HELSINKI UNIVERSITY OF TECHNOLOGY
Laboratory of Water Resources

Water for Development

Contents

- ⊕ Water use
- ⊕ Development:
  - ⊕ Demography
  - ⊕ Aid
  - ⊕ Economy
  - ⊕ Food
  - ⊕ Energy
  - ⊕ Environment
  - ⊕ Catastrophes
- ⊕ Challenge

Olli Varis
Helsinki University of Technology
Water Resources Laboratory

WORLD WATER CHALLENGES

Water scarcity

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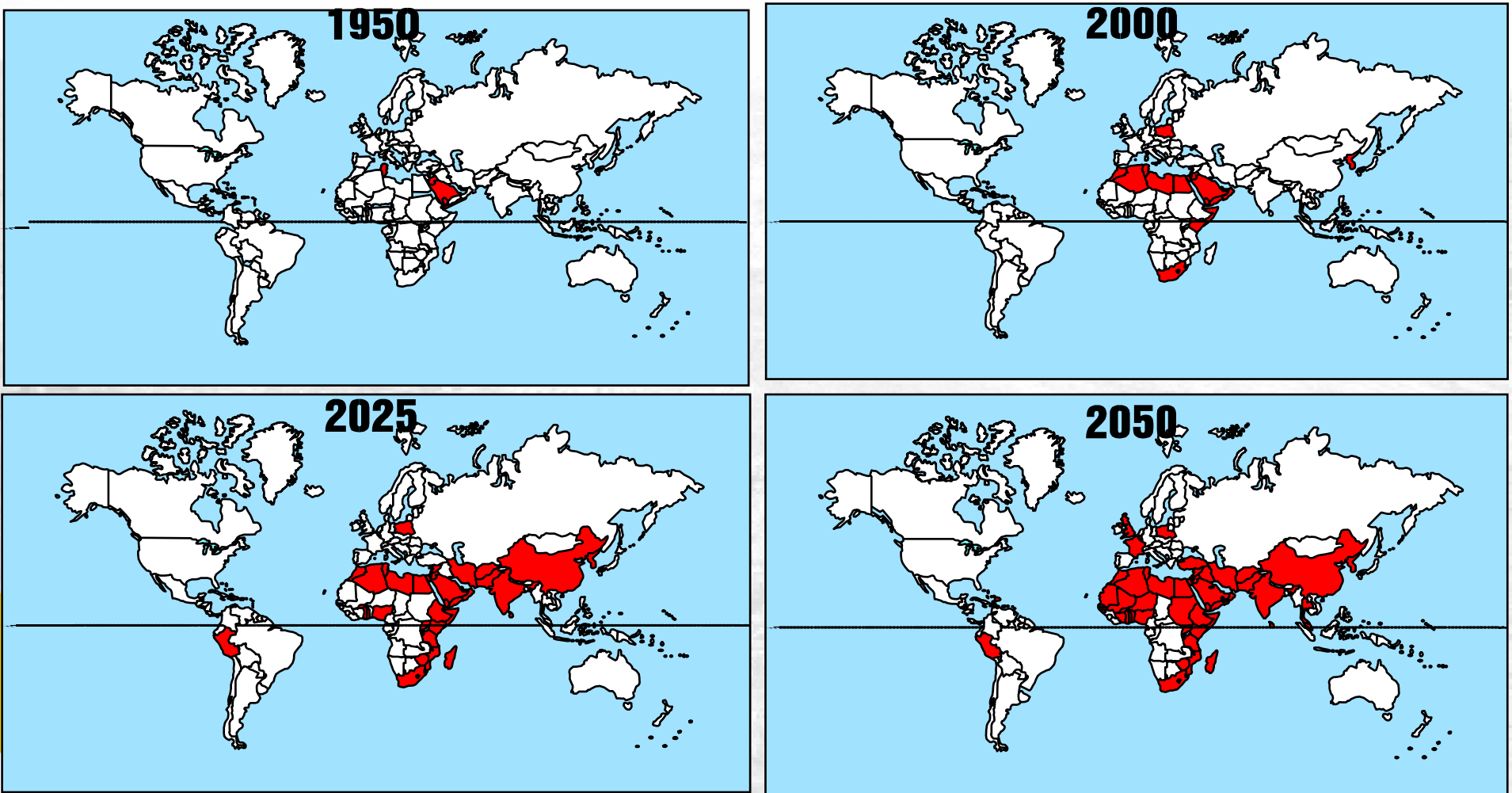
Evolution of water shortages in 100 years



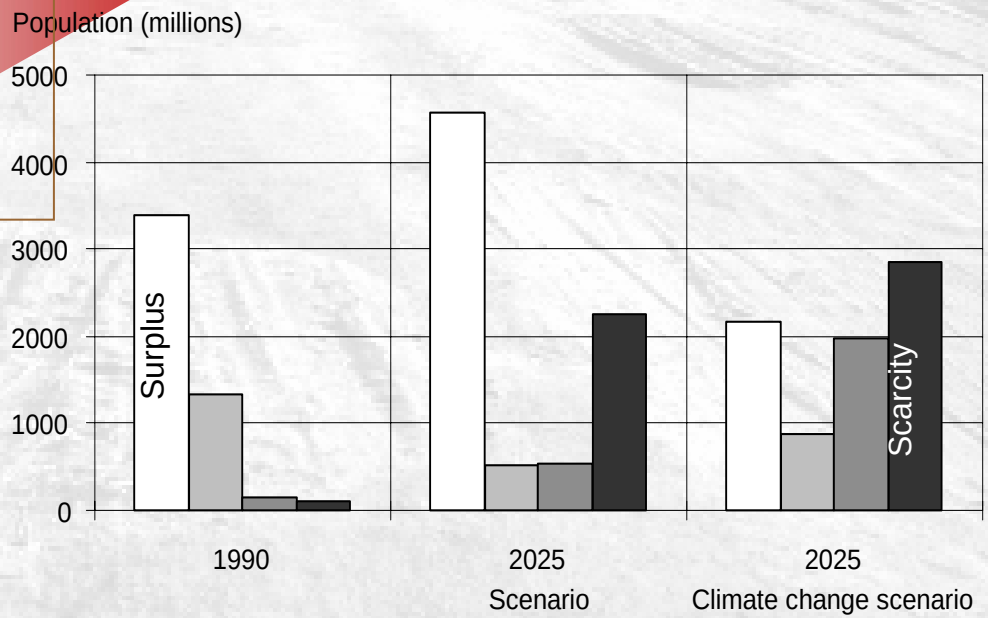
Introduction

Water as a natural resource

Water:
One of the most strategic resources
- Source of conflicts
- Hydropower
- Agriculture
- Industry
- Domestic use
- ...

Water:
- Kills much more and more dramatically than AIDS or "terror"
- Each 10 seconds
- > 9000 per day

Water and development closely connected



Water circle

Water:
"The blood of the planet"

Introduction

Water: natural resource

Water:

One of the most strategic resources

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Introduction

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Water and development closely connected

Water use

Orders of magnitude

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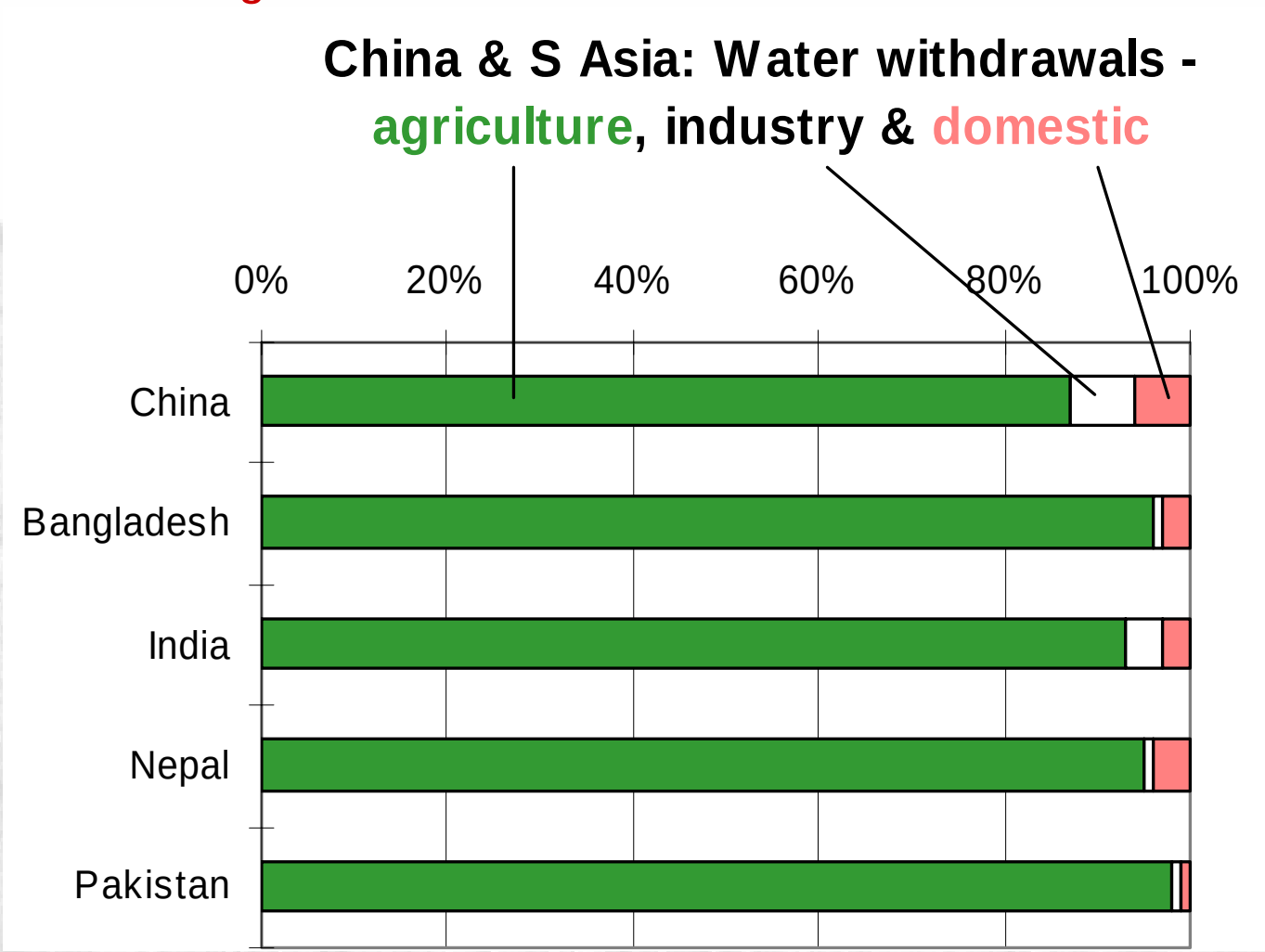
	Drinks	Domestic use		Eats	
		Rural	Urban		
1 person	2	50	250	1500	Litres per day
	0.7	20	90	550	m^3 per year
6 billion people	4.4	110	550	3300	km^3 per year
	0.04%	0.9%	4.6%	28%	Of stabile runoff
	0.01%	0.27%	1.3%	8%	Of continental runoff
	140	3500	17000	32 500	m^3 per second
	0.27	7	33	200	Times the flow of Kemijoki
	0.04	2	10	60	Times the flow of Nile

Water use

Orders of magnitude



Population

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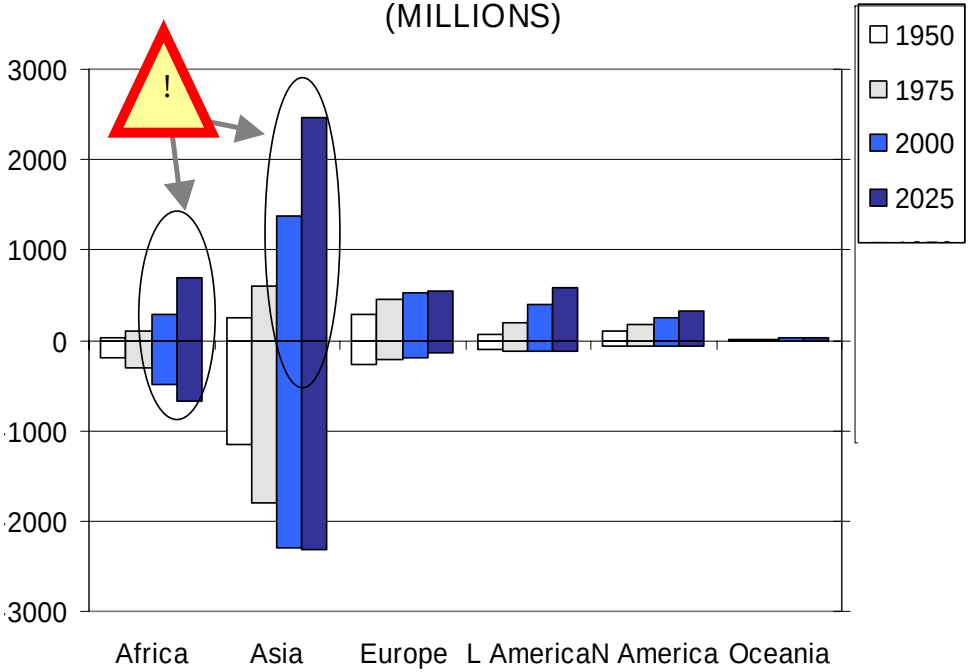
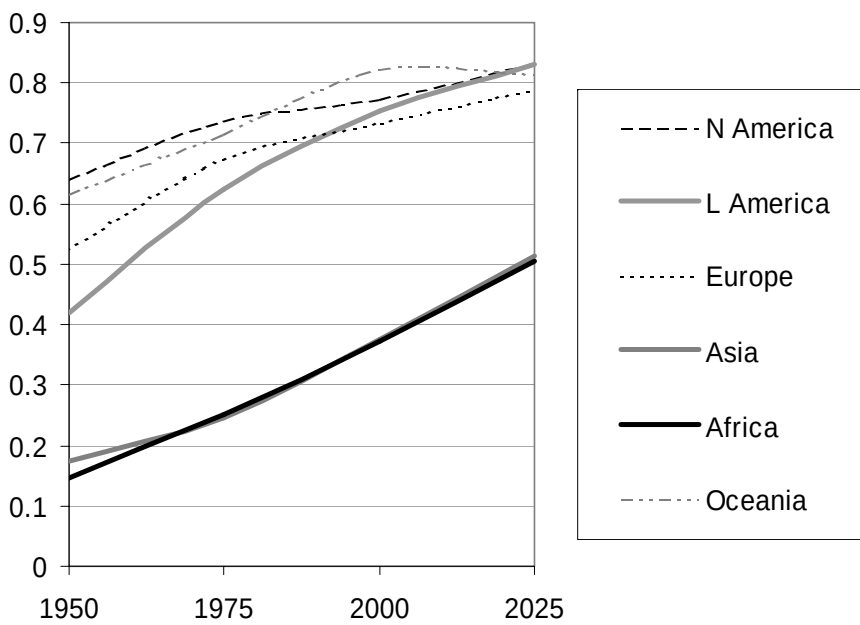
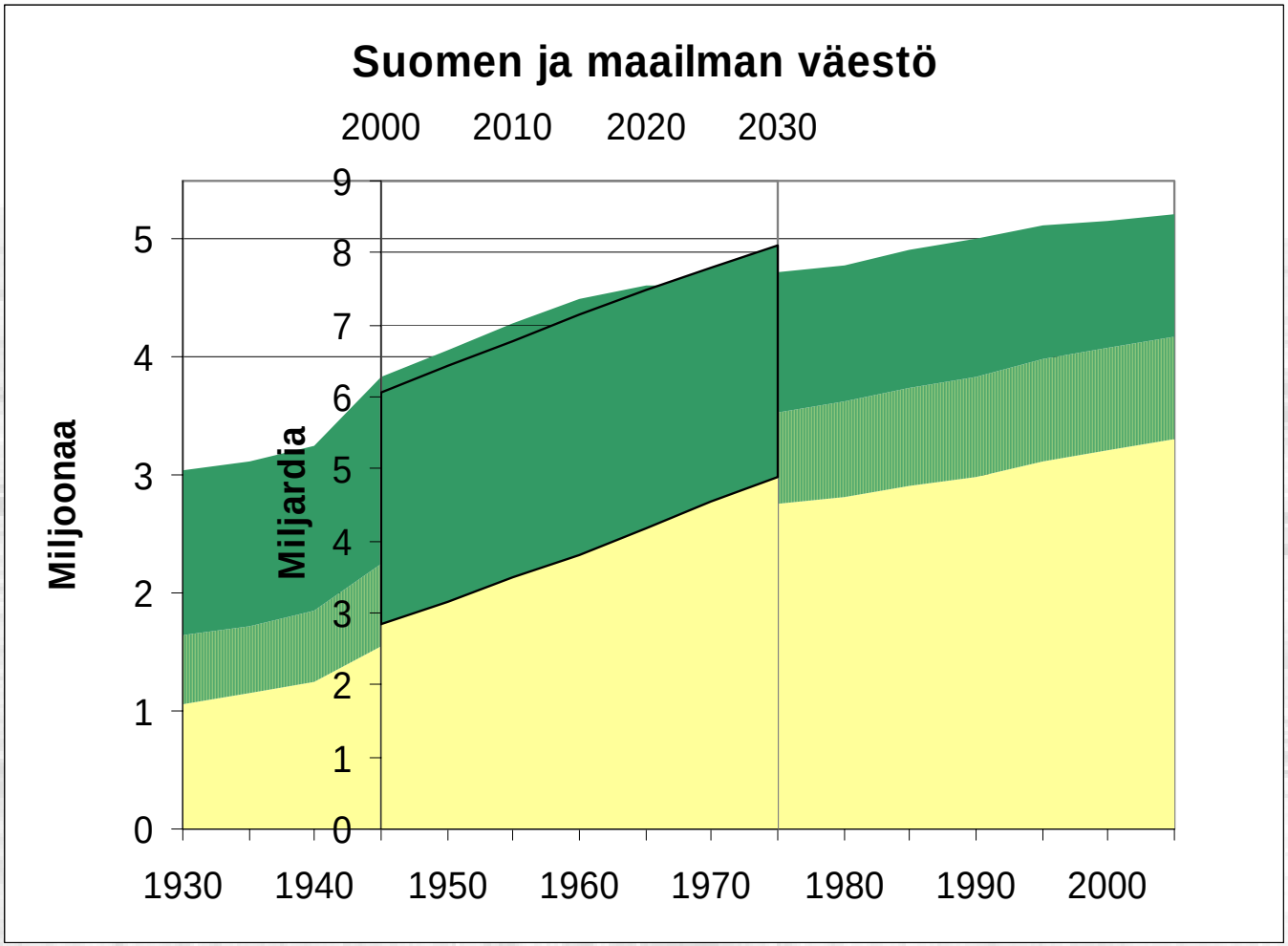
Rural population: ~stabile
Urban population: +70M / year

Feeding new urbans: 0.7 Niles a year!





Comparison



Development

Water and hunger

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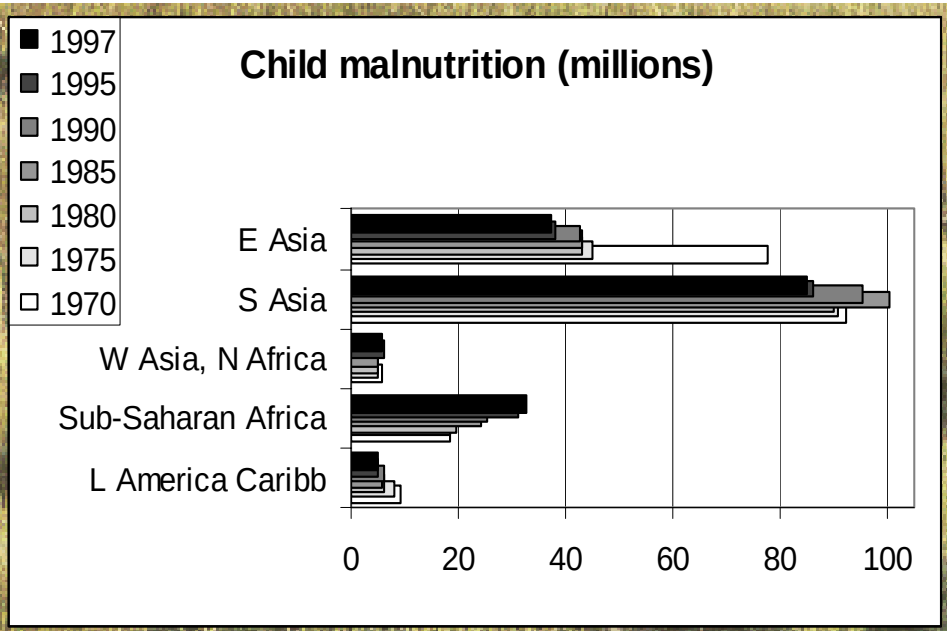
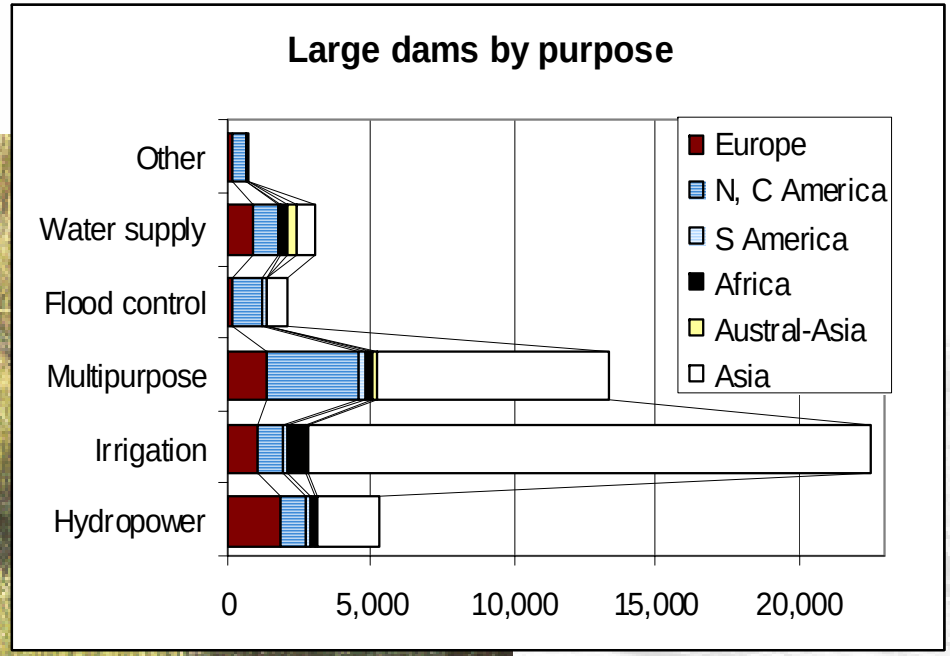
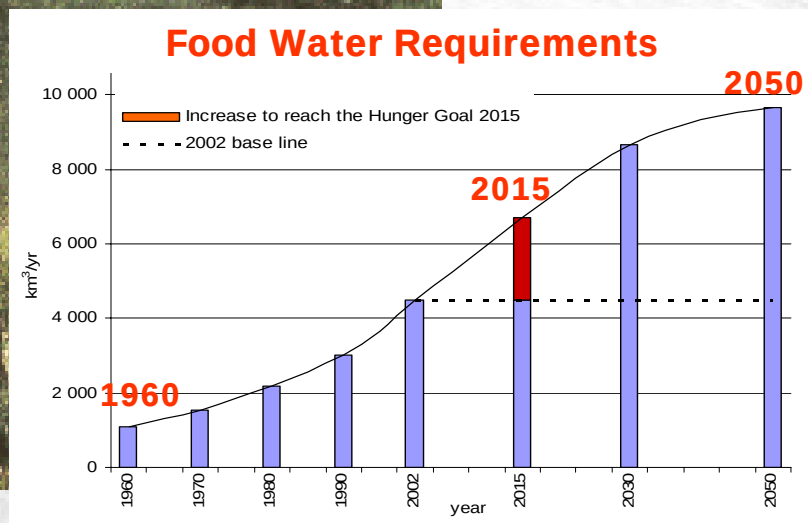






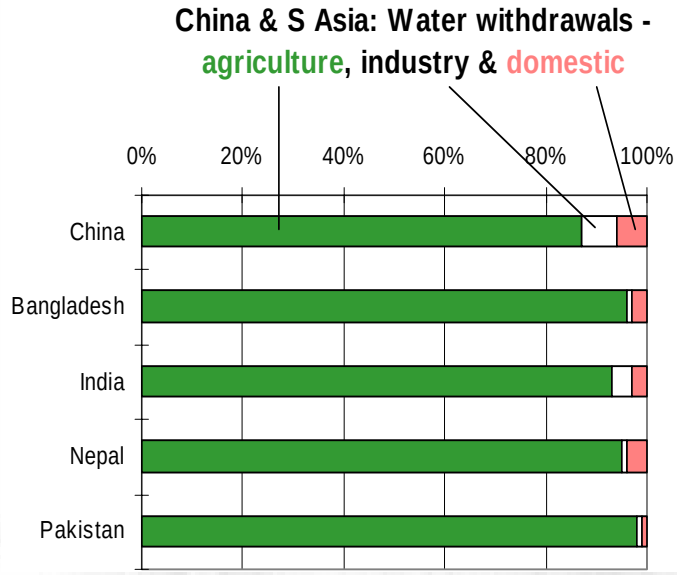
Development

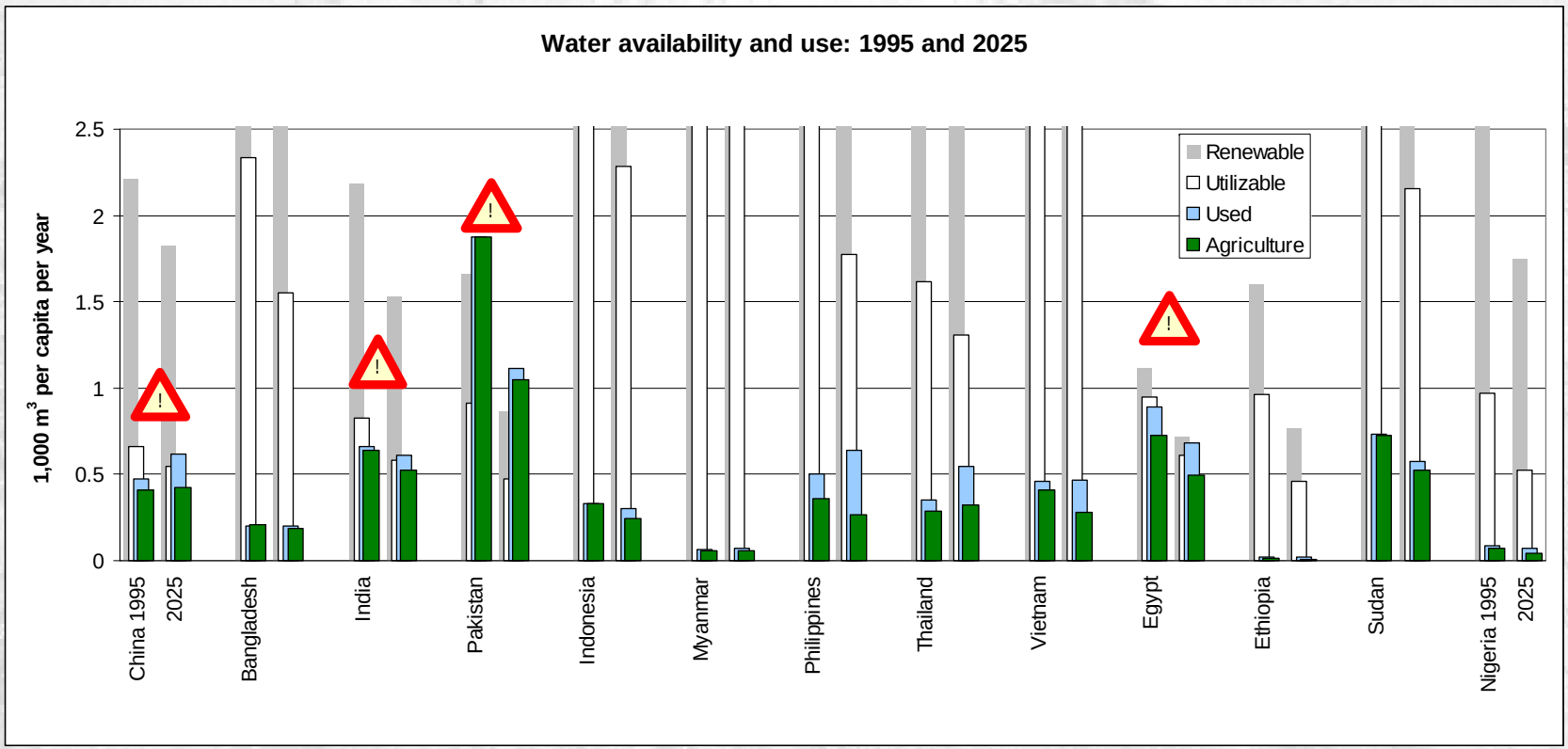
Water and hunger

- About 90% of water used for agriculture is returned to the atmosphere in the vapour form
- All rain-fed and irrigated agriculture occupy about one third of the land surface for crops and livestock production.
- Only about 17% of these lands are under irrigation and account for 40% of the total output
- Agriculture is the major user of freshwater in the world. It accounts for 70% of all uses of water worldwide today.

Development

Water and hunger





Development

Water and health

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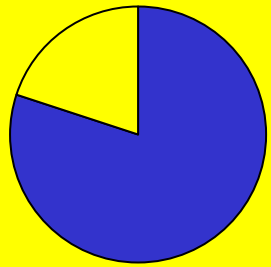
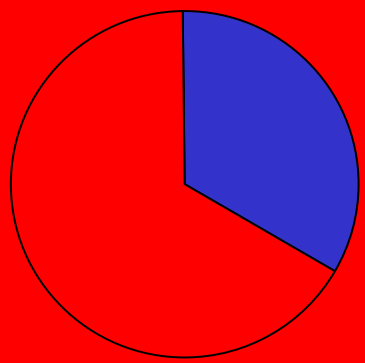
Low quality domestic water

4/5 of all diseases





1/3 of all deaths

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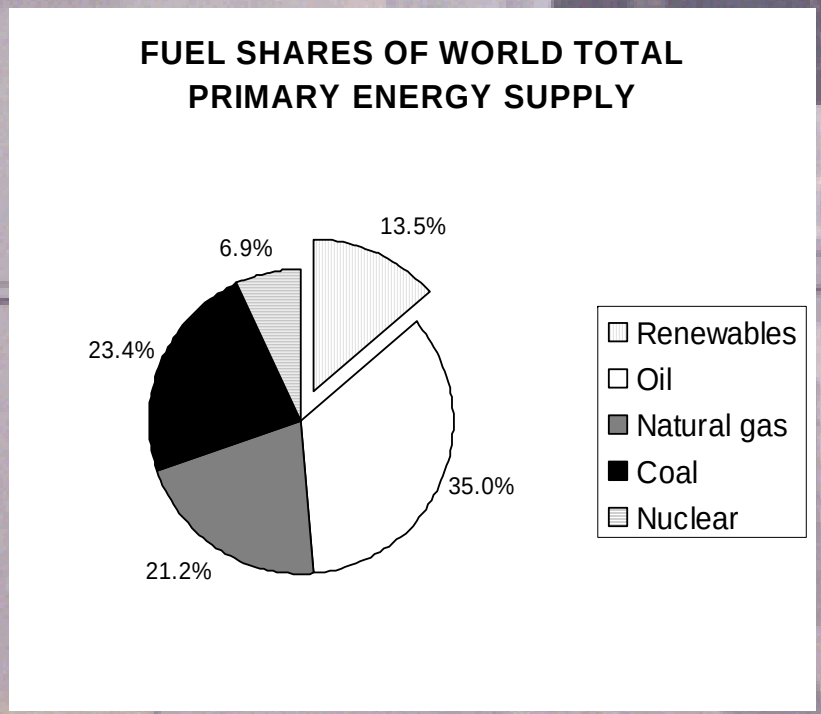
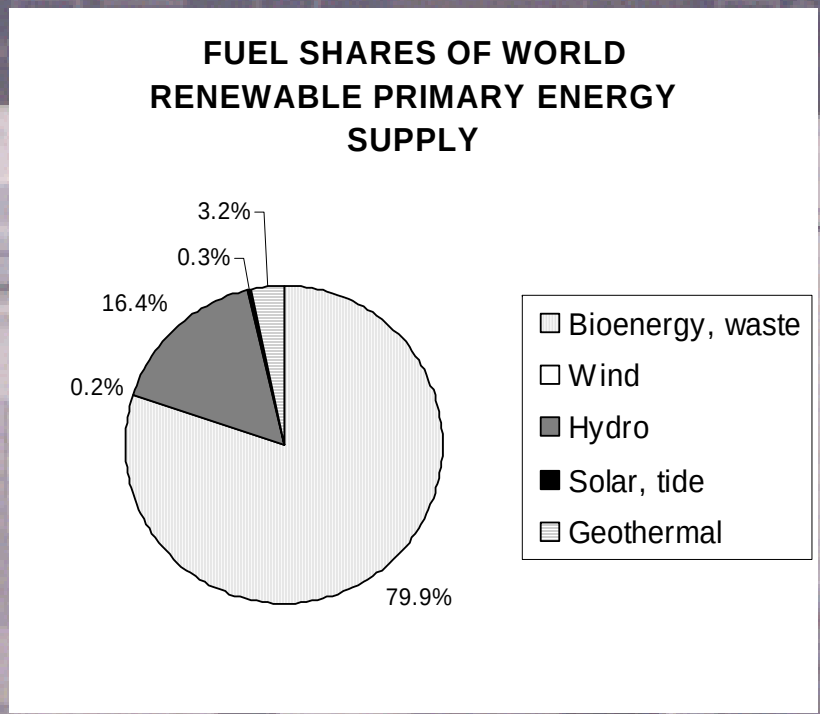
Development

Water and energy





Johannesburg 2002:

Diversify energy supply and substantially **increase the global share of renewable energy sources** in order to increase its contribution to total energy supply.

of Hong Kong, covers only 25 central inces.

urrently, CAT generates revenue from S95A network when Hutch subscribers their handsets outside the 25 central inces, and from foreign visitors who CDMA handsets in Thailand.

he nationwide CDMA expansion pro-

current cost of 20,000-30,000 baht for a fixed-line number.

As a result, CDMA wireless technology could replace fixed lines in most areas of the country at a much lower cost, Mr Withit said, adding that in areas where it is difficult to lay cable for fixed-line numbers or there are insufficient numbers

To win back customers, CAT plans to relaunch CDMA95A services with very competitive handsets and airtime prices, Mr Withit said.

CAT Telecom is now talking to Hutchison about a joint marketing campaign nationwide, as well as amending the two companies' existing marketing contract.

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1997 economic crisis," Mr Xie said. hile domestic savings in China, at of gross domestic product, was one e highest in the world, domestic credit jumped to 165% of GDP from 96% the past 12 years.

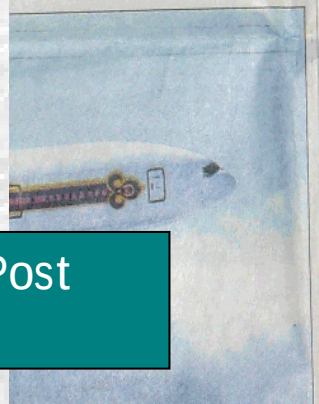
Ir Xie said the lending trend could to a financial crisis if the quality of k lending turns downwards.

hina's role in the global market mean- le was expected to rise faster, with e value having doubled over the past e years compared with every five years iously. Chinese exports, within the 2-3 years, would exceed even that of n to the world market.

Ir Xie said China's economy was one worked primarily on low margins, to its vast labour pool.

ut rapid growth is creating rising and for natural resources, such as oil water.

nd without a social safety net, Chinese sumers have increased their spending. income inequality is increasingly oming a social problem in the country, Xie said.



ENERGY ALTERNATIVE FUELS

B2 fuel sold at Bangchak and PTT stations is 30 satang a litre cheaper than regular diesel.

Biodiesel programme increasingly popular

PHITSANU THEPTHONG

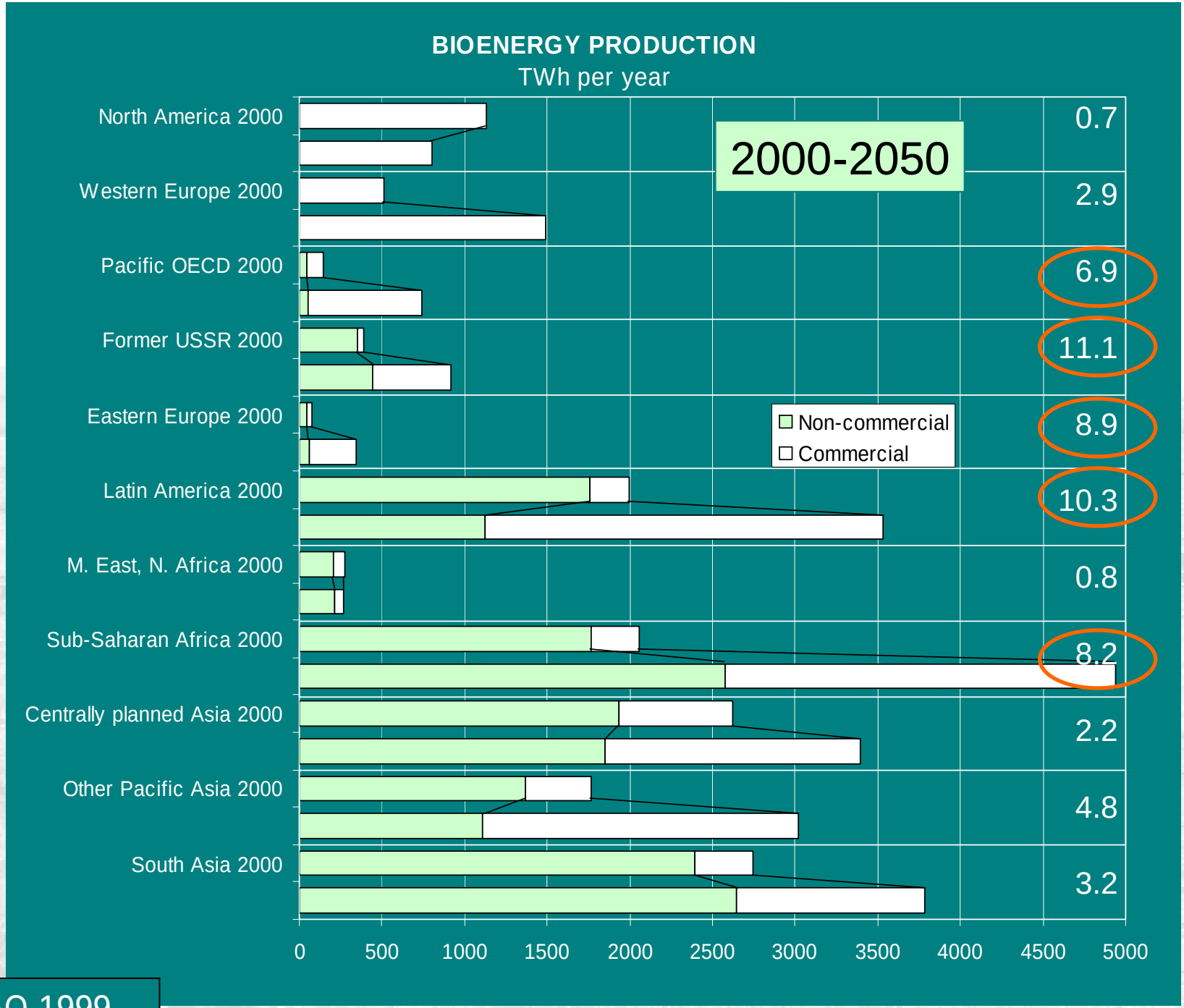
Chiang Mai — More and more drivers are participating in a programme to use biodiesel, in particular *song taew* mini-

become more educated about its use.

At a Bangchak station on Mahidol Road, sales to co-operative buses, municipal vehicles and other users were now around 1,000 litres per day, up from 300-400 litres

Lähde: Bangkok Post
January 20 2005

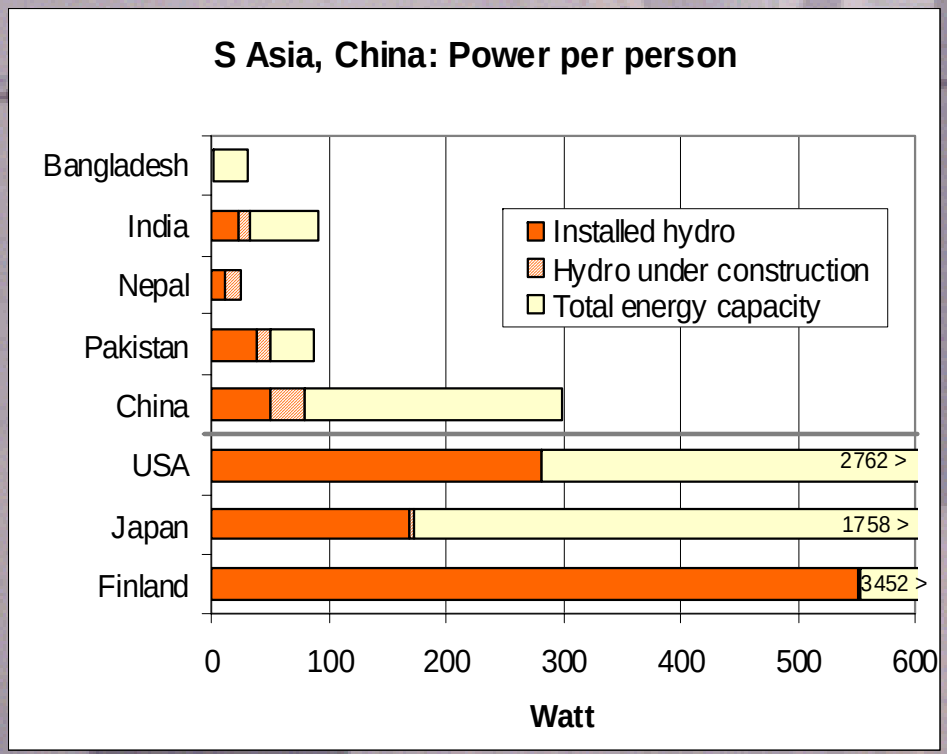

1123
B
Bio
diesel
bus



Source: FAO 1999

Development

Water and energy



70M new urbans need ~35 000 MW

Compare:
Finland's all hydro 1300 MW (1/26)

3 Gorges Dam 17500 MW (1/2)

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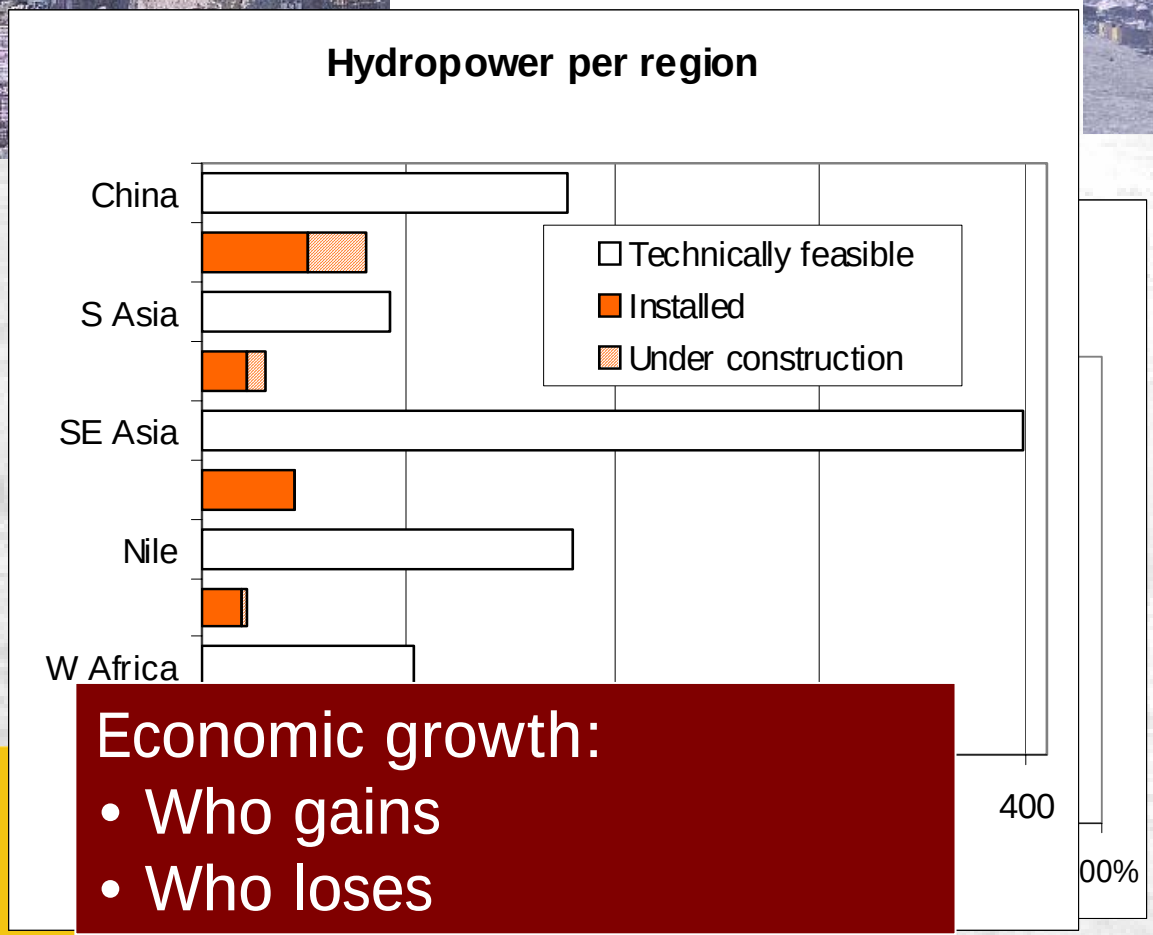
Water and energy:
A big controversy



Economic growth:
- Who gains
- Who loses

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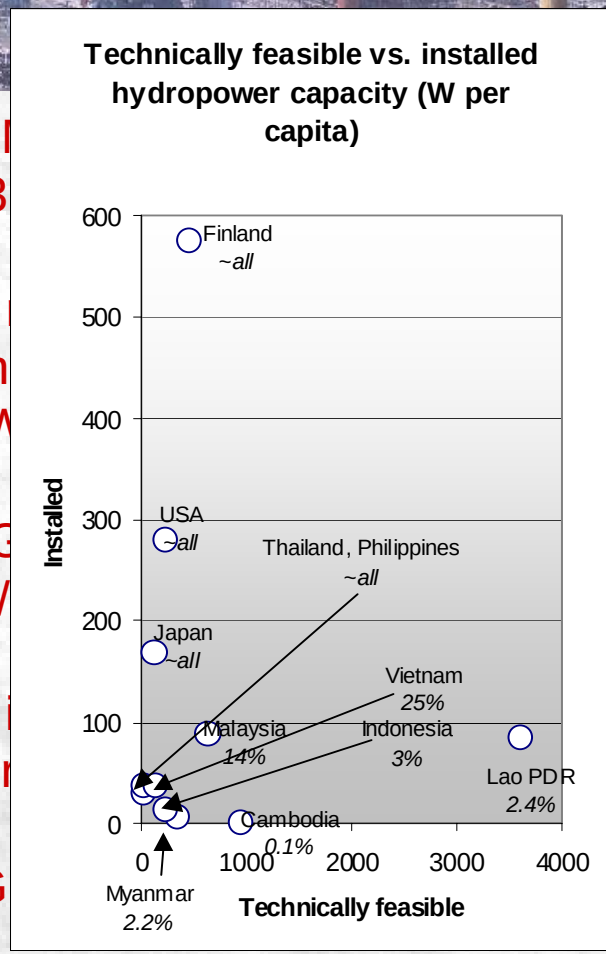
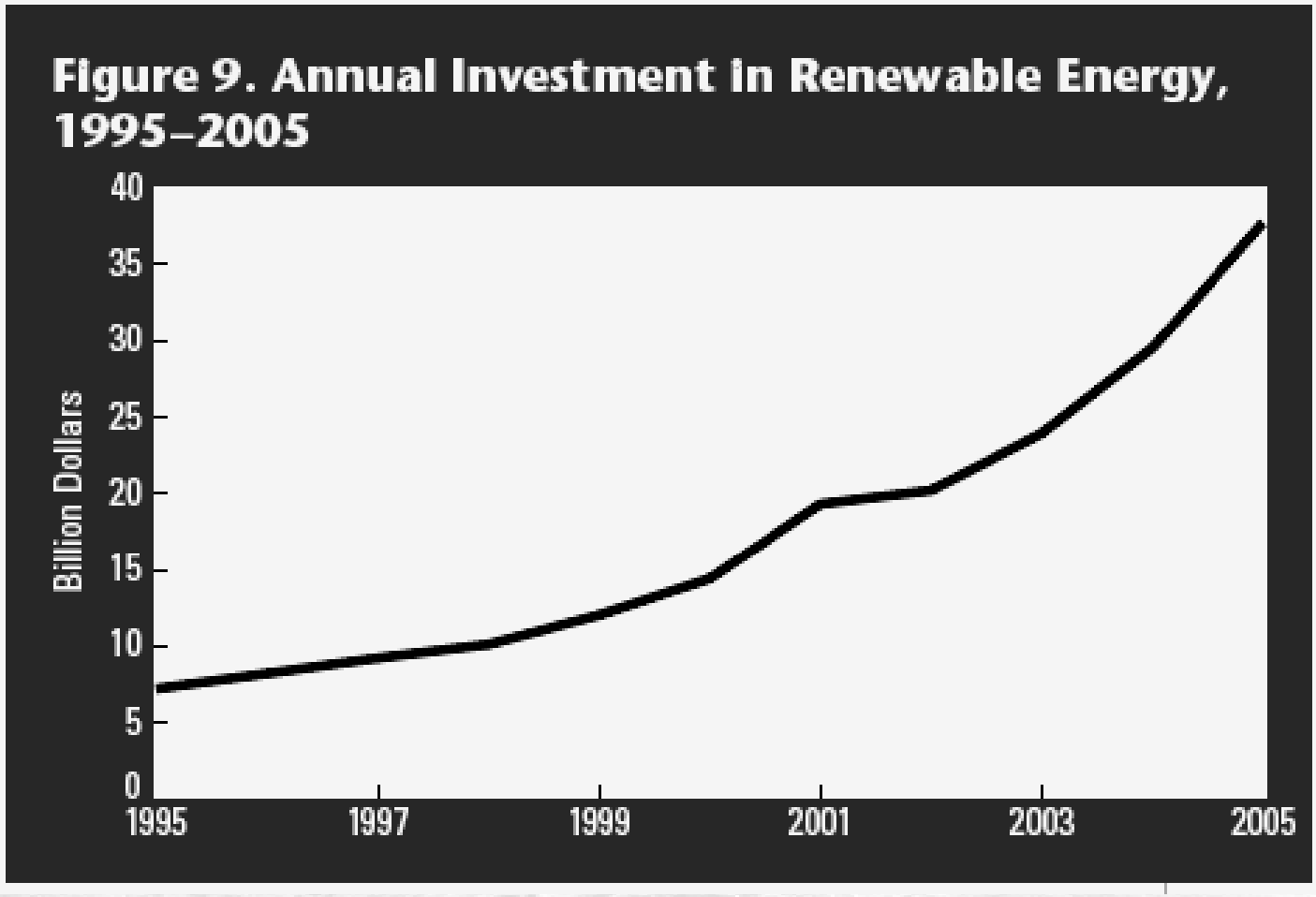


Investment in Renewable Energy



REN21, Global Status Report 2006

Development

Water and environment

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Sample environmental problems (int. commitments)

- Biodiversity
- Wetland degradation (Ramsar)
- Desertification
- Climate change

Water is the key: eg climate change

STATUS
IPCC 3rd Assessment on Global Circulation Models

MOST IMPORTANT UNCERTAINTIES OF GCMS

- **Atmospheric feedbacks** Most important feedback of greenhouse warming: growing water vapour concentration in the troposphere
- **Water vapour** feedback doubles the warming in comparison to former models
- **Cloud system** is now the greatest uncertainty
- **Ocean processes** improved: heat fluxes (atmosphere-water), large-scale circulations (ENSO etc), major problems: narrow straits, mixing, convection
- **Thermohaline circulation** salinity – temperature interplay a great problem (Arctic flows, Gulf stream, melting glaciers etc!)
- **Vegetation photosynthesis and water use** improvements
- **Snow, permafrost and sea ice** improvements, but ice dynamics are still a major problem
- **From global to regional processes** improvements, e.g. NAO, ENSO
- **Threshold type of changes** abrupt changes typical but poorly recognized

Development

Water and environment

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- Biodiversity
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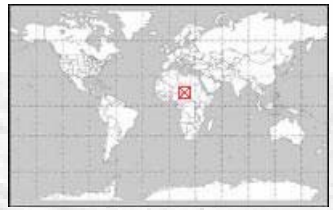
- Desertification
- Climate change

Water is the key: eg climate change

Often interlinked: eg Lake Chad

Lake Chad

- Basin 2,4 M km^2 (Finland x 7)
- Surface area
  - 1960s 25 000 km^2 (Päijänne x 25)
  - 2000s 2 000 km^2 (Päijänne x 2)



⊕ 1970s: a civil war (”cold” war)

⊕ Regional economies destroyed

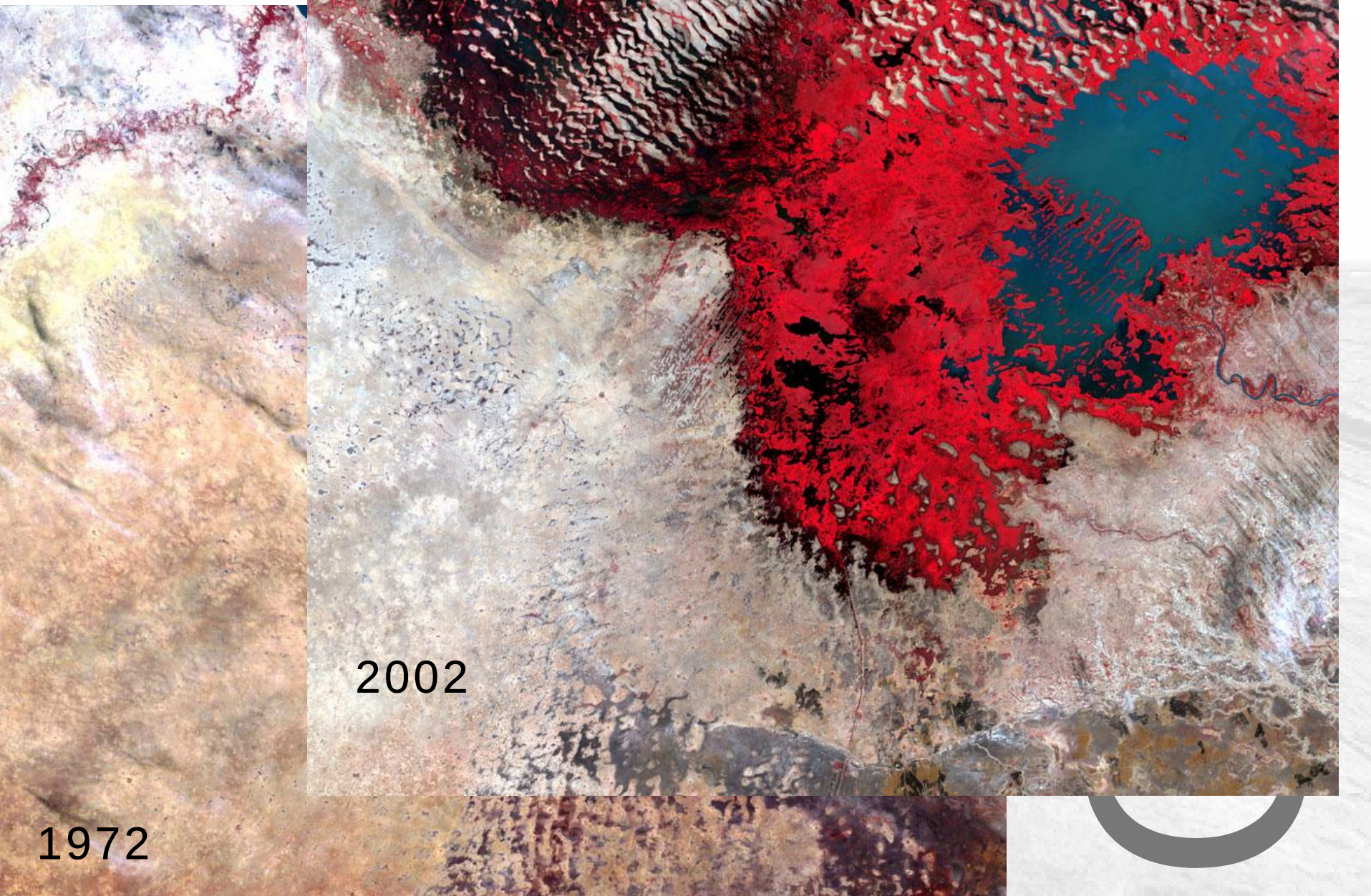
⊕ Most of population uprooted

Chad

⊕ 1970s onwards: serious droughts -> Lake Chad has lost 90% of surface area

⊕ Rapid urbanization

⊕ Urban formal sector almost NIL


2002
1972

Development

Water and environment

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Water is the key: eg climate change
Often interlinked: eg Lake Chad

Water: entry point for ecosystem management!

Selected water quality problems

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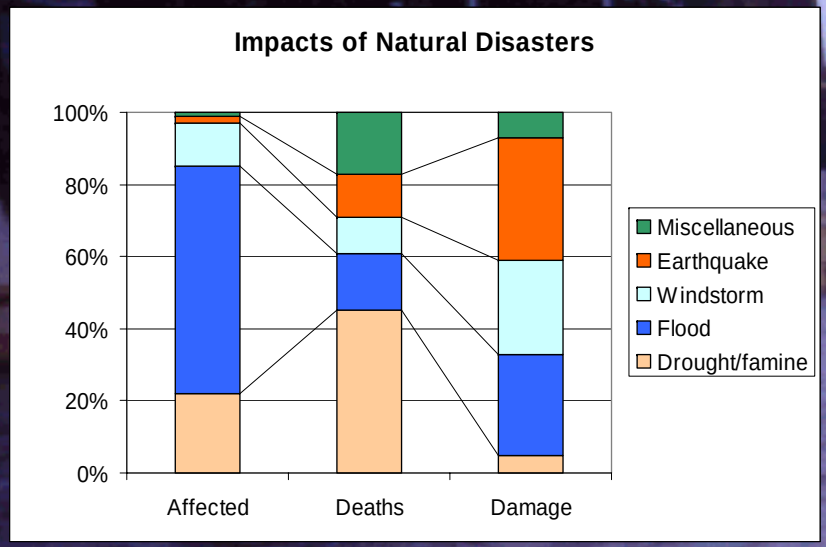
- Eutrophication abundance of nutrients → enhanced primary production
- Oxygen depletion caused by degradation of organic matter in water
- Hygienic problems pathogens such as viruses, bacteria or protozoa
- Salinization high concentrations of ions such as calcium, sodium, chloride and sulphate
- Acidification due to atmospheric deposition of SO_2 and NO_x or by industrial, mining or natural emissions
- Toxic or cumulative compounds heavy metals or other trace elements, radioactive compounds, halogenated hydrocarbons, water-borne toxins
- Suspended material and turbidity inorganic or organic matter
- Changed thermal conditions thermal pollution, flow control or changed climate

Pollution source abatement

- Domestic: minimize disease agents
  - facilitate nutrient reuse
  - wastewater reclamation for reuse
- Industrial: minimize output of hazardous substances
  wastewater reclamation for reuse
- Agricultural: minimize pesticide output
  - improved fertilisers
  - facilitate local nutrient recycling

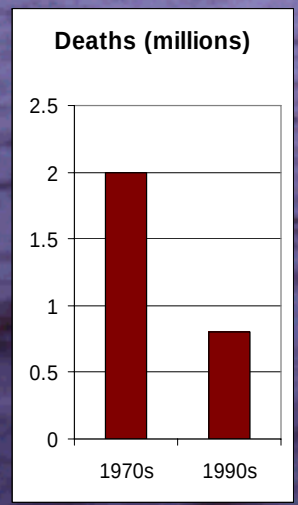
Development

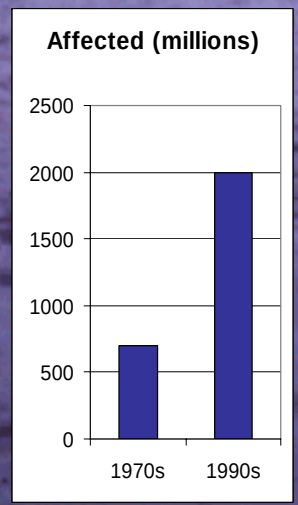
Water and Catastrophes

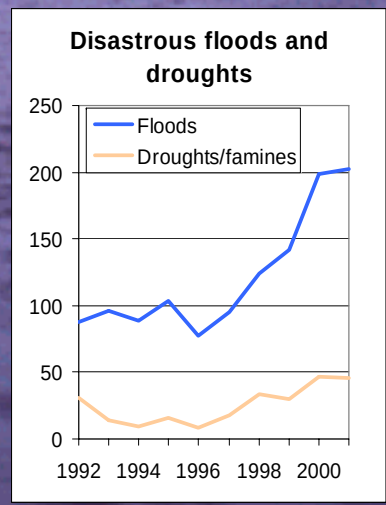


- **Catastrophic floods: influence 1.3 billion people**
- **Droughts kill 4x more than earthquakes**

(Red Cross & Red Crescent 2002)







Water & development paradigms

Johannesburg WSSD

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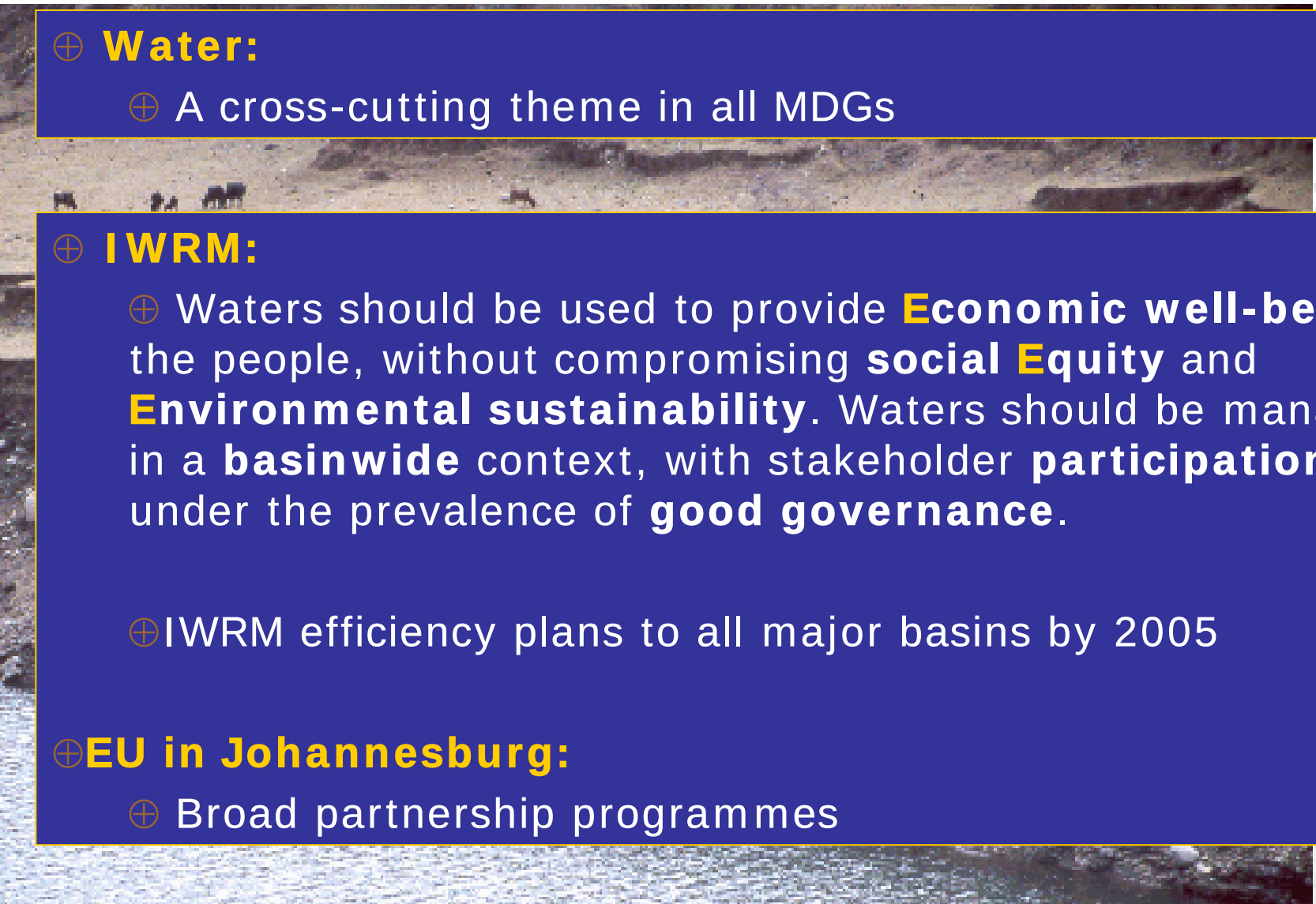
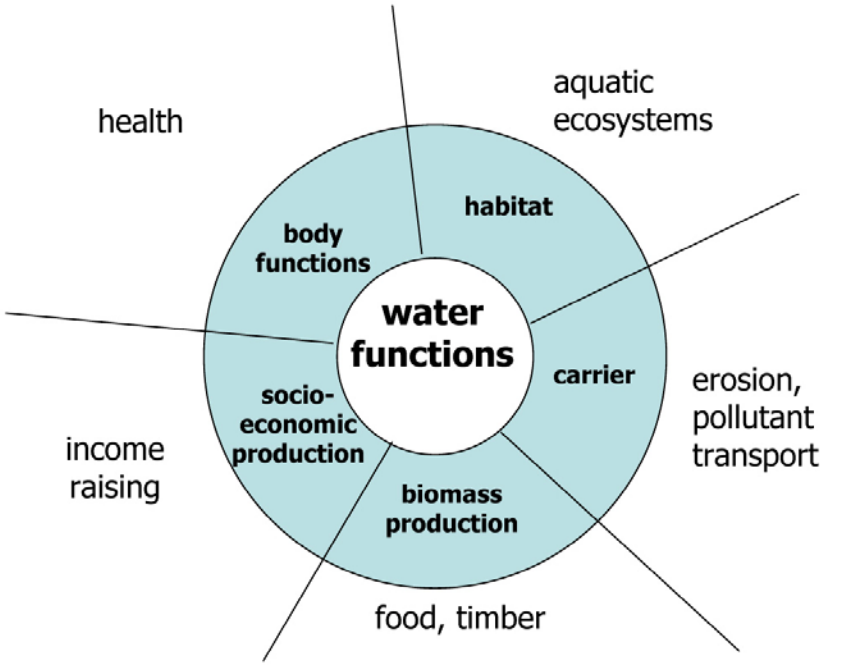


- **Water:**
  - A cross-cutting theme in all MDGs
- **IWRM:**
  - Waters should be used to provide **Economic well-being** to the people, without compromising **social Equity** and **Environmental sustainability**. Waters should be managed in a **basinwide** context, with stakeholder **participation** and under the prevalence of **good governance**.
  - IWRM efficiency plans to all major basins by 2005
- **EU in Johannesburg:**
  - Broad partnership programmes

Broadening the perspective

Water has many parallel functions



- Three sets of emerging problems to face
  - ***quantity limitations***
  - ***quality limitations***
  - ***ecosystem collapses***

- Challenges to manage
  - ***40 percent more people to feed***
  - ***bioenergy to replace fossil fuels***

Challenge

We MUST be able to break conventional boundaries and find interconnections in a way not seen before

DOABLE?