



INTEGRATED SOLUTIONS FOR WATER, ENERGY and LAND (ISWEL)

Simon Langan

IBKF workshop, 2nd June 2018, Laxenburg

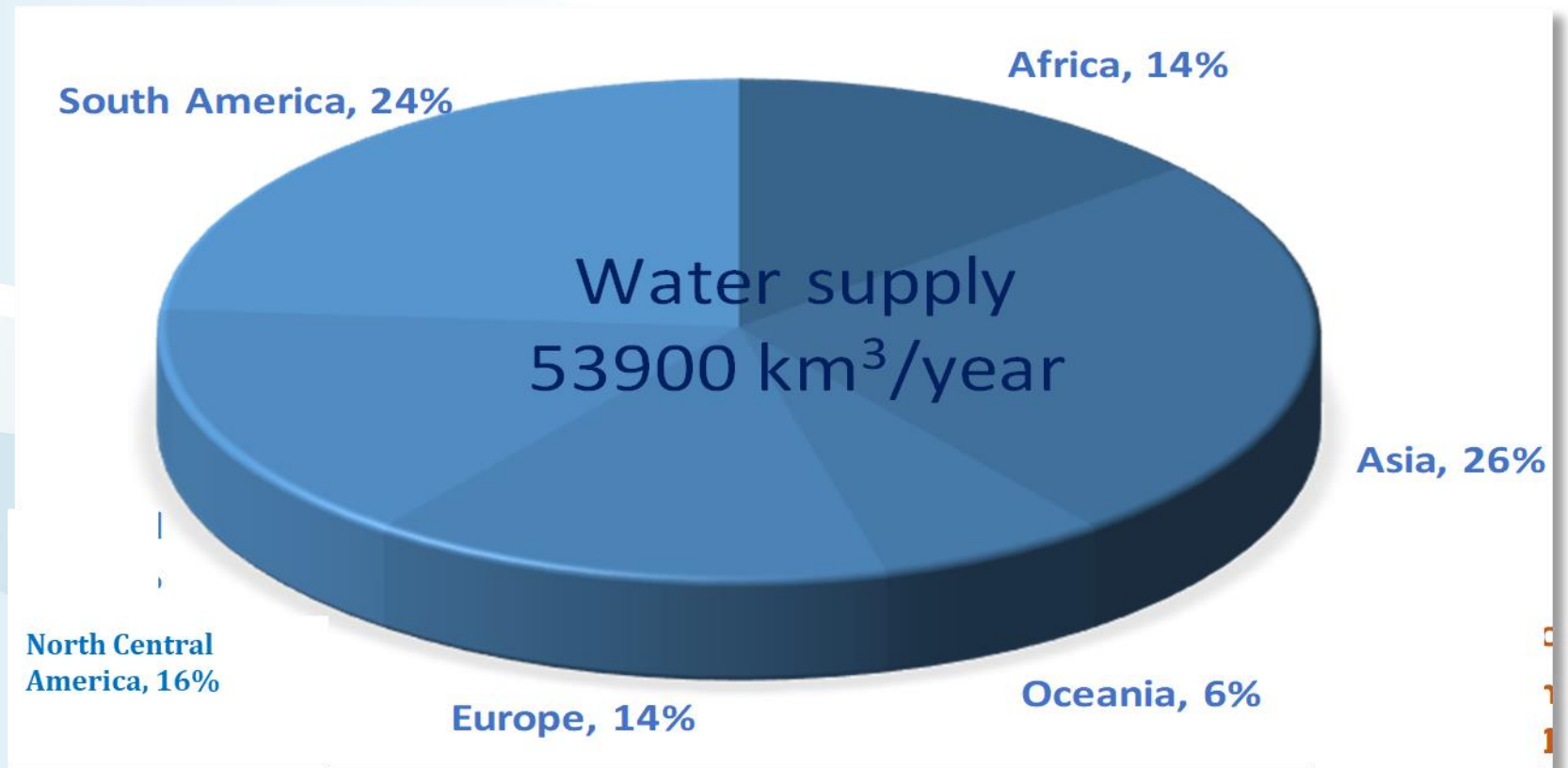


IBKF, Sri Lanka, July 2107, Action point 9

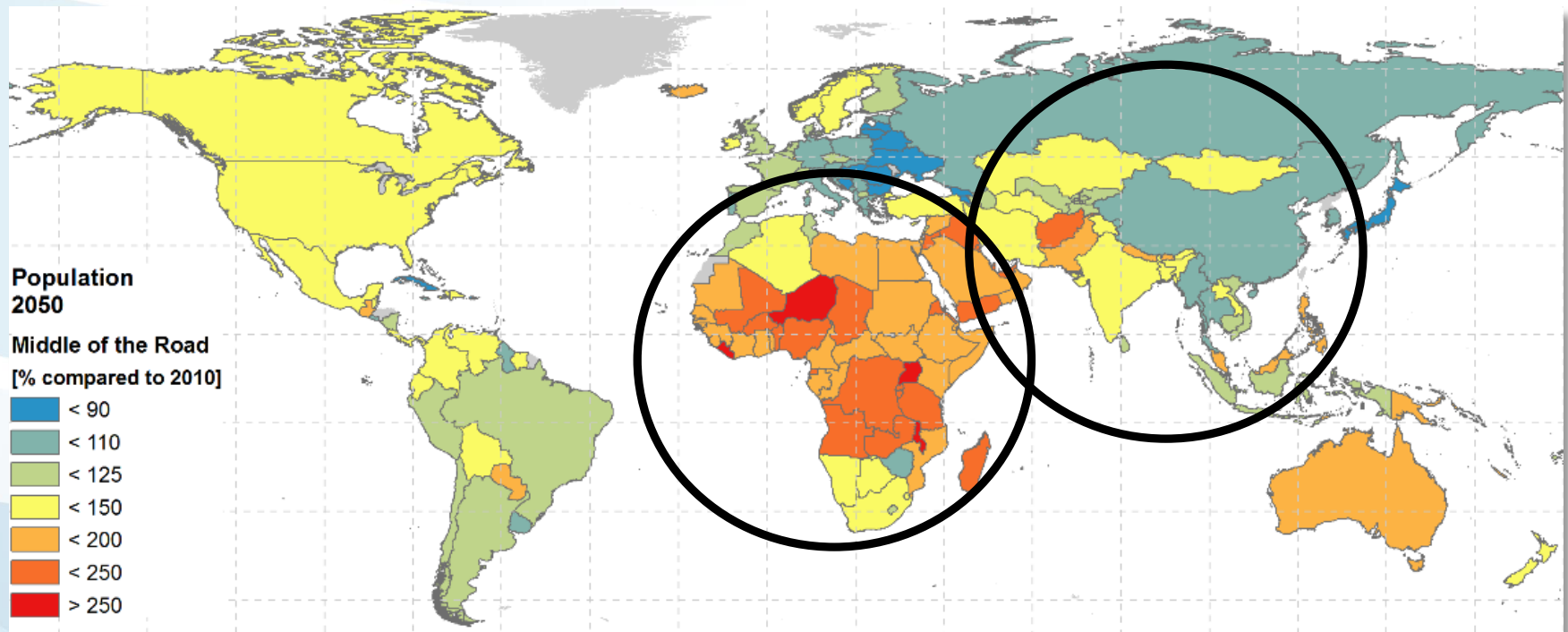
Scenarios/trends/futures (systems): Simon Langan, IIASA:

This Action Point can act as an **interface between science and policy**, and assist **informed decision making** through answering **‘what if’ questions** and scenario building.....It can, therefore, **provide a means for dialogue** about the entire system. To do so, it could provide a common framework based on a set of assumptions and data, thereby ensuring transparency. **The next step in taking forward this Action Point would be to develop the necessary engagement in a scenario development exercise for the Indus Basin.**

Water Resources: Global/Asia



Socio-Economic Scenarios



Middle of the Road future

- 33% more people by 2050 compared to 2010 globally (6.8 billion to 9.1 billion)

Population in [billion]

GDP [1000 billion US\$/yr]

GDP per cap (PPP) in [1000US\$/cap/yr]

Africa

Pop: 1.0 to 2.0 2 times more

GDP: 2.8 to 19.2 7 times more

GDP pc: 2.7 to 9.5 3.5 times more

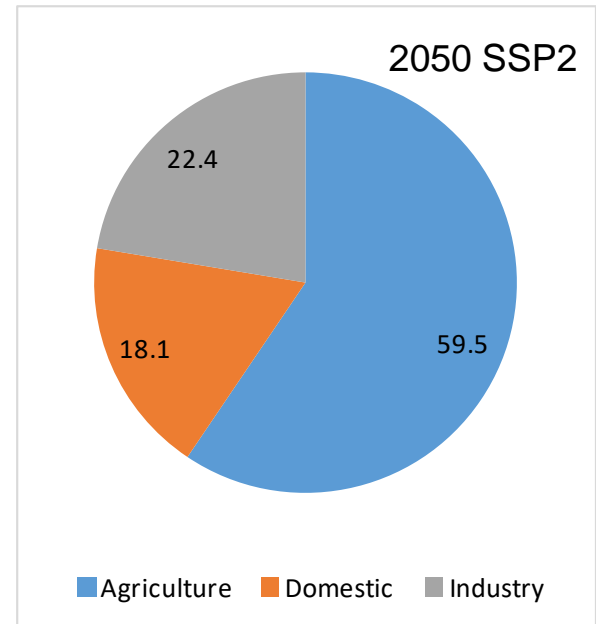
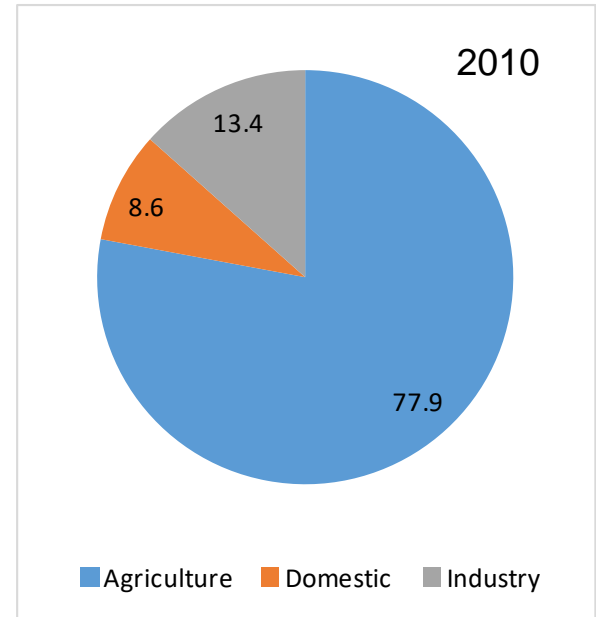
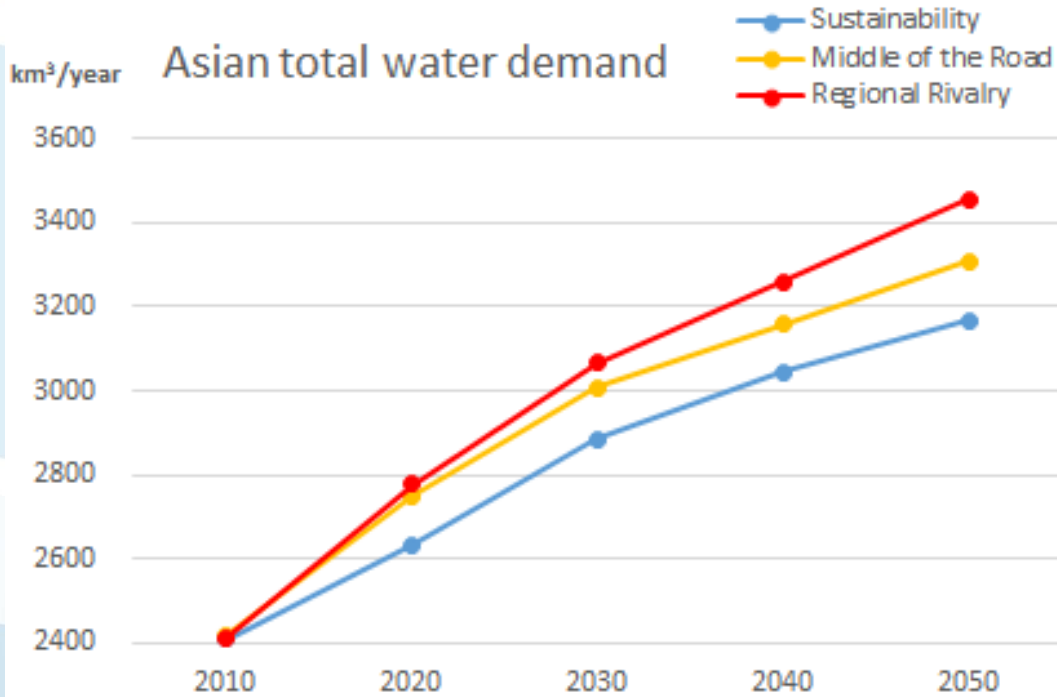
Asia

Pop: 4.1 to 5.1 1.3 times more

GDP: 26 to 123 5 times more

GDP pc: 6.2 to 24.1 4 times more

Water Demand - Asia



Water demand in Asia region, by sector (km³/yr).

Asian total water demand in the 2010s is about 2410 km³/year and will be 3170 - 3460 km³/year (increase 30 - 40%) under the three scenarios

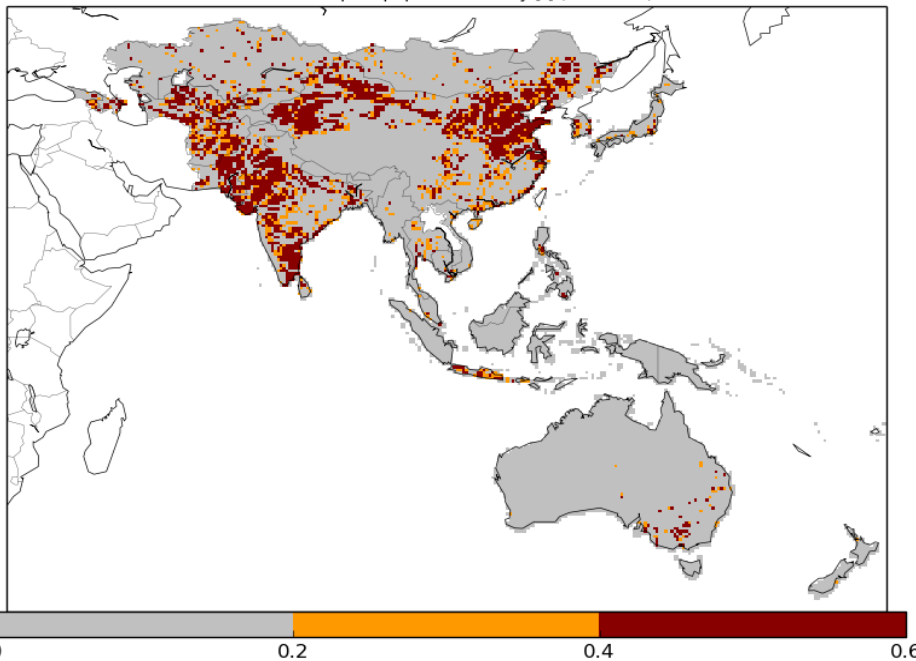
Satoh et al., 2017

Imbalance between demand and supply and sustainability

$$\text{Water scarcity index} = \frac{\text{Water demand}}{\text{Available water resource}}$$

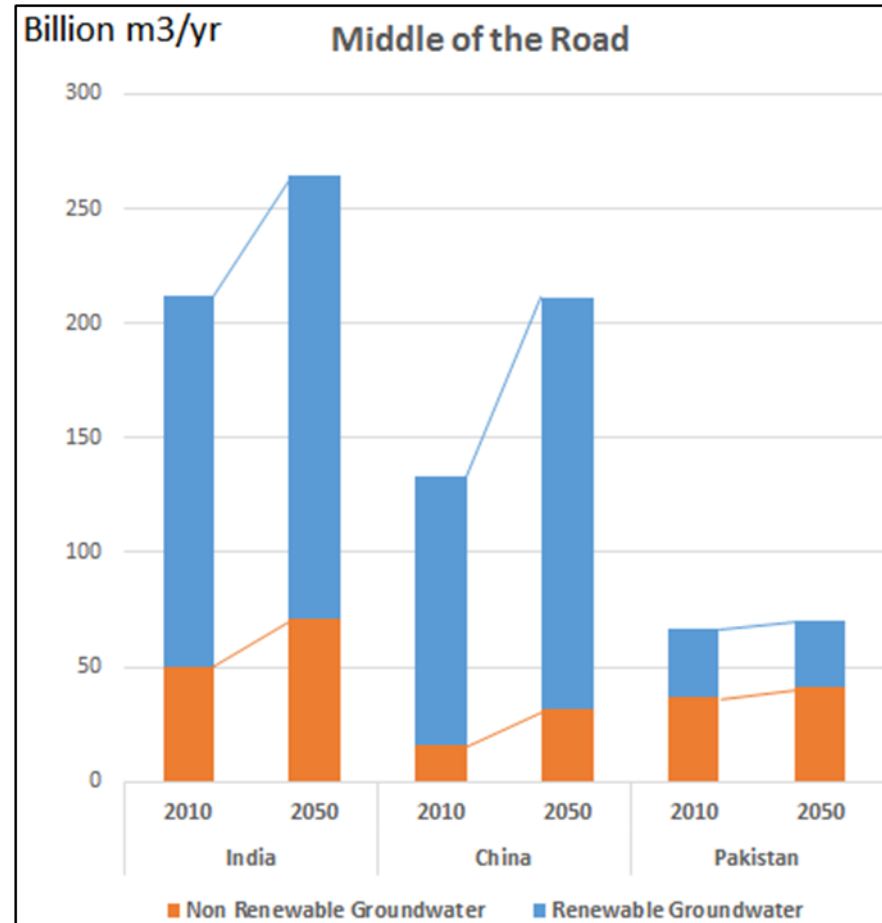
Water stress index
Middle of the Road scenario - 2050

STRESS - ssp2 rcp6p0 2050 Yearly [-] (0.0-179.7)



0.0 0.2 0.4 0.6

Safe water scarce Severely water scarce



Groundwater abstraction in India, China and Pakistan

Global Food Trade

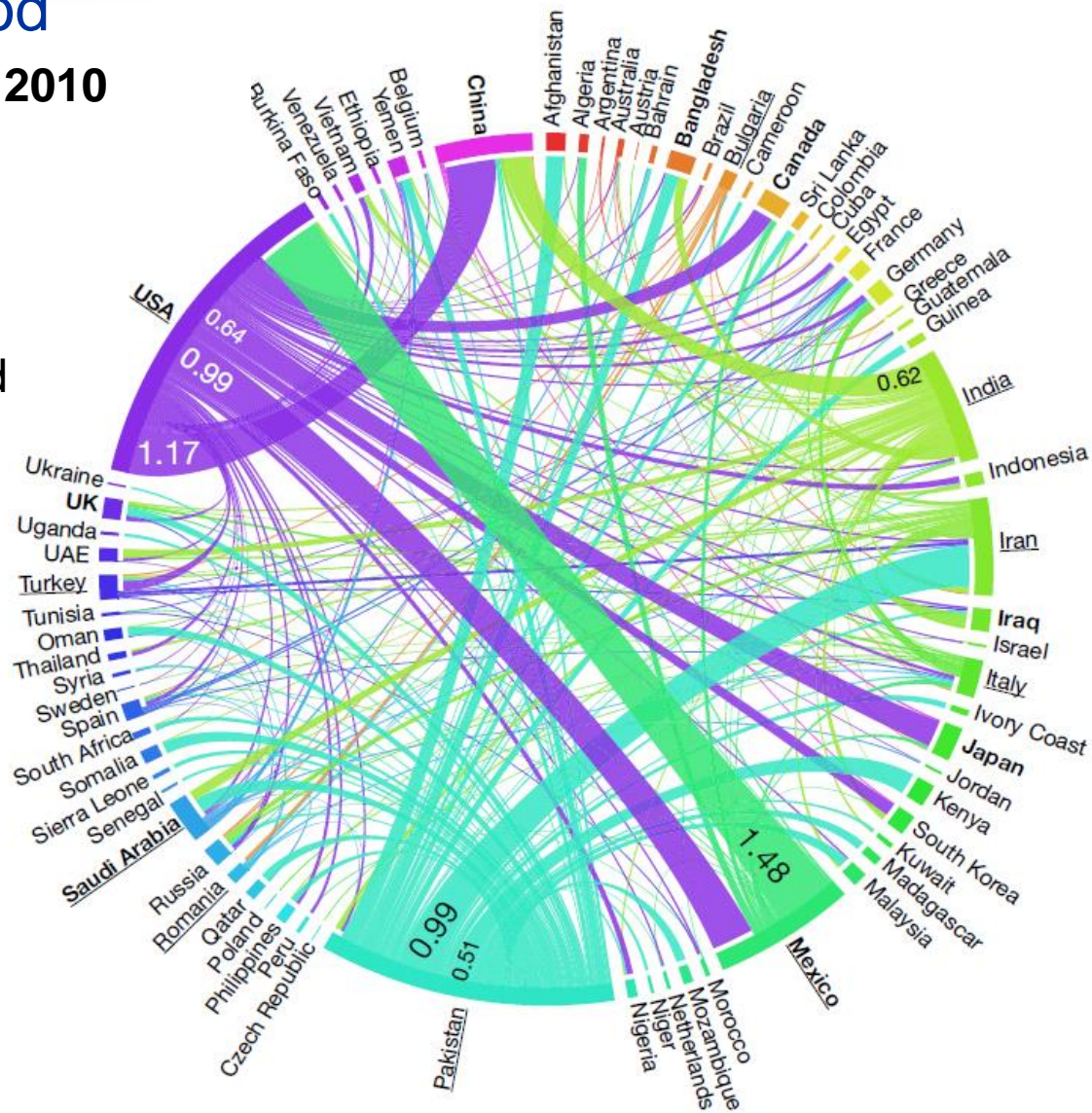
Embedded groundwater depletion in international trade of food

11% of non renewable
Groundwater in int. food trade
2/3 exported by India, USA and
Pakistan

KEY

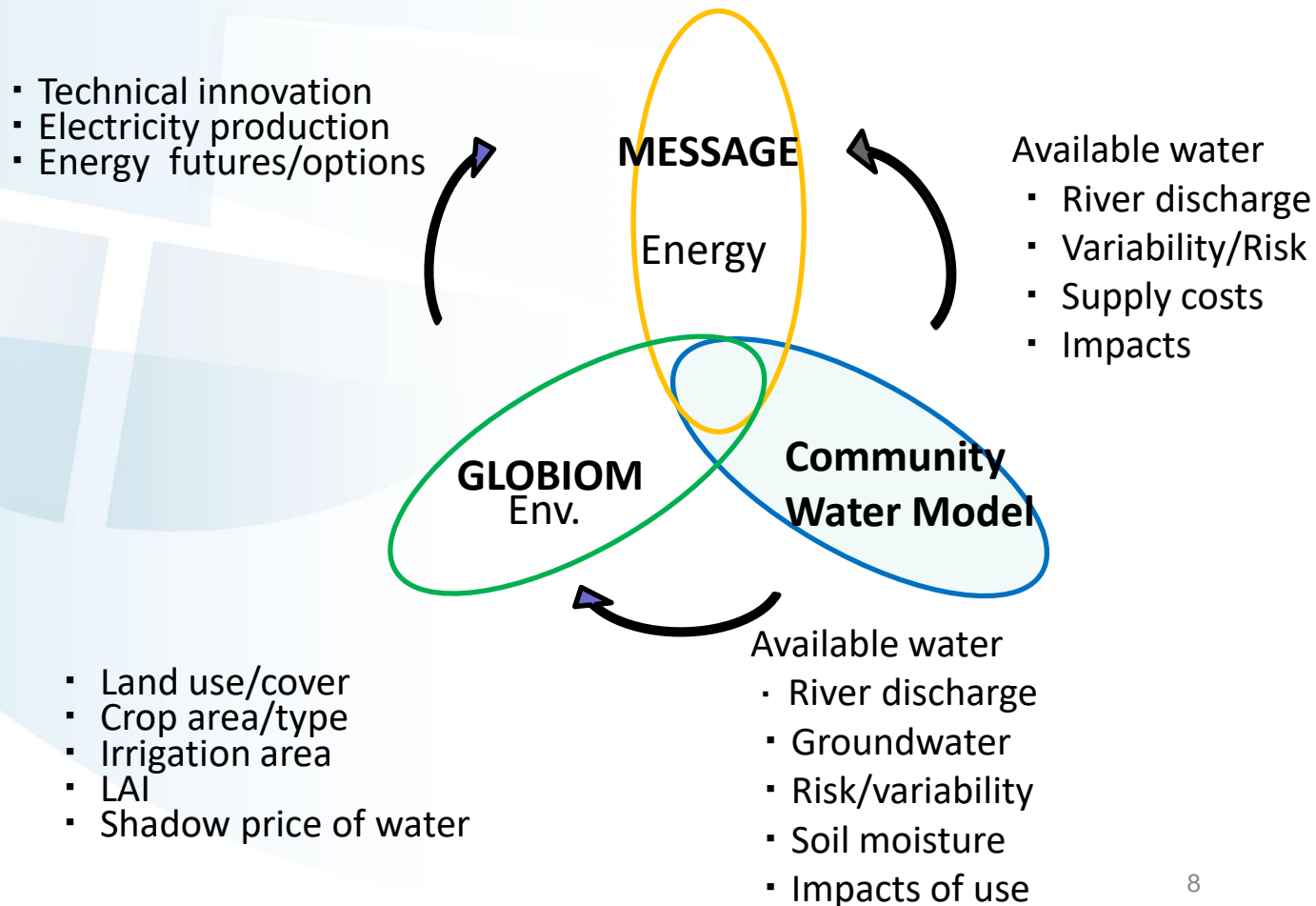
- Units km³
- Colour=country of export
- Top 10 exporters underlined
- **Top ten Importers in bold**

2010





















Nexus model Integration towards SDGs

Improved analysis feedbacks



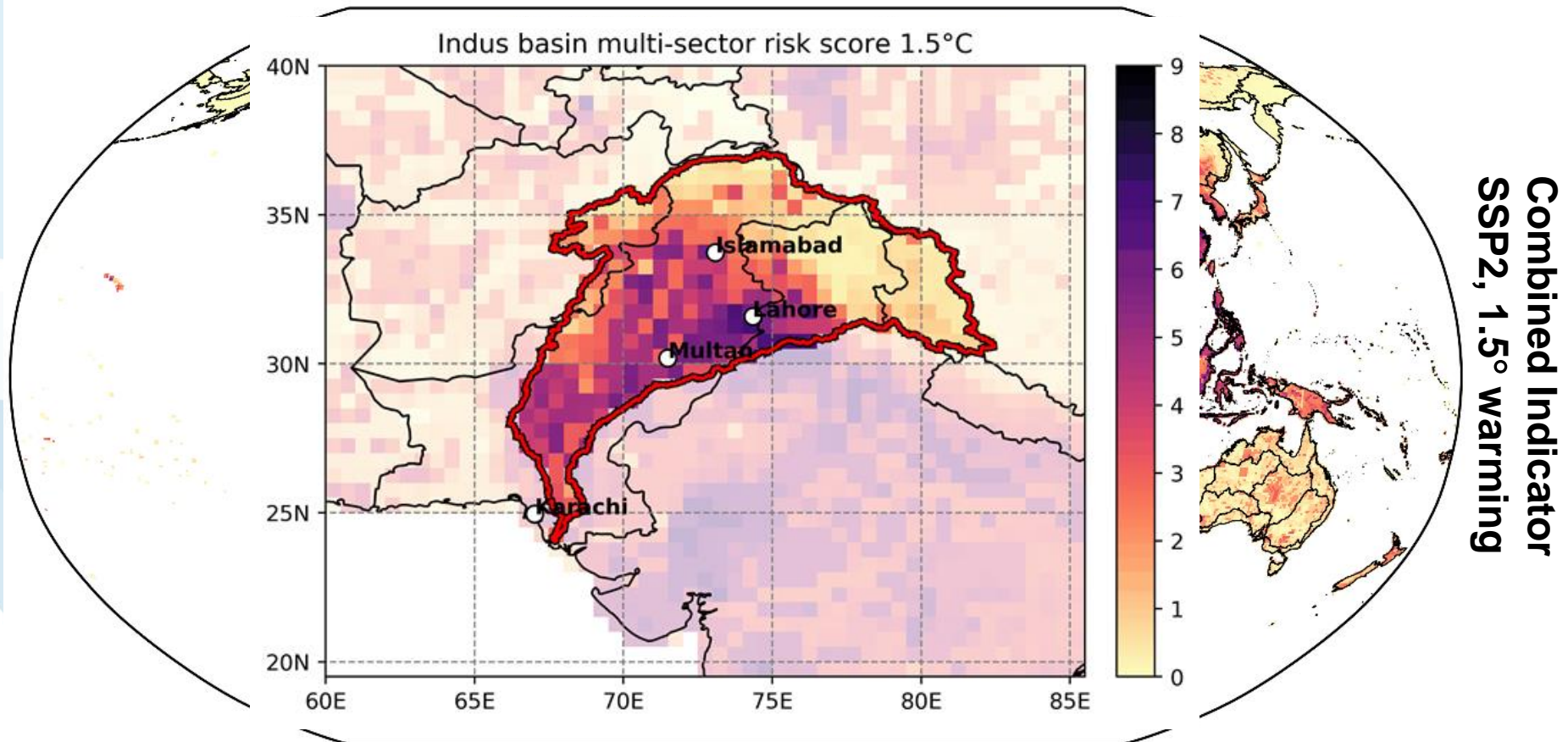
Indicators

 Water	 Energy	 Land
 Water stress index	 Clean cooking access	 Crop yield change
 Non-renewable GW abstraction	 Heat event exposure	 Environmental flow exploitation
 Drought intensity	 Cooling demand growth	 Habitat degradation
 Peak flows risk	 Hydroclimate risk to power	 Nitrogen leaching
 Seasonality		
 Inter-annual variability	 Population and income level projections	

Byers et al. 2018

Basin analysis of nexus hotspots

Identification of multi-sector exposure and vulnerability hotspots



Byers et al. 2018

Regional Basin Case Studies

Indus



Area: 1.100.000 km²
 Countries: Pakistan, India, China, Afghanistan

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

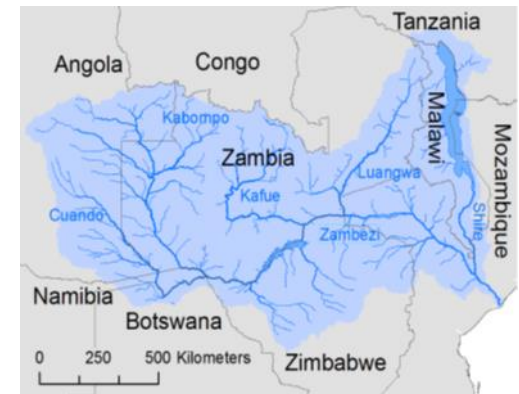
Main land cover: [%]
 Cropland: 30 Irrigated cropland: 24
 Forest: 0.4

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 km²
 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

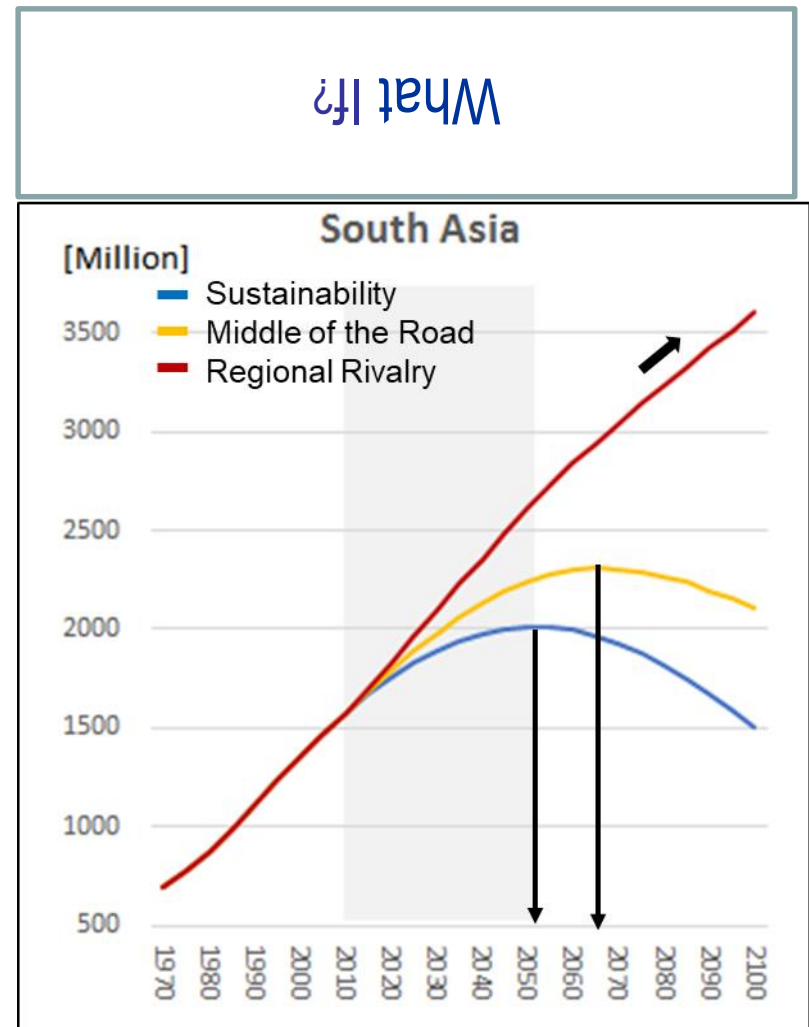
GDP per cap. [US\$]: 950 (Zimbabwe) - 5400 (Angola)

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

What do stakeholders think of their future?

- Aspiration grounded in reality
- 'Bottom up' scenario development as a co-development and enhancing technical capacity (YSSP....)
- What points of entry towards solutions?



Prioritising nexus challenges for the Indus basin assessment

Water and land

- Canal and irrigation efficiency
- Groundwater depletion
- Water storage
- Wastewater treatment
- Environmental flows

Energy systems

- Electricity reliability
- Mitigation of air emissions
- Hydropower expansion

Livelihoods

- Transformations and employment impacts

Laghari and others (2012)

