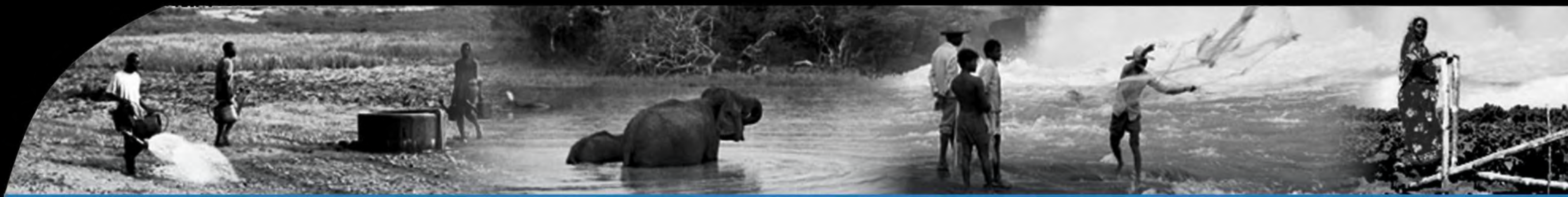


Water and food security: integrated scientific and governance based solutions

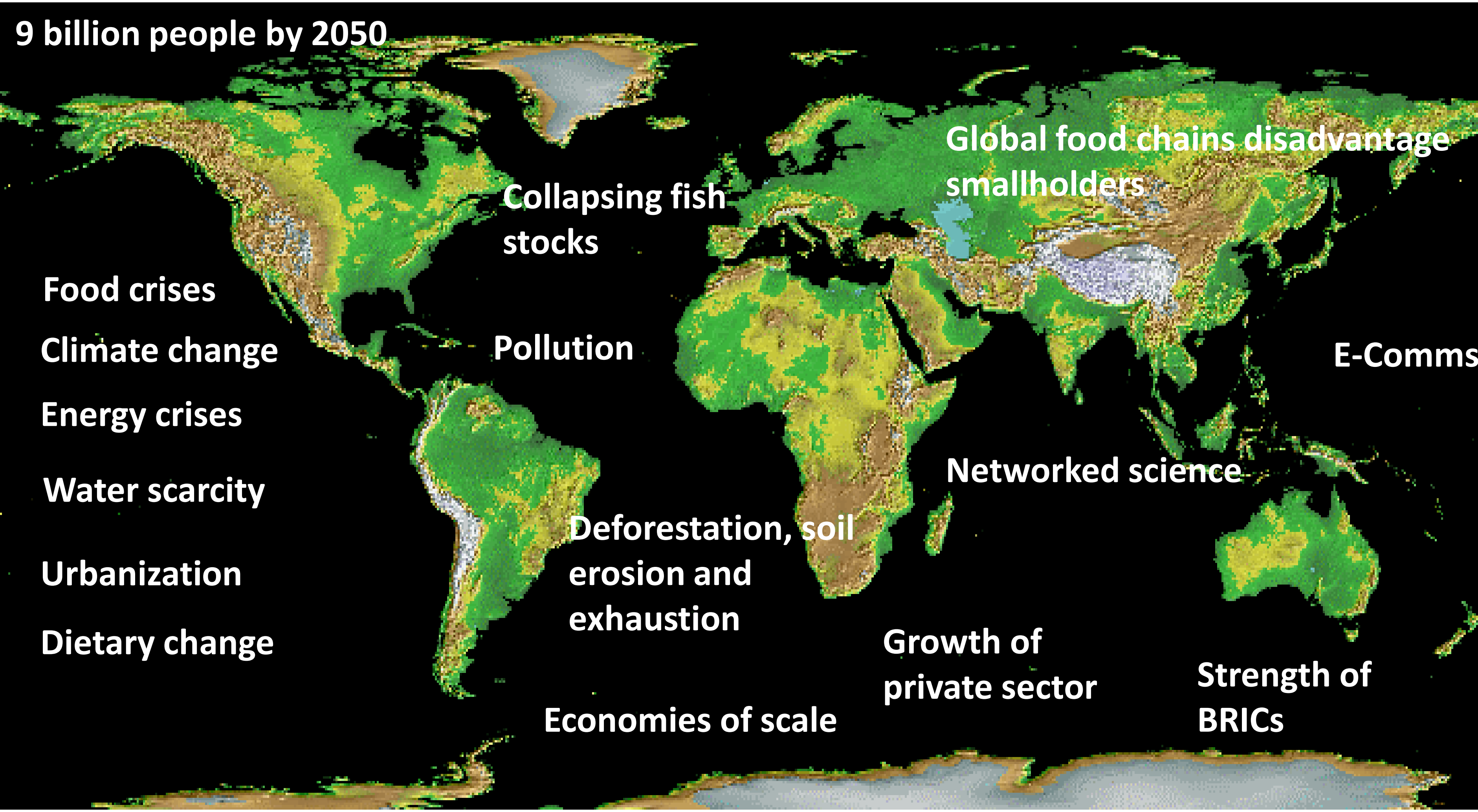
Colin Chartres

International Water Management Institute

Contents

- Drivers of food and water scarcity
- Water and climate change
- A global paradox and a challenge
- Adapting to challenges
  - Technology and investment
  - Incentives
  - Governance
- Six Solutions

We are living in a fast changing world



increasing challenges – increasing opportunities

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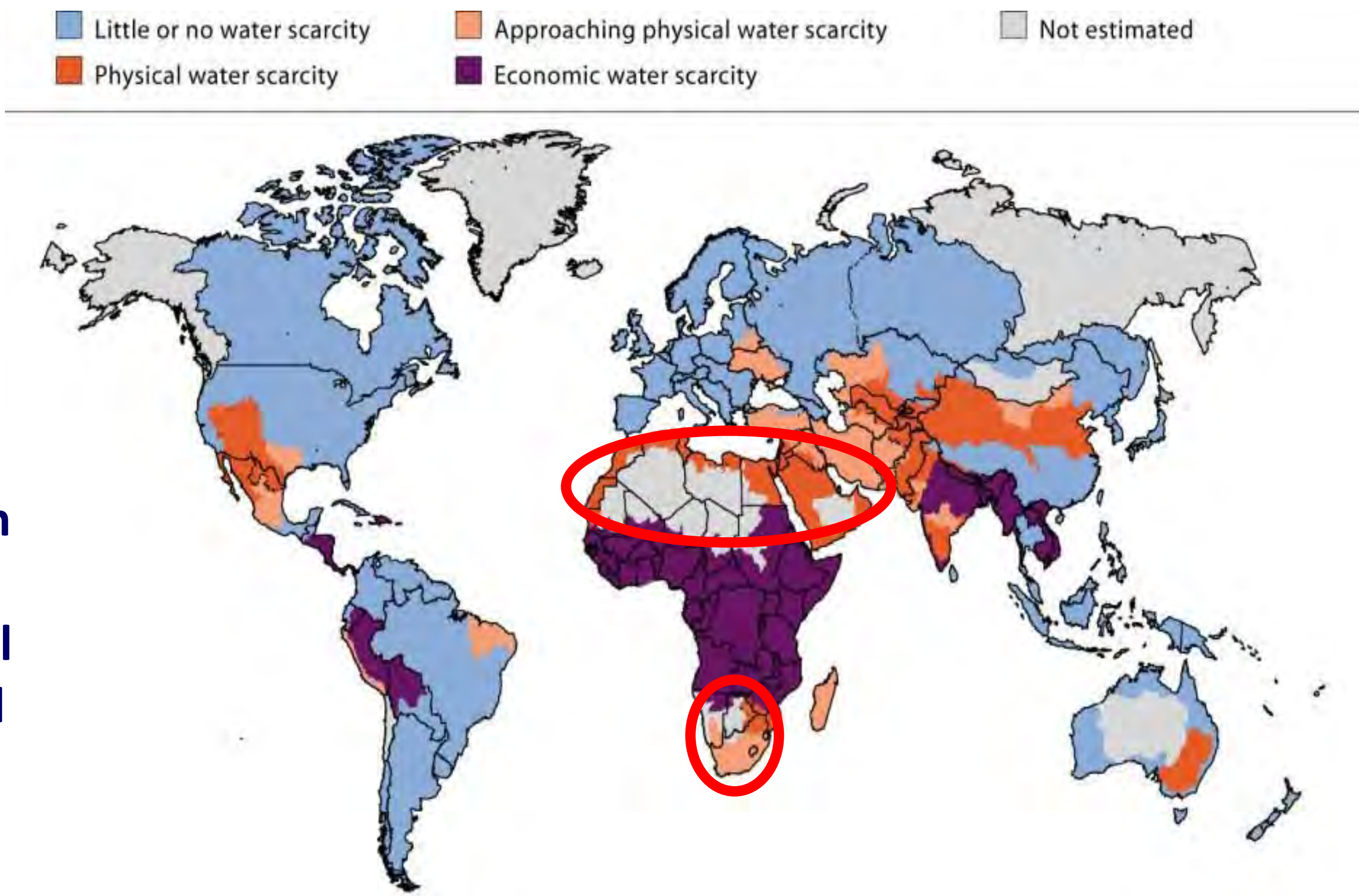
Water scarcity

Physical scarcity: Water resources development approaching or exceeding sustainable limits

Economic Scarcity: Water resources can meet needs; but human, institutional and financial capital lacking to actually harness and use these resources



Source: Water for Food, Water for Life, IWMI, 2007

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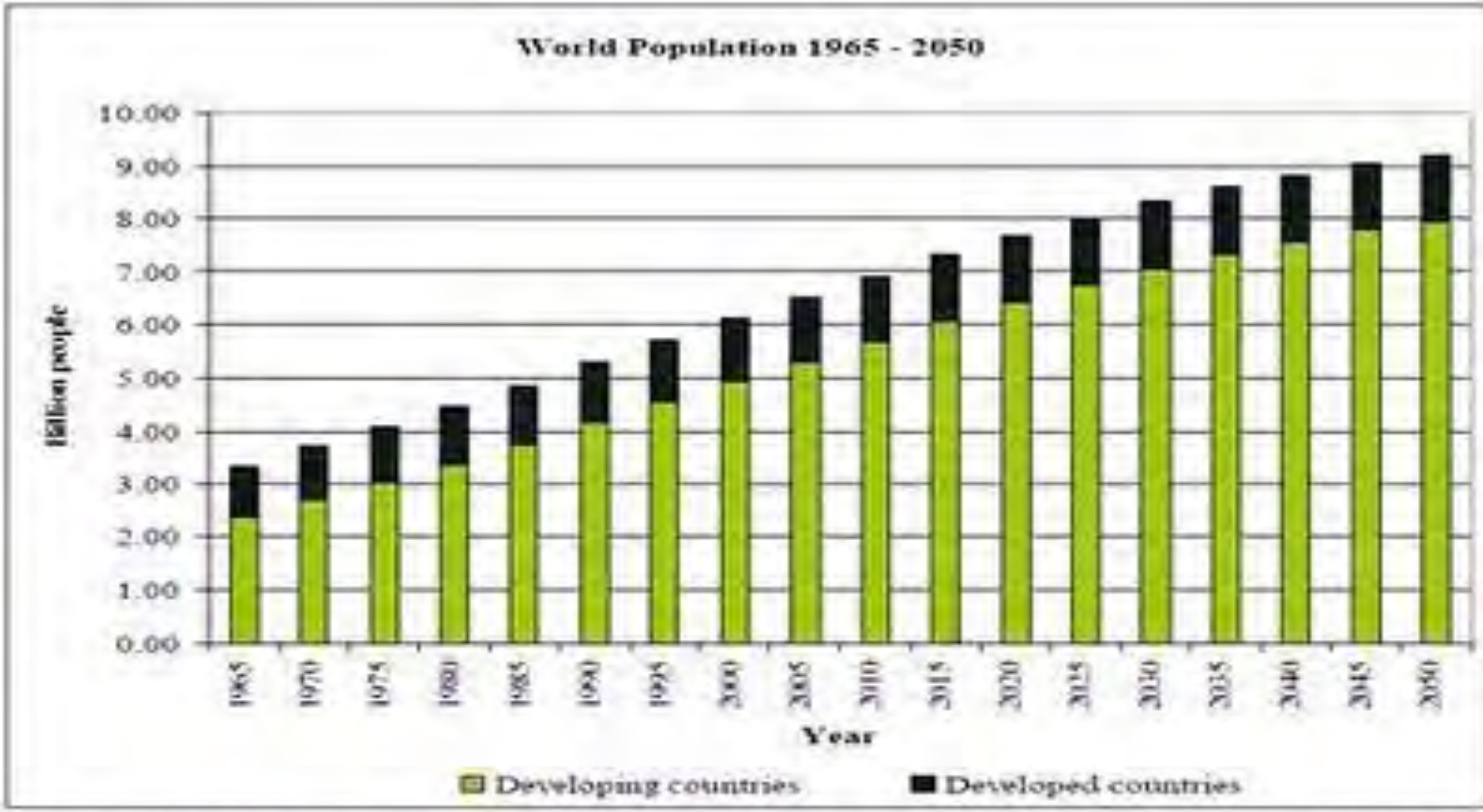
Drivers of Food and Water scarcity

The major drivers of water scarcity and food security are:

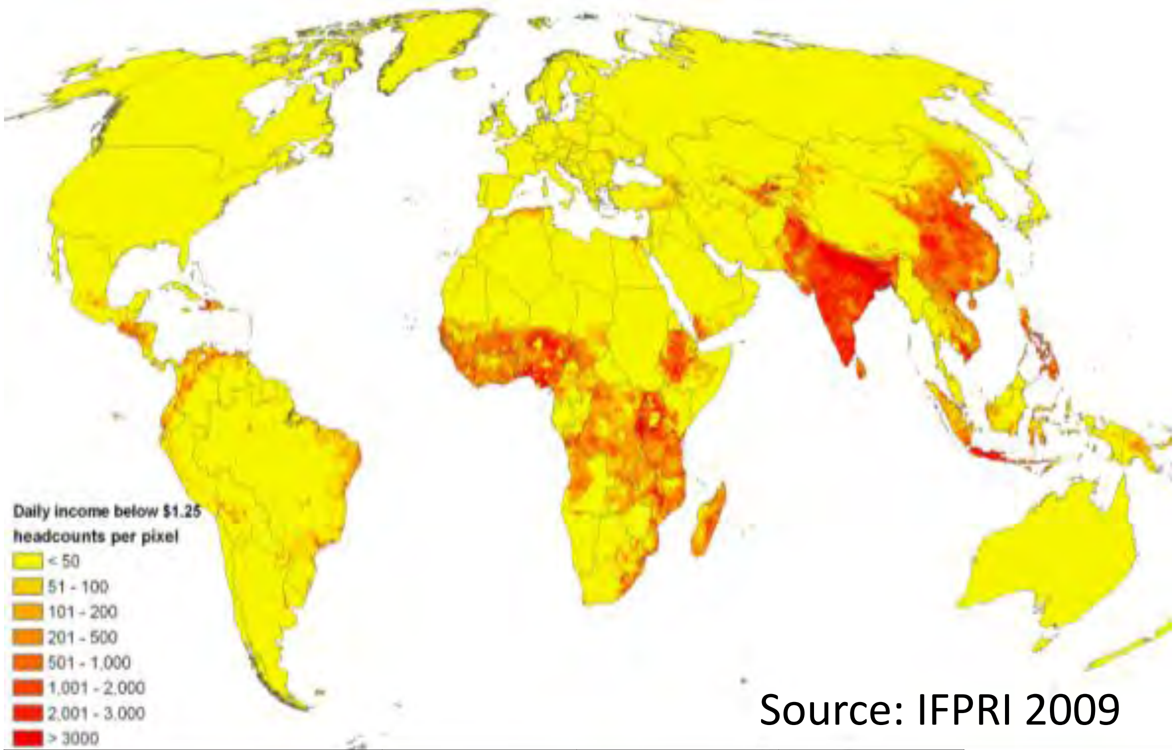
- Population growth (6.7 b today to 9.0 b in 2050)
- Dietary change
- Urbanisation
- Globalisation
- Biofuel production
- Climate Change

Global Population



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007)

Poverty and Population

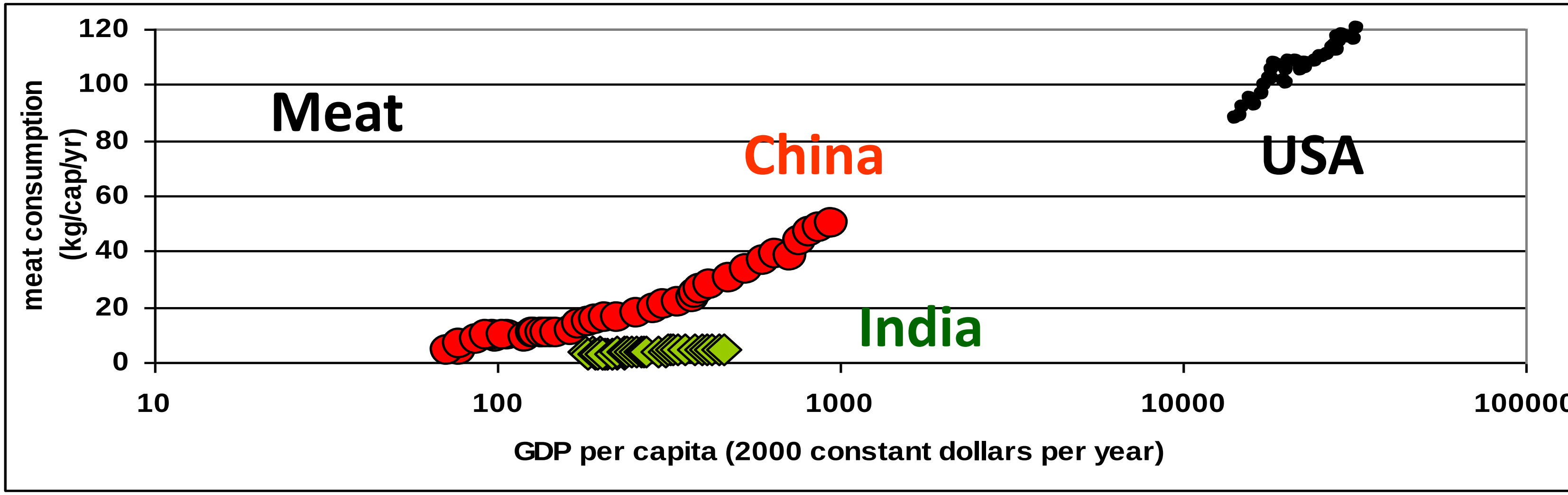


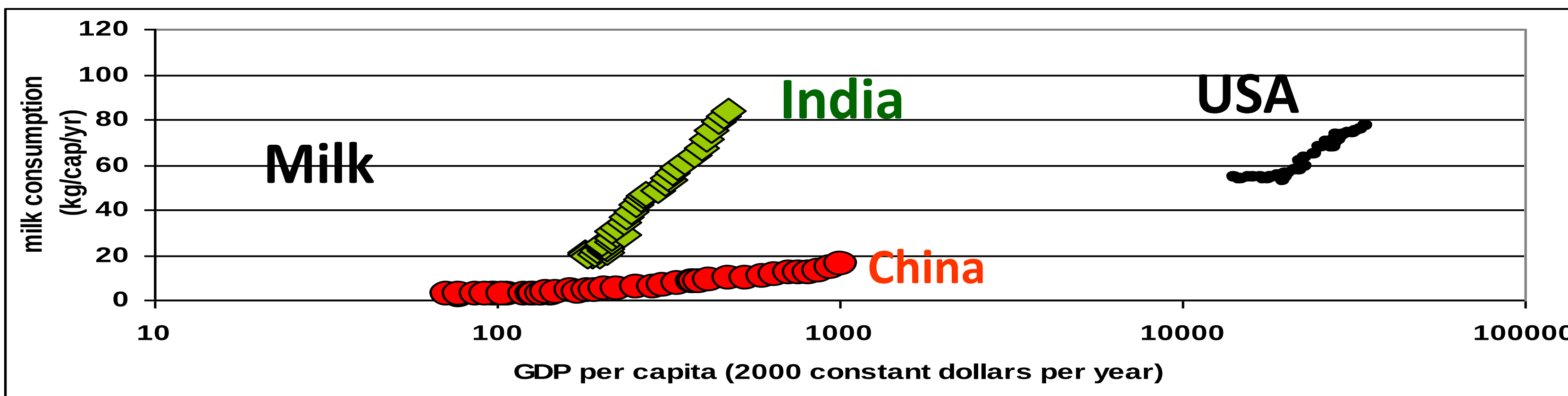
Source: IFPRI 2009

Population growth, dietary change, and poverty and malnutrition will be key drivers with respect to agriculture

Region	Pop. m 2009	Pop. m 2050	Growth
Africa	1010	1998	98%
Asia	4121	5231	27%
Europe	732	691	- 5%
LA and Caribbean	582	729	25%

Consumption and income 1961-2000





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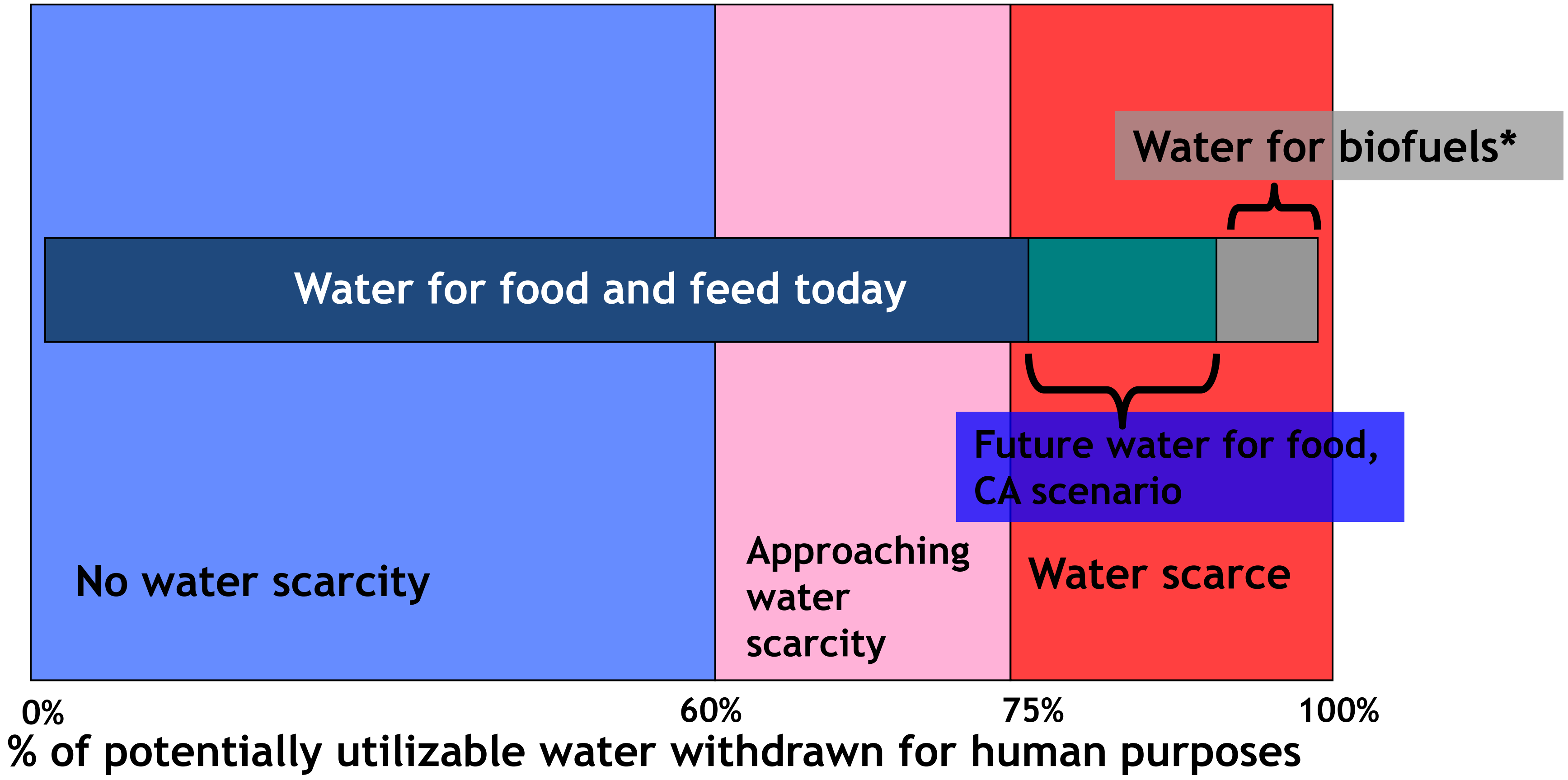
Biofuels: India: and in 2030 (WaterSim analysis by IWMI).

Green solution with blue impacts!

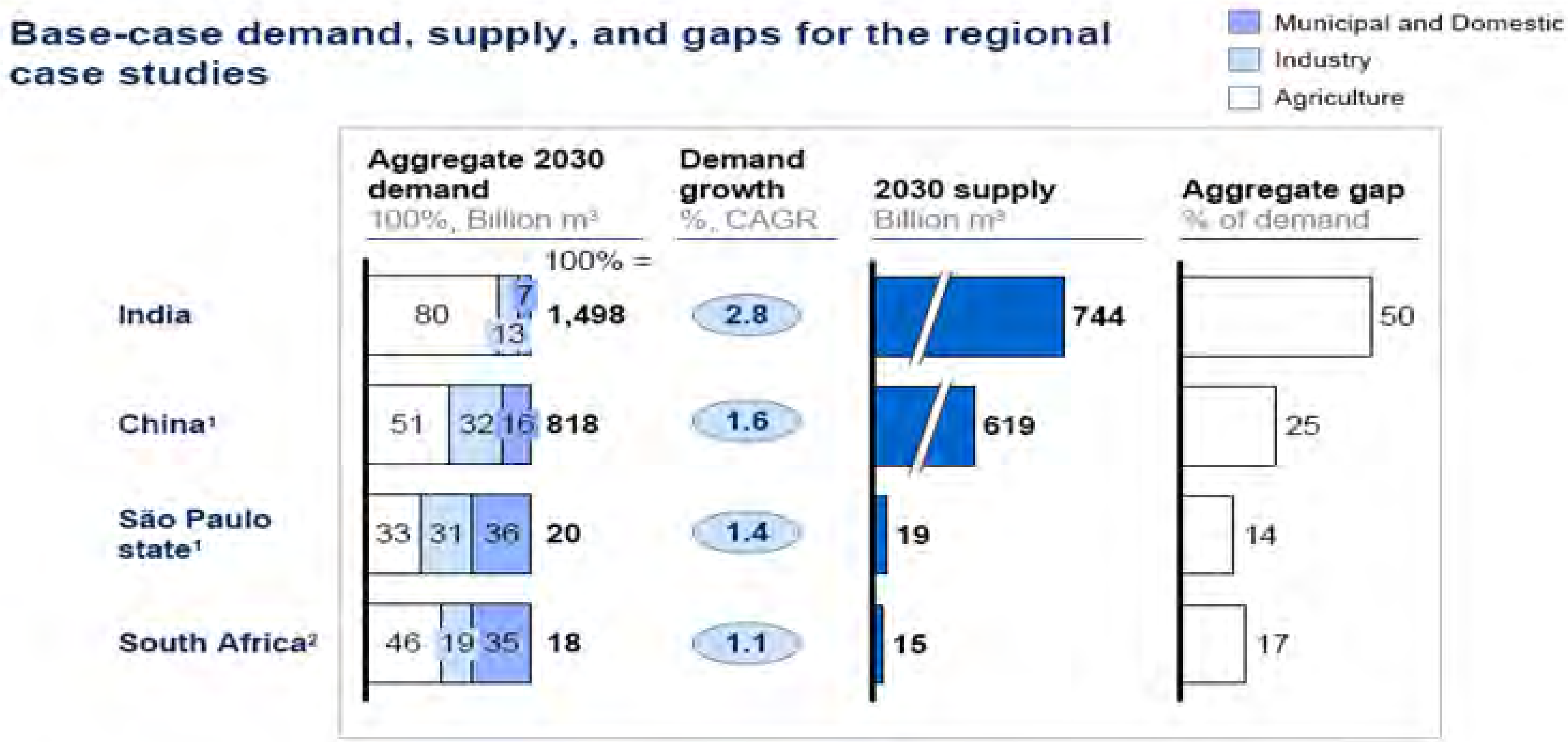


*Assumes that 10% of gasoline demand is met by biofuels by 2030

Water needs for biofuel production, but a word of caution .....

	liters of ET	Liters of Irrigation water
China	3800	2500
India	4100	3500
US	1750	300
Brazil	2250	200

Issue identification: Water supply vs. demand gaps



1 Gap greater than demand-supply difference due to mismatch between supply and demand at basin level
2 South Africa agricultural demand includes a 3% contribution from afforestation
SOURCE: 2030 Water Resources Group

McKinsey & Company 2

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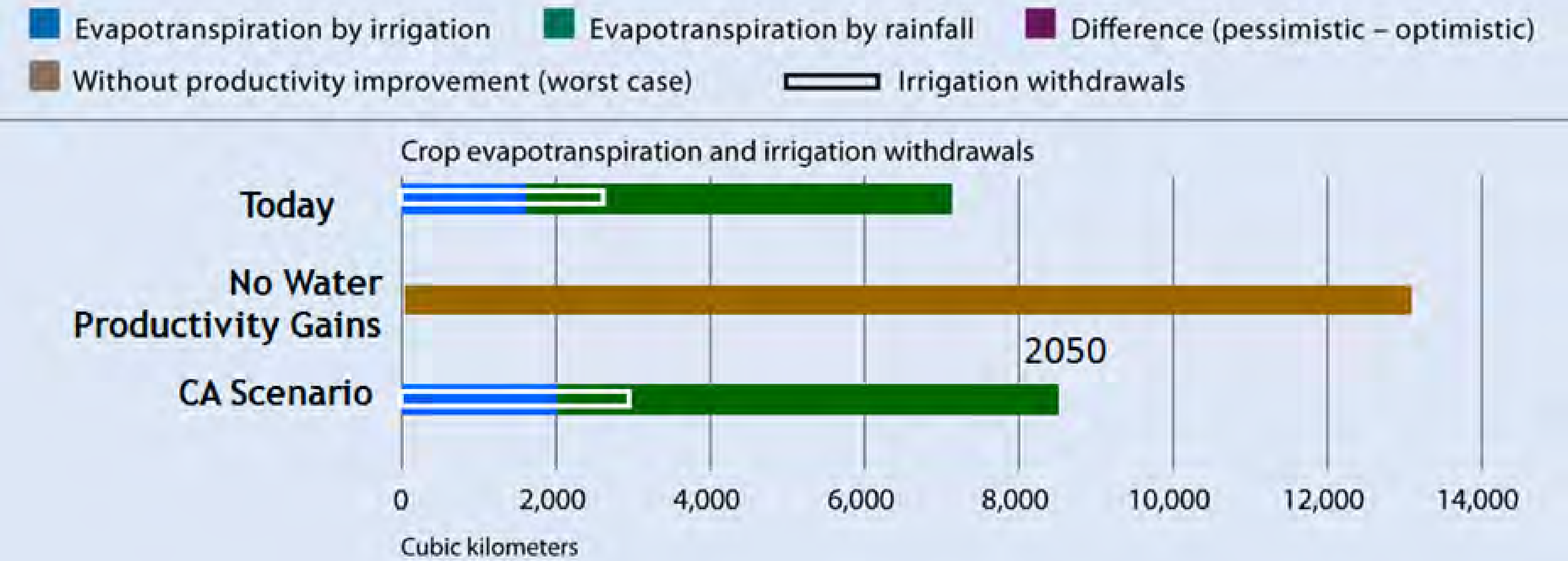
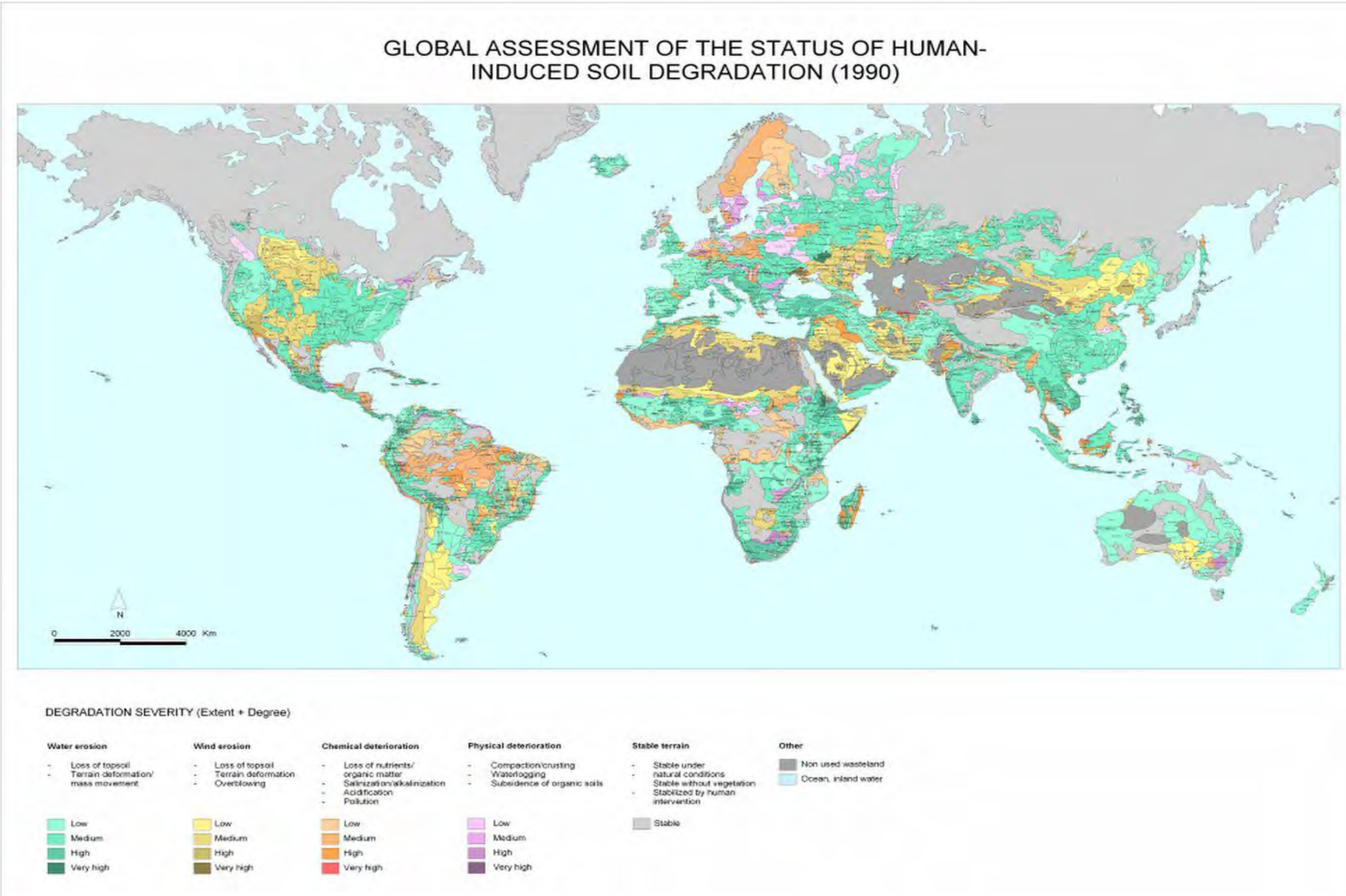
Comprehensive Assessment Scenario: Policies for productivity gains, upgrading rainfed areas, revitalized irrigation & trade



Based on WaterSim analysis for the Comprehensive Assessment of Water Management in Agriculture

Other Key Factors



The Global Paradox and Challenge

Feeding c.2.5 billion more people with

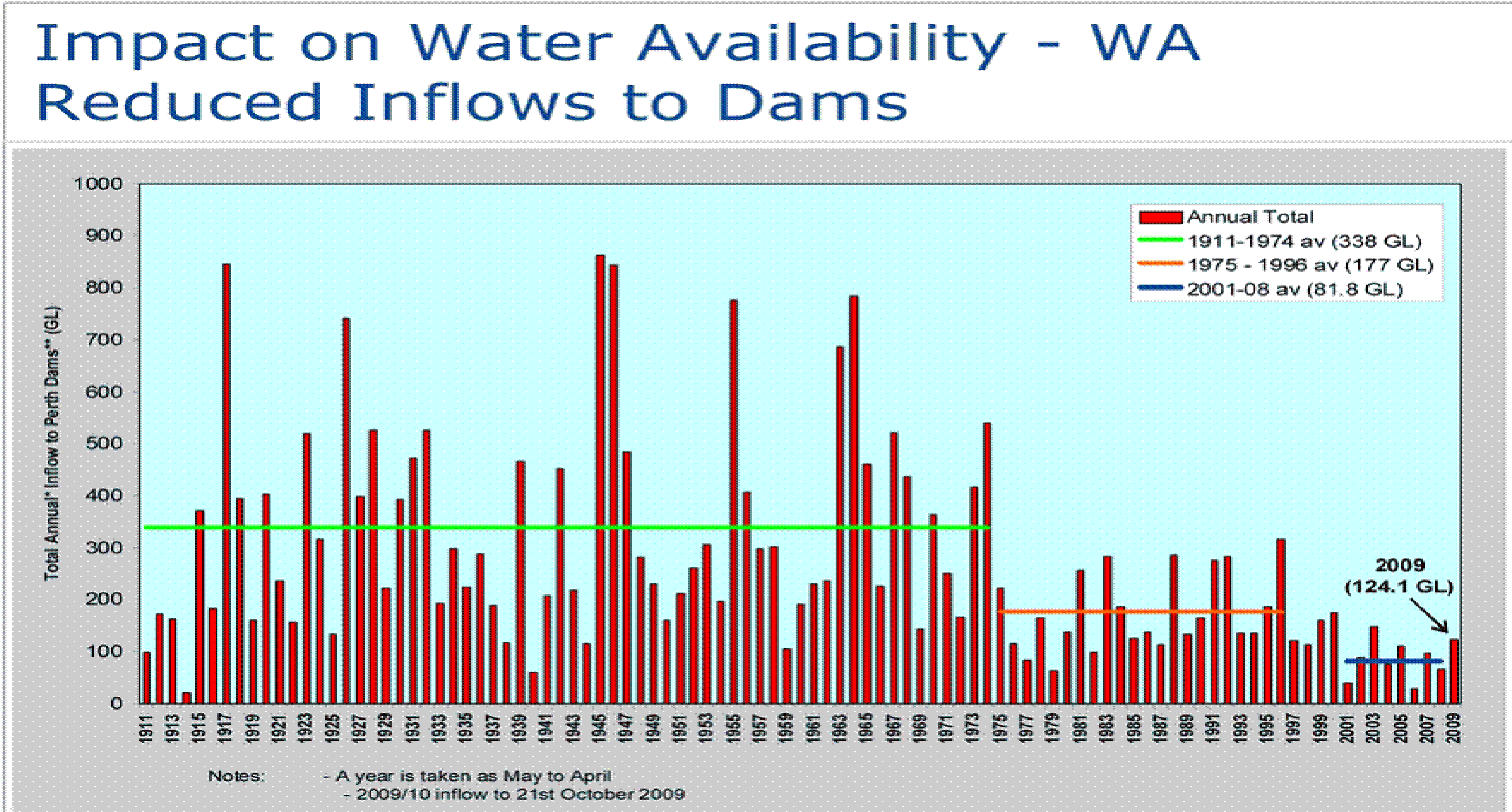
less

water for agriculture than we have now

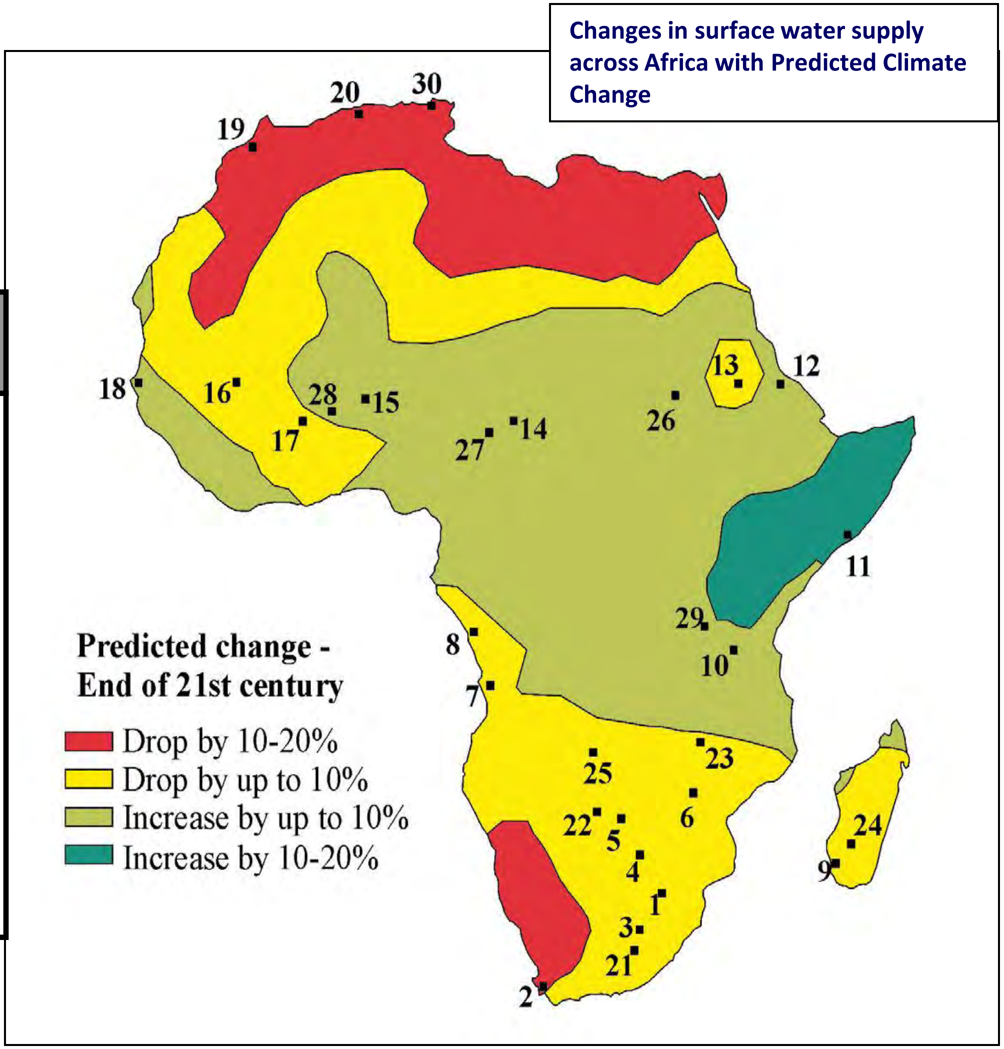
in

an era of climate change

How will climate change impact Africa's water resources?



African Scenarios – uncertainty is the keyword!



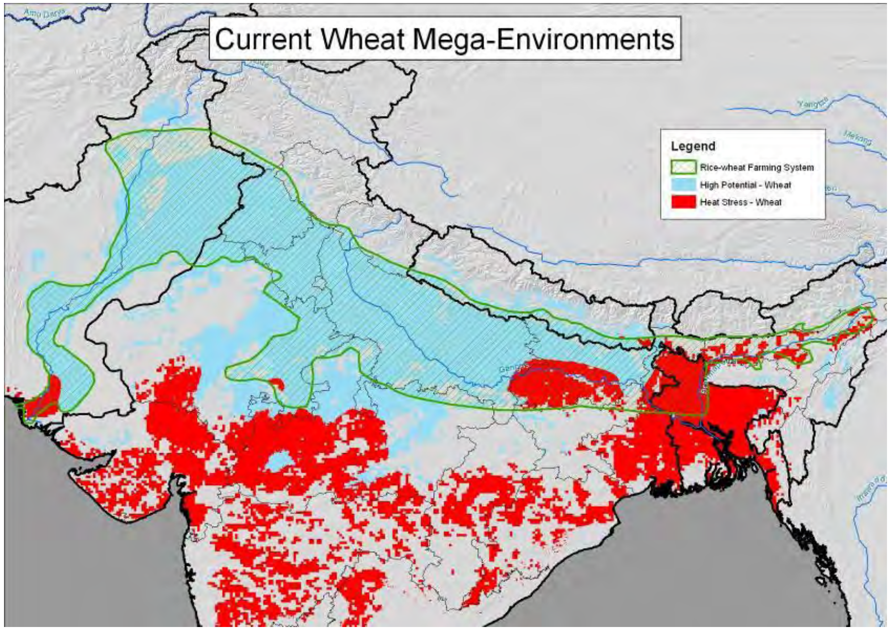
Increases and decreases:

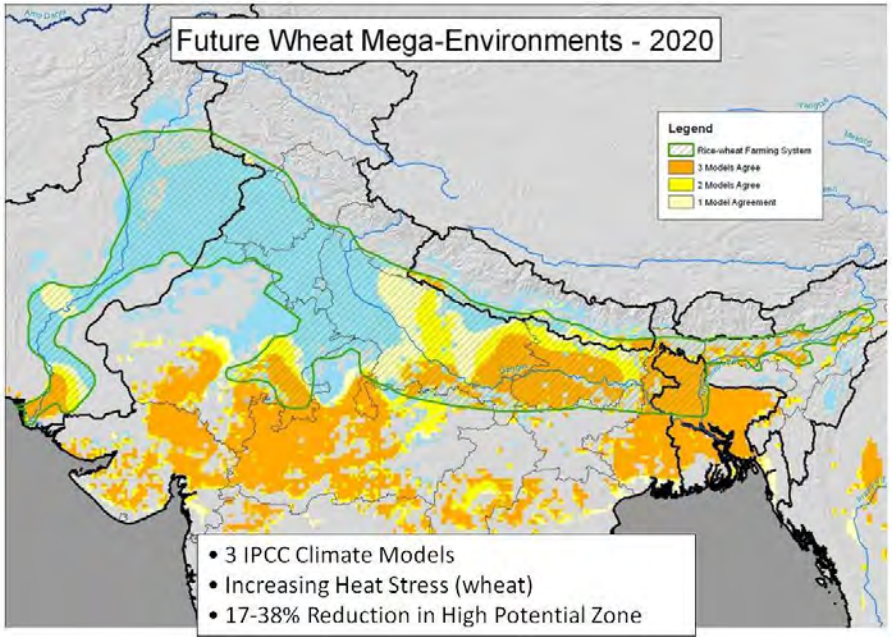
Small changes in temperature will see average river flows and water availability *increase* by 10-40% in some regions, while in others there will be a *decrease* of 10-30%

Source: Maartin de Wit and Jacek Stankiewicz
www.scienceexpress.org/2March2006/Page1/10.1126/science1119929

Specific challenges to wheat in South Asia

- Wheat in developing countries most strongly affected by climate change
  - 2025: USD 15-20 billion losses pa (12–16%)
  - 2050: USD 32-48 billion losses pa (20–30%)
  - 10% Yield potential loss for every C^0 increase





Courtesy Dr M Banziger, CIMMYT

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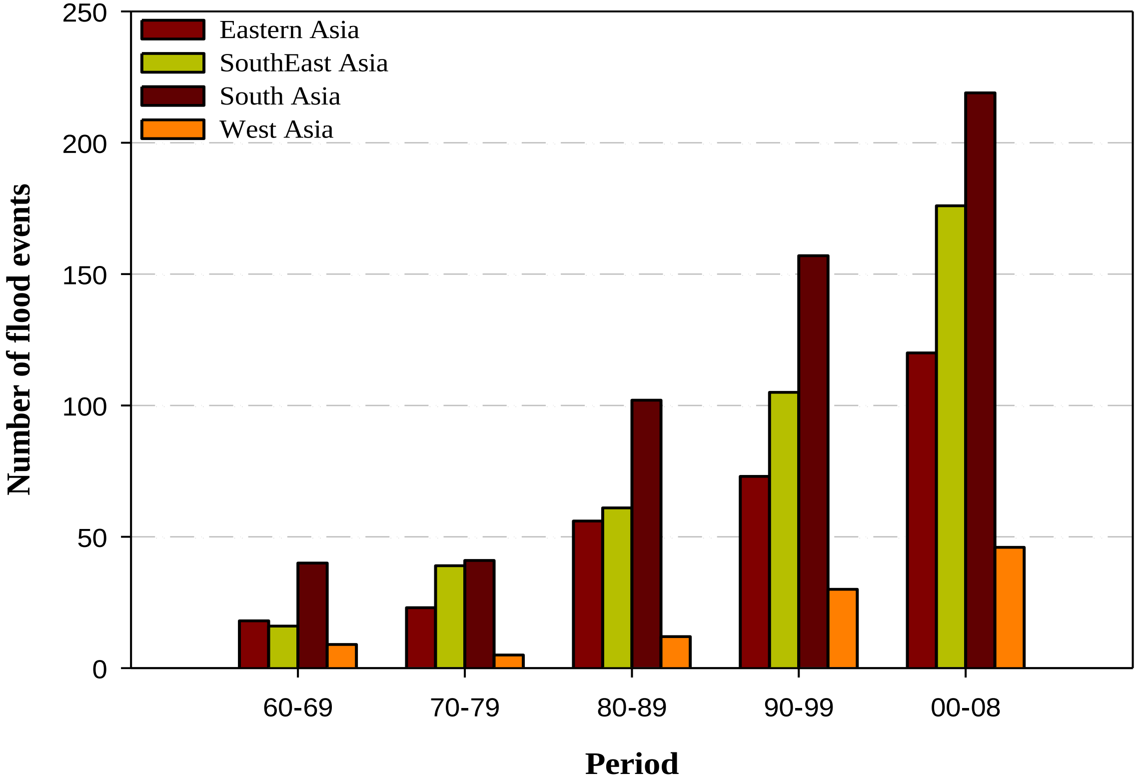
Vulnerability and floods



Flood disaster trend in Asia in the last 48 years

Source: Sharma and Sharma (2008)

How can we adapt to the challenges?

1. **Technology and investment**

   Investing in water storage

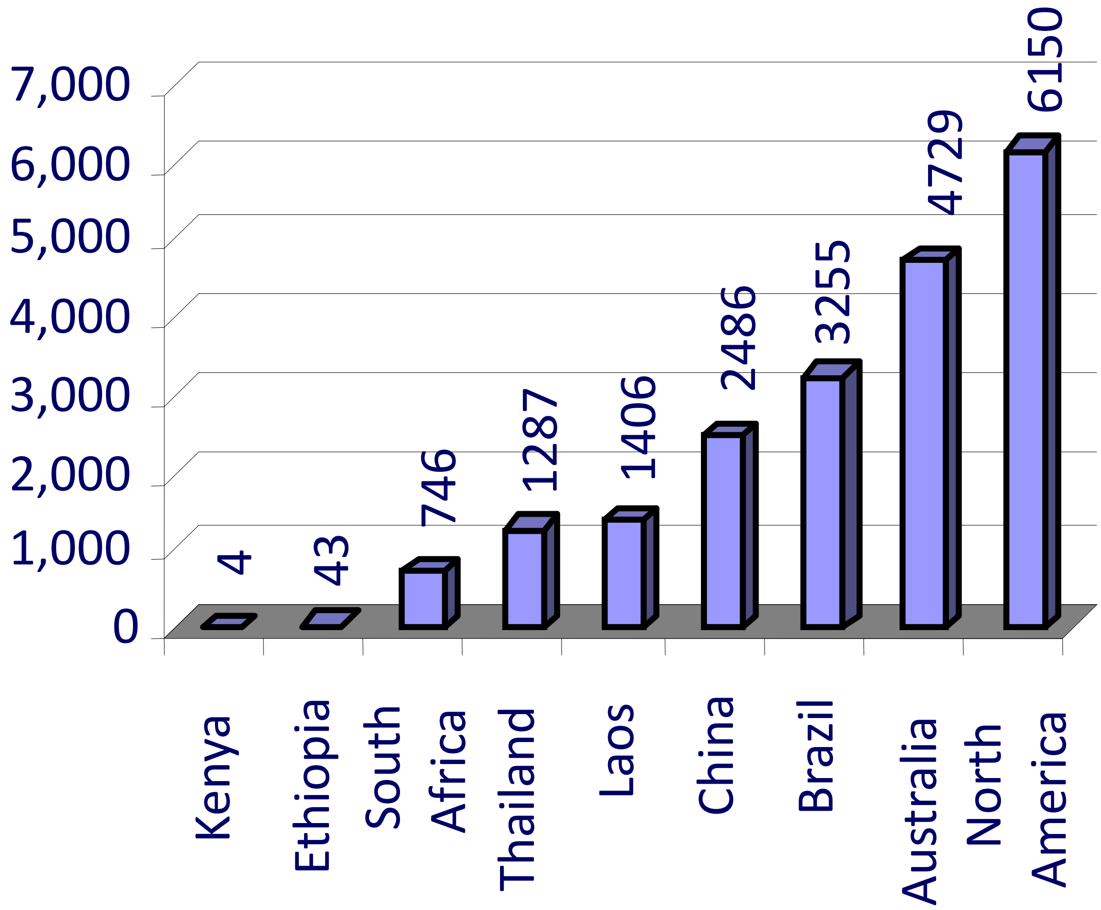
2. **Governance and Institutional Changes**

   Jyotigram in Gujarat, India

   Ferghana Valley, Central Asia

Technology and Investment – investing in water storage

Low per capita storage (m^3/capita)



World Bank (2003)

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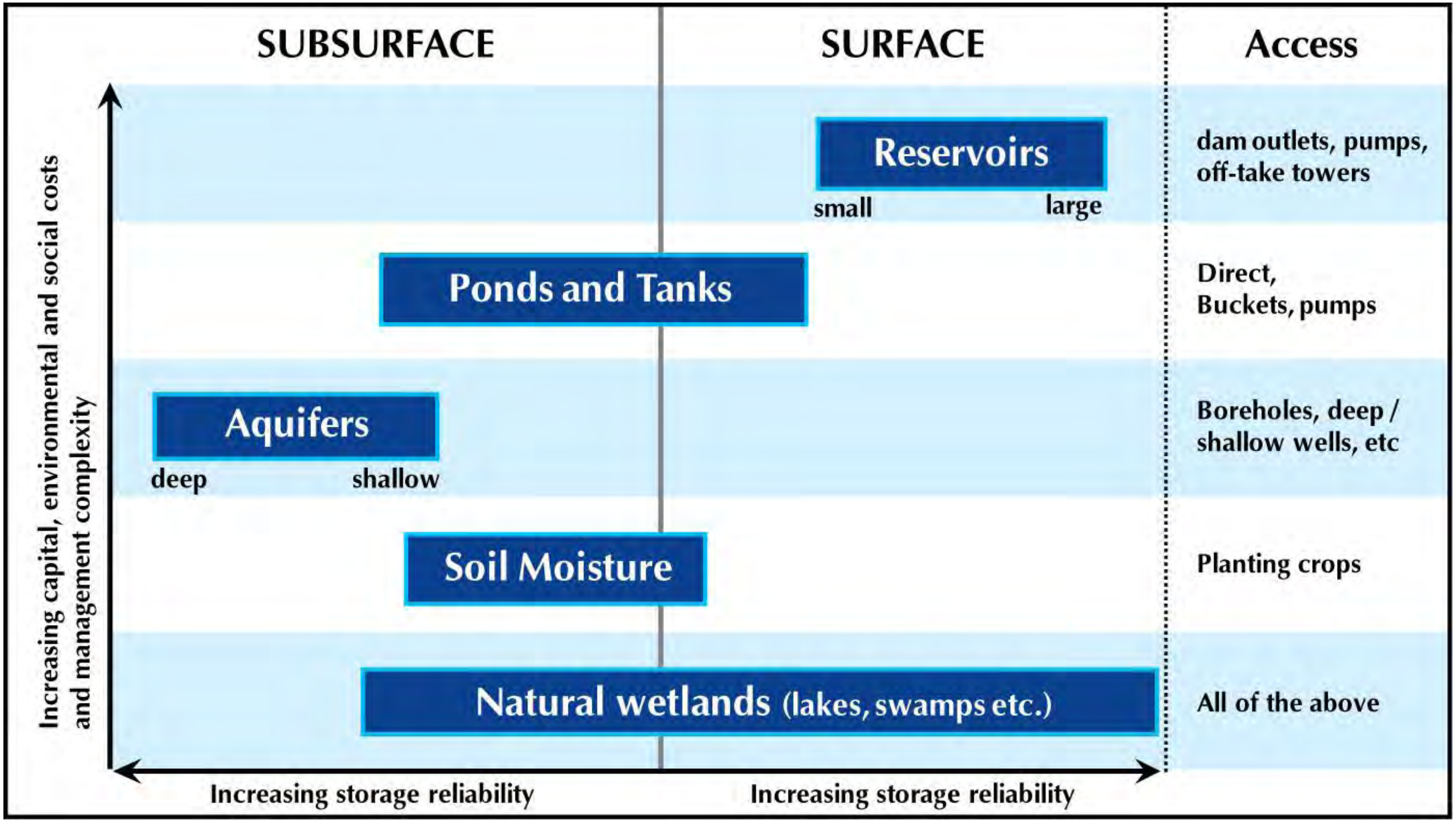
Water Storage continuum for adaptive management



Source: McCartney and Smakhtin (2010)

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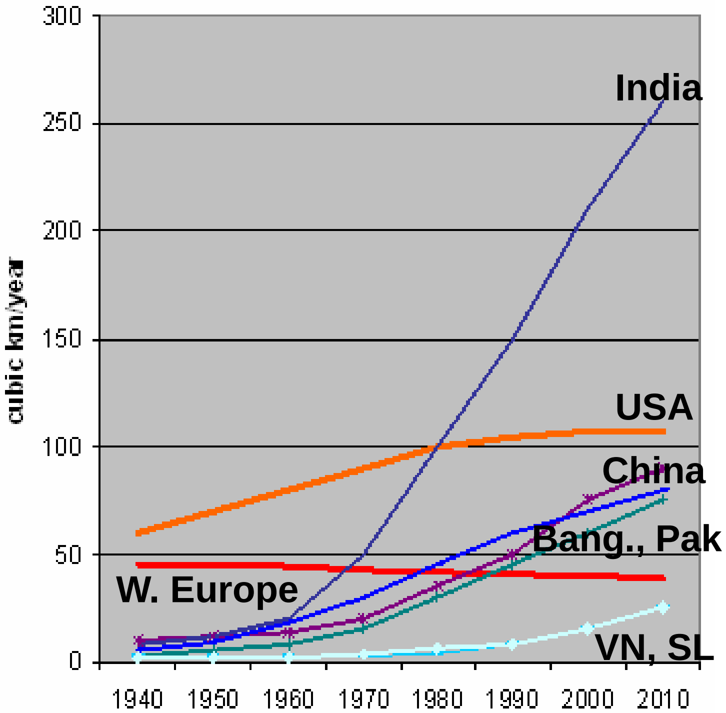
Evaluating Climate Change Options: the case of groundwater in India

Groundwater use in Asia



CC and water storage alternatives

Measurable criteria	Small Surface Storage	Large Dams	Managed Aquifers
Water where needed	3	2	5
Water when needed	1	2	5
Level of water control	1	2	5
Non-beneficial losses – e.g. evaporation	-4	-2	-1
Protection against a single annual drought	1	2	5
Protection against successive droughts	-1	1	4
Ease of recovery during monsoon	5	4	3
Other			

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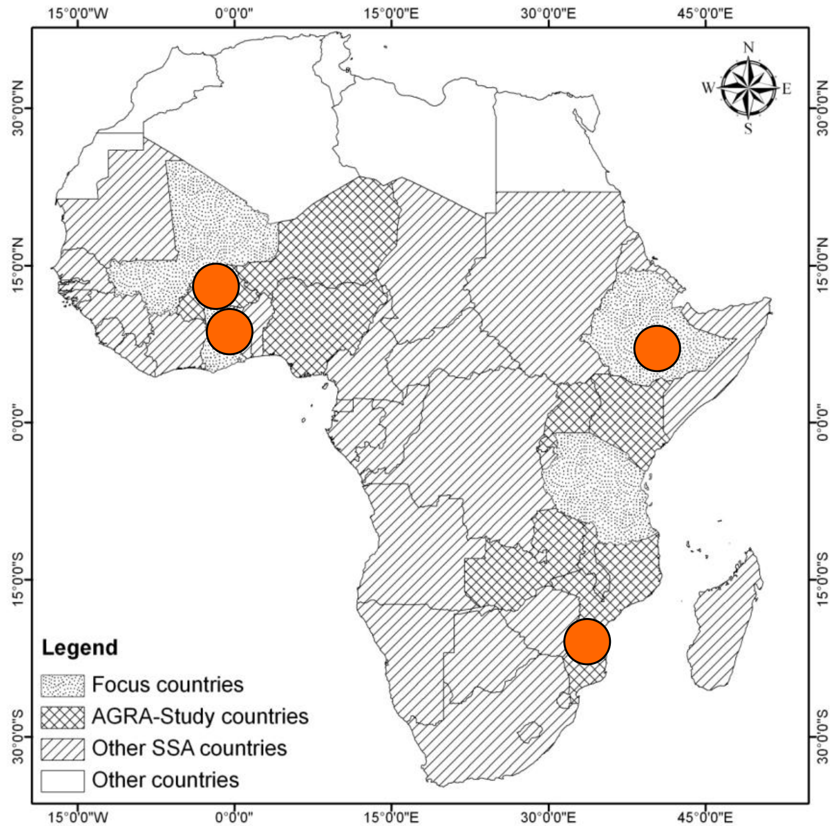
Groundwater in SSA for small-scale agriculture

Research includes

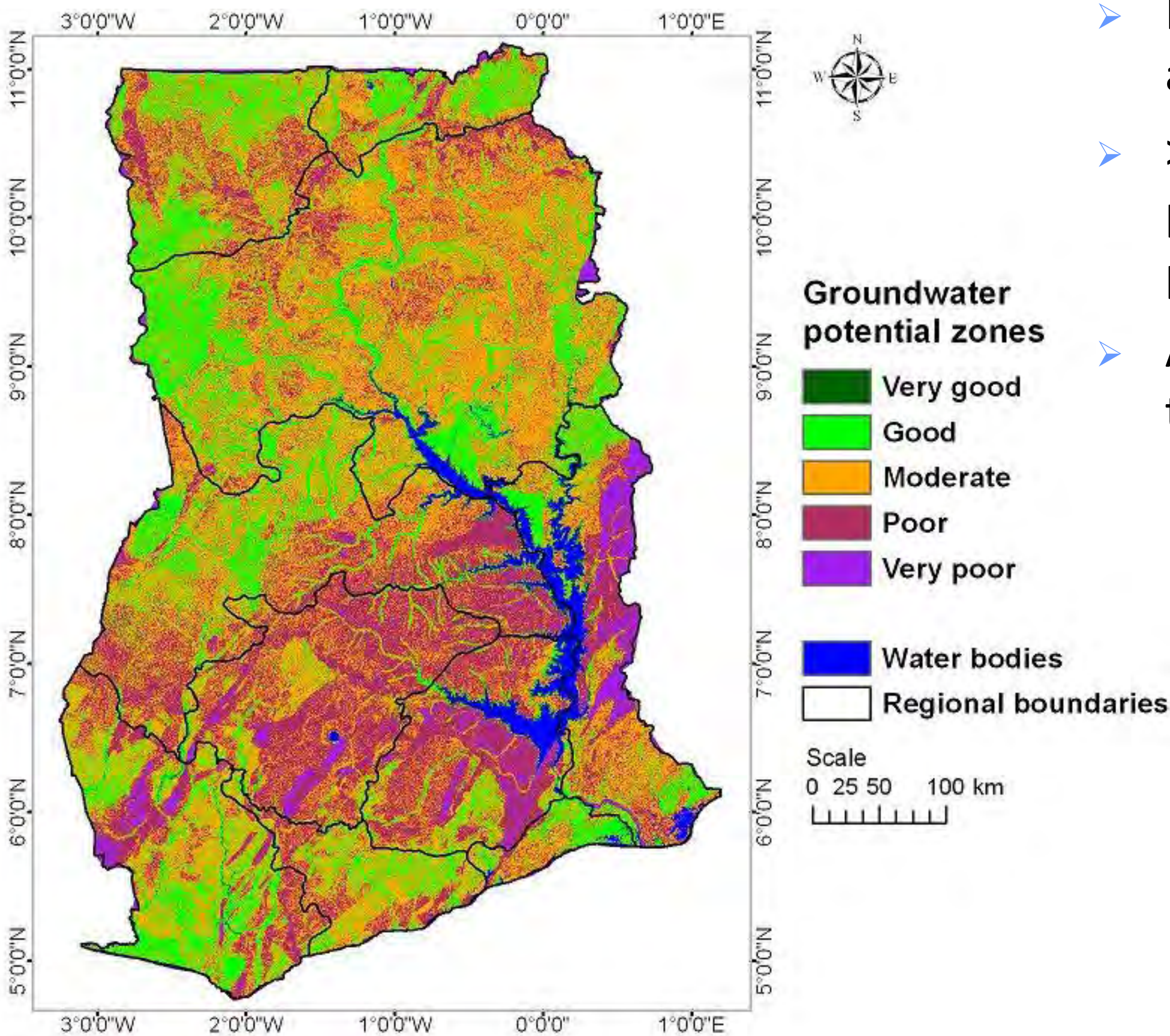
- Data compilation & synthesis
- GW characterization, mapping
- Monitoring & modelling
- Socio-economic costs & benefits
- Management plans
- Governance

Uses a multi-region, multi- scale approach

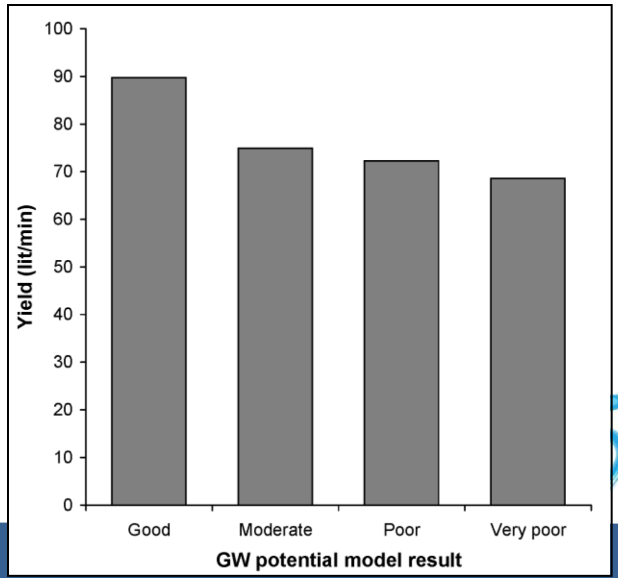


3. Local
2. Focus Country
1. SSA-AGRA

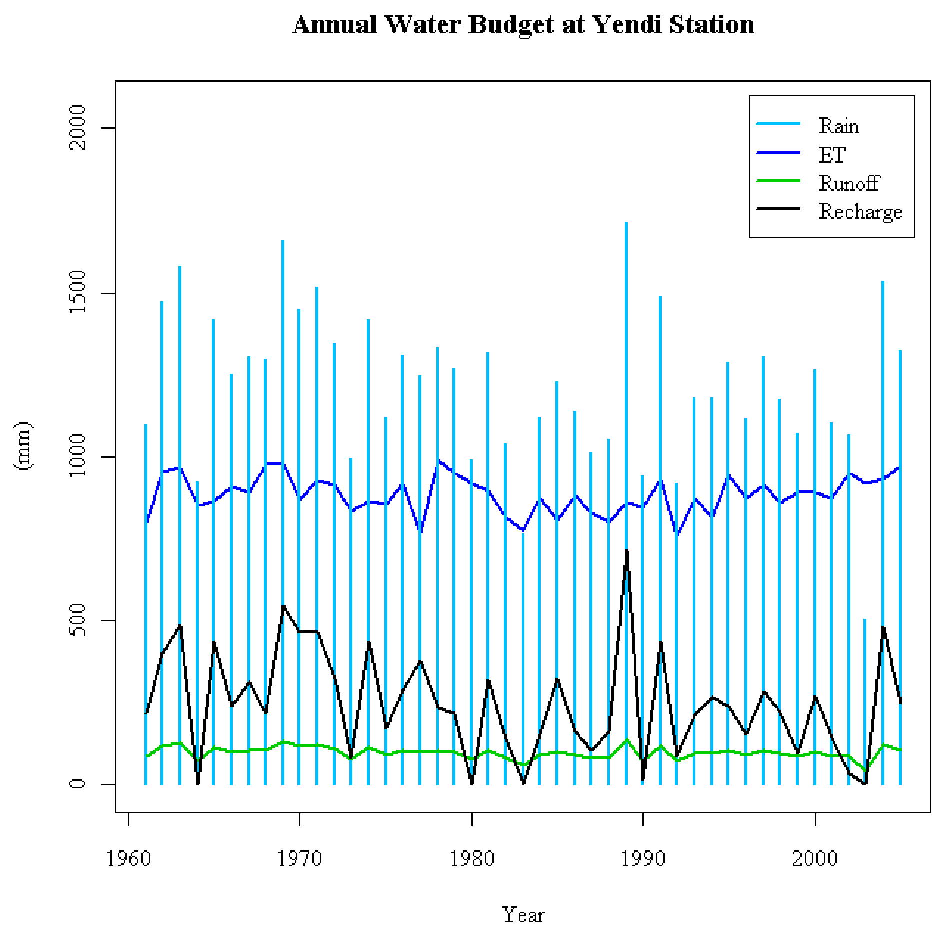
Country-scale mapping of groundwater potential

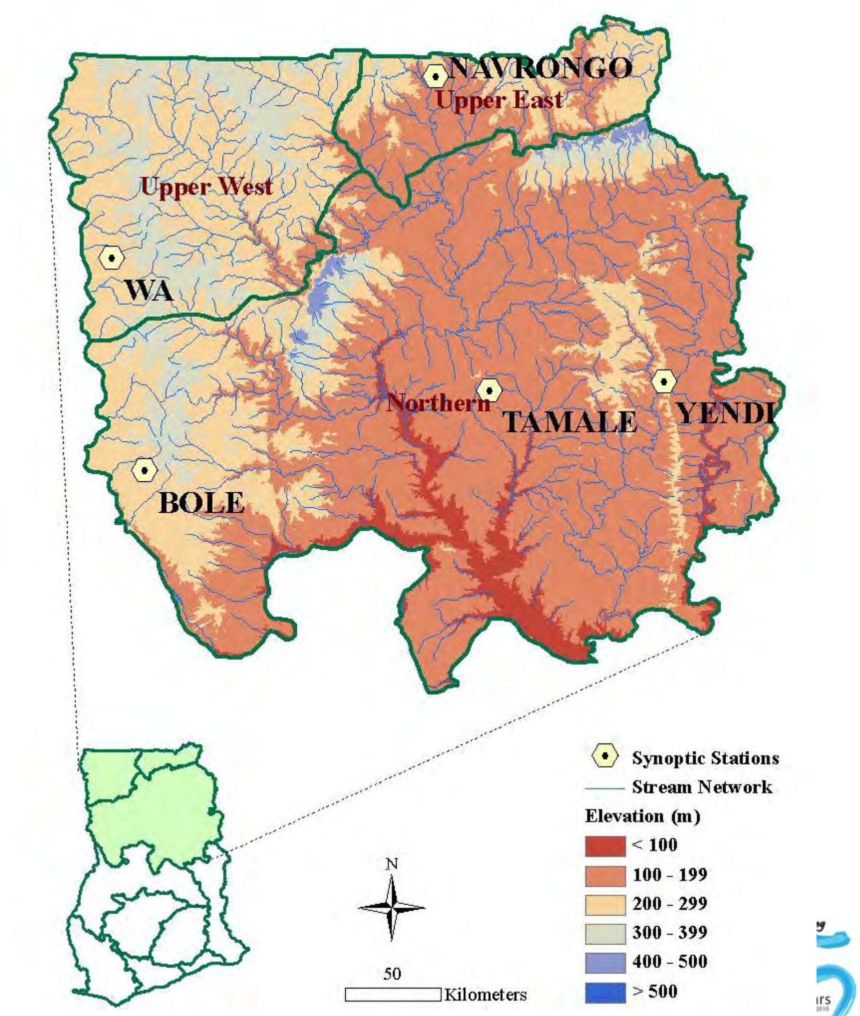


- RS/GIS 'multi-layer' assessment of GWP
- >20% of country has good potential (from hydrogeol perspective)
- Approach could be upscaled to other countries



Groundwater has great potential, but we must avoid the mistakes in S Asia





- Northern region is prospective for GW development
- Understanding the waterbalance allows **sustainable yield** to be defined

Storage options

- Each type has niche in terms of technical feasibility, socioeconomic suitability, externalities and institutional requirements
- CC will affect the function and operation of different storage types, differently
- Because of uncertainties in CC predictions, storage systems need to be able to function across a range of CC scenarios

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Governance

- ‘Free’ water has been taken for granted in many countries
- Water rights poorly defined
- Water governance often divided between agencies and sectors
- Groundwater and surface water not treated as one resource
- Institutional stationarity?
- Environmental water needs seldom heeded, to our peril
- Inclusion and representation of the poor and marginalised groups in water institutions
- Literal application of concepts such as IWRM and participatory irrigation management

Incentives and Disincentives

- Water as a free good, but there is little incentive for wise use
- Water pricing has been effective in some places, but there are political and social concerns
- Demand management tools rarely used

Jyotigram in Gujarat, India

- **Issue** was over-pumping of groundwater because of subsidised electricity
- **Solution** suggested by IWMI was separation of electricity supply to villages and pumps
- **Outcome** was reduced electricity use, less groundwater use, improved power supply to domestic users

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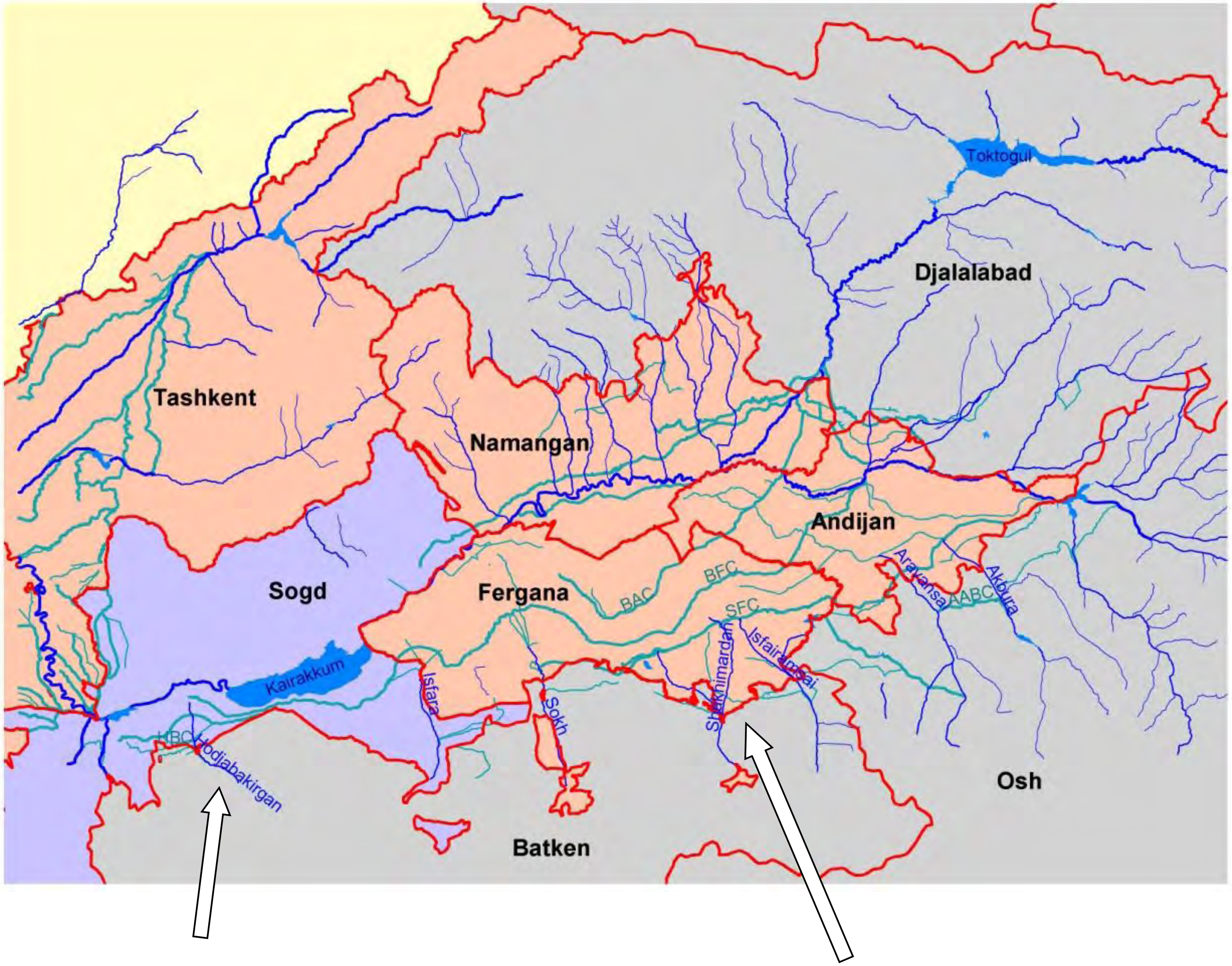
Ferghana Valley, Central Asia

- **Issue** was that irrigation systems were in decline because by the larger number of farmers after land reform and a management gap
- **Solution** was to reform water management in Central Asia by introducing hydrographic management (unified Canal Management Organizations, and WUAs); user participation; management transfer: joint state-public governance
- **Outcome** was the institutionalisation of water reform and expansion of the governance structure

Integrated Water Resources Management (IWRM) Ferghana

- Key concepts introduced:
  - Hydrographic management (unified CMO, WUA mgt)
  - User participation (Canal water user unions, WUA councils, WUGs)
  - Management transfer: joint state-public governance
- Stages:
  - Formulation and conceptual framework (2001-2002)
  - Implementation (creating pilot WUAs, canal orgs) (2002-2005)
  - Strengthening and expansion to whole canal (2005-2008)
  - Small Transboundary Tributaries (STT) component started in 2007
  - Packaging tools and dissemination (2008-2010)

Two pilot STTs within the Ferghana Valley



2 STTs:

Khojabakirgan
(Kyrgyzstan-Tajikistan)

Shahimardan
(Kyrgyzstan-Uzbekistan

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Tasks

- Micro: Introduce IWRM at each STT side
  - Hydrographic composition
  - WUA reorganization or establishment
  - WUA strengthening (training, councils, WUGs)
- Macro: STT Framework and Agreement
  - Institutional aspects (prepare ground, bi-lateral cooperation and only then umbrella agreement)
  - Technical aspects (informal working groups, exchange of information, cooperation during extreme situations)

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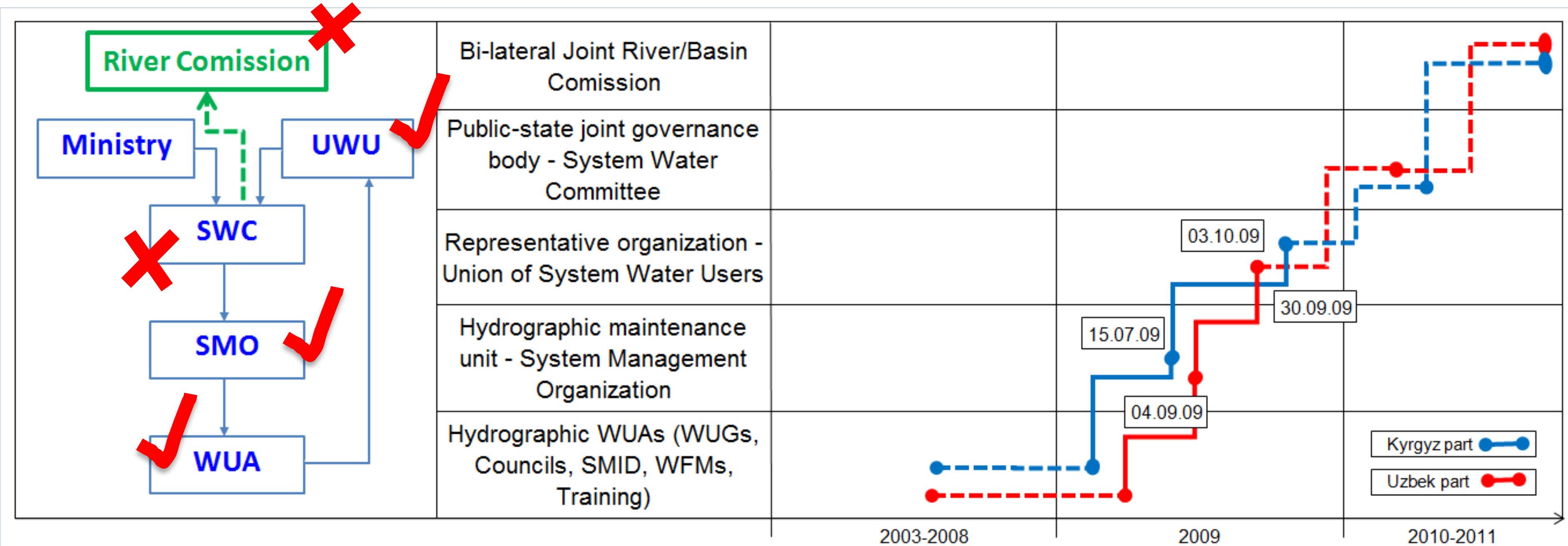
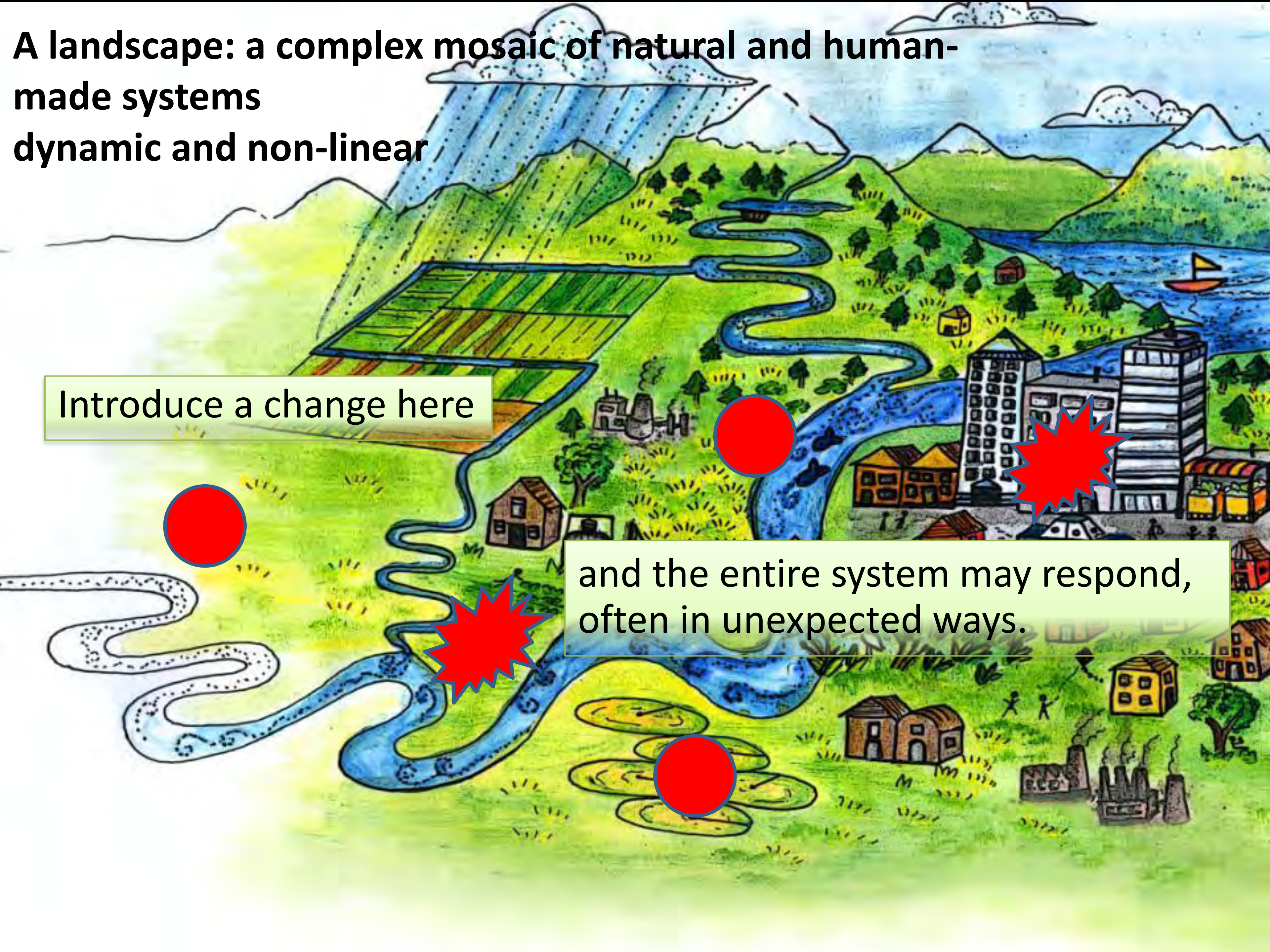
Where we are now: Shakhimardan



- What needs to be done:
  - Establish/formalize Water Committees on Uzbek side;
  - Discuss options for Joint Cooperation;
  - Establish Joint River/Basin Commission

A landscape: a complex mosaic of natural and human-made systems
dynamic and non-linear



The developing world will not make progress unless:

1. We have access to more and better quality data via improved measurement
2. We deal with outdated governance and institutions
3. Agriculture is viewed as part of the environment
4. Water productivity is significantly increased through revitalization of agricultural water use,
5. There is better management of urban and industrial demand, and
6. The poor and women are empowered in water management.

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CONCLUSION

Water is complex, solutions to issues will only come from approaches that integrate physical, social, economic and environmental facors