Asia's Water Future

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Asia's Future: Critical Thinking for a Changing Environment
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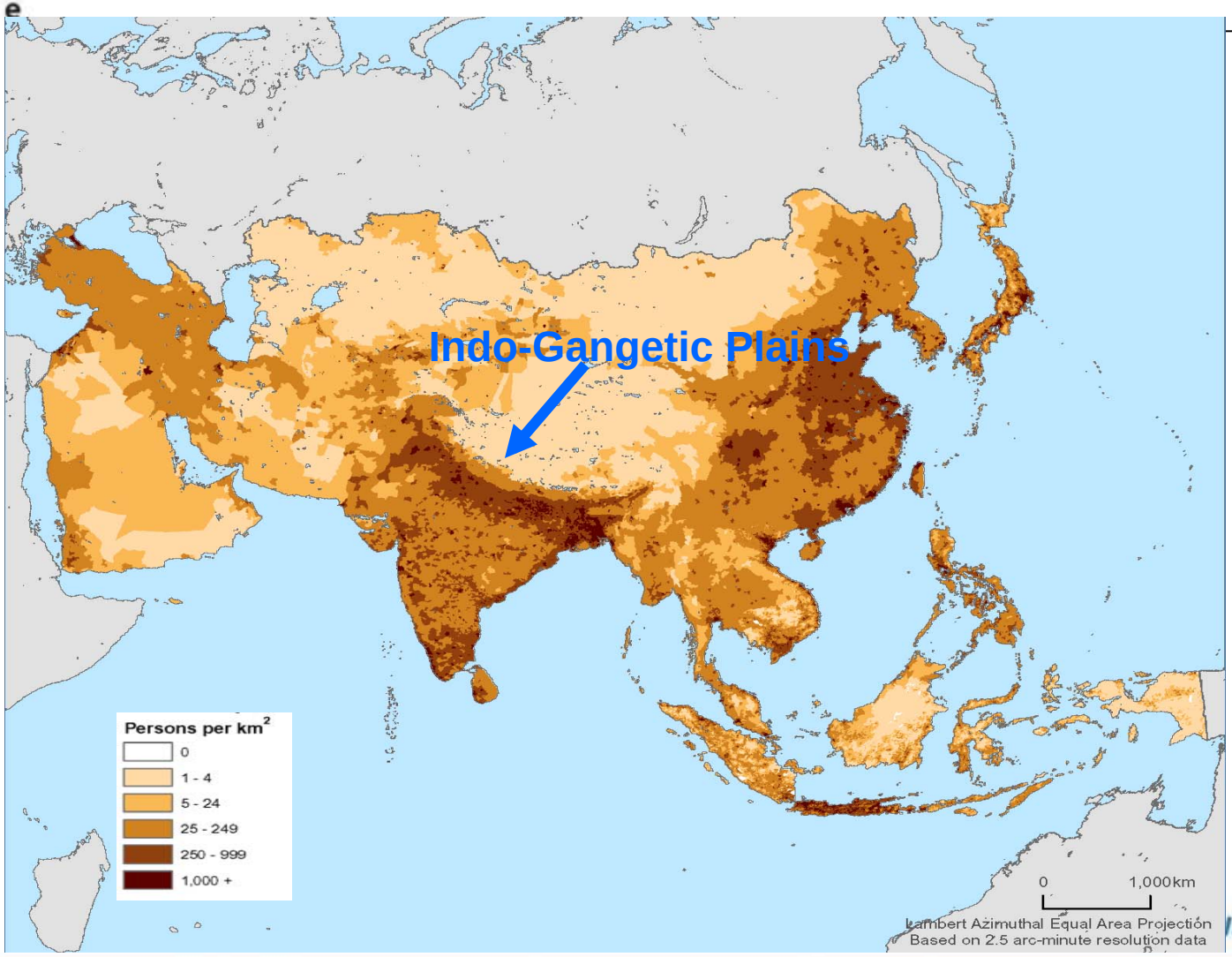
Improving water and land resources management for food, livelihoods and nature

FOCUS OF PRESENTATION

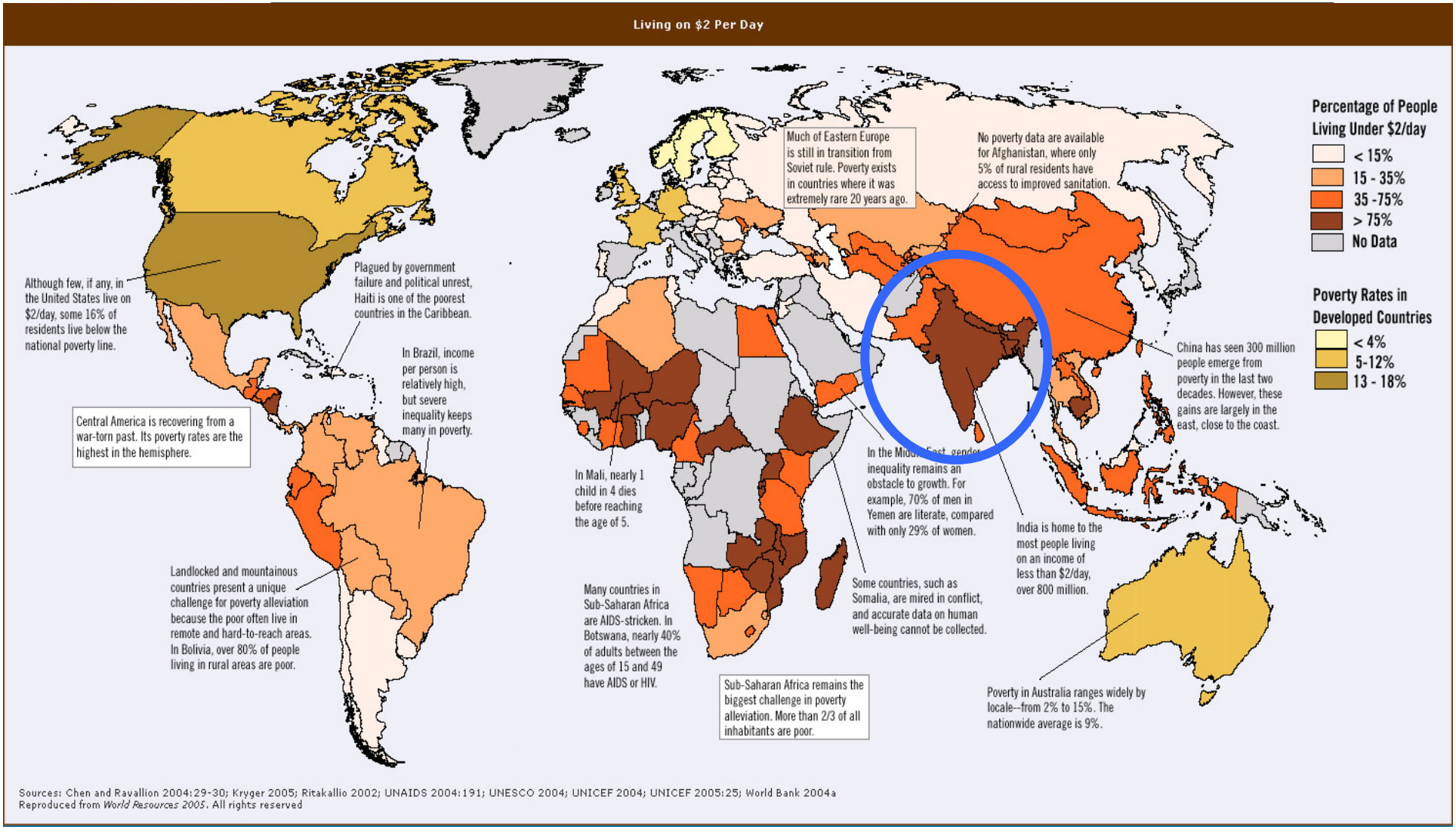
- **Salient Features of Asia's Water Sector**
- **Overview Climate Change Impacts**
- **Promising Adaptation Strategies**

Asia: High Population Density



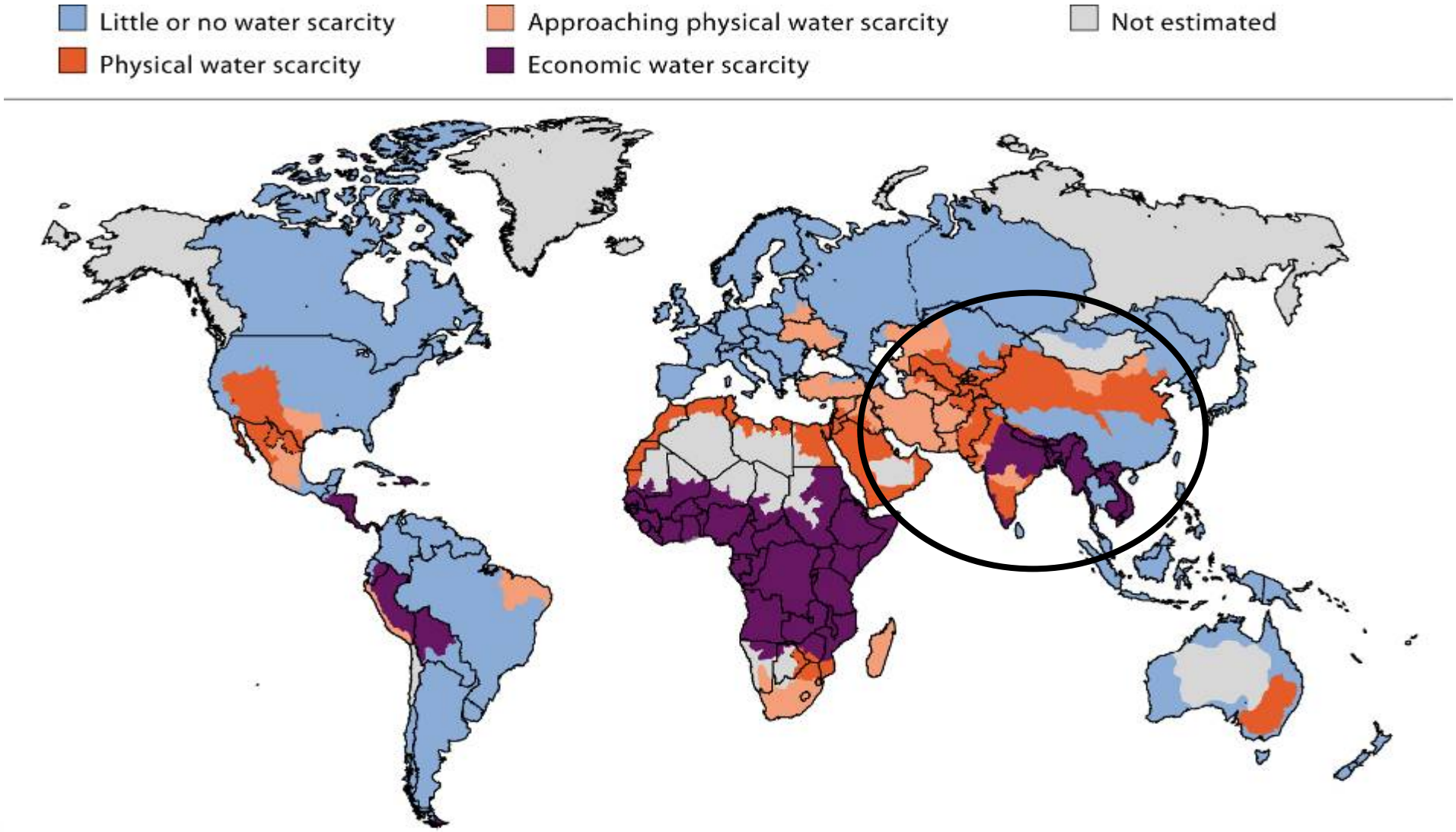
Source: Columbia University

ASIA: High Incidence of Poverty



Sources: Chen and Ravallion 2004:29-30; Kryger 2005; Ritakallio 2002; UNAIDS 2004:191; UNESCO 2004; UNICEF 2004; UNICEF 2005:25; World Bank 2004a

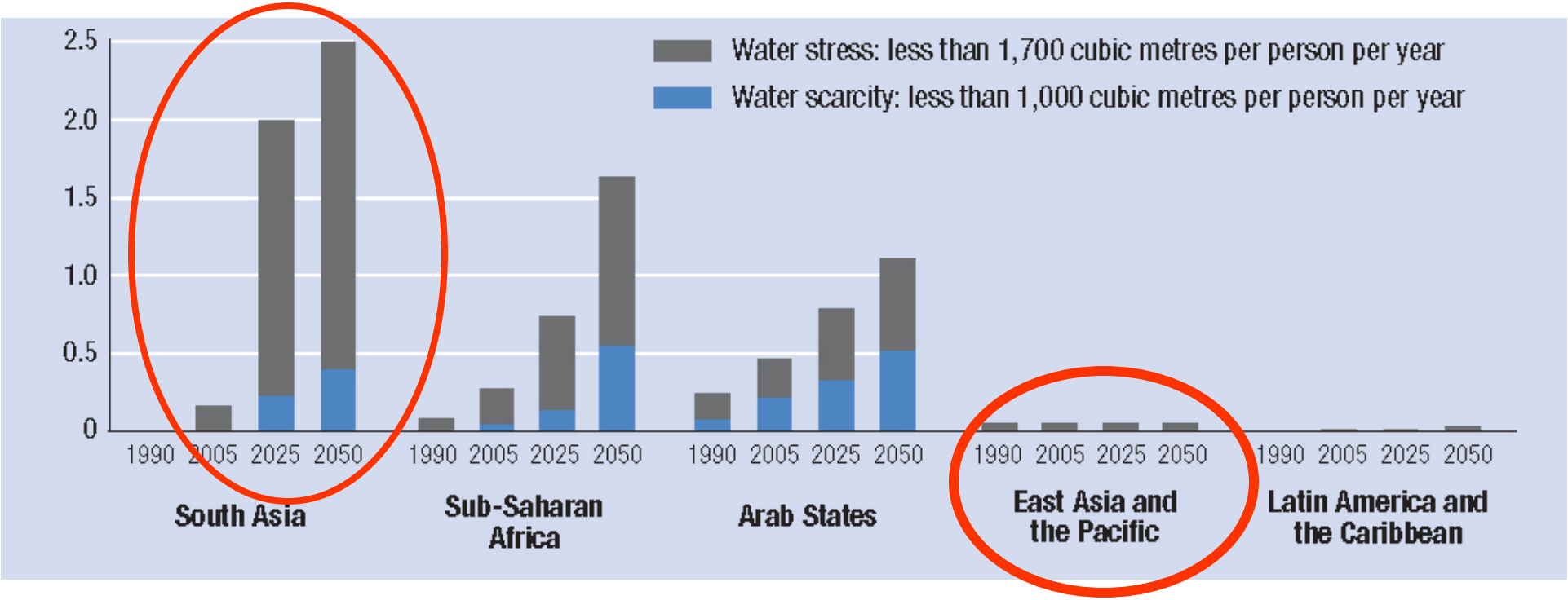
Water Scarcity 2000



1/3 of the world's population live in basins that have to deal with water scarcity

Water stress is projected to accelerate in intensity in several regions

Population of countries facing water stress or scarcity (billions)



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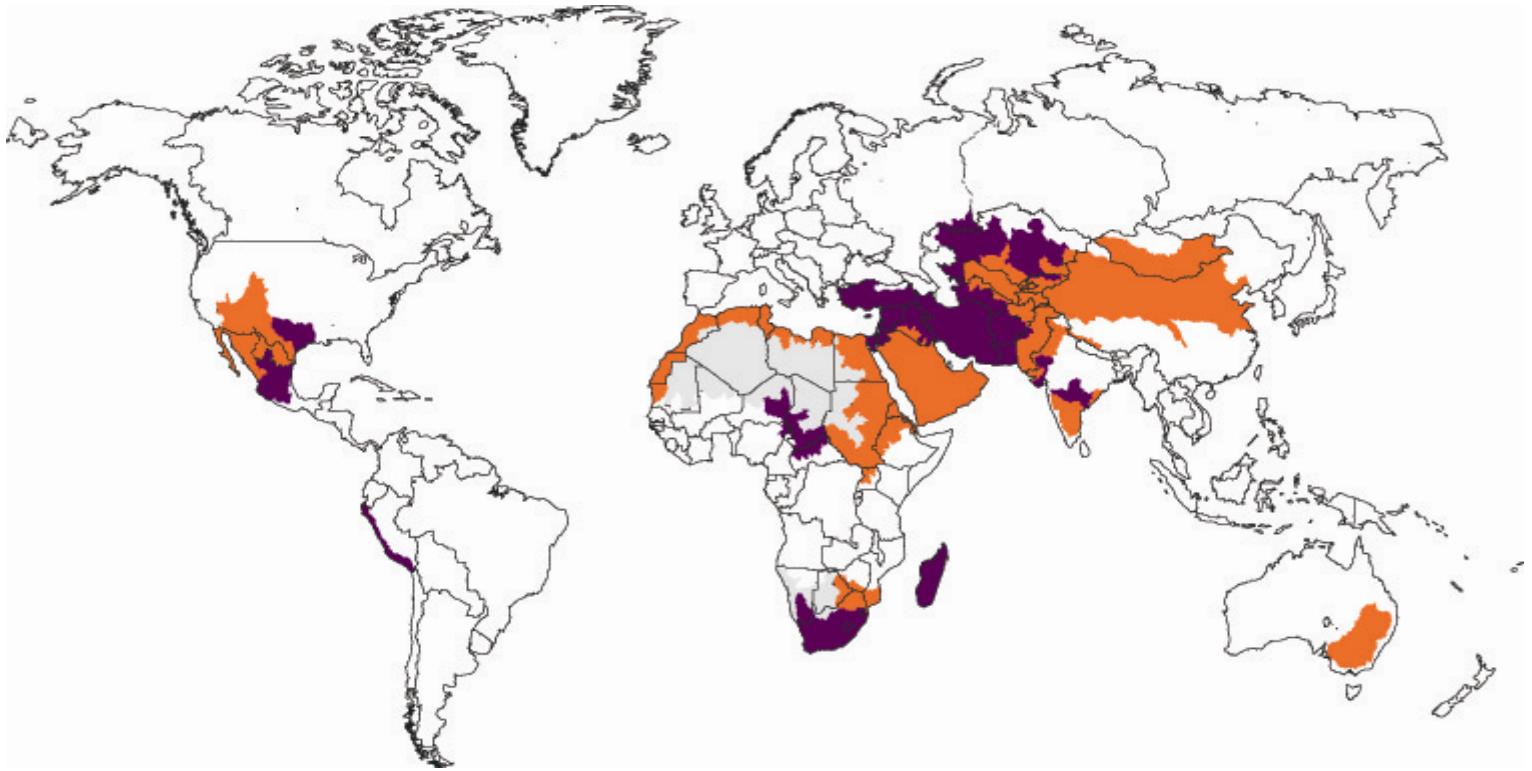
Source: Calculated on the basis of FAO 2006

International Water Management Institute

Irrigated area expansion leads to 2.6 billion people living in water-scarce basins by 2050



Water-scarce basins in 2000 and 2050

Water-scarce basins in 2050 but not in 2000

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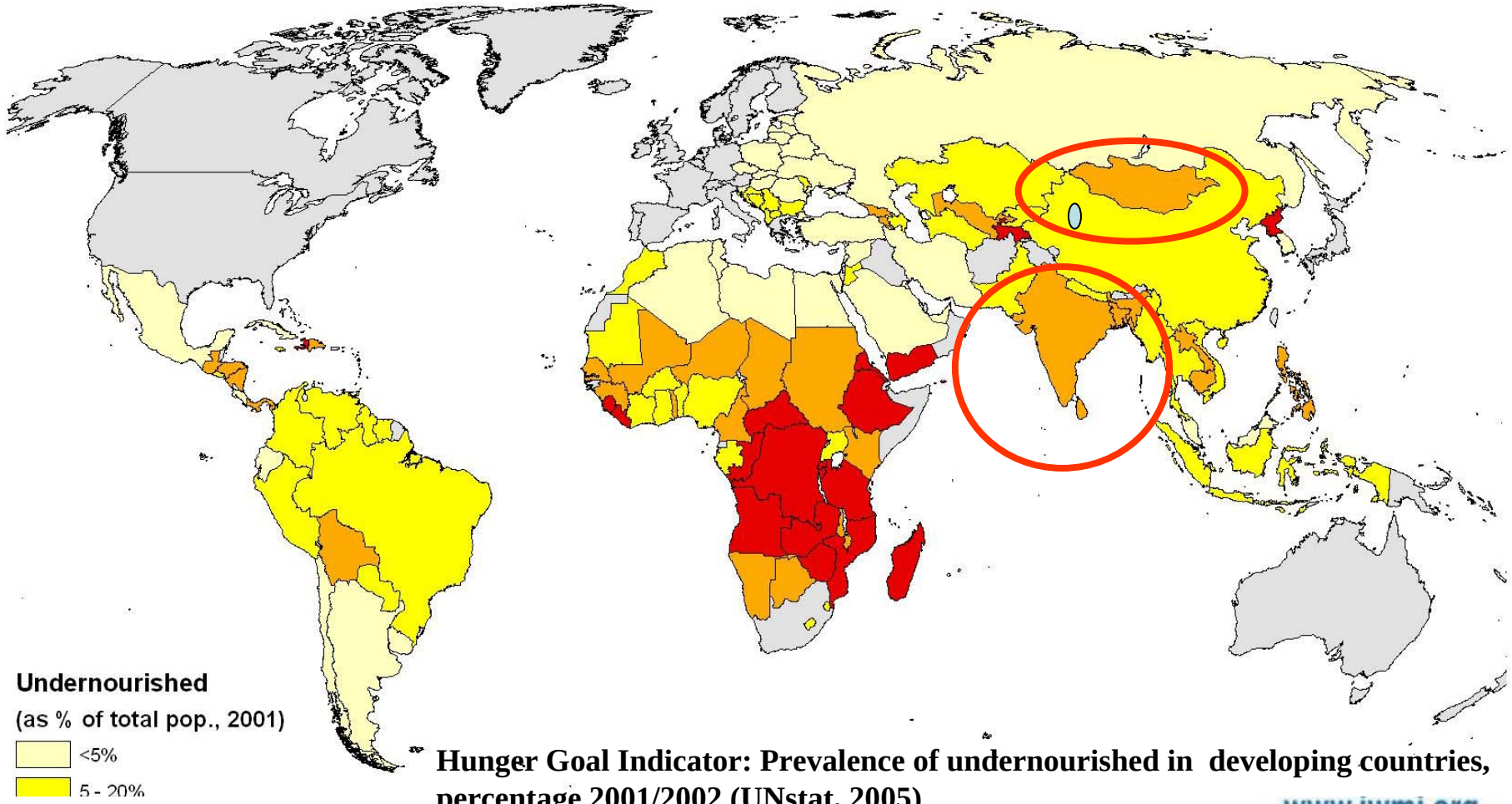
Most hungry and poor people live where water challenges pose constraint to food production



Hunger Goal Indicator: Prevalence of undernourished in developing countries, percentage 2001/2002 (UNstat, 2005)

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Food projections

	South Asia			East Asia		
	2000	2050	% change	2000	2050	% change
Wheat (mt)	96	205	114%	121	193	60%
Maize (mt)	17	32	88%	184	341	85%
Rice (mt)	113	202	79%	219	287	31%
Total cereals*(mt	249	471	89%	529	935	77%
Meat(mt)	8	32	300%	75	190	153%
Milk(mlit)	114	382	235%	19	60	216%

*Includes food and feed

Source: Fraiture et. al., 2007

KEY QUESTION

The question is whether we have enough water resources to grow enough food to meet future demand for food and biofuels?

DRIVERS OF WATER DEMAND

What are the driving forces?

- Growing population
- Dietary change
- Urbanization
- Biofuel production
- Need for environmental water
- Climate change

Limits – reached or breached

River basins – many rivers running dry at the end

Groundwater overdraft – in agricultural breadbaskets

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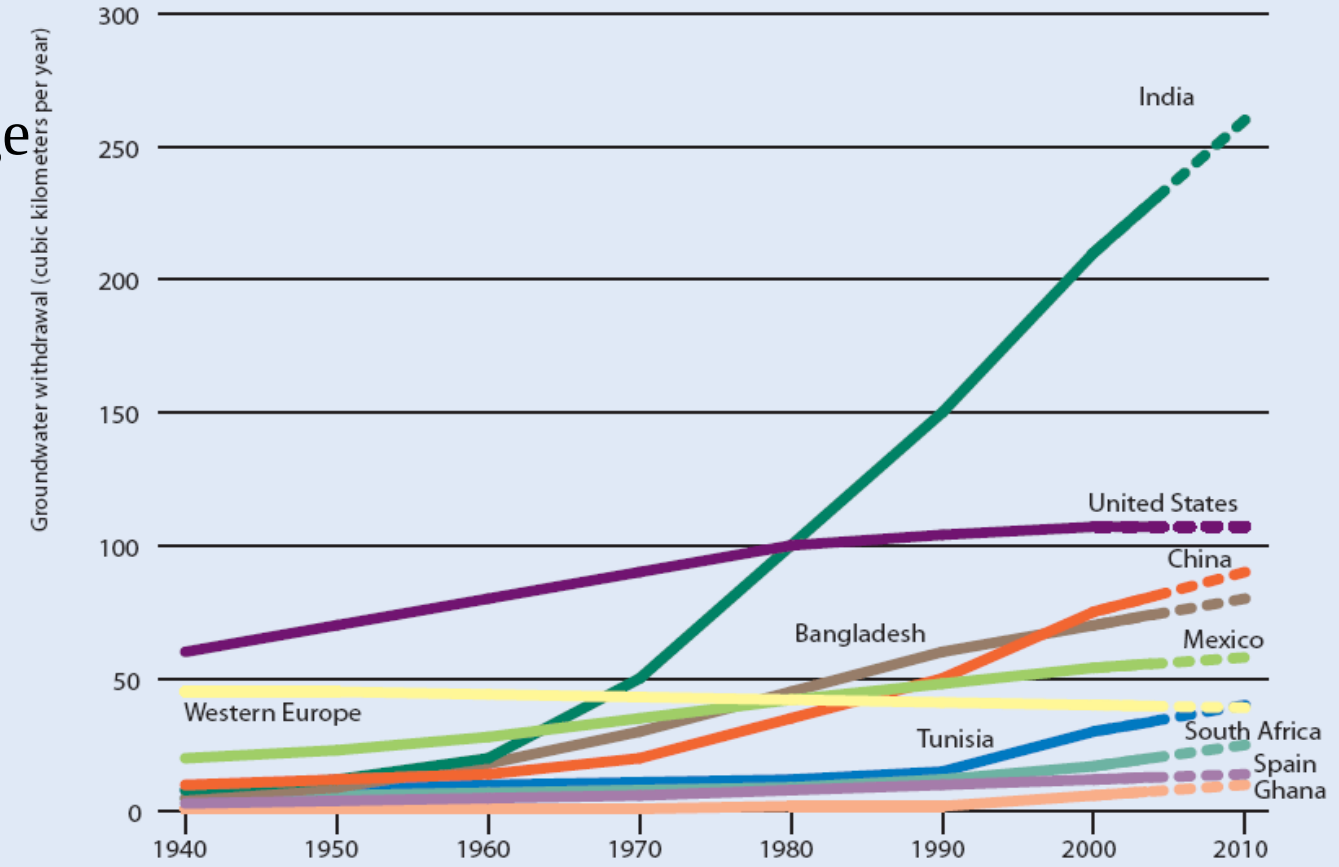
Increasing groundwater usage is a water time bomb

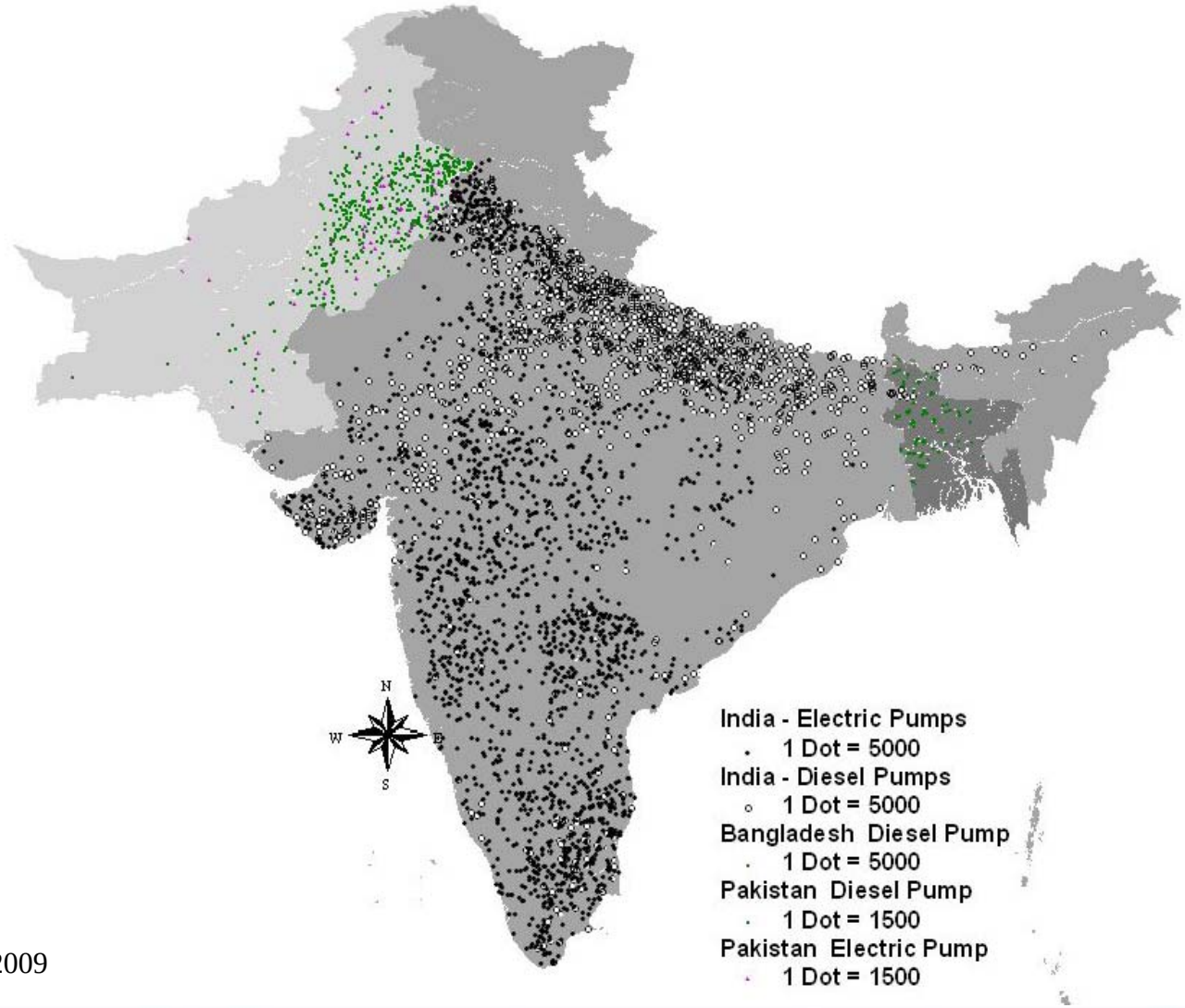
Development in groundwater withdrawal in selected countries



Source: Shah 2005.

Credit: Comprehensive Assessment of Water Management in Agriculture
Publisher: Earthscan www.earthscan.co.uk

Distribution of Groundwater Units in South Asia



Source: Tushaar Shah. 2009

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Limits – reached or breached

- **Fisheries – ocean and freshwater at a limit, aquaculture will become more prevalent**

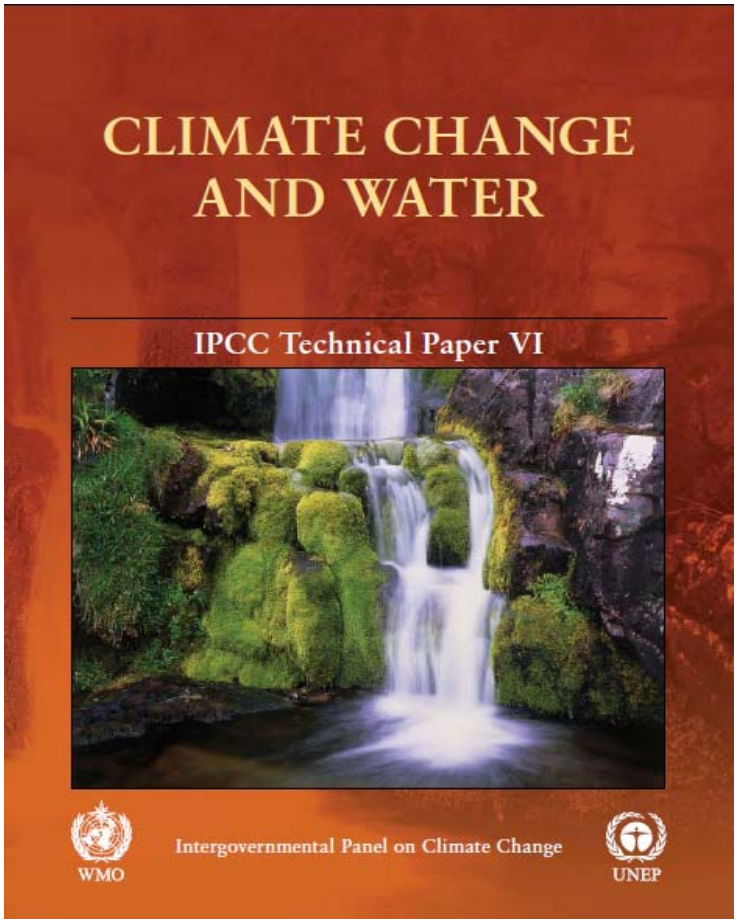
- **Livestock – limit on extent of grazing land, more will come from mixed and industrialized production**

Rising Energy Costs Impact Water Use

- **Demand for cheaper energy source: hydropower and bio-energy**
- **Cost of water pumping increases**
- **Desalinization costs increase – prohibitive for irrigation**
- **Fertilizer and other ag input prices increase, increasing the cost of water productivity gains**

Climate Change Impacts

Climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted with wide-ranging consequences on human societies and ecosystems.



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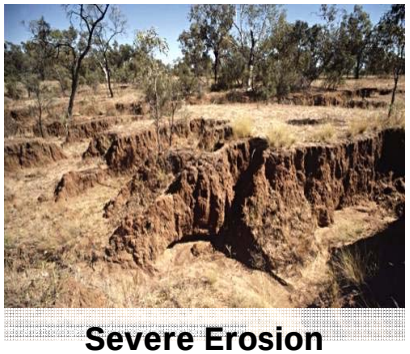
⇨ During Rainy Season !

High Intensity Rainfall

Excessive Runoff

Increasing Flood Peaks

Floods



Severe Erosion

Landslides ?

Silted Rivers

⇨ During Dry Season!

High Temp & evaporation; Dry soils

Reduced Stream flow

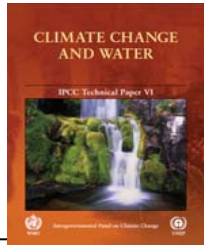
Declining Groundwater Level

Insufficient Water for Irrigation

- Reduction in Yield
- Total Crop Loss

Limiting Water Supply for Domestic & other Purposes

Hotspots of Climatic Impacts and Vulnerabilities in Asia



Forest production in North Asia is likely to benefit from carbon fertilization. But the combined effects of climate change, extreme weather events and human activities are likely to increase the forest fire frequency. [10.4.4.1]

The Lena delta has been retreating at an annual rate of 3.6-4.5 m due to thermo-erosion processes which are likely to be influenced by projected rise in temperature. [10.6.1]

Net primary productivity of grassland in colder regions of Asia is projected to decline and shift northward due to climate change. The limited herbaceous production, heat stress from higher temperature and poor water intake due to declining rainfall could lead to reduced milk yields and increased incidence of diseases in animals. [10.4.1.3]

Cereal yields could decrease up to 30% by 2050 even in South Asia. In West Asia, climate change is likely to cause severe water stress in 21st century. [10.4.1.1]

In East Asia, for 1°C rise in surface air temperature expected by 2020s, water demand for agricultural irrigation would increase by 6 - 10% or more.

Rice yield is projected to decrease up to 40% in irrigated lowland areas of central and southern Japan under doubled atmospheric CO_2. [10.4.1.1]

The gross per capita water availability in India will decline from ~1820 m^3/yr in 2001 to as low as ~1140m^3/yr in 2050. [10.4.2.3]

The projected relative sea level rise, including that due to thermal expansion, tectonic movement, ground subsidence and the trends of rising river water level are 70-90, 50-70 and 40-60 cm in the Huanghe, Changjiang and in the Zhujiang Deltas respectively by the year 2050. [10.4.3.1]

Increase in coastal water temperatures would exacerbate the abundance and / or toxicity of cholera in South Asia. [10.4.5]

Increases in endemic morbidity and mortality due to diarrhoeal disease primarily associated with floods and droughts are expected in East, South and South-East Asia. [10.2.4.6]

Tibetan Plateau glaciers of 4 km in length are projected to disappear with 3°C temperature rise and no change in precipitation. If current warming rates are maintained, glaciers located over Tibetan Plateau are likely to shrink at very rapid rates from 500,000 km^2 in 1995 to 100,000 km^2 by the 2030s. [10.4.4.3,10.6.2]

With a 1 m rise in sea level, 2,500 km^2 of mangroves in Asia are likely to be lost; Bangladesh would be worst affected by the sea level rise in terms of loss of land Approximately 1,000 km^2 of cultivated land and sea product culturing area is likely to become salt marsh, and 5,000 km^2 of Red River delta, and 15,000 – 20,000 km^2 of Mekong River delta are projected to be flooded. [10.4.3.2]

Around 30% of Asia's coral reefs are likely to be lost in the next 30 years due to multiple stresses and climate change. [10.4.3.2]

Climate Change, Rural Vulnerabilities, and Migration

- **Rural households tend to rely heavily on climate-sensitive resources** such as local water supplies and land; climate-sensitive activities such as arable farming and livestock husbandry; and natural resources such as fuelwood and wild herbs.
- **Climate change can reduce the availability of these local natural resources,** limiting the options for rural households that depend on natural resources for consumption or trade.
- **Marginalized, primary-resource-dependent livelihood groups in Asia are particularly vulnerable to climate change impacts** if their natural resource base is severely stressed and degraded by overuse, or if their governance systems are not capable of responding effectively [WGII 17.1].

Migration:

The link between migration and climate change has been well documented.

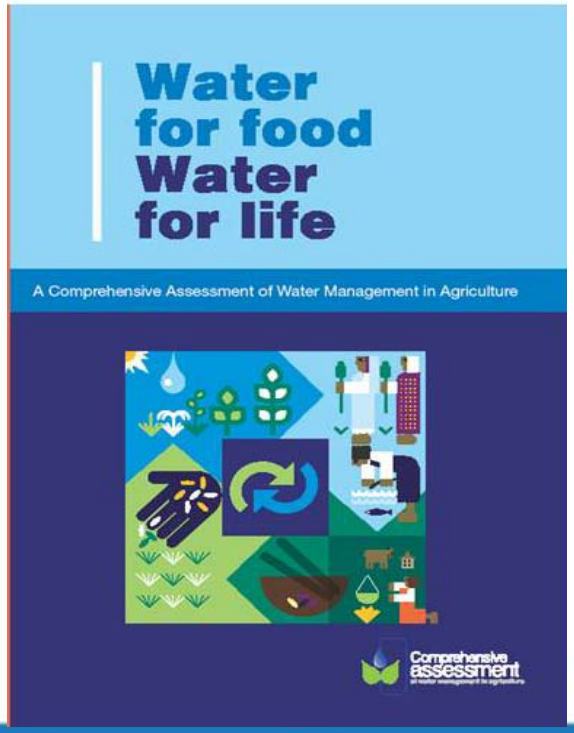
- **The Ferghana Valley. exemplifies the inter-twining relationship between environmental degradation, climate change and migration.**
- **The Aral Sea had fallen by about 15 metres, Its surface area had been halved and its volume reduced by two-thirds.**
- **An estimated 10.5 million people living in the Ferghana Valley, and a significant part of this population may potentially be affected by forced migration**

What of the future?

There are many adaptation measures that could be applied in many parts of Asia to minimize the impacts of climate change on water resources, several of which address the existing inefficiency in the use of water.

Promising Pathways in

Comprehensive Assessment of Water Management for Agriculture:



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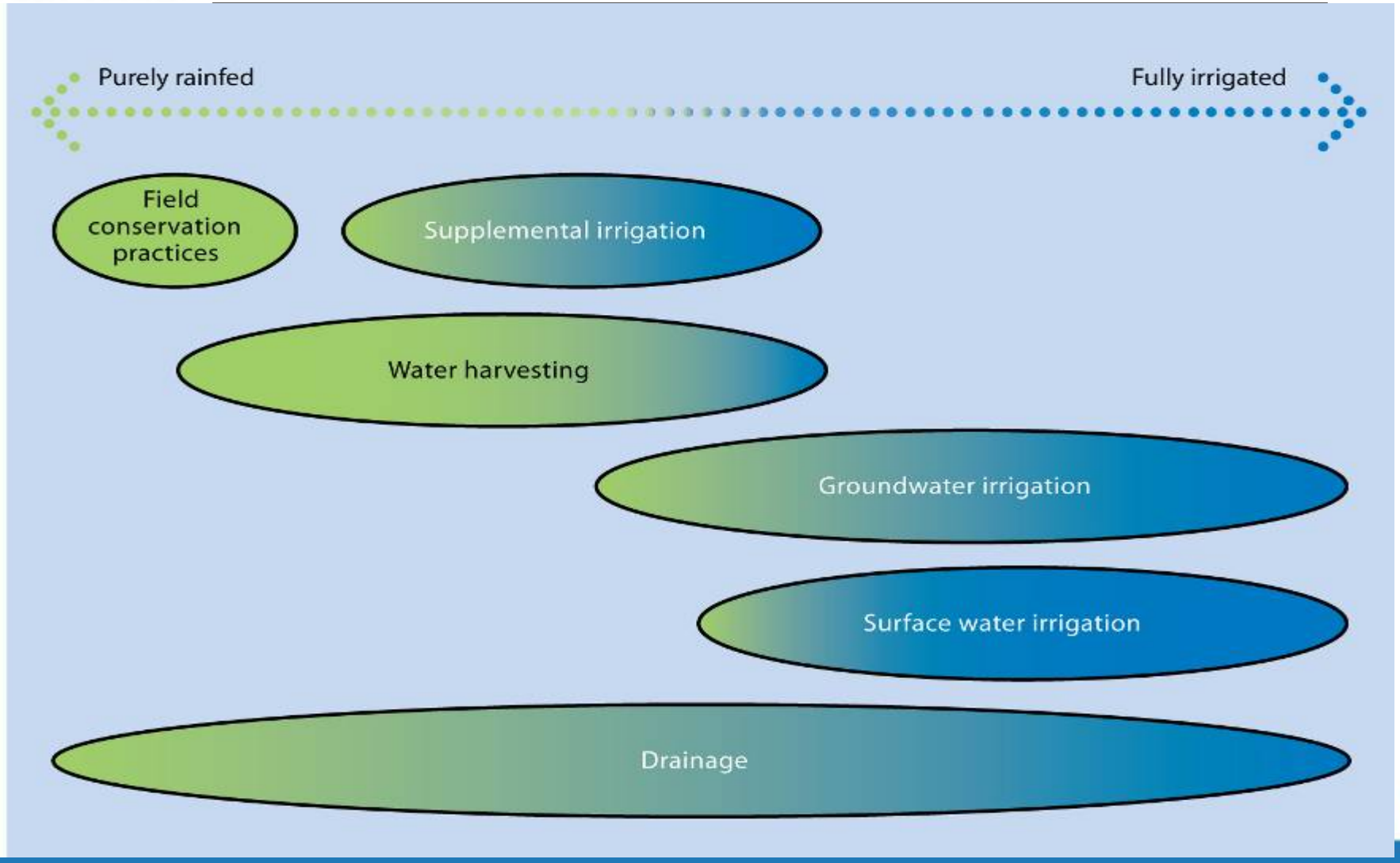
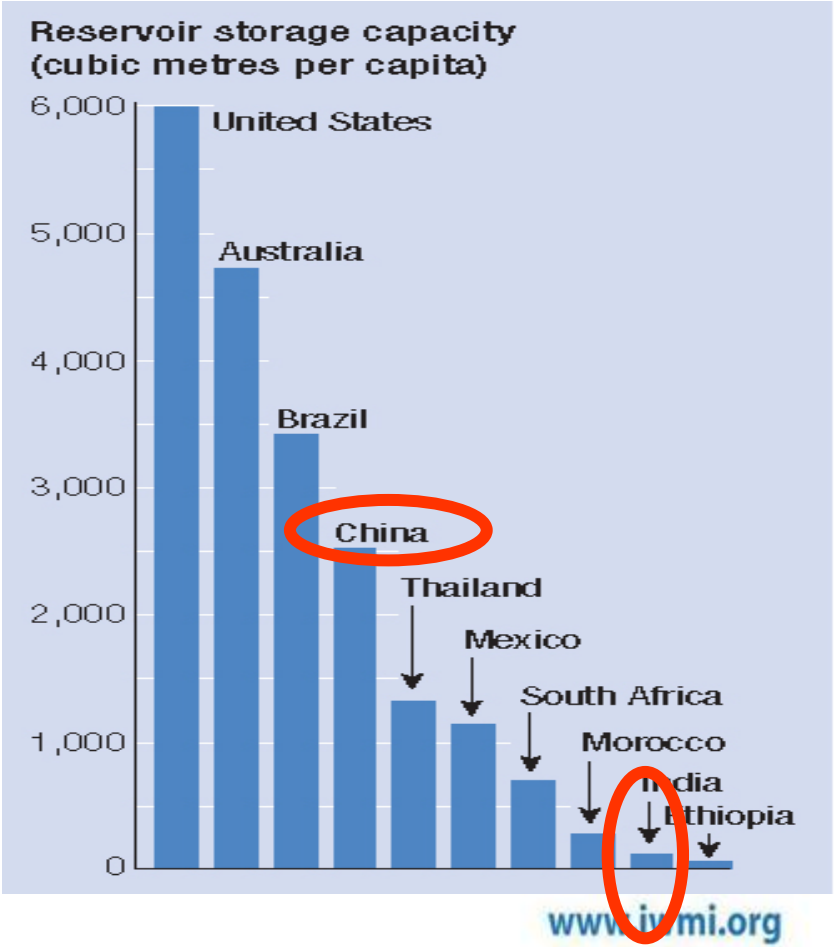
Agenda 1 – Think differently about water

A Range of Ag Water Management Options



Agenda 2: Water Storage Mitigates Climate Variability

- **Water storage becomes an important investment with climate change**
- **Think more creatively about water storage:**
  - **Explore wide range of options: small village ponds, groundwater, water harvesting (i.e. soil moisture storage)**



Irrigation Development has dominated public investment in agriculture in Asia and is important in the world food system

- **Need to improve performance of many systems, particularly in South Asia**
- **Focused investments - rehabilitate priority public schemes with most potential and set in a new rural development strategy (with better links to agriculture markets).**
- **Adapt to changes – water scarcity, competition, climate change, energy**
- **Increase multiple benefits and ecosystem services, while reducing negative impacts**
- **Groundwater is providing much more on-demand irrigation service. Canal irrigation re-engineered do the same**

Agenda 4 – Improve Water Productivity

- **Physical Water Productivity – more crop per drop**
  - **To reduce future water needs**
  - **For food production increases**

- **Economic Water Productivity – more value per drop**
  - **For more income, growth**

Agenda 5 – Expand Policies to Upgrade Rainfed Agriculture

- **Sixty percent of all rainfall never reaches a river or aquifer; it replenishes the soil moisture and evaporates from the soil or is transpired by plants**

- **The traditional split between rainfed and irrigated agriculture has become obsolete. It should be replaced by water management for agriculture, accounting for the complete spectrum from pure rainfed, via rainwater harvesting, to supplemental or deficit, to full irrigation.**

Agenda 6 Policy and Institutional reforms

- **The basic management basic approaches and institutional frameworks that were in place at a time of surplus water are inadequate.**

- **Recent reform efforts to improve in the irrigation sector in Asia have to a large extent concentrated on governance and institutional issues through participatory irrigation management and irrigation management transfer.**

  - **Populist, Politically neutral intervention,**
  - **Sense of democratization and empowerment**
  - **Appealing to NGOs**

What is needed ?

Innovative Instruments not new organizations to govern water resources:

- **empowering users by giving them clear, enforceable water entitlements**
- **water pricing**
- **stimulating water markets for irrigation and other water services;**
- **introducing incentive-based, participatory management of services and water resources;**

- **Sectoral reforms needed**
  - **craft solutions suited to local needs**
  - **no blueprints**
- **Policies outside of water sector have huge influence on water resources –**
  diets, trade, agricultural subsidies, energy

CONCLUDING REMARKS

- **No doubt that we have a water crisis**
- **Given current projections of food and water demand we can possibly avert future food crises**
- **Ensuring availability of water for agriculture is vital, but requires major productivity increases and underpinning water reform**
- **The impacts of climate change are still uncertain, but investment in adaptation to CC will also be relevant to the impacts of the other drivers of water scarcity**

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Thank You

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