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science for global insight

Water, Energy and Food- Towards operationalization

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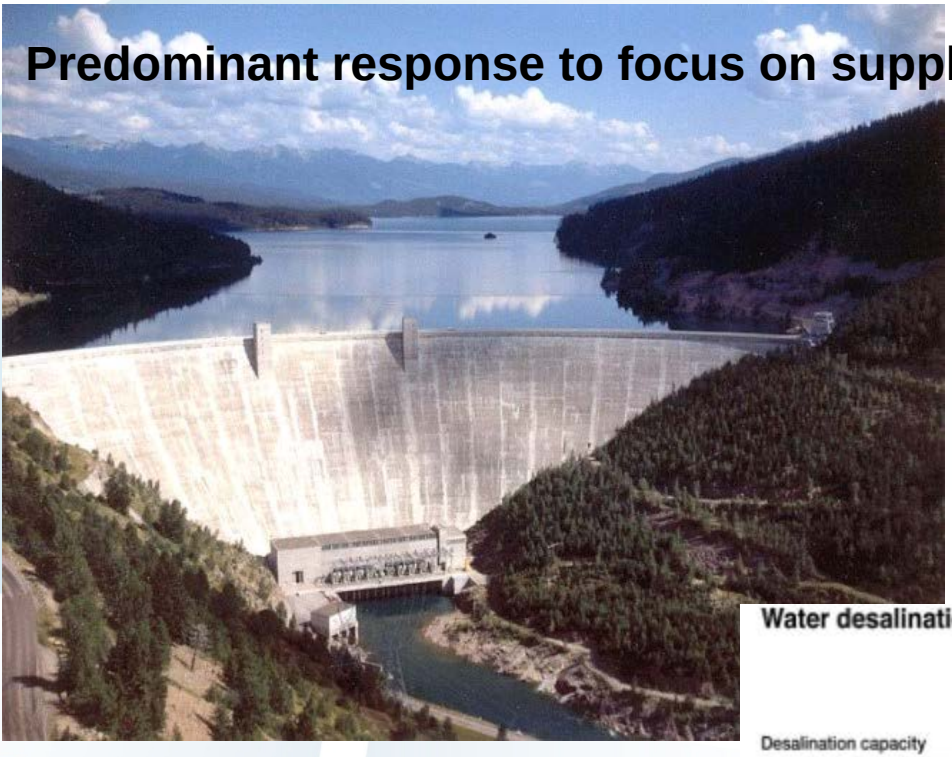
Introduction

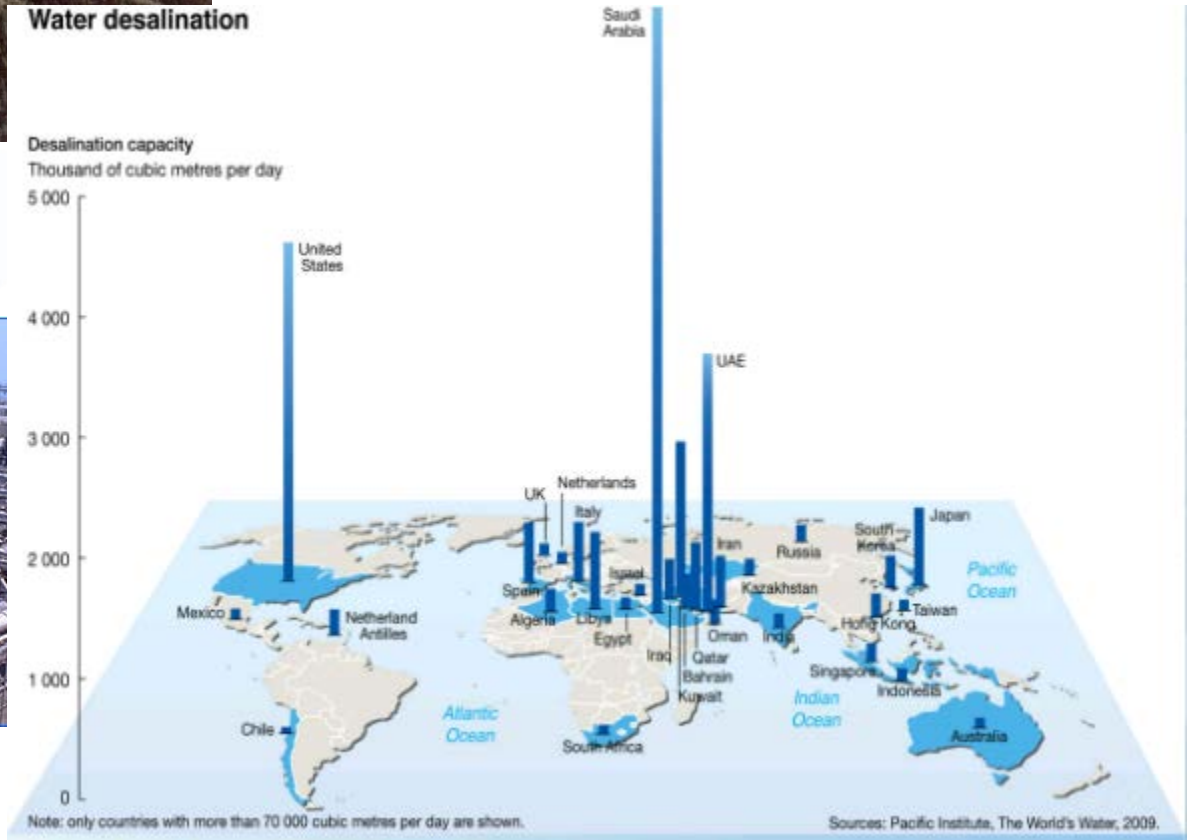
- Up to 2 billion more people by 2050
- Need to produce 70 percent more food
- For access to energy to be universal energy generation needs to double
- With increasing energy and food demands WATER demands are expected to rise by 55 percent
- Up to 40 percent of the worlds population will live in severe water stressed regions

Predominant response to focus on supply

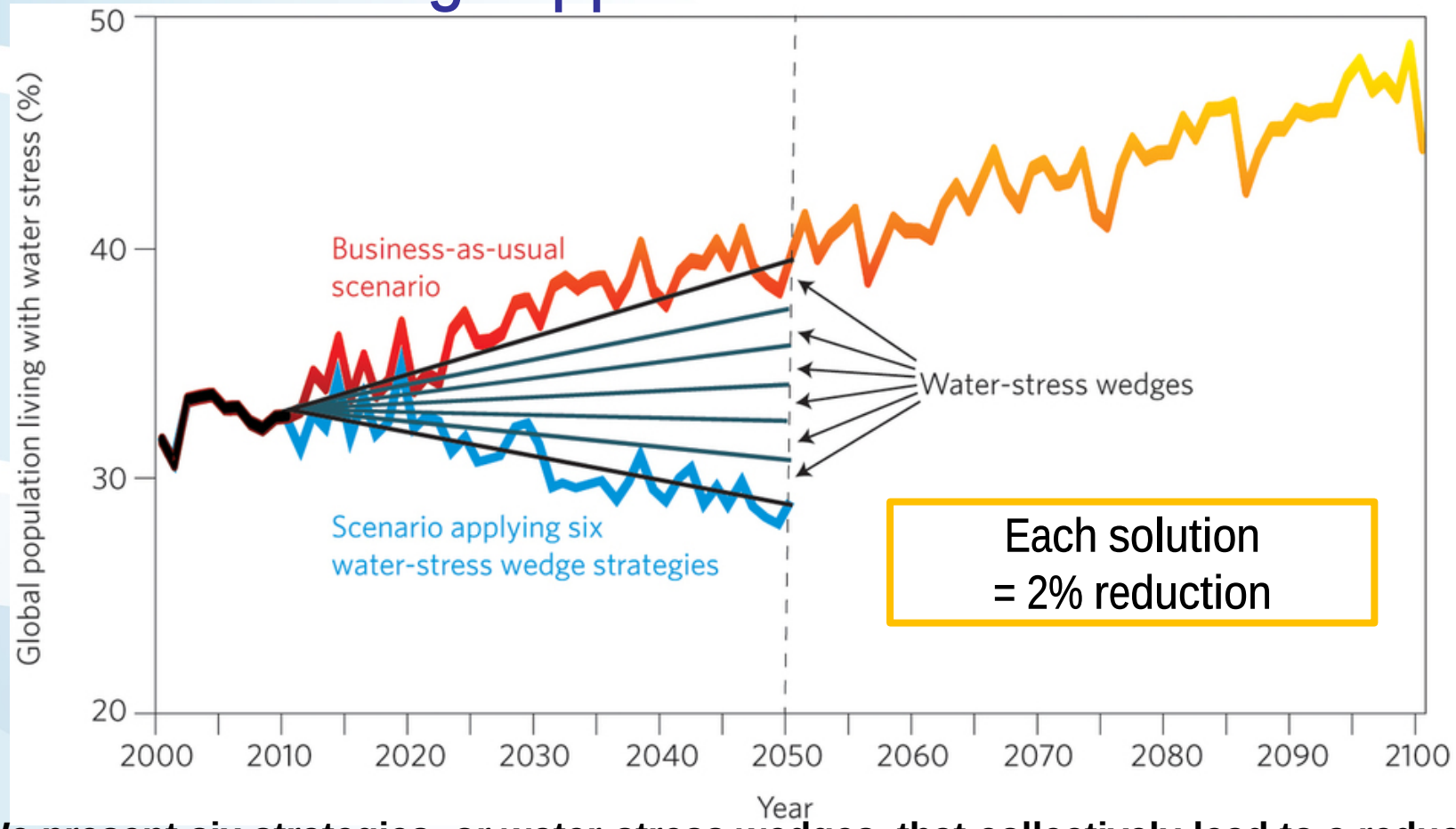


Additional 600 km^3 reservoir storage
(by 2050)
US$ 10 billion??

50 times increase in desalination capacity
(by 2050)
US$ 20 billion??



Wedge approach to water stress



We present six strategies, or water-stress wedges, that collectively lead to a reduction in the population affected by water stress by 2050, despite an increasing population.

- **Water productivity – crop per drop**
- **Irrigation efficiency – decrease losses**
- **Water use intensity – industry and domestic**
- **Population**
- **Reservoir storage**
- **Desalination**

Soft path vs. Hard path

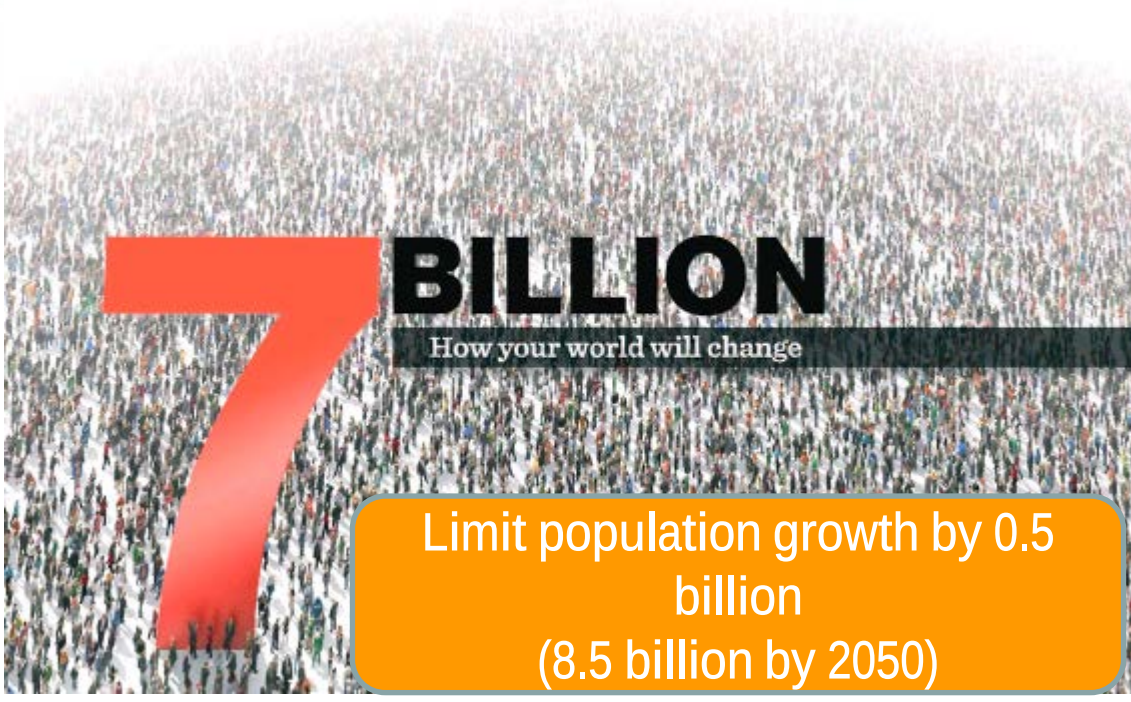
Wada et al. (2014), Nature Geoscience

More Crop Per Drop

Improvement in water productivity at 0.5% per year (20% by 2050)

Efficiency increase by 1% per year (40% by 2050)

Improvement of 0.5% per year (20% by total)



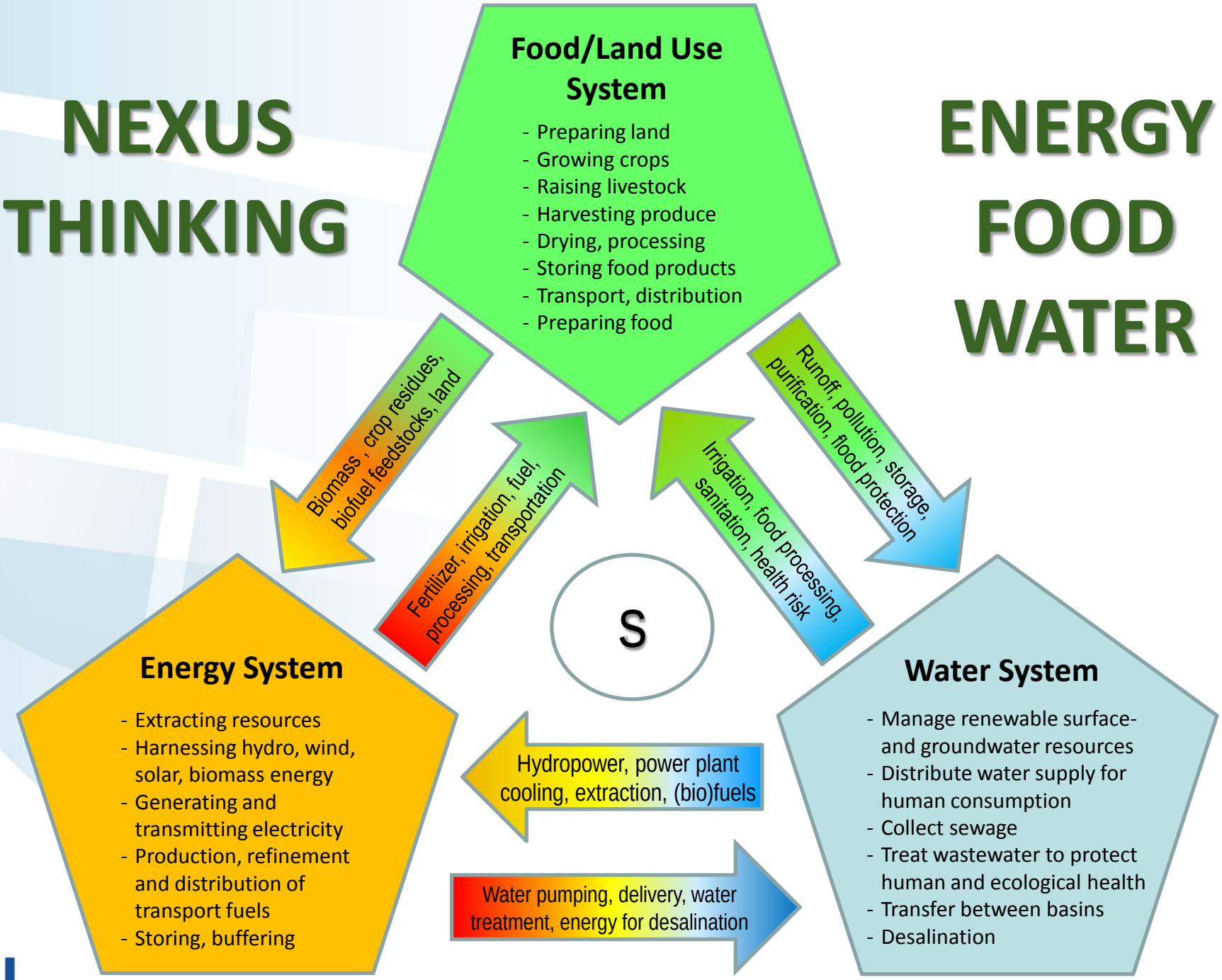
Limit population growth by 0.5 billion (8.5 billion by 2050)

A new approach is required to operationalize investments and planning at a regional scale

- To capture synergies and trade- offs among food, energy, water and ecosystems
- Identifies cross-sectoral solutions responding to various alternative futures
- ***Integrated Solutions for Water, Energy and Land*** is a new project funded by the Global Environment Facility which sets out to do this

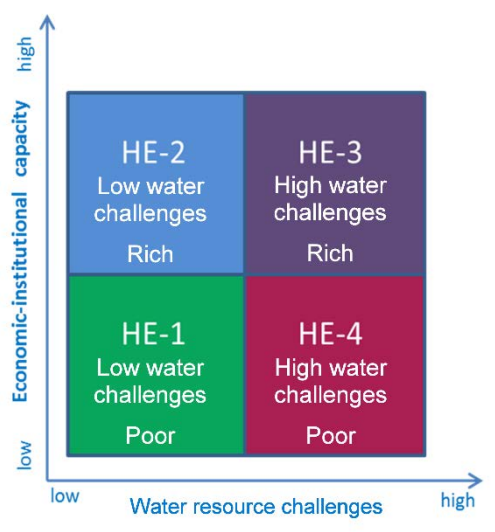
NEXUS THINKING

ENERGY FOOD WATER



Multiple scenarios

Developing narratives of the future



SSP1: The world is moving toward sustainability

SSP characteristics

- Improved resource use efficiency
- More stringent environmental regulations
- Rapid technological change is directed toward environmentally friendly processes
- Management of global commons improves.

Implications for Manufacturing Water Use:

- Manufacturing industries with efficient water use and low environmental impacts are favored.
- Enhanced treatment, reuse of water, and water-saving technologies;
- Widespread application of water-saving technologies in industry

With global and regional stakeholders co-design scenarios that identify cross sectoral, transboundary issues and priorities for solutions to promote ownership.
Use these to drive Integrated Assessment models (MESSAGE, GLOBIOM, COMWAT)

Regional Basin Case Studies

Indus

Area: 1.100.000 km^2
Countries: Pakistan, India, China, Afghanistan

Population: 257 Mio. people
Projection 2050 (SSP1-5): 370-440 Mio. people

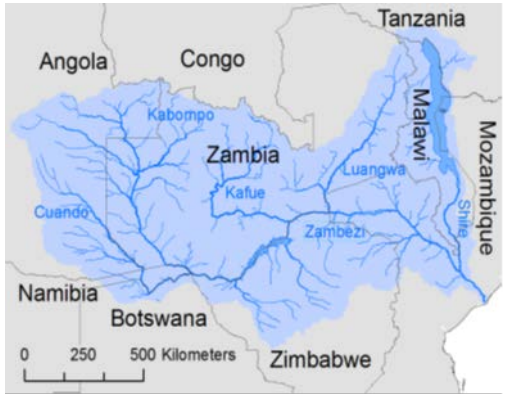
Main land cover: [%]
Cropland: 30 Irrigated cropland: 24
Forest: 0.4

GDP per cap. [US$]: 700 (Afghanistan) - 7600 (China)

Main challenges:

Climate Change	glacier melting
	flood & drought risk
Water security	water scarcity
	agricultural pollution
Energy security	potential of hydropower
	energy access
Food security	irrigation
	groundwater exploitation
Socioeconomic	population growth
	urbanization
	economic growth
Ecosystems	loss of biodiversity

Zambezi



Area: 1.332.000 km^2
Countries: Zambia, Angola, Zimbabwe, Mozambique, Malawi, Tanzania, Botswana, Namibia
Population: 38 mio. people
Projection 2050 (SSP1-5): 70-95 Mio. people

Main land cover: [%]
Cropland: 20 Irrigated cropland: 0.1
Forest: 4

GDP per cap. [US$]: 950 (Zimbabwe) - 5400 (Angola)

Main challenges:

Climate Change	flood & drought risk
Water security	water infrastructure
	water scarcity
	urban, industrial pollution
Energy security	potential of hydropower
	energy access
Food security	potential of irrigation
	soil degradation
Socioeconomic	population growth
	urbanization
	economic growth
Ecosystems	loss of biodiversity

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- (PS Citizen science, see Geo-wiki!)