <li>✓ Agricultural water use (%)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Area rehabilitated through irrigation</li> <li>✓ Area with technified agriculture</li> <li>✓ Proportion of agricultural area covered by Agroseguros (insurance for agricultural production)</li> <li>✓ Beneficiaries of INDAP programs</li> <li>✓ Agricultural water use</li> <li>✓ Water infrastructure (increase or decrease?)</li> </ul>
	Institutional			

- Cash crops = irrigation
- Rain-fed = regional crops
- Drip-irrigation = increase or decrease resilience?

- Economic: level of debt = social factor? (lower adaptation?)
- Social: water consumption per family
- Environmental: Meteorological extremes, climatology throughout the country (adaptation capacity?)
- Agricultural: Siniestralidad (existing measure can be mapped – frost, drought, flooding etc = map how much compensation is paid in the different regions of Chile)

# Agricultural vulnerability

- Indicator (choose one)
- Which data you would use?
- Temporal resolution (frequency?)
- Spatial resolution
- Standardizing (0 = not vulnerable  
                          1 = highly vulnerable)
- Weight



United Nations  
Educational, Scientific and  
Cultural Organization  
1945-2015



International  
Hydrological  
Programme



# Thank you!

[www.unesco.org/water](http://www.unesco.org/water)  
[k.verbist@unesco.org](mailto:k.verbist@unesco.org)

