



Climate change adaptation:  
The role of wetlands

Dr. Bart (A.J.) Wickel  
[bart.wickel@wwfus.org](mailto:bart.wickel@wwfus.org)

Dr. John Matthews



“We can’t wait 30 years for precise science.... I want to see climate adaptation programs based on *non-precise* decision making. Now.”

Vahid Alavian, World Bank Water Advisor  
Stockholm, Sweden  
August 2008

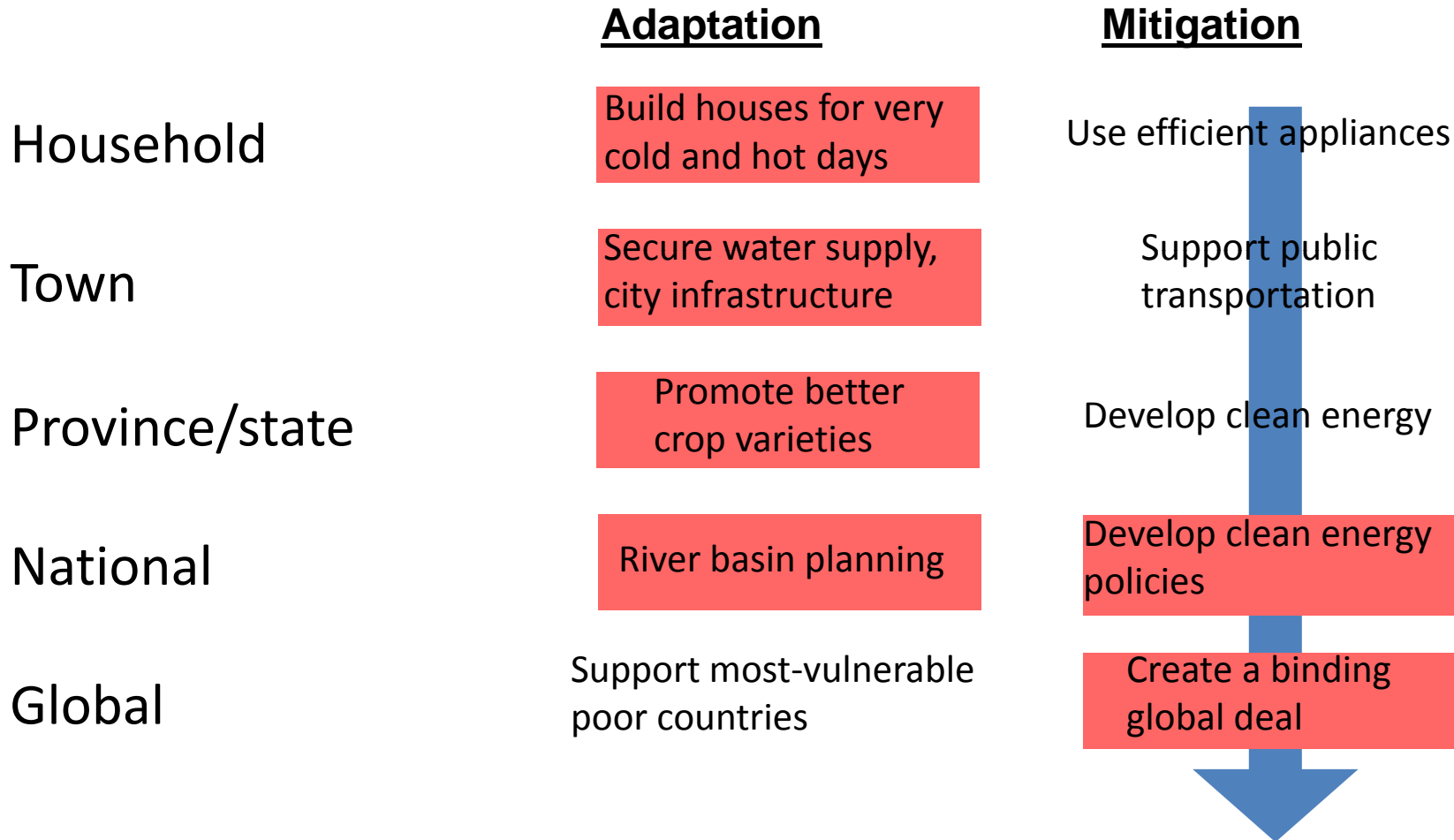
## Mitigation

**Climate mitigation** focuses on how to slow and eventually stop the **rate** of climate change. If climate mitigation works, we will reduce the rate of climate change in **~50-100 years**.

## Adaptation

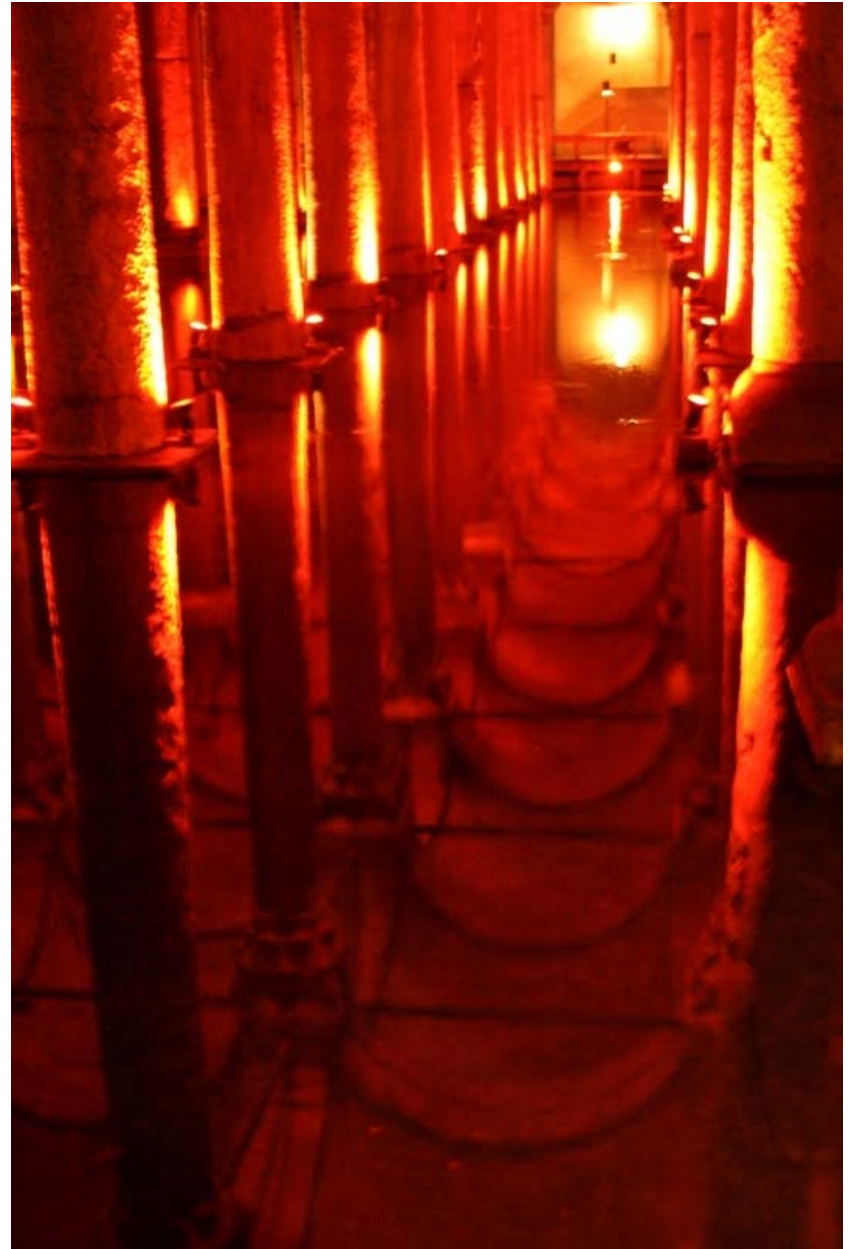
**Climate adaptation** focuses on how to respond to the **impacts** of climate change, **while we bring our emissions down**. If adaptation works, we will reduce our vulnerability to impacts **today**.

# Scales: mitigation & adaptation



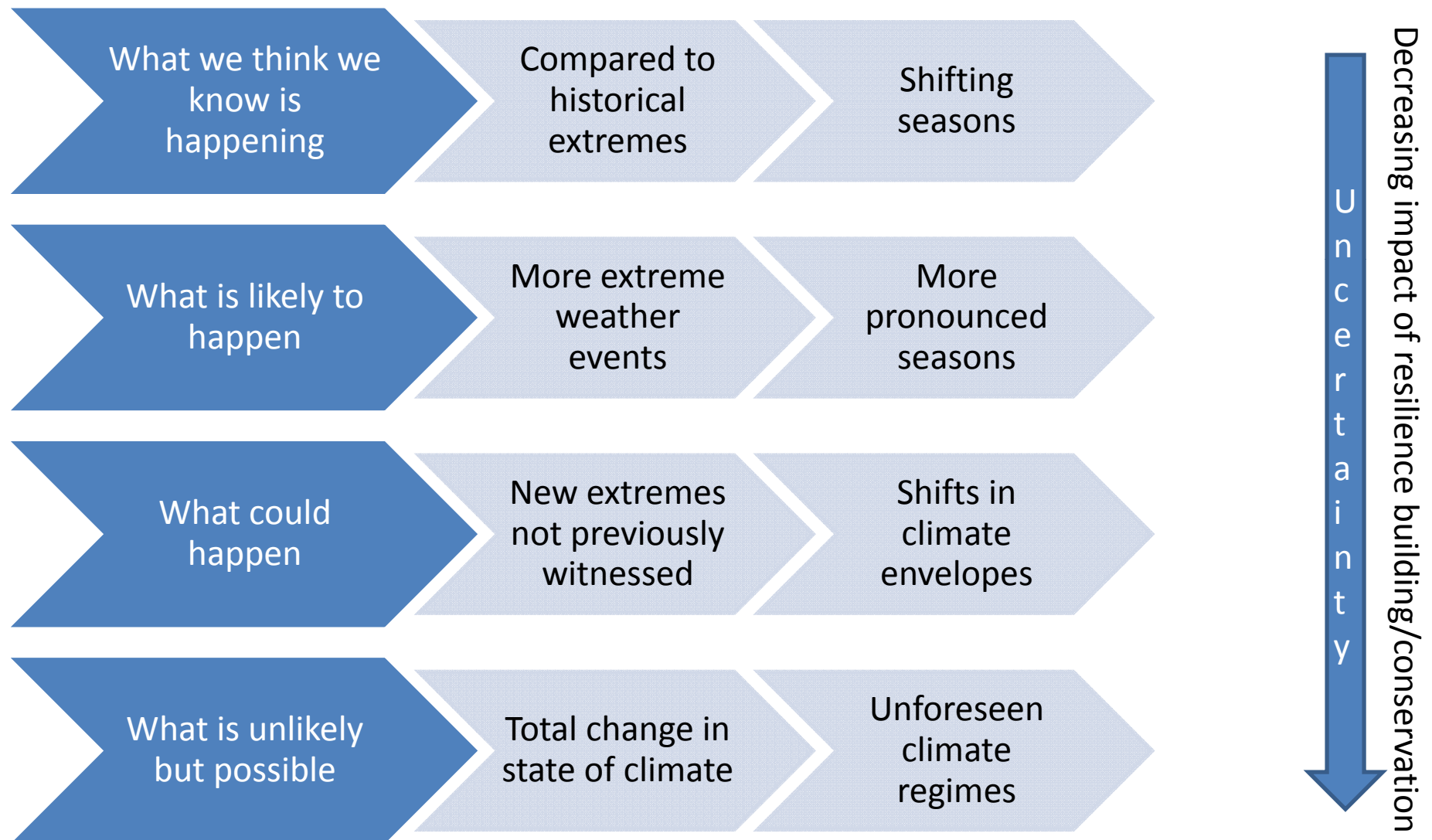
# What is Climate change adaptation?

- “process of adjusting to and preparing for climate change impacts”
- Minimizing risks (natural hazards, food security etc.)
- Resilience building (government, business, local communities, ecosystems etc.)
- Adaptation = “Buying time”



*Roman storage chamber, Istanbul, Turkey, 535 AD*

# The adaptation challenge



# Use of scenarios

**Scenarios are used to predict possible impacts and evaluate alternatives**

- What are the projected impacts?
- What will we experience in comparison to today?

**Most projections are coarse in**

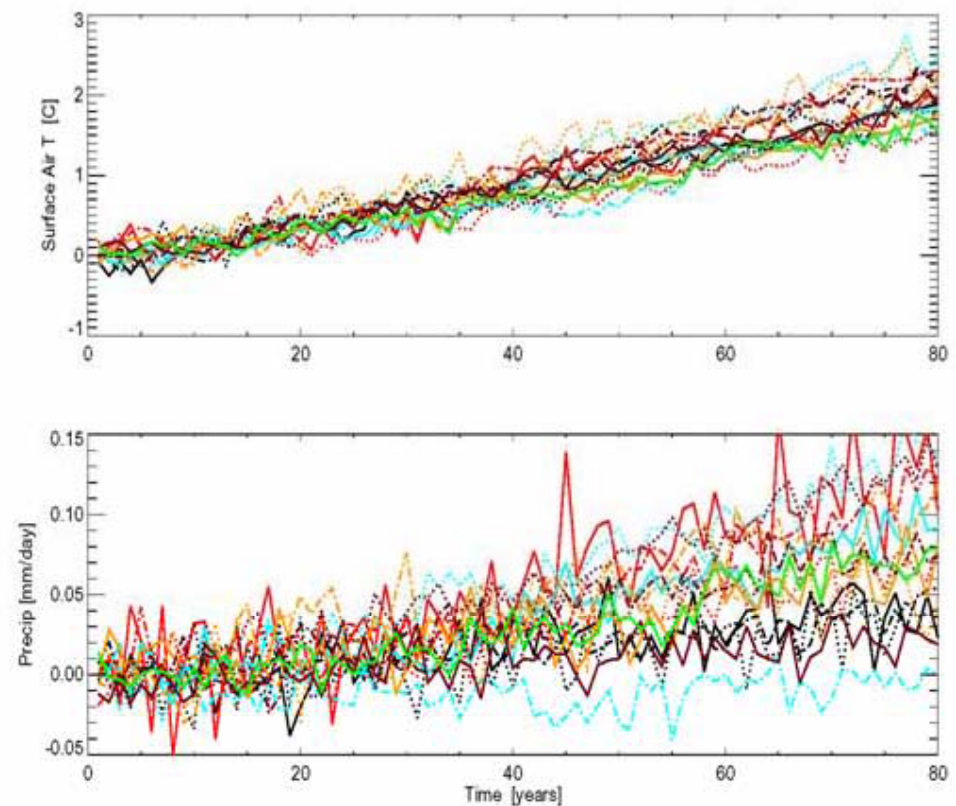
- spatial scale (10's -100s of km)
- Temporal scale (months-years)

**Models are a reflection of the data that are entered**

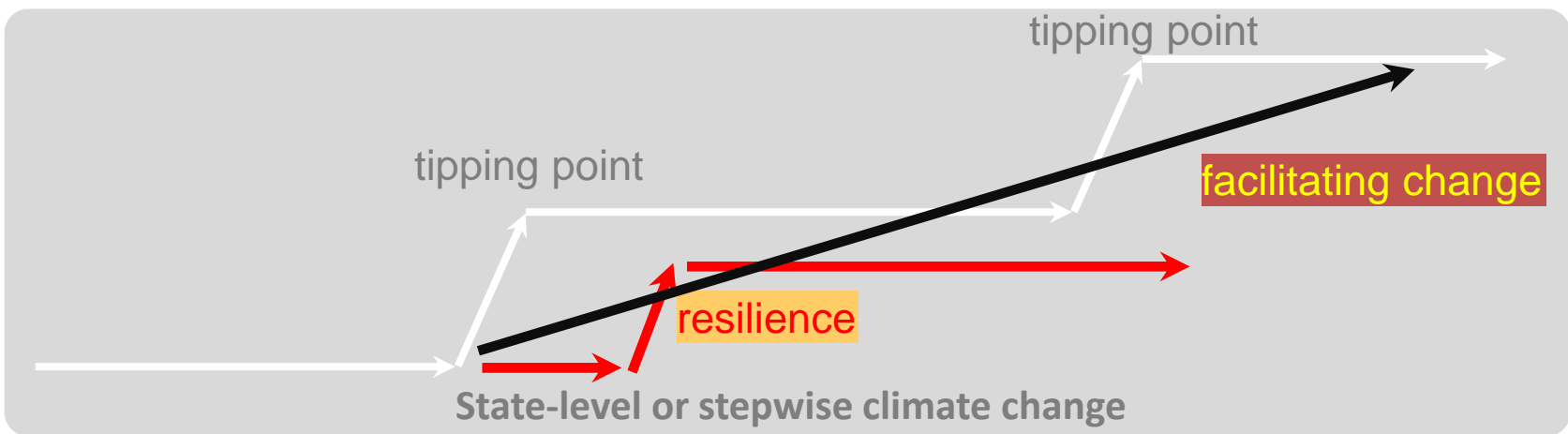
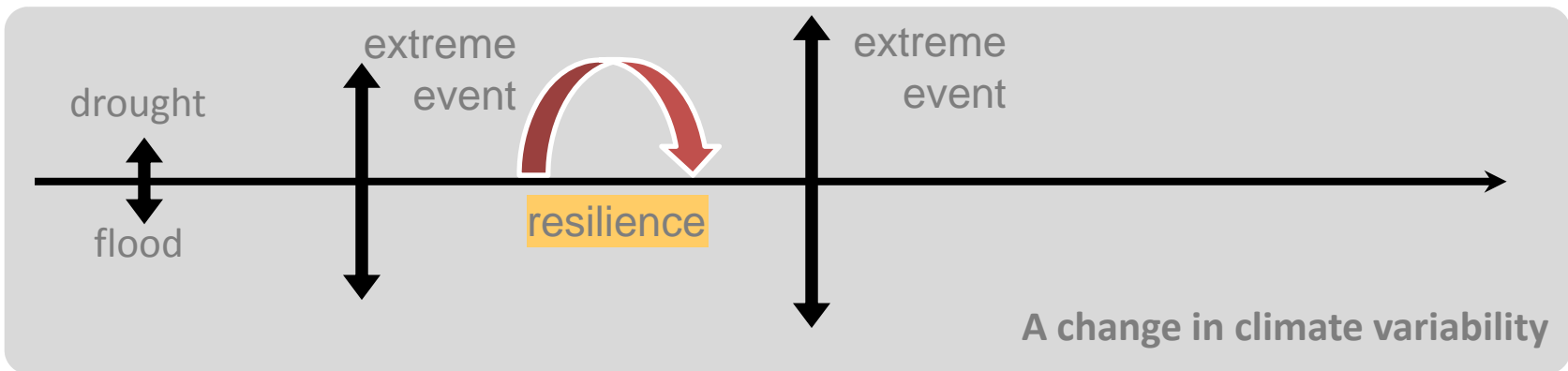
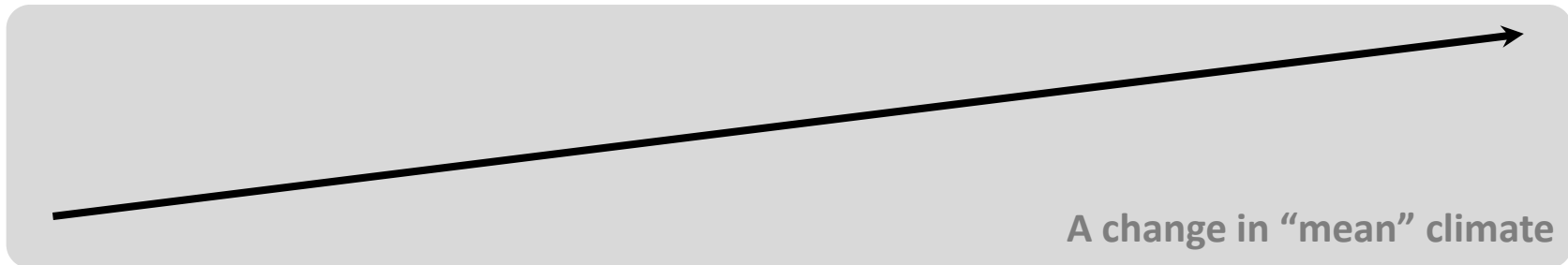
**Scenarios are not able to capture:**

- Impacts of extreme events
- State-level changes
- Unexpected changes

Global+Annual Means (1% / yr CO<sub>2</sub> - control)



# What change?





# Adaptation principles: The conservation challenge

*Assumed Stationary Climate*

**Ecological  
Balance**

**Repair  
damaged places**



**Unchanging  
Preservation**

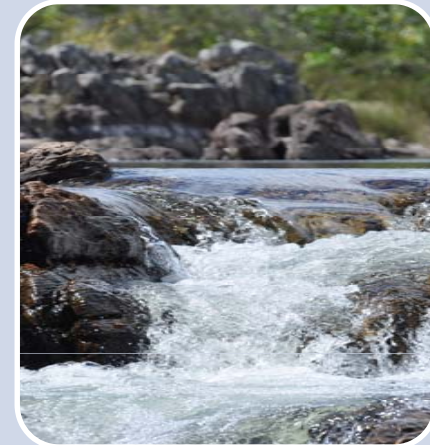
**Preserve  
undamaged places**



*Dynamic Climate*

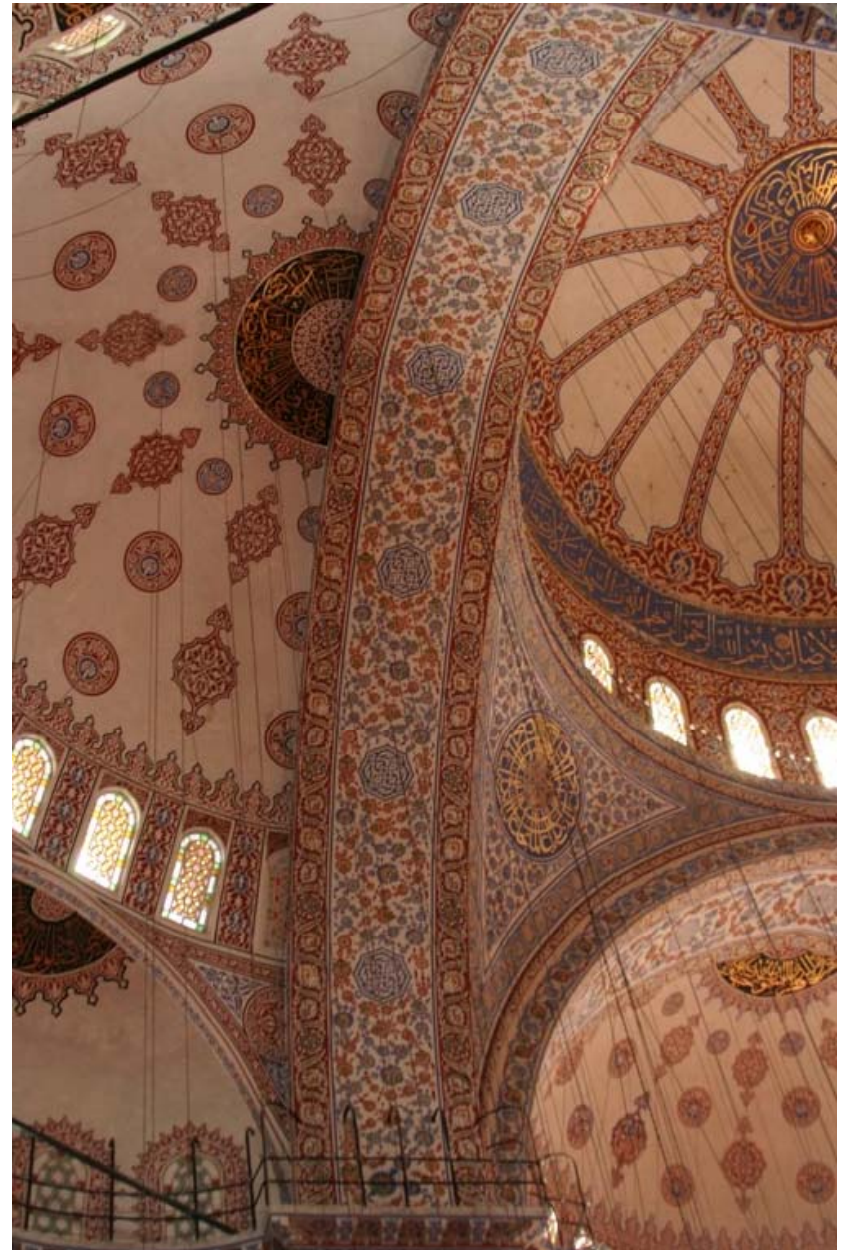
**Facilitating  
Change**

**Promoting &  
maintaining flexibility**



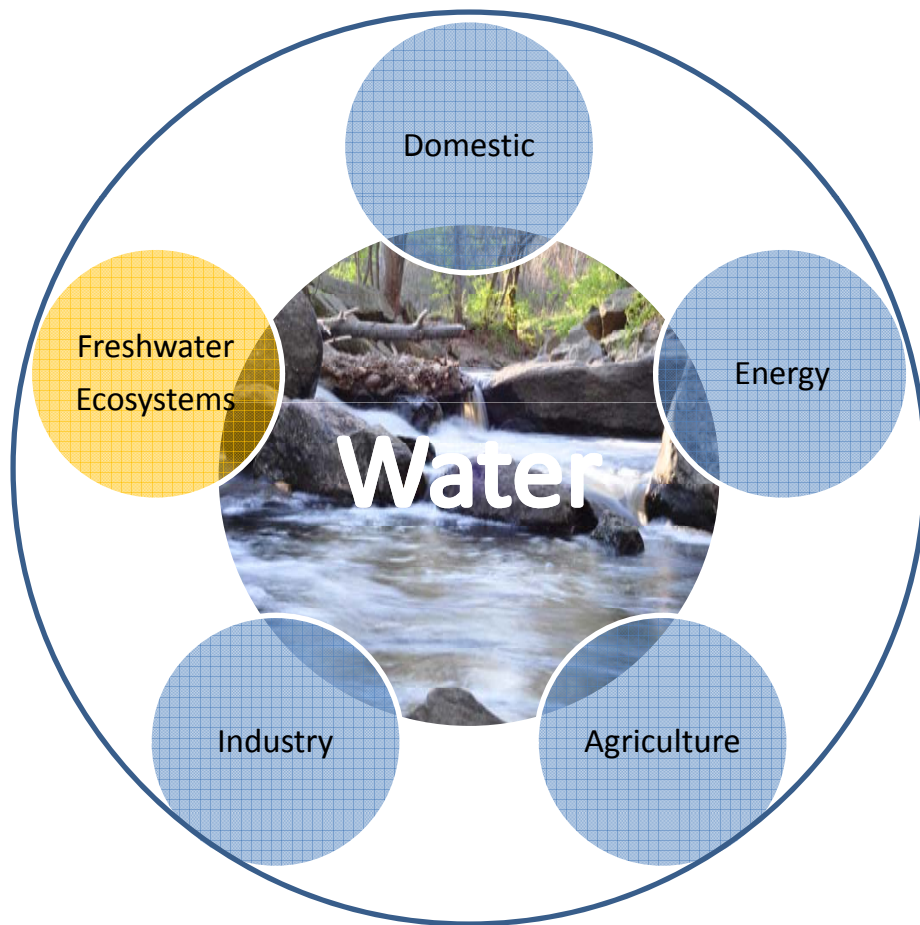
# Adaptation is ultimately an *uncertainty* problem

- **Stationarity** — the assumption that the past is a good guide to the future (Milly et al., *Science*, 2008)
- Our policies, institutions, conservation, and even water infrastructure design and management largely assume ***climate*** stationarity
- We are not able to easily adjust to shifting or emerging climate conditions



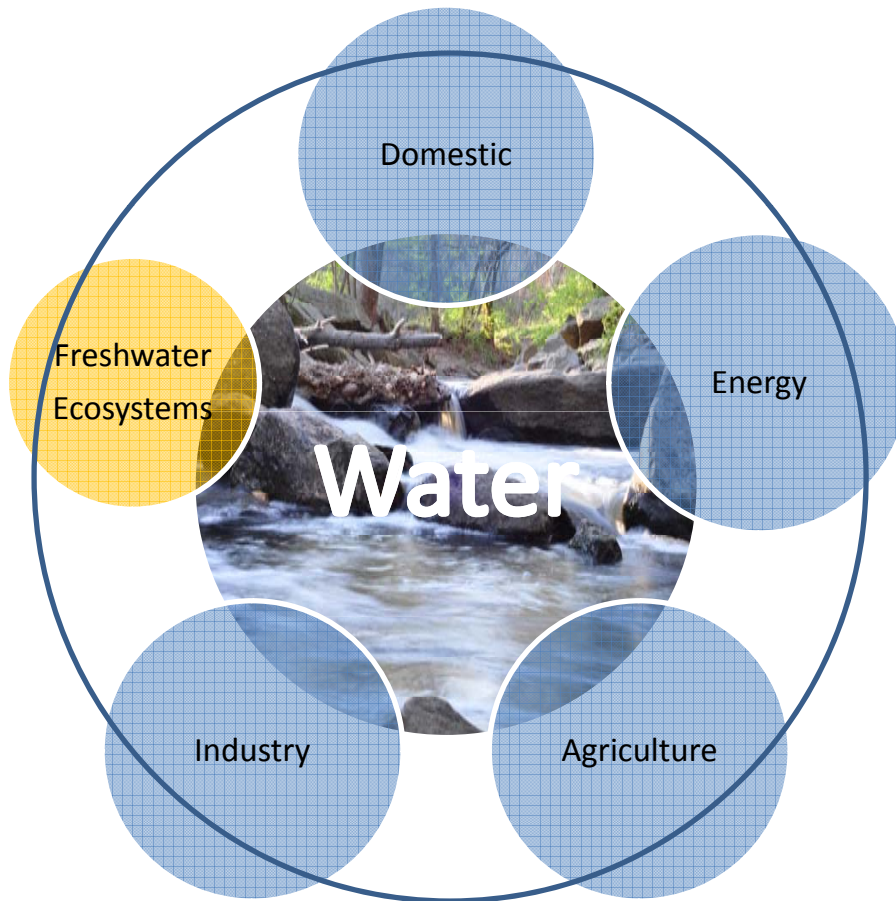
*Blue Mosque, Istanbul, Turkey*

# Role of water



- The water available to **natural freshwater ecosystems** depends on climate and the natural interaction with the landscape
- The water available in **altered basins** depends on how much water is left for ecosystems after other usage needs are satisfied

# Water



- Under changing climate conditions both permanent shifts, as well as episodic unexpected shortages could be expected
- Driven by an increased need for water security alteration of systems could accelerate, and result in **maladaptation**

# Adaptation principles: Two emerging approaches

## Impacts thinking



Long, deterministic,  
singular, quantitative,  
absolute

Top-down

## Adaptation thinking

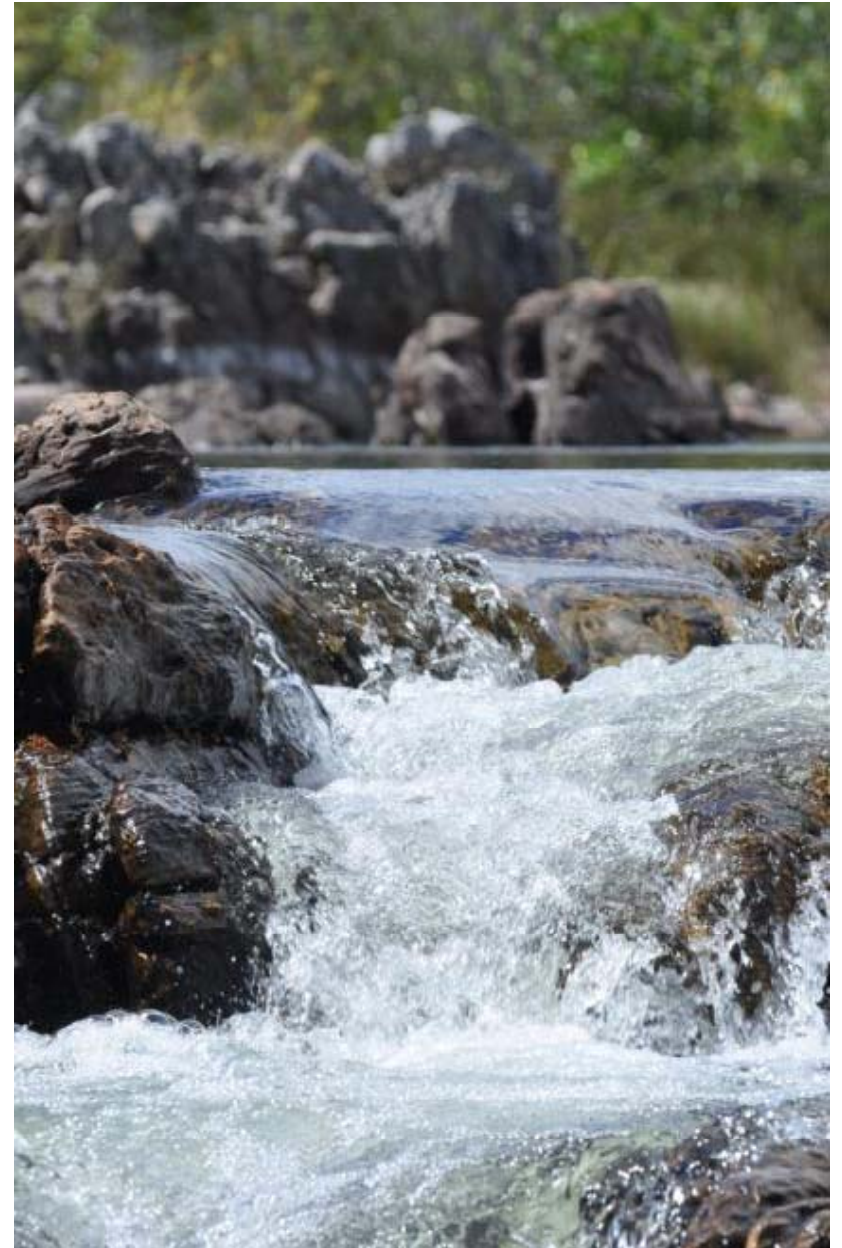


Quick, open-ended,  
continuous, semi-  
quantitative, relative

Bottom-up

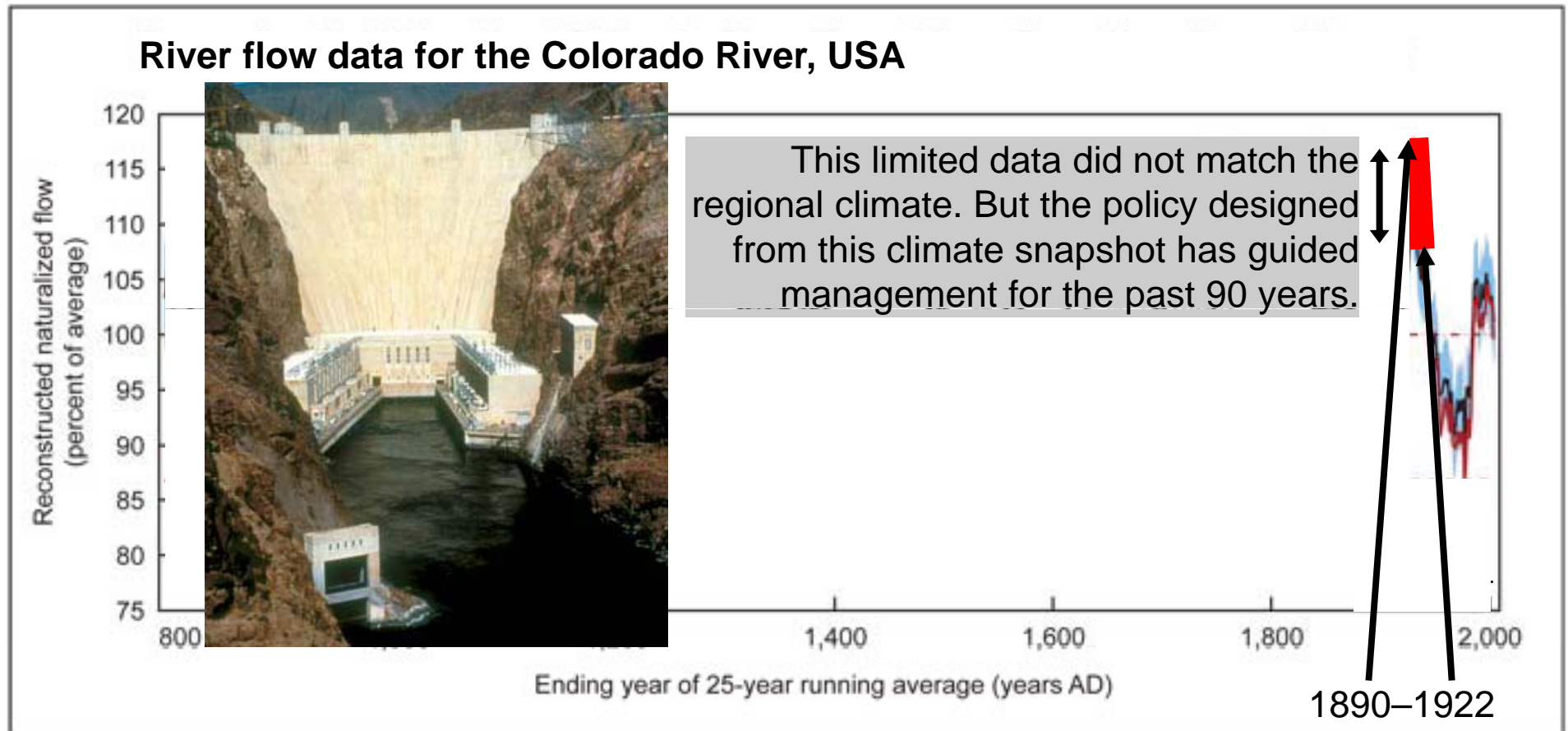
# The climate change opportunity

- Water is the key issue
- A common understanding of the problem
- A common ground for Economical and Human Development and Conservation (Food, Water and Energy Security)
- The water science community holds a wealth of tools, data products and solutions



*Chapada dos Veadeiros, Brazil*

# Infrastructure mal-adaptation



***Most infrastructure has been designed for a single climate future***

# Water Infrastructure and Climate Change:

“Water is the medium through which humans will experience ... most climate change impacts”  
*IPCC, 4th Assessment Report*

Climate Change = Water Change  
*UNECE, 2010*

Water has been the object of human responses to local climate conditions for millennia

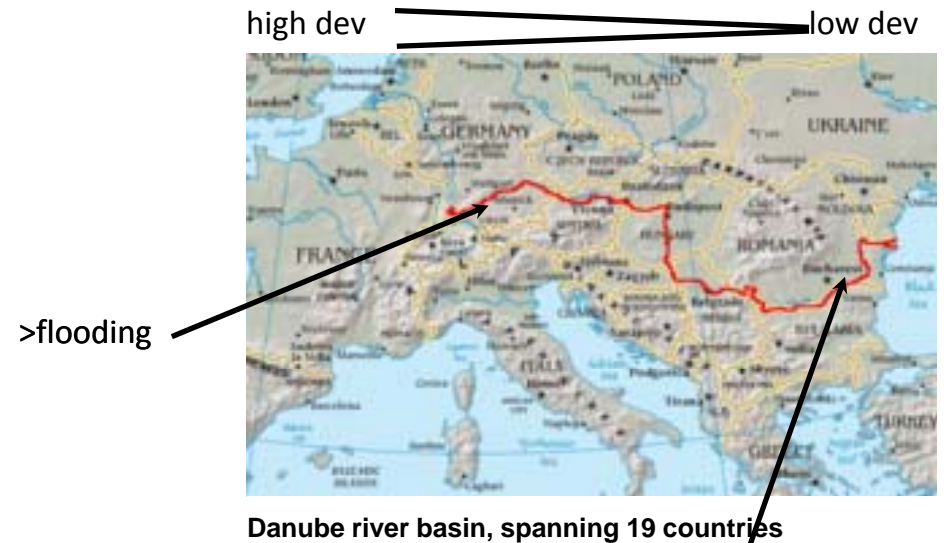
Most bodies of water are actively managed by humans





# Explicitly integrating “soft” infrastructure

- Wetlands can provide some traditional infrastructure needs: flooding, water storage
- Wetlands support essential processes that benefit people in the form of ecosystem services
- Water quality must include monitoring ecosystem health
- For the sustenance of people, ecosystems must be the ultimate stakeholder: we need to keep some water in the ecosystem



# Hard + Soft Infrastructure



- Integrating hard infrastructure with ecosystems (“soft” infrastructure) is a good approach to adaptation
- Integrating ecosystems into infrastructure means:
  - Ecosystems are recognized for supplying critical services
  - Sustainable resources use can respond to shifting climate conditions
- *However*, soft infrastructure:
  - Will not always be the best solution for infrastructure problems

# What happens when institutions do not adapt?

## New Orleans, USA in 2005:

- Policy makers knew the city was not prepared for such an event the size of Hurricane Katrina a year prior.
- Major Development in floodplain regions that were not adequately protected by levees
- What flood protection did exist was inadequate and/or poorly maintained.
- The city was incapable of effectively adjusting their actions in order to preemptively prepare



# Case Study: Restoration of Riparian Wetlands

1950: Chinese engineers channelize the mainstem of a section of the Yangtze river.

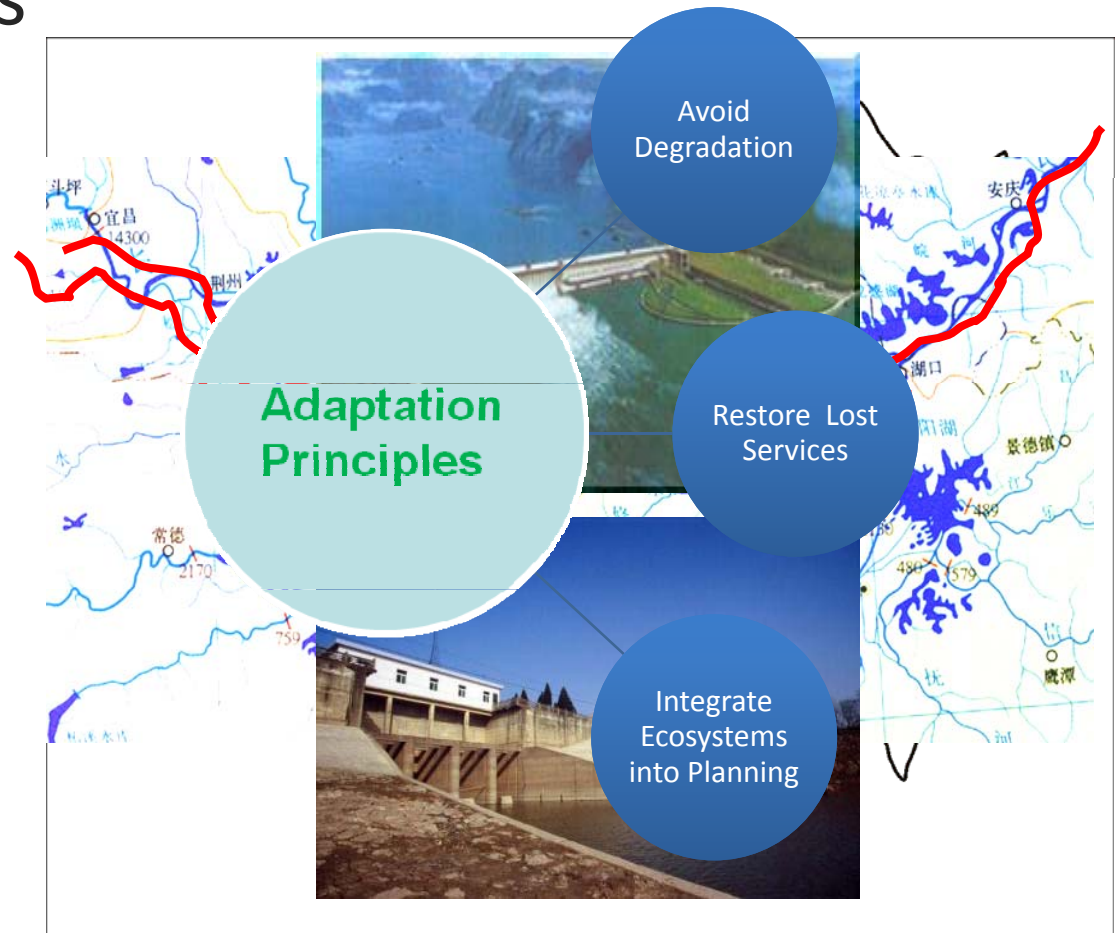
- Separated from networks of lakes and wetlands
- Wetlands drained and converted to farmland.
- Wetlands used for aquaculture programs

1970 -1980's:

- large portions of wetlands are lost.
- Massive flooding risk increases downstream
- Agricultural productivity dropped
- Water quality worsened
- Species started to decline

Presently:

- government is reconnecting the river to the system of wetlands and lakes.
- Wetlands once again providing flood protection services



# Role of wetlands

## Adaptation

- Bioshield (coastal wetlands)
- Water regulation
- Water quality
  - Temperature control
  - Purification
- Habitat

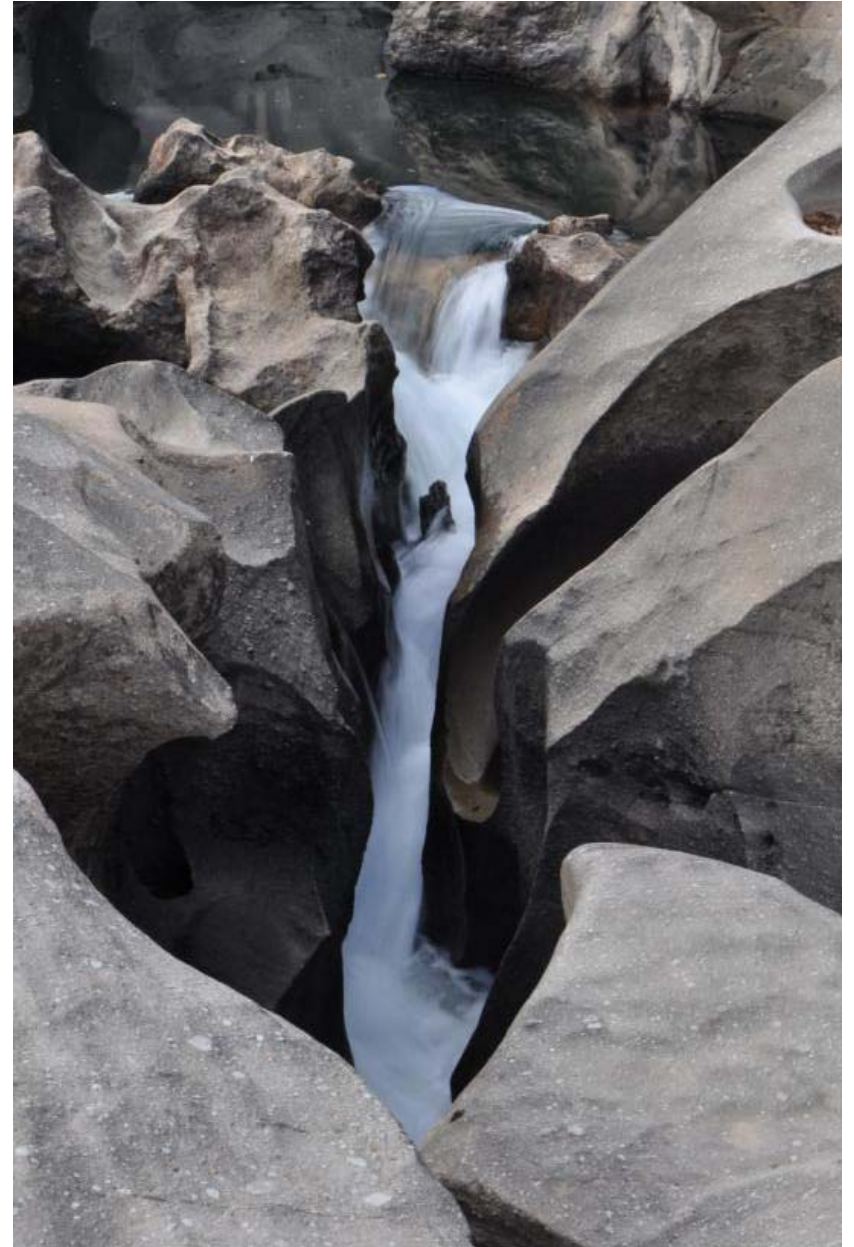
## Mitigation

- Carbon sink



# Adaptation Principles

- **Basin level, cross sectoral planning**, emphasizing the role of freshwater ecosystems and wetlands in particular
- **Avoid degradation** of existing ecosystems
- **Plan for multiple future scenarios:** Infrastructure development should operate under multiple climate and development scenarios
- **Restore lost services** building resilience
- **Monitor and evaluate natural resources regularly**



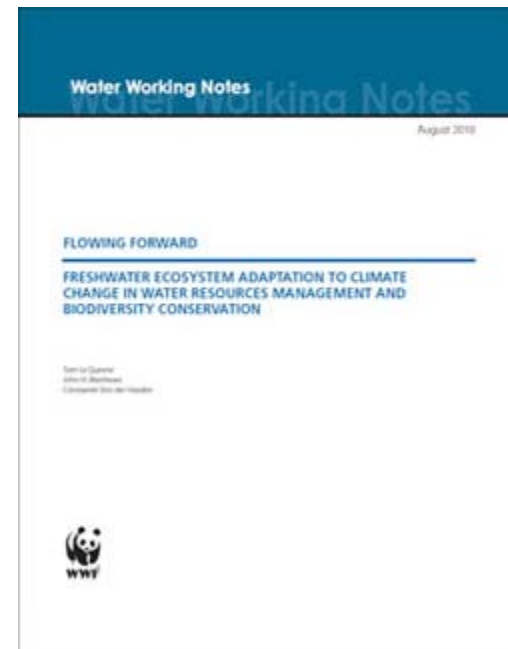
# Flowing forward

WWF-World Bank Report

Flowing Forward:

*Freshwater ecosystem  
adaptation to climate  
change in water resources  
management and  
biodiversity conservation*

[www.flowingforward.org](http://www.flowingforward.org)



Many thanks for your patience



**Special thanks**  
Eugenio Barrios



[bart.wickel@wwfus.org](mailto:bart.wickel@wwfus.org)

[Flowingforward.org](http://Flowingforward.org)

[ClimatePrep.org](http://ClimatePrep.org)

[AdaptationPortal.org](http://AdaptationPortal.org)

[ClimateChangeWater.org](http://ClimateChangeWater.org)





# Objective

- Examinar las experiencias nacionales e internacionales sobre las principales amenazas y los cambios potenciales que enfrentan los humedales frente a los impactos del cambio climático.
  - Otros temas a discutir incluyen las posibles medidas de adaptación que pueden adoptarse ante las variabilidades climáticas, así como el impacto del cambio climático sobre los sistemas de inventario, evaluación y monitoreo.
- Examine national and international experiences on the primary threats and potential changes that wetlands face under the impacts of climate change
  - Other discussion themes are adaptation measures that one could take against climate variability as well as the impacts of climate change on inventory, evaluation and monitoring

# Objetivo

- Intercambiar experiencias que destaquen los impactos del cambio climático sobre los humedales.
  - Identificar los componentes conceptuales y metodológicos más importantes para emprender medidas de adaptación ante las variabilidades climáticas.
  - Hacer recomendaciones de aplicación ante el impacto de cambio climático para el Inventario Nacional de Humedales.
- Exchange experiences that emphasize the impacts of climate change on wetlands
  - Identify the most important concepts and methods to start taking adaptive actions against climate variability
  - Provide recommendations of action against climate change for the National Wetland Inventory

# Preguntas

- ¿Cuáles son los efectos del cambio climático para los humedales en México?
- ¿Qué debe hacer el país ante estos cambios?
- ¿Cómo puede el país pagarlo?
- What are the impacts of climate change on wetlands in Mexico?
- What can we do at a national level against these changes?
- How can we finance this?