



**Sustainable Water
Integrated Management (SWIM) -
Support Mechanism**



Project funded by
the European Union

Water is too precious to waste

SESSION 2: ASSESSING CLIMATE CHANGE RISKS ON ENVIRONMENT AND DEVELOPMENT

Training workshop on the identification and development of climate change no-regret actions in the water sector, 3-5 October 2012, Amman

Presented by: Dr. Sara Fernandez, Senior Water Expert

Objectives of Session 2

- **Goal:** Provide an overview of the socio-economic and environmental consequences of climate change impacts on freshwater resources
- **Learning Objectives:**
 - Understand the interrelations between climate change, water and human development
 - Assess the main consequences of climate change hydrological impacts on key development sectors
 - Be aware of the policy implications for water managers and emerging approaches within the international water debate

The regional development context

SWIM countries have made substantial development progress over the last three decades in a number of critical areas, e.g.:

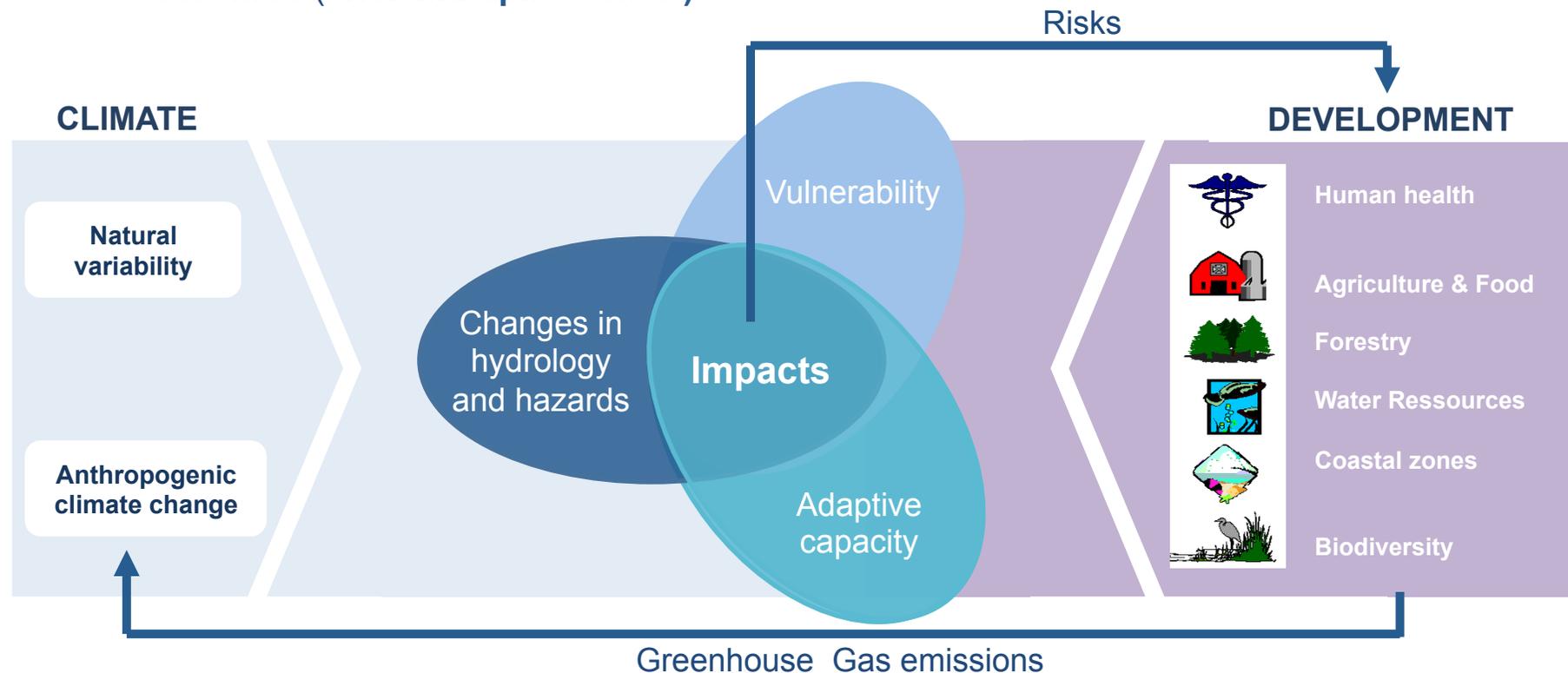
- access to safe water
- increase in life expectancy by about 15 years
- decreased mortality rates for children under five by about two-thirds
- a near doubling of adult literacy

However, many vulnerabilities and challenges subsist, within & outside the water sector, which can compound the impacts of climate change and variability:

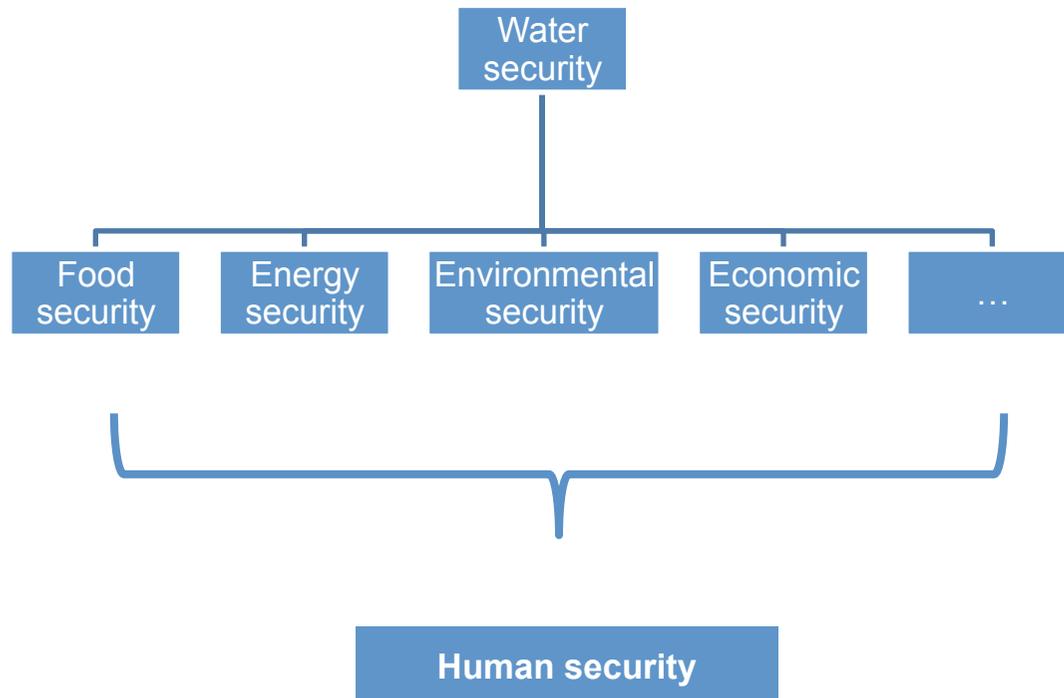
- Aridity, water scarcity, dwindling natural resources
- Increasing population
- Fast growing urbanization in disaster-prone areas
- Lack of diversification and fragile growth
- Chronic unemployment and poverty
- Unequal access to land and resources
- Food security and food prices
- Sustainability of energy
- High illiteracy rates and lack of skills
- Women and youth empowerment
- Low access to technology and information,
- Lack of political commitments, rule of law, etc.
- Political and social instability
- Wars, militarized conflicts

Climate change will intensify current development challenges

- **Water is the “face” of climate change:**
 - Water links the physical climate and the human and natural systems
 - Water is central to many sectors and hence is the primary transmitter of CC impacts on societies and the environment
 - Climate change impacts on water add to existing problems of desertification, water scarcity and food production, while also introducing new threats to human health, ecosystems and economies (“**risk multiplier**” effect)



What is at stake?



“Water security is the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production coupled with an acceptable level of water-related risks to people, environments, and economies” (Grey and Sadoff, 2007)

What is at stake?

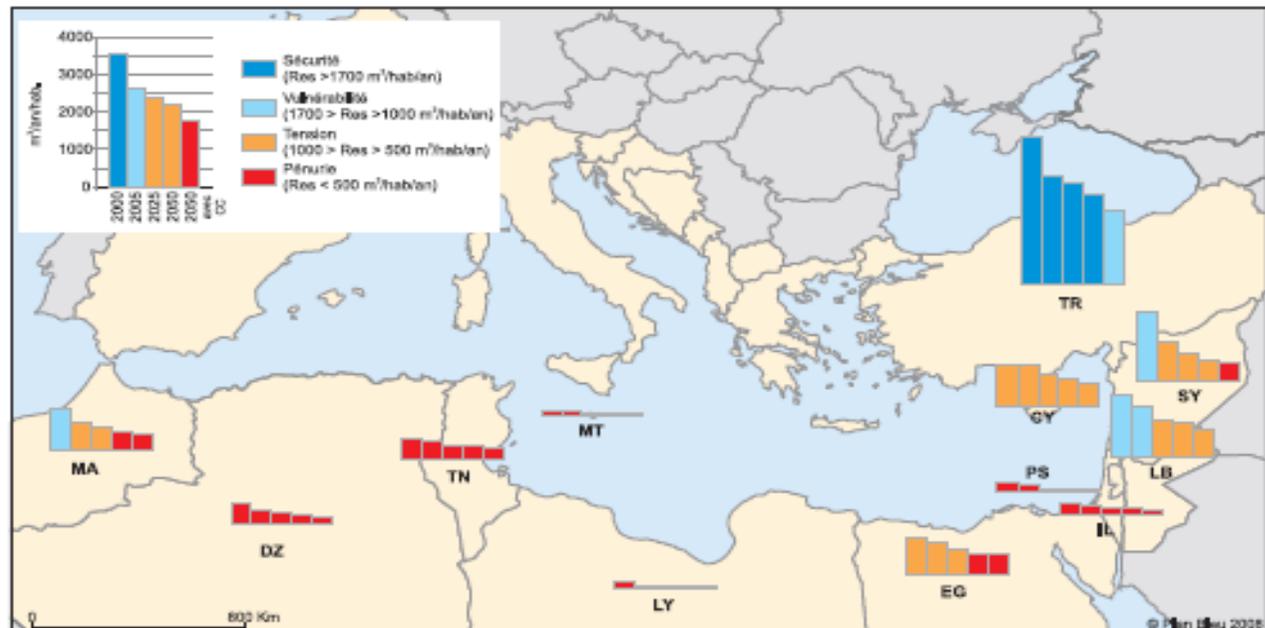
Climate-driven hydrological changes pose a serious threat to the achievement of the MDGs in PCs

Millennium Development Goals	CLIMATE CHANGE RISKS
 <p>1 Eradicate extreme poverty and hunger</p>	<p>Depleted livelihood assets, reduced economic growth, and undermined food security.</p>
 <p>2 Achieve universal primary education</p>	<p>Reduced ability of children to participate in full-time education by loss of infrastructure, livelihoods (forcing children to work), and displaced families.</p>
 <p>3 Promote gender equality and empower women</p>	<p>Additional burdens on women's health and time to participate in decision-making and income-generating activities.</p>
 <p>4 Reduce child mortality; 5 Improve maternal health; 6 Combat HIV/AIDS, malaria and other diseases</p>	<p>Greater prevalence of vector- and water-borne diseases, heat-related mortality. Declining food security, maternal health and availability of potable water.</p>
 <p>7 Ensure environmental sustainability</p>	<p>Negatively impacted natural resources and productive ecosystems.</p>

Water resources and demands gap

- Climate and global change will exacerbate the regional water gap by reducing supply, deteriorating quality and increasing demand
- Renewable water supply/demand gap in the MENA region (WB, 2011): 16 % in 2009, 37% in 2030, 51% in 2050
- Water poverty in the Mediterranean region (source: Plan Bleu)
 - In 2005: 60 million people living with less than 500 m³/pers./y.
 - In 2050: 258 million (without CC) and 292 million, considering the scenario B1

**In 2050:
+34 million people
living with less than
500 m³/pers./y.
due to CC
(scenario B1)**



Source : Plan Bleu

Water supply and sanitation

From the point of view of service operation:

- Declining and more variable freshwater resources might disrupt reliability and continuity of drinking water supply systems
- Drinking water services could become more erratic than they are already, cities could come to rely more and more on expensive desalination and could have to rely more frequently on emergency supplies brought by tankers or barges
- Wastewater networks are particularly vulnerable to excessive rainfall events and SLR.

Overall CC could prevent achieving MDG targets on water supply and sanitation

(supply has already shown moderate progress in the MENA region with 17 % of the population without access to improved water sources)

Food security and rural livelihoods

Agricultural production

Increased length of drier periods, changing growing seasons coupled with reduced precipitation and water supply may lead to:

- Decrease in or loss of rain fed agricultural and grazing land (70% of agricultural lands in MENA)
- Fluctuation and long-term reduction in agricultural yields (WB, 2007)
 - For the MENA region as a whole, agricultural output could decrease by 21% in value terms by 2080
 - With peaks of an almost 40% decrease in countries like Algeria and Morocco
- Desiccation, accelerated desertification and resulting extension of agriculture in marginal and forested lands (deforestation)

Food security and rural livelihoods

Food security

Food products:

- Decreased availability, especially cereals
- Increased volatility of food prices



- Reduced access to food for vulnerable groups
- Increase in hunger, starvation and malnutrition of the most fragile
- Increased food imports impacting household and public budgets (poverty)
- Potential development reversal and failure in attaining MDG nutrition related targets

Food security and rural livelihoods

Rural development and livelihoods

In the MENA region:

- 70 % of the poorest people live in rural areas
- Most vulnerable are female headed households, landless and farm laborers



- ✓ Increasing cost of government's support (food and inputs subsidies)
- ✓ Impediments to private and international investments (risk aversion)
- ✓ Threatened rural economies and enhanced already high rural unemployment (part. young people and women)
- ✓ Irrigated agriculture: unreliable water services could depress farmers' incomes
- ✓ Rainfed agriculture: decline in natural resource base and loss of livelihoods could worsen living conditions of rural poors and boost internal and international migrations

Energy

Energy production

Equitable and sustainable access to energy for all is a prominent challenge for most PCs.



- ✓ Higher intensity and frequency of hot days could increase the demand for energy and impact power generation supply
- ✓ Low flow conditions could pose threats to thermal plants that require water for cooling
- ✓ Increased floods frequency and intensity would also pose a risk to energy infrastructures (power transmission lines, offshore drilling, rigs and pipelines etc.)

Energy

Hydropower

- ✓ New hydrological conditions may reduce the potential output of current and projected hydroelectric projects:
 - Reduction in river flow and water levels in reservoir would reduce power generation
 - More conservative water storage strategies withstand more intense droughts and floods would decrease hydropower potential (water not available for release or reservoirs not kept full)
- ✓ New hydrological conditions are likely to lie outside safety margins of current hydropower facilities → need for retrofitting or building new structures (additional costs)

Human health

- Climate change hydrological impacts are likely to induce a deterioration of health conditions through both direct and indirect effects:
 - heavy precipitation events (floods) may increase risk of deaths, physical injuries and infectious, respiratory and skin diseases, post-traumatic mental disorders, etc.
 - Increasing droughts events and decreasing water availability could increase risk of food and water shortage, malnutrition, hunger and increased mortality rates (children and aged)
 - altered water quality conditions and growing contamination may lead to the emerging or reemerging of pathogens and diseases (e.g. diarrheas, typhoid and hepatitis)

Human health

- A special concern is linked to the disruption of water supply and sanitation systems during extreme events that might result in an increase in water-borne infectious diseases
- Change in hydro-climatic conditions could also change in the future the geographic range of vector-borne disease (e.g. malaria) potentially bringing them to new areas which lack either population immunity or a strong response capacity
- The poorest communities are the most exposed to climate-related health impacts :
 - Displaced people and refugees
 - Rural and urban households living in harsh socio-economic conditions and lacking access to health services
- Vulnerability: sub-optimal healthcare systems, inability to deal effectively with existing climate-related diseases

Urban settlements and livelihoods

PCs are experiencing an exponential and poorly regulated urbanization phenomenon:

- MENA region has one of the highest level of urbanization in the world
- Most part of the coastline and low-lying coastal areas are urbanized
- Urban development faces important challenges including fast developing slums and informal settlements built on low-value and disaster vulnerable areas (slopes, ravines, flood plains and low-lying coastal lands)



If left unaddressed, climate change impacts will severely affect cities and urban livelihoods

Urban settlements and livelihoods

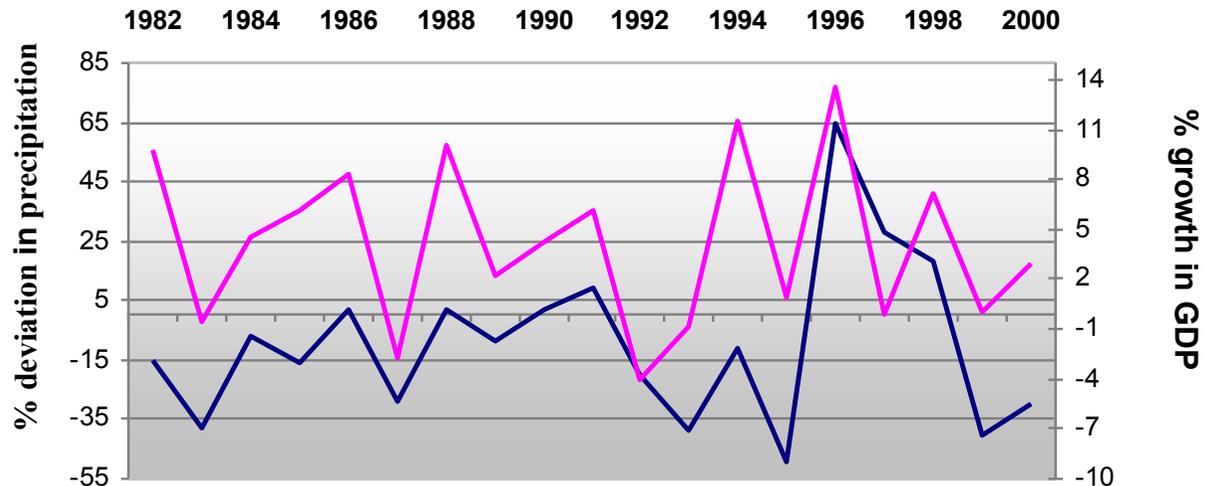
- In urban areas in North Africa, between 6 and 25 million people are estimated to be exposed to coastal flooding under a temperature increase of between 1 - 3 °C
 - Alexandria: 0.5m SLR would leave more than 2 million people displaced, with \$35 billion of losses in land, property, infrastructure and cultural assets.
- More aggressive flash floods and storm surges are likely to threaten the integrity of buildings and infrastructure and submit them to extreme climate and hydrological conditions for which they have not been designed (e.g. transportation systems, water and energy supplies, drainage and wastewater networks)
- Heat waves, increased “heat island effect”, water scarcity, decreasing water quality, worsening air quality, and ground ozone formation will deteriorate public health and living conditions.

Economic growth and investments

- Economic growth in water-scarce and agriculture-dependent economies is highly climate-sensitive
- Increased frequency of drought could decrease regional GDP by 1 %.

— % Deviation in mean precipitation
— % Growth in GDP

Variation in GDP and Precipitation, Morocco



ODA flows in the region is highly vulnerable to climate change

Increased aid is needed

To achieve MDGs

Aid to risk management is growing

From 2001-2005, up >200% in climate-sensitive sectors

Aid to risk management is significant

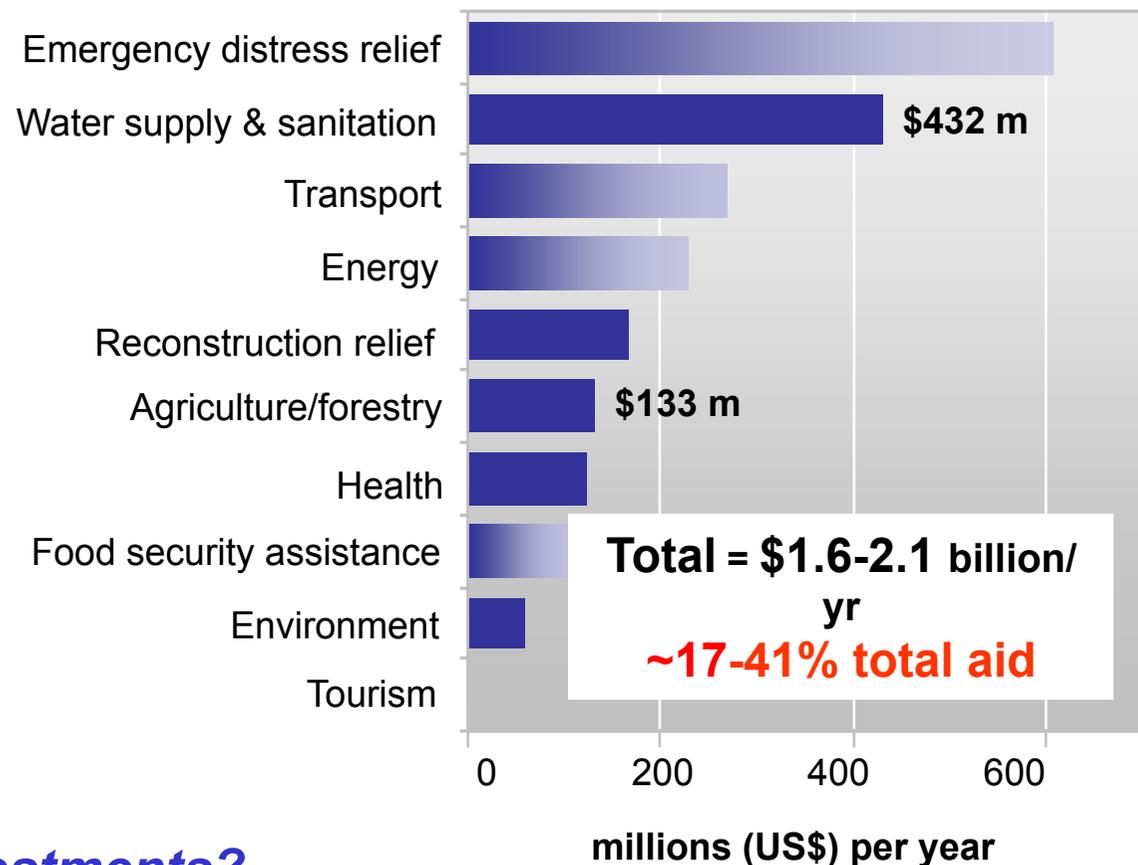
ODA potentially affected by climate change = ~17-41% of Total

How resilient are these investments?

* Does not include I

ODA to Arab States in Climate-Sensitive Sectors*

(average per year 2001-2005)



Other cross-cutting impacts

Worsening living conditions, natural resource base and natural disasters due to climate change are likely to compound existing social, political and security issues:

- Possible famine and civil unrest
- Internal and international migrations
- Occurrence of hydro-conflicts (among communities, social groups, sectors or countries) and militarized disputes over dwindling water and other resources
- Effects on poverty and exclusion of most vulnerable groups (e.g. women)

Policy implications (1)

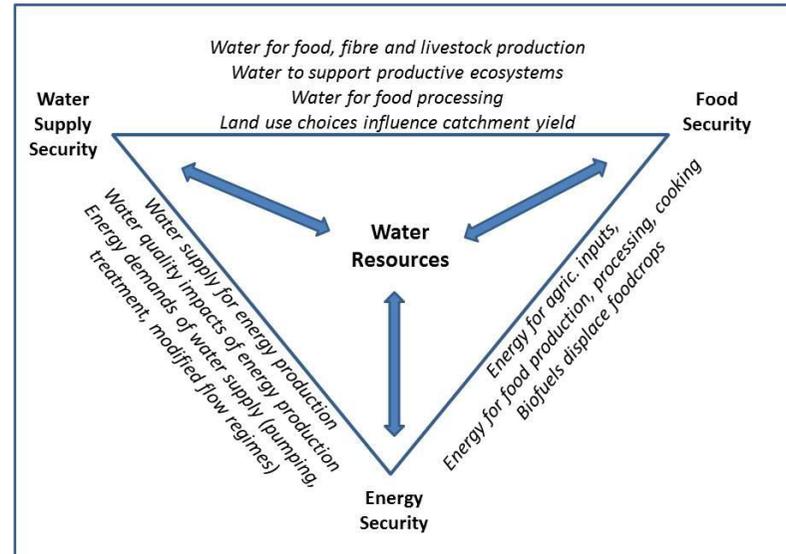
- Climate change impacts on water are directly undermining human development because of their linkages to water supply, sanitation, food, energy, health, and, by extension, the Millennium Development Goals (MDGs)
- Making optimal water allocation between a growing number of competing sectors (e.g. municipal water, agriculture, hydropower, ecosystems, etc.) will become even more challenging for water managers under a changing climate (“doing more with less”)

Policy implications (2)

- Simple sector-based approaches to climate change adaptation are insufficient and inadequate for both the water sector and other sectors
- Urgent need to view water as a cross-sectoral input to development and primary vehicle for adaptation that should be placed at the center of the adaptation agenda in PCs
- Water-related adaptation requires integration and cooperation across sectors and institutions and calls for decision-makers to think beyond sector-based boundaries ('thinking 'beyond the water box')

Emerging perspectives for building water-based resilience

- **The Water-Food-Energy Nexus approach**



- Recognizes the inter-linkages, trade-offs and synergies in improving access to water, energy and food while conserving ecosystems
- Develops joint perspective on common challenges and their interrelations
- Promotes instruments that minimize tensions and realize synergies through policy coherence, accelerated access to resources, increasing resources productivity, reducing wastes and losses, valuing ecosystems services, mobilizing consumers influence

Emerging perspectives for building water-based resilience

Green Growth/Economy (Rio+20 Conference)

- Green growth' or development of green economies is “a strategy that fosters economic growth and development, protects natural ecosystems and the resources and environmental services they provide, and enhances socially-inclusive development” (WWC, 2012)
- It is an implementing strategy for sustainable development, not a replacement
- Promotes a shift from resource-intensive to resource-efficient consumption and production patterns
- Recognizes the central role of good and climate-resilient water management in generating “public goods” and supporting a number of sectors with green economic potential (e.g., agriculture, forestry, energy, etc.)

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Thank you for your
attention



Q&A, Discussion

- Needs for clarification ?
- What are the most significant impacts of climate change on the water sector in your context?
- How does CC manifest itself from a social, economic and environmental point of view?