Reducing humanity's water footprint

Challenges from a global perspective

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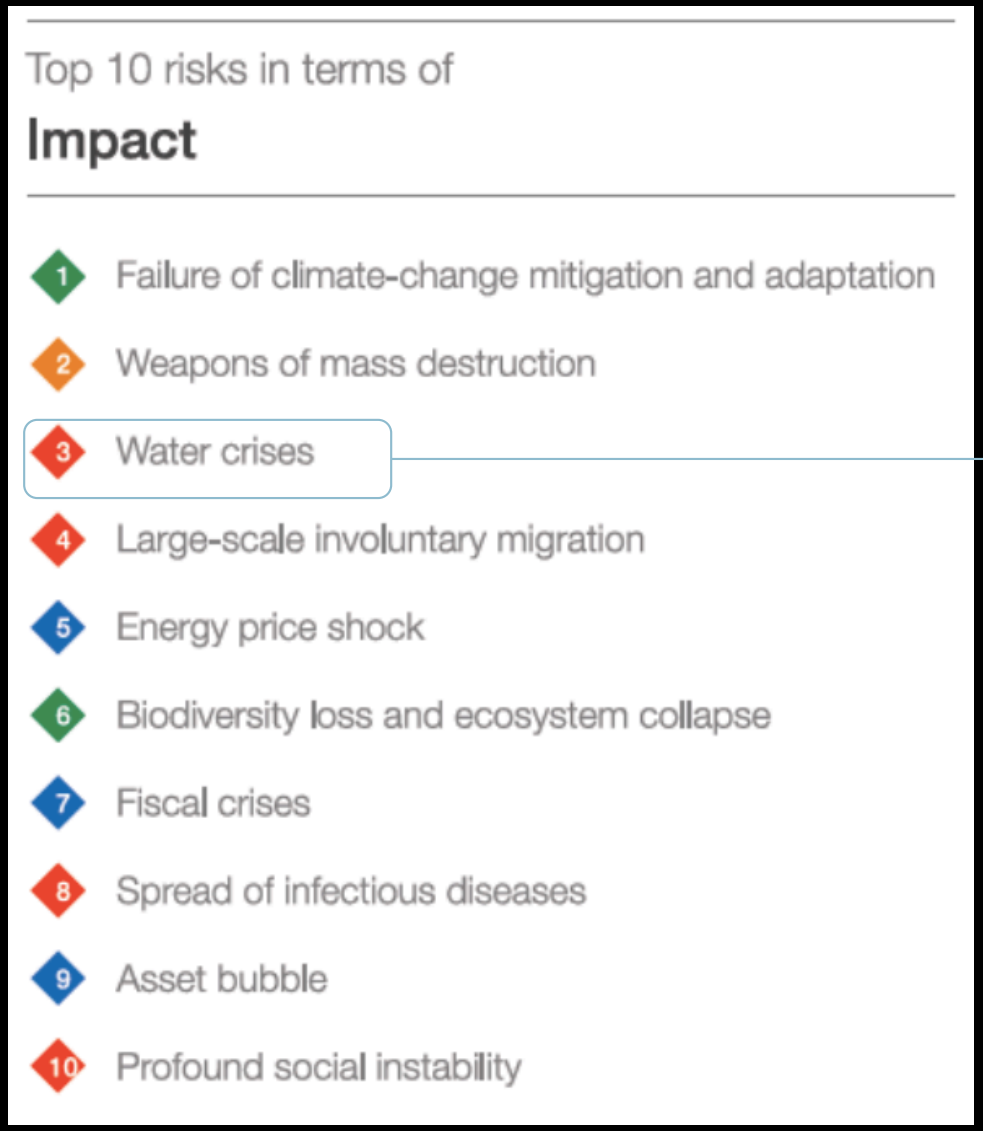
WEF's Global Risk Report 2016



- Sustainability of water use
- Water use efficiency
- Fair sharing of water
- Resource security

The Coca Cola Company

New Delhi, 4 Oct 2006

Water footprint of a Coke

Water footprint of a 0.5 litre PET-bottle coke
as produced in the Netherlands

0.44 litre water content
27.6 litre for sugar
5.3 litre for PET bottle and closure
3.0 litre for other ingredients & overheads

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36 litre total

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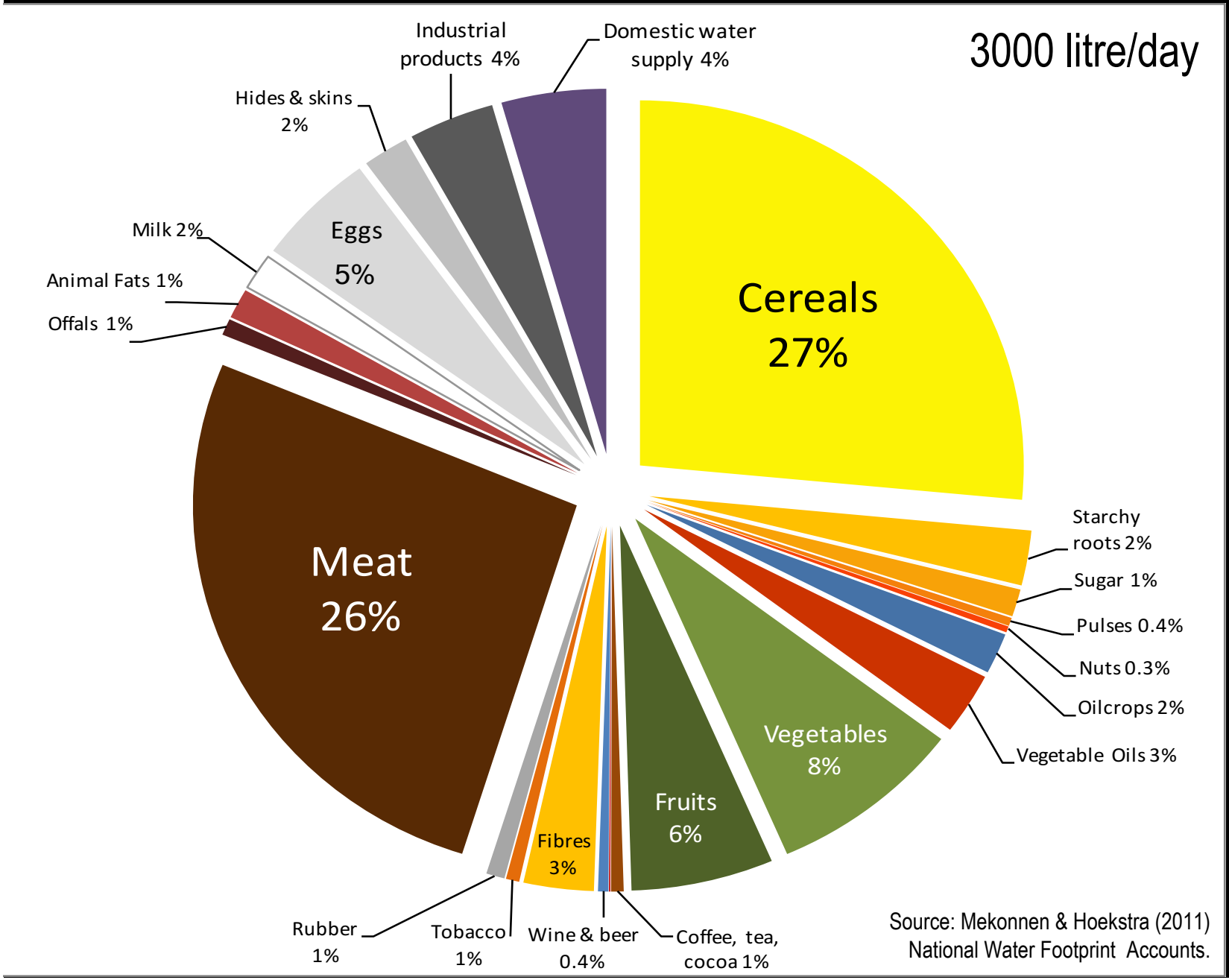
The water footprint of the Chinese consumer



The water footprint of the Chinese consumer

alfalfa

[mm/y]

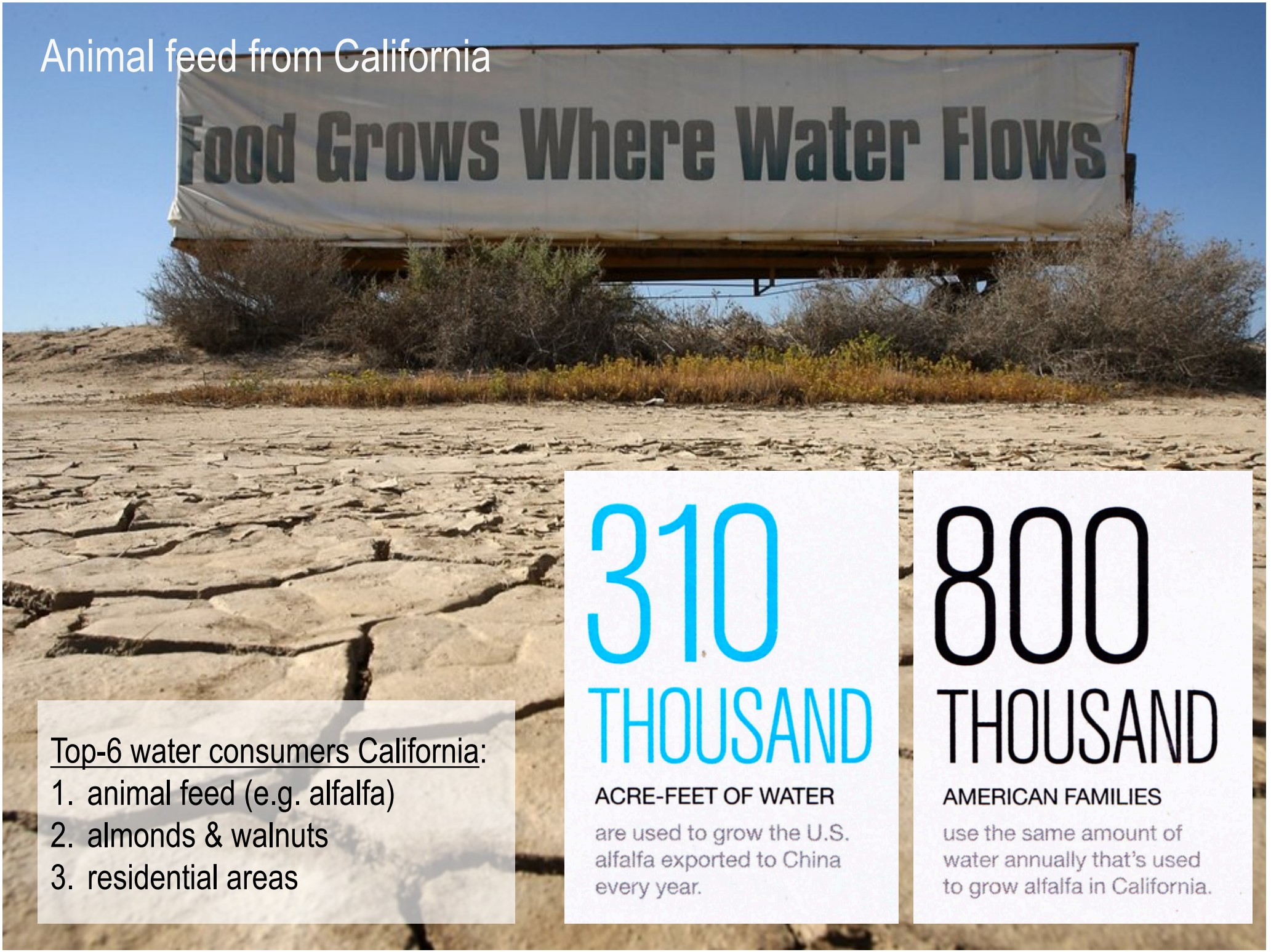
- 0 - 1
- 1 - 10
- 10 - 50
- 50 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 2,000
- No WF

soybean

wheat

barley

Animal feed from California



Top-6 water consumers California:

1. animal feed (e.g. alfalfa)
2. almonds & walnuts
3. residential areas

The water footprint of a product

Green water footprint

volume of rainwater consumed (evaporated)

Blue water footprint

volume of surface or groundwater consumed (evaporated)

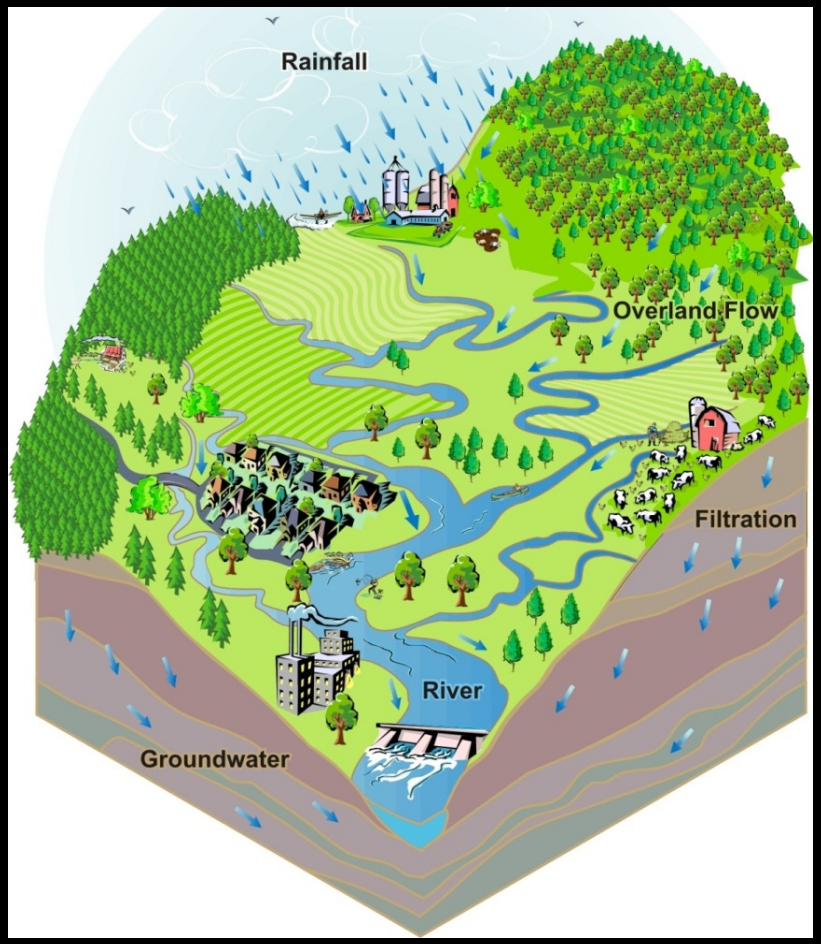
= net water abstraction

Grey water footprint

volume of surface or groundwater polluted

Source: Hoekstra et al. (2011) *The Water Footprint Assessment Manual*, Earthscan, London, UK

The maximum sustainable green and blue water footprint



Precipitation in a catchment

Evapotranspiration (green water)

Runoff (blue water)

Environmental water needs

Green water availability

Blue water availability

Environmental water needs

Maximum sustainable green WF

Maximum sustainable blue WF

Grey water footprint

The volume of water required to assimilate pollutants

Grey water footprint = (Load / Critical load) × River flow

Max. sustainable grey water footprint = River flow

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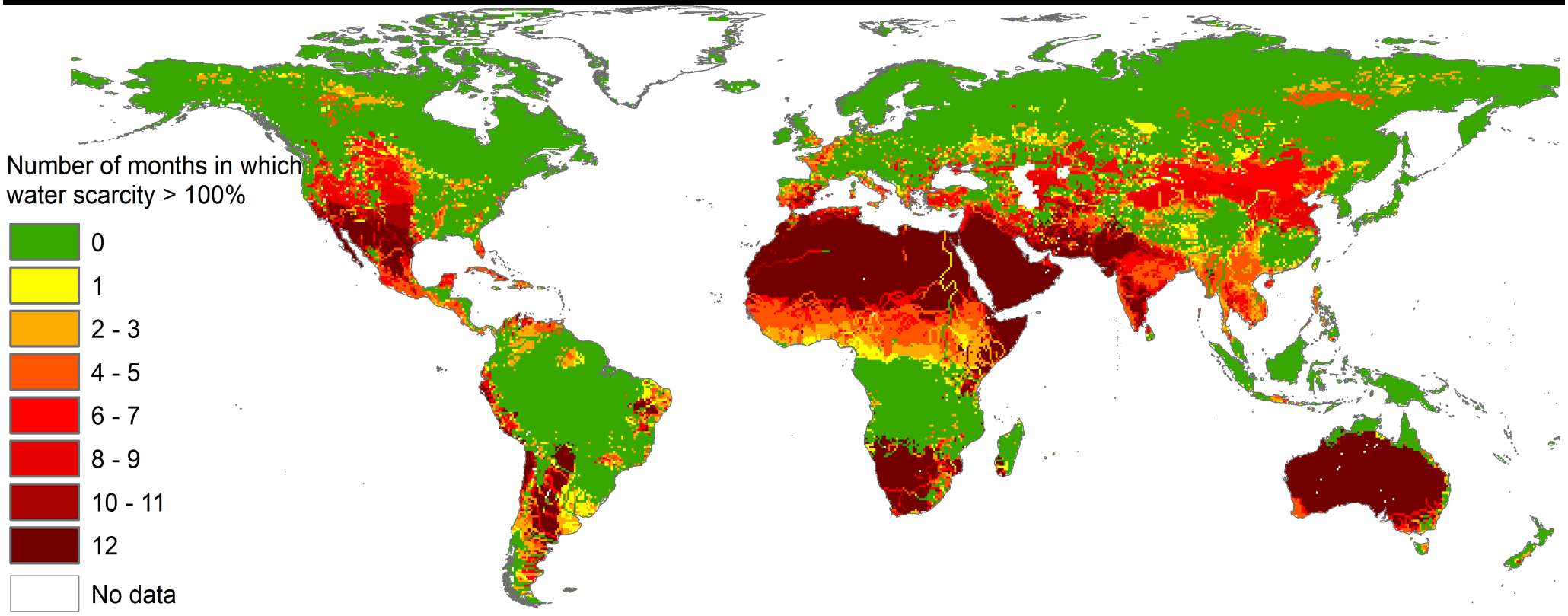
Source: Hoekstra et al. (2011) *The Water Footprint Assessment Manual*, Earthscan, London, UK

The blue water footprint of humanity: not sustainable

Blue water scarcity = blue WF / maximum sustainable blue WF



Source: Mekonnen & Hoekstra (2016)

We need to agree on water footprint caps per river basin (specified per month)

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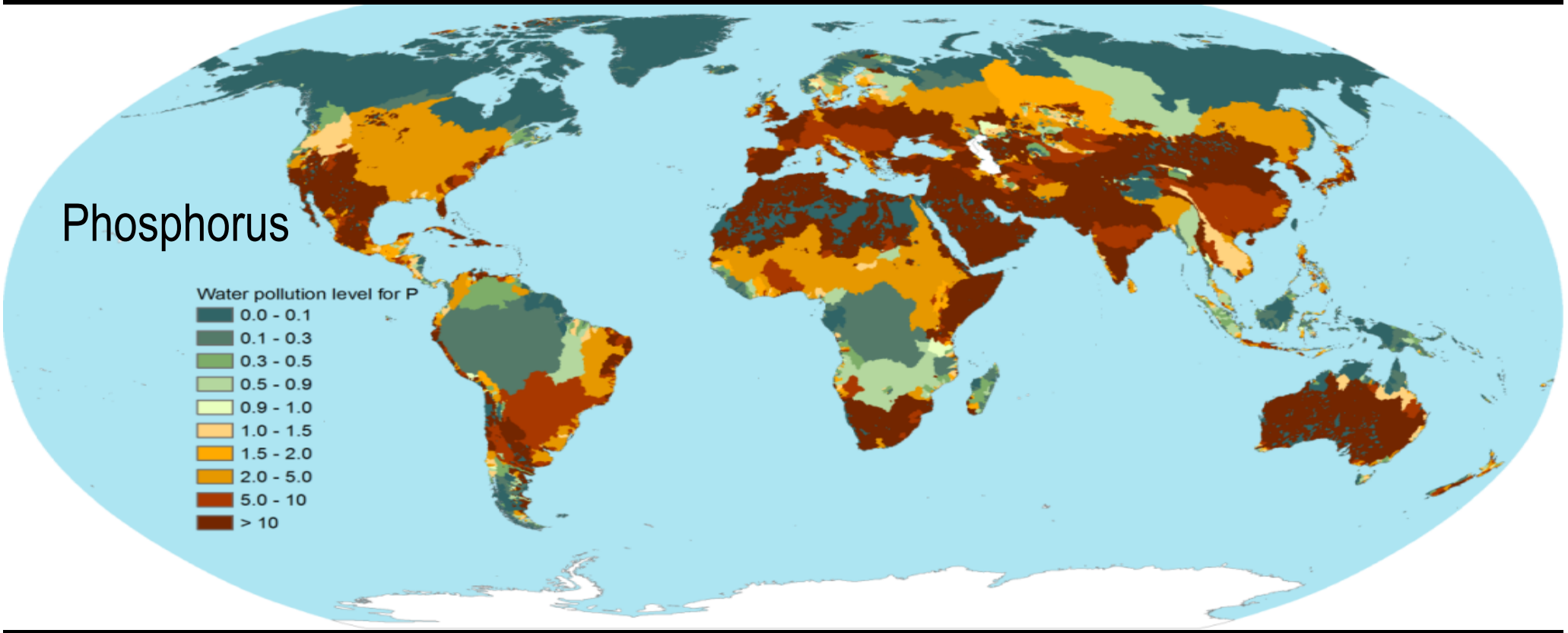
The grey water footprint of humanity: not sustainable

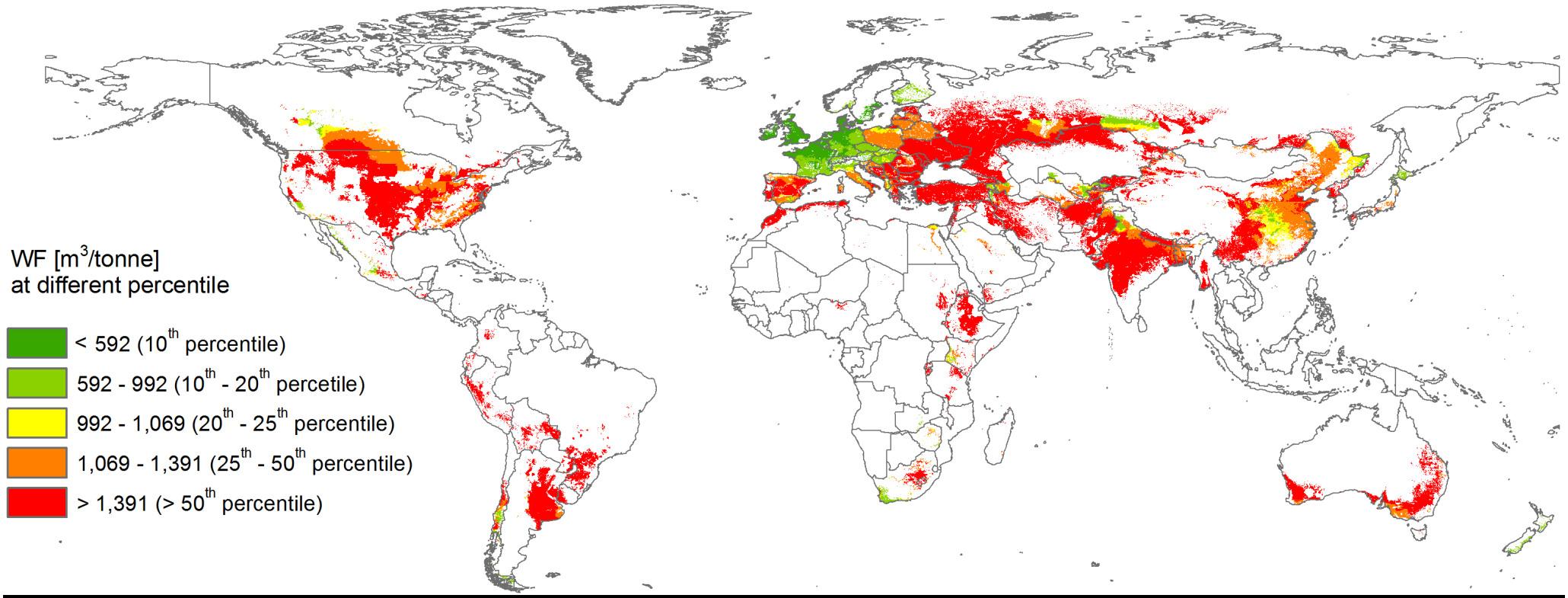
Water pollution level = grey WF / maximum sustainable grey WF



Source: Mekonnen & Hoekstra (2017)

The water footprint of humanity: not efficient

Spatial differences in the water footprint of wheat



Reduction of water footprints of crops to benchmark levels set by the best 25% of global production, will result in a global water saving of 40%.

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Source: Mekonnen & Hoekstra (2014)

The water efficiency of our food

Global average water footprint

	litre/kcal
starchy roots	0.5
cereals	0.5
sugar crops	0.7
pulses	1.1
vegetables	1.3
fruits	2.1
pork	2.2
poultry	3.0
beef	10.2

Source: Mekonnen & Hoekstra (2012) A global assessment of the water footprint of farm animal products, *Ecosystems*

The water efficiency of our food

- The WF of animal production is 29% of the WF of the agricultural sector.
- The WF of the agricultural sector is 92% of the total WF of humanity.

Source: Mekonnen & Hoekstra (2012) A global assessment of the water footprint of farm animal products, *Ecosystems*

The water efficiency of our food – example Hong Kong

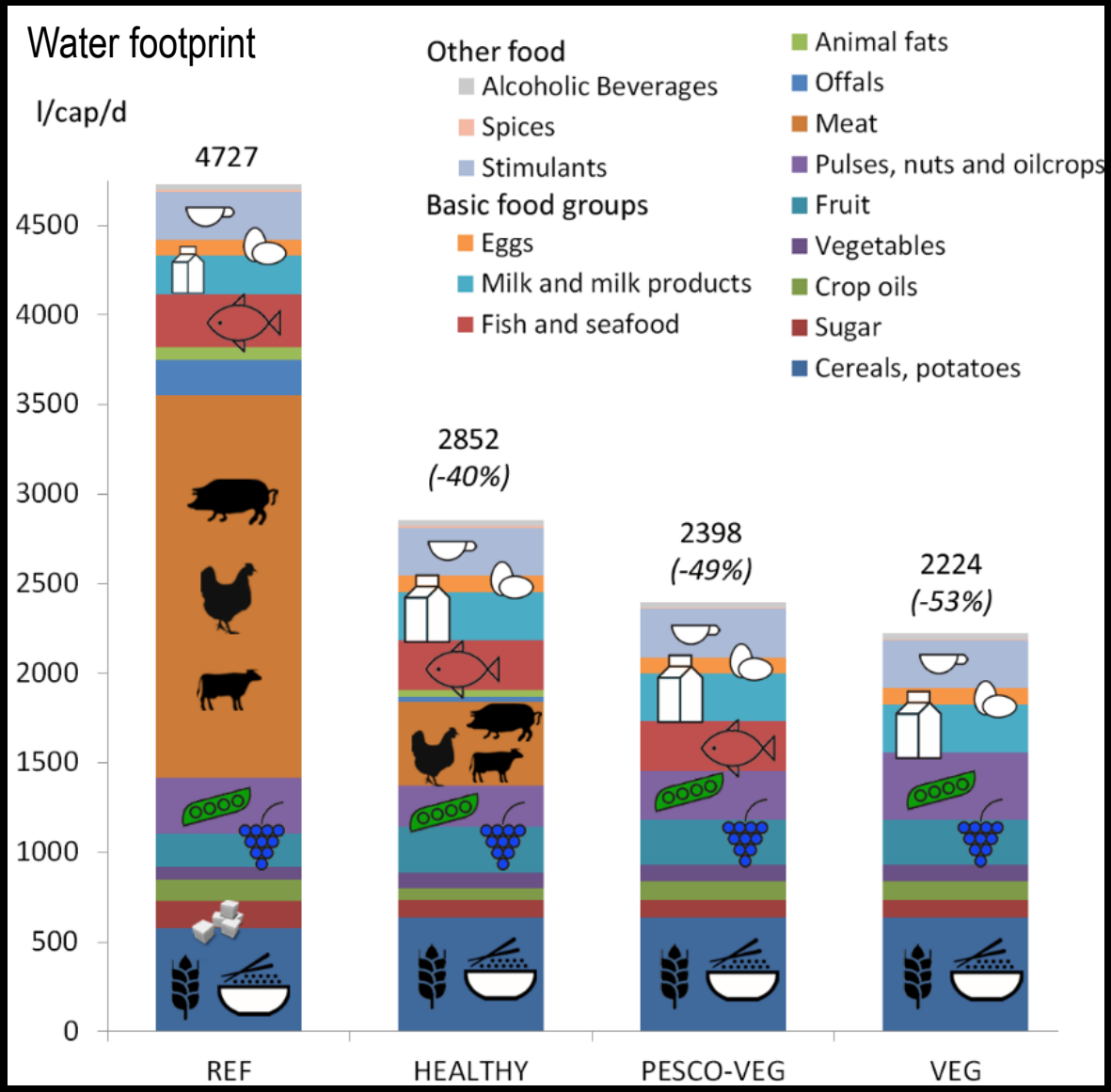
Diet scenarios:

REF
Reference period (1996-2005)

HEALTHY
Healthy diet, based on Chinese dietary guideline

PESCO-VEG
Pesco-vegetarian diet

VEG
Vegetarian diet



Source: Vanham et al. (2017) Journal of Hydrology Special Issue on Water in megacities: new risks, new solutions

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The water footprint of our choices

Stop showering = water saving of 50 litre/day

Stop eating meat = water saving of 800 litre/day

The two separate worlds of water and energy

- The water sector is becoming more energy-intensive

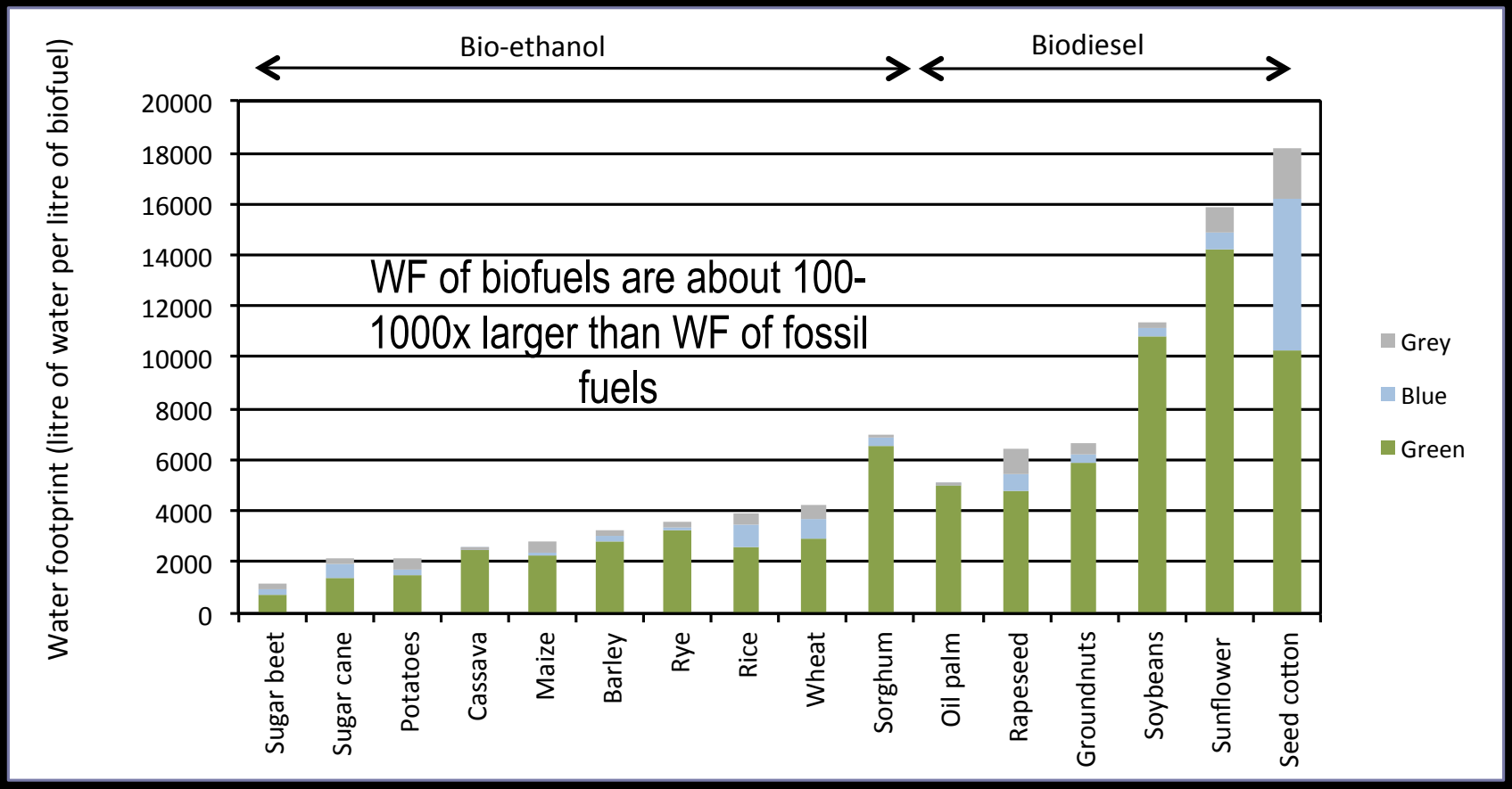
  - desalination
  - pumping deeper groundwater
  - large-scale (inter-basin) water transfers

- The energy sector is becoming more water-intensive

  - shale oil & gas (fracking)
  - tar sands & oil / kerogen shales
  - biomass

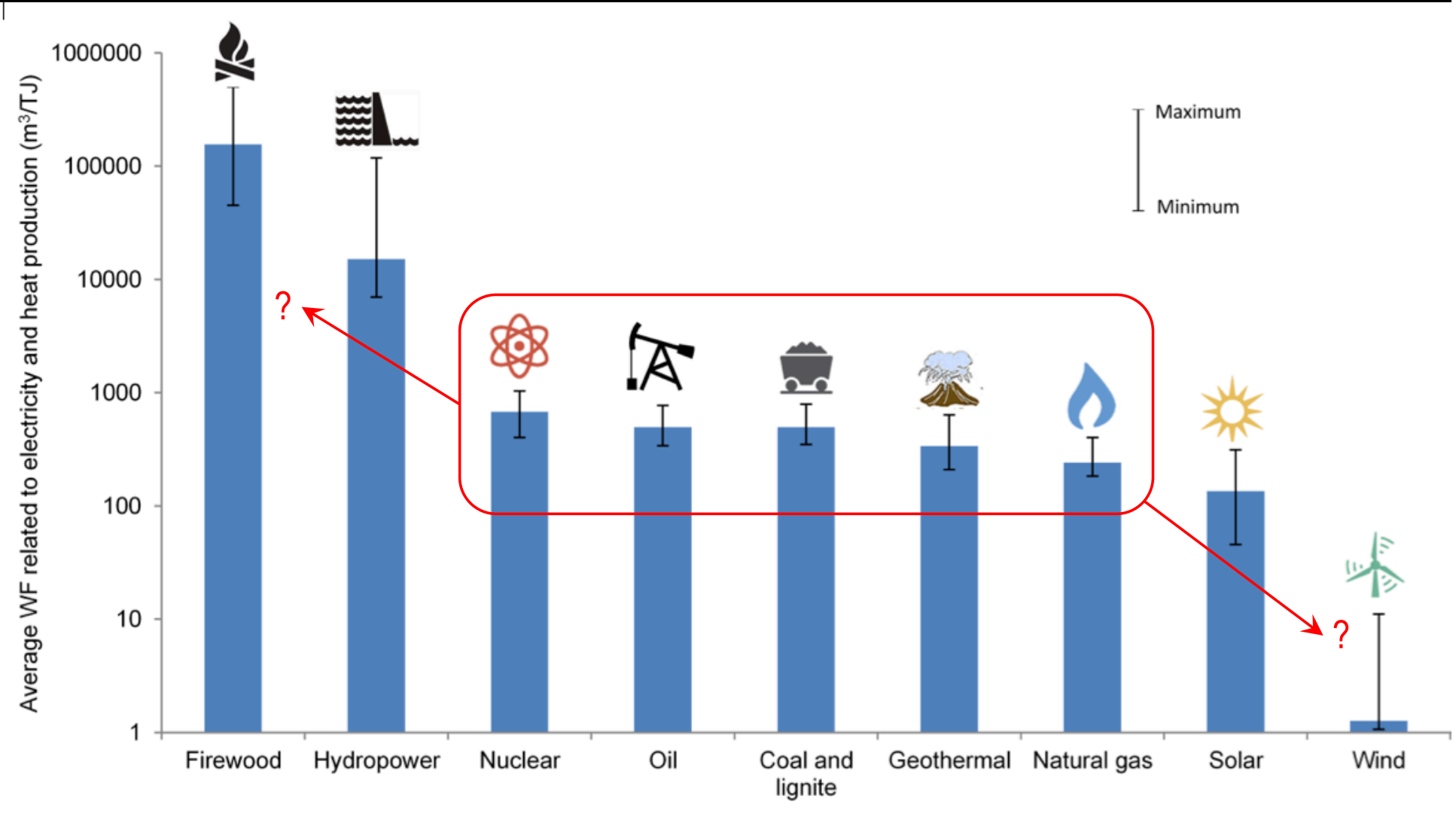
Source: Hoekstra (2013) *The Water Footprint of Modern Consumer Society*, Routledge, London, UK

The water efficiency of energy supply



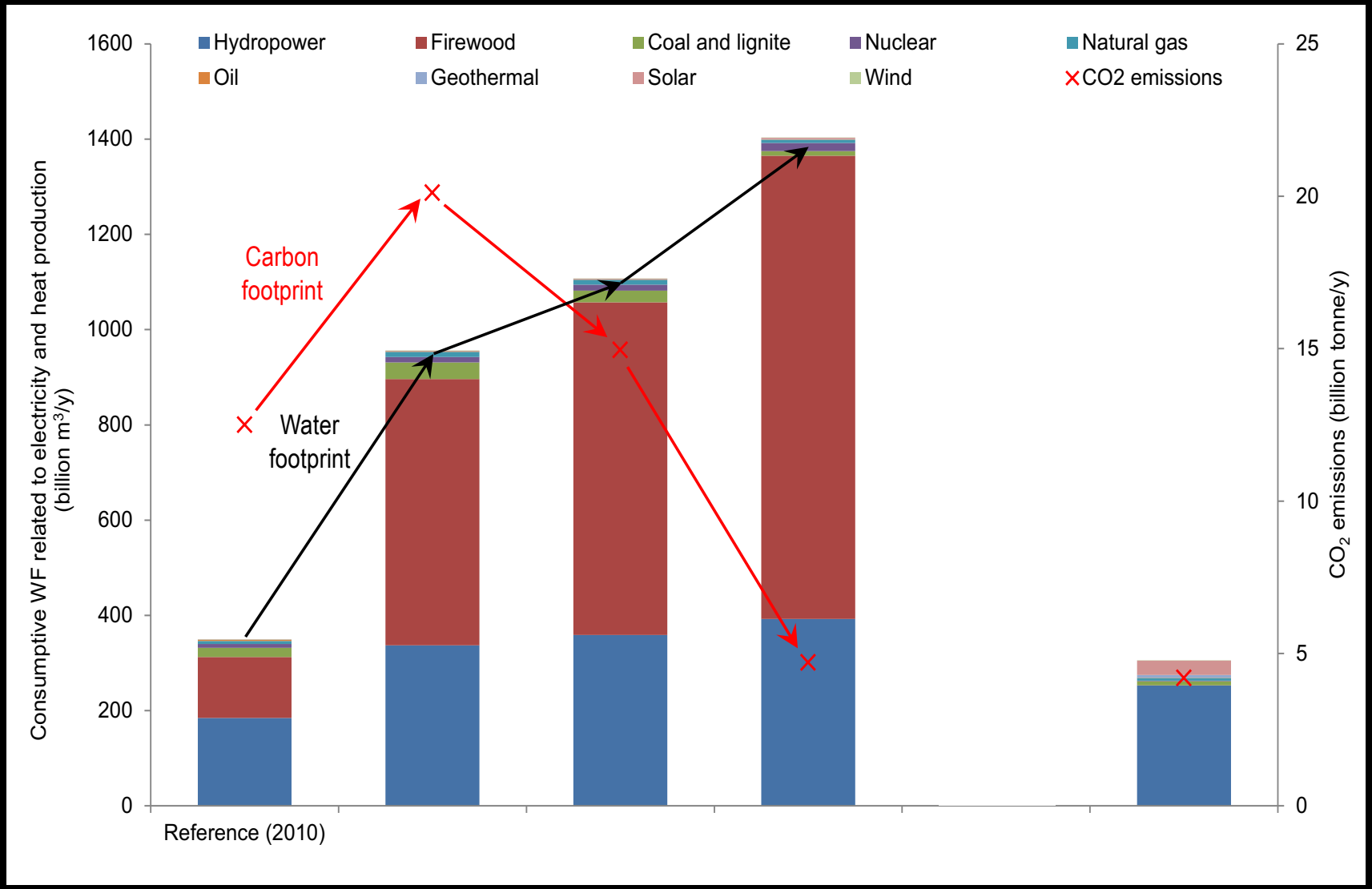
Source: Mekonnen & Hoekstra (2011)

The water efficiency of electricity



Source: Mekonnen, Gerbens-Leenes & Hoekstra (2015)

The water footprint of electricity in 2035 – IEA scenarios



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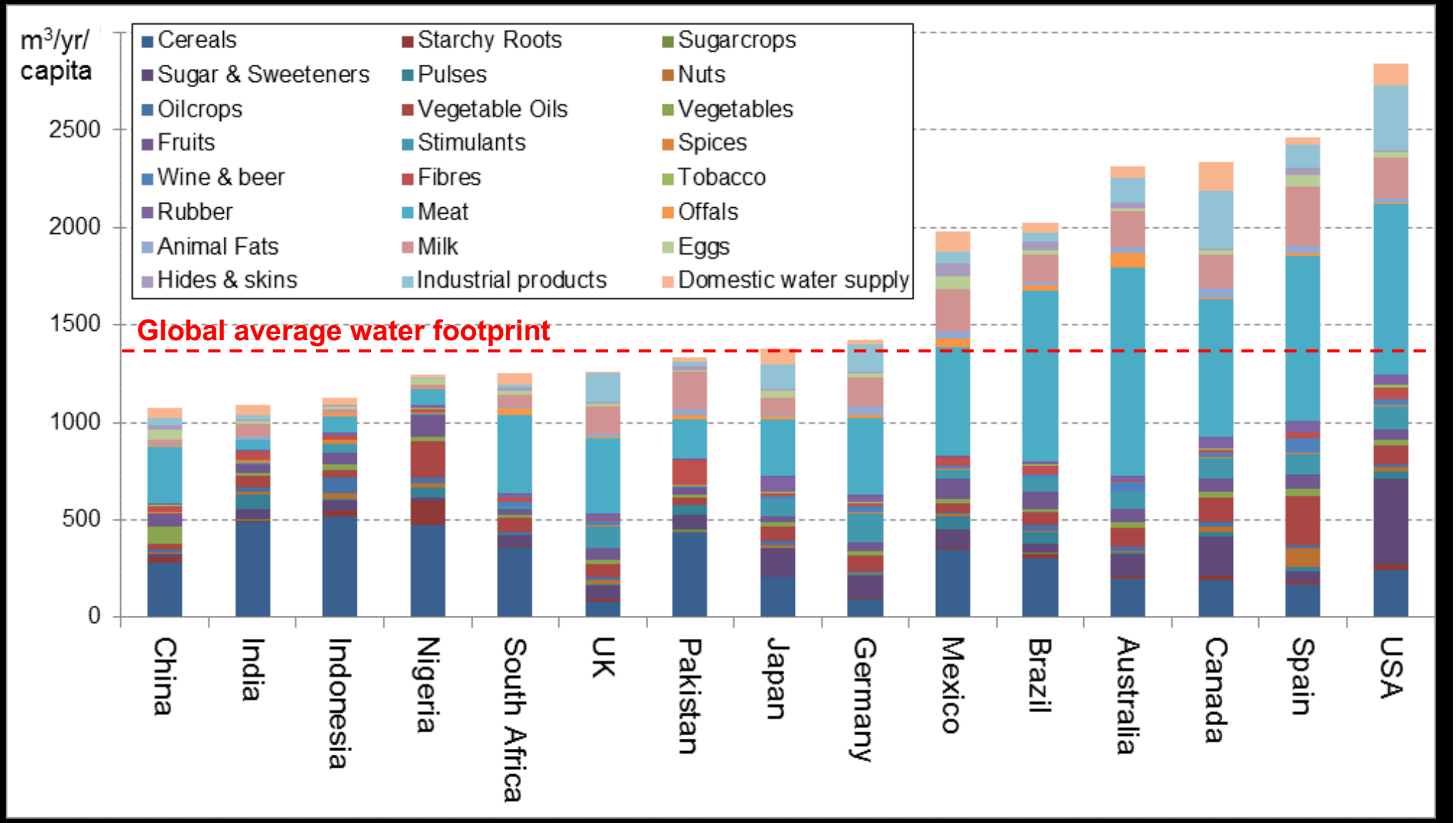
Source: Mekonnen, Gerbens-Leenes & Hoekstra (2016)

The water footprint of humanity: not fairly distributed



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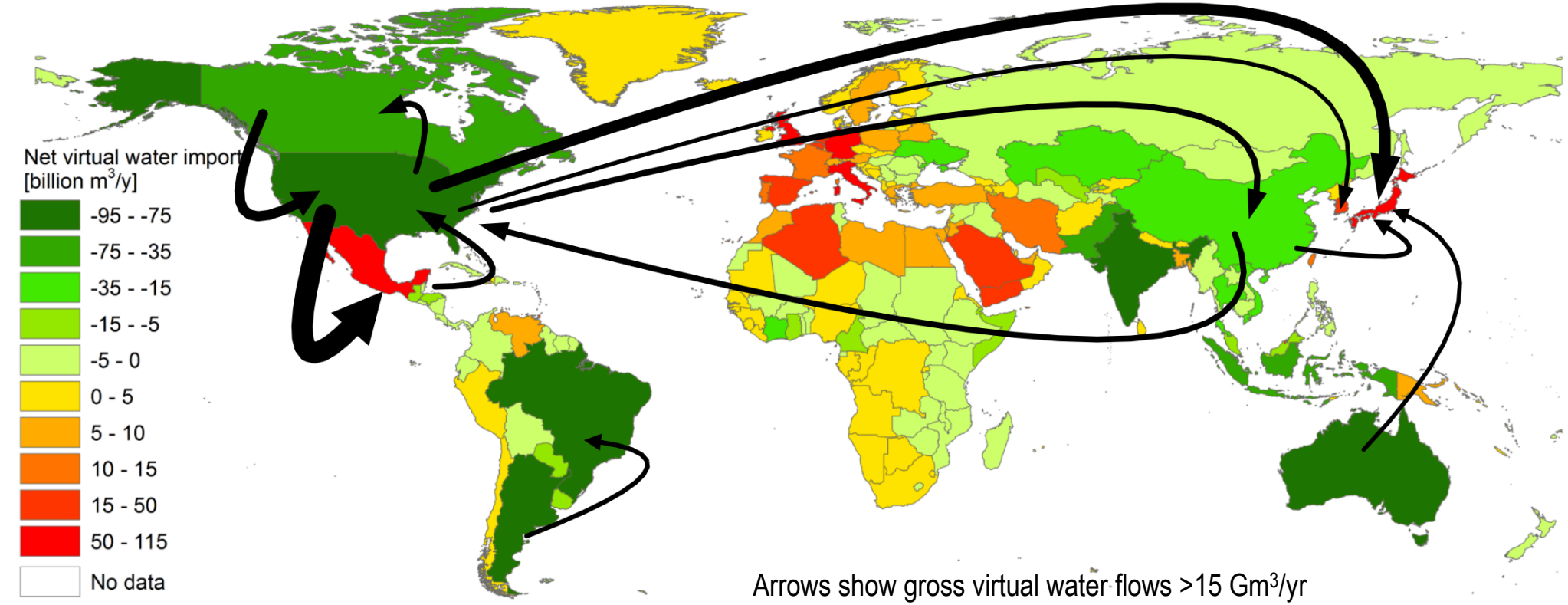
Source: Hoekstra & Mekonnen (2012) The Water Footprint of Humanity, *PNAS*

The water footprint of humanity: international dependencies

On average, 26% of the water footprint of national consumption lies outside the country



Source: Hoekstra & Mekonnen (2012) The Water Footprint of Humanity, *PNAS*

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Virtual water transfers in China

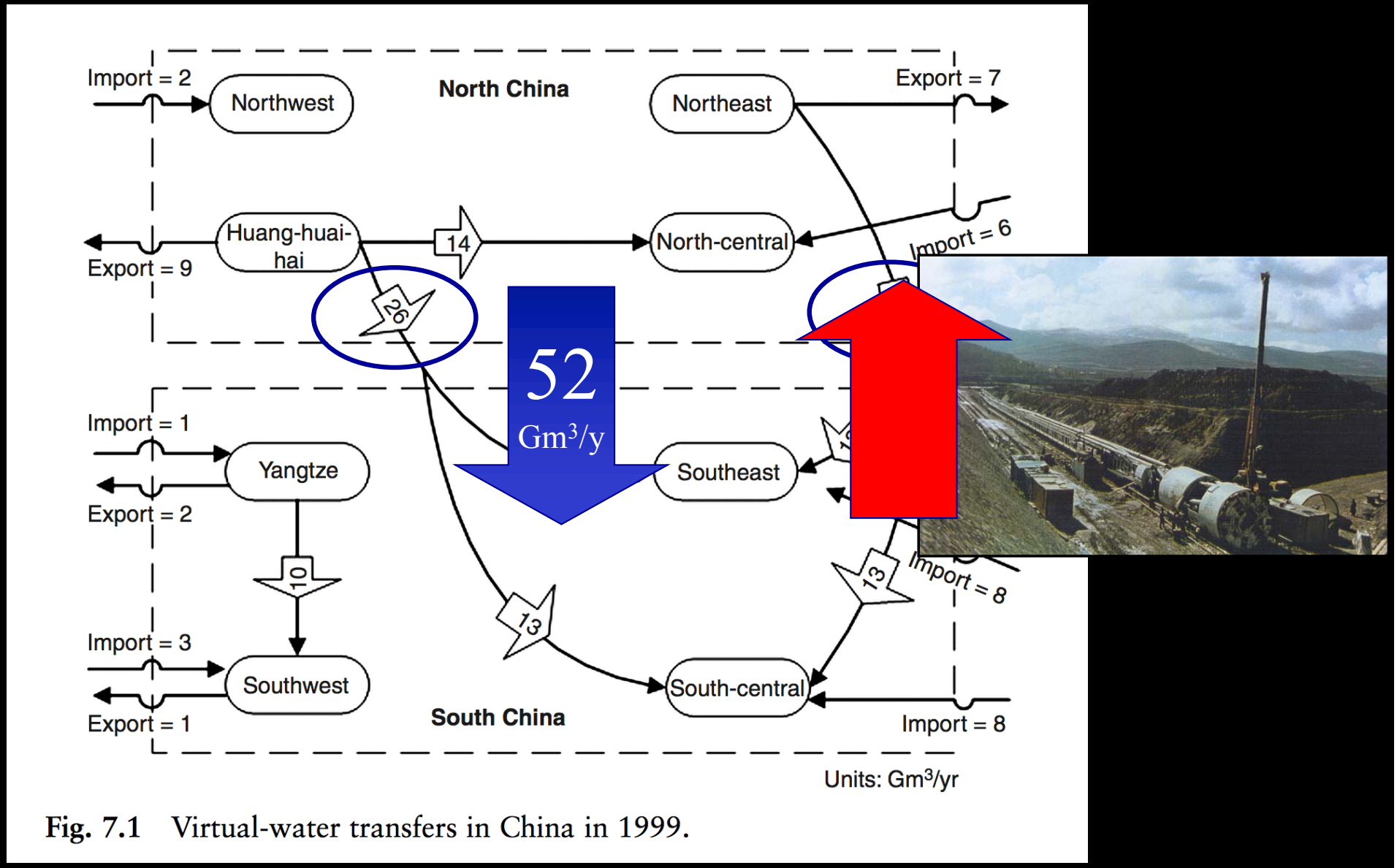


Fig. 7.1 Virtual-water transfers in China in 1999.

Source: Hoekstra & Chapagain (2008)

Virtual water transfers in China

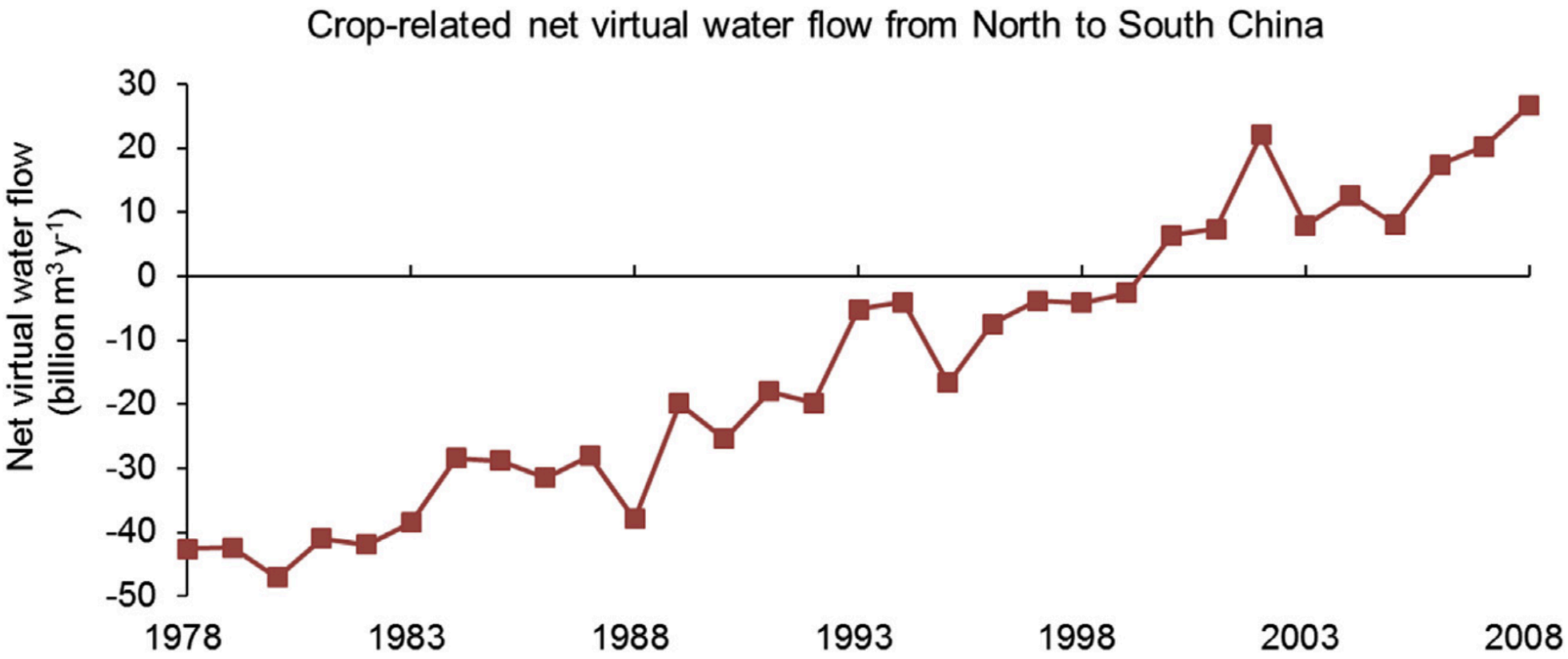
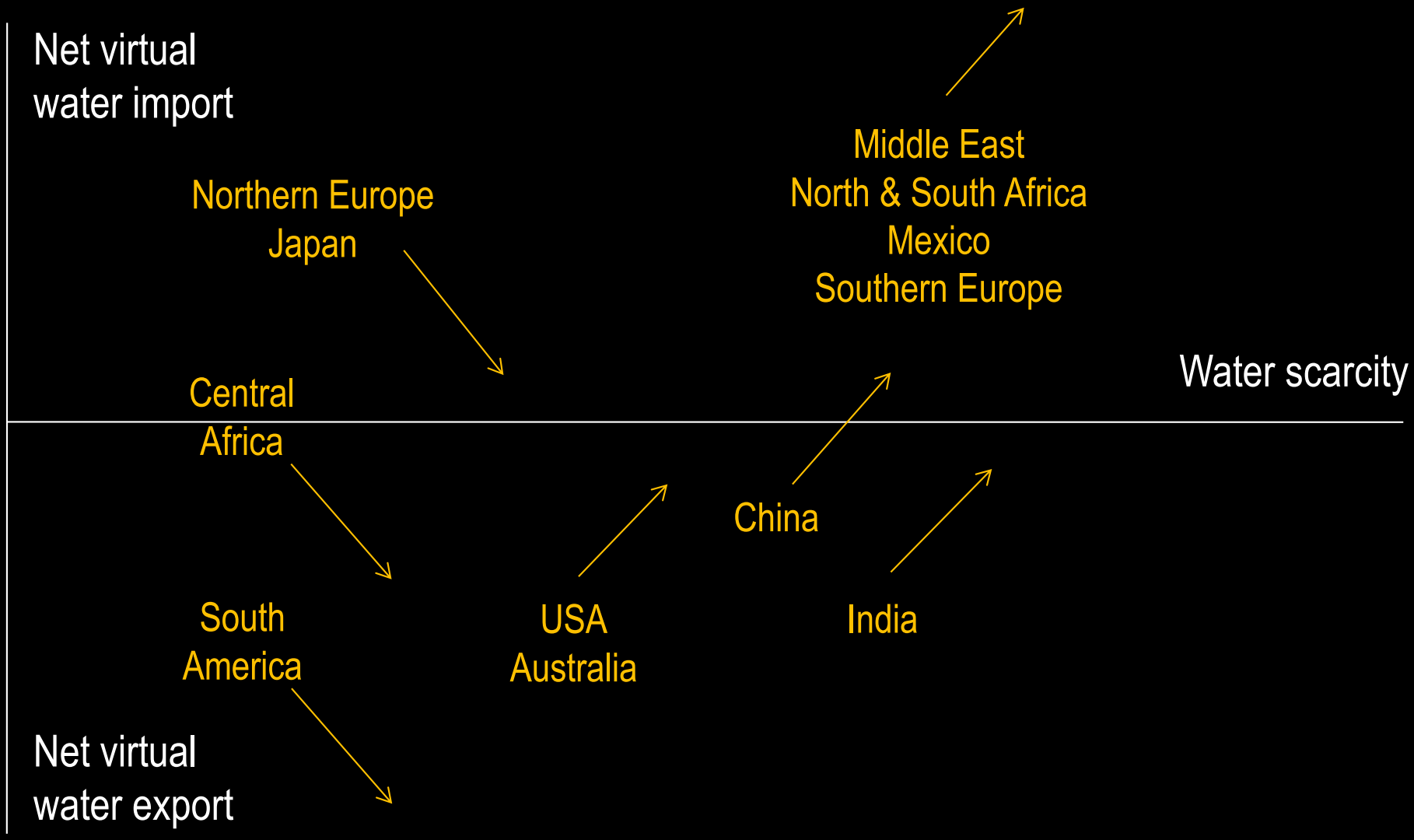


Fig. 10. Net VW transfer from North to South China resulting from inter-regional crop trade.

Sources: Zhuo et al. (2016)

Future under growth and climate change



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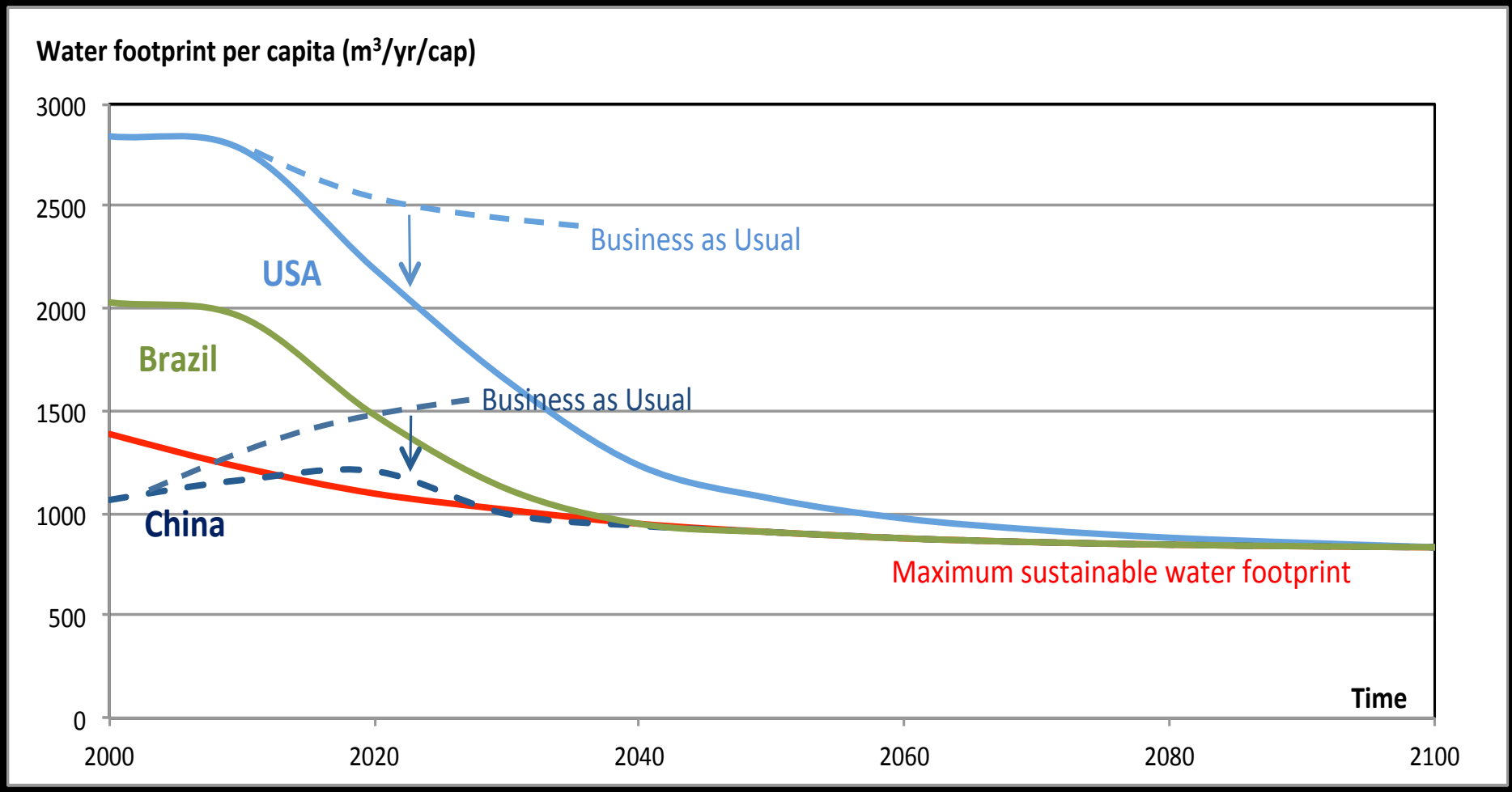
Source: Hoekstra (2012)

Wise water governance

- water footprint caps by river basin
- water footprint benchmarks by product
  - best available technology and practice
  - water disclosure
  - product transparency
- fair water footprint shares by consumer
  - national water footprint reduction targets
- greater levels of (water-food-energy) self-sufficiency

The need for contraction and convergence



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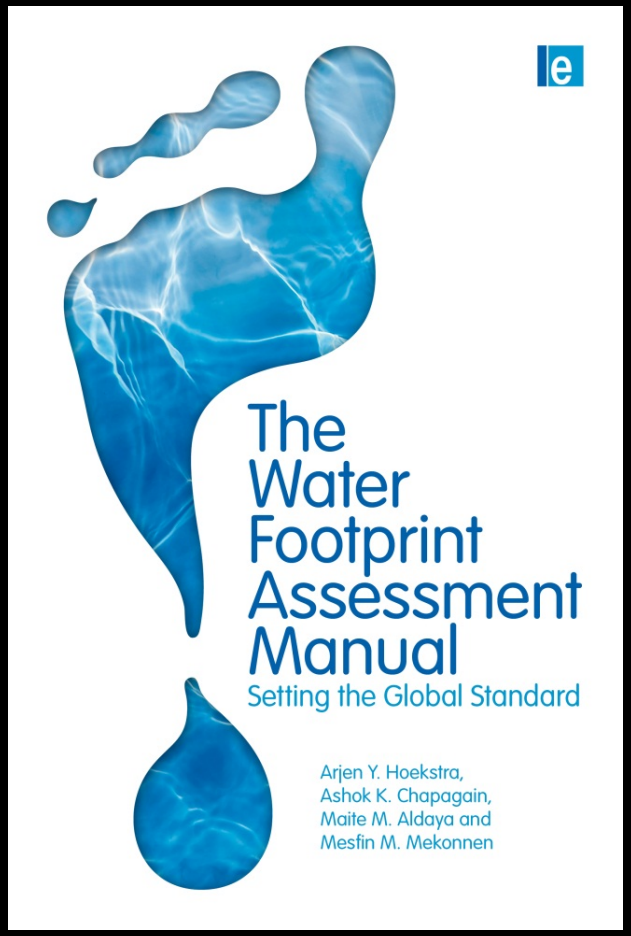
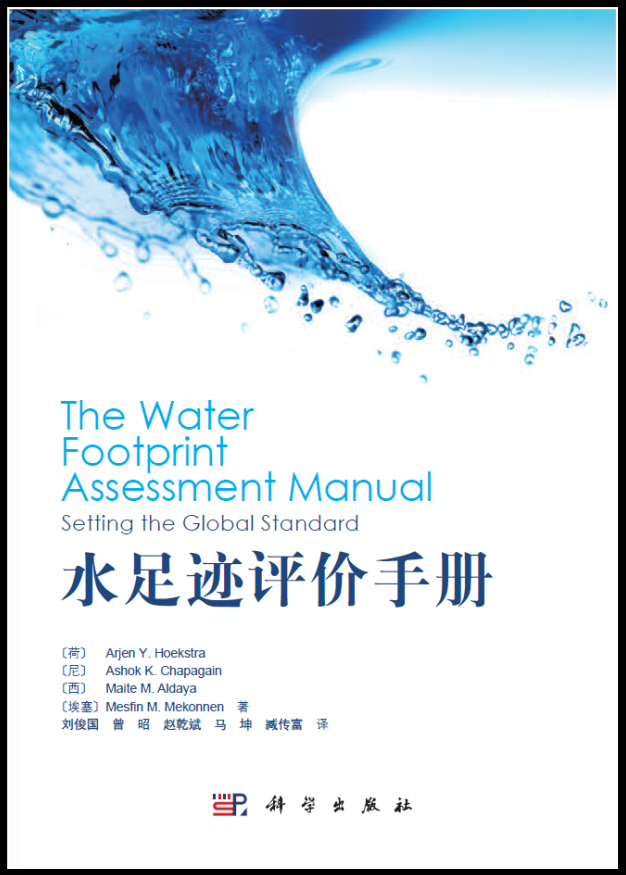
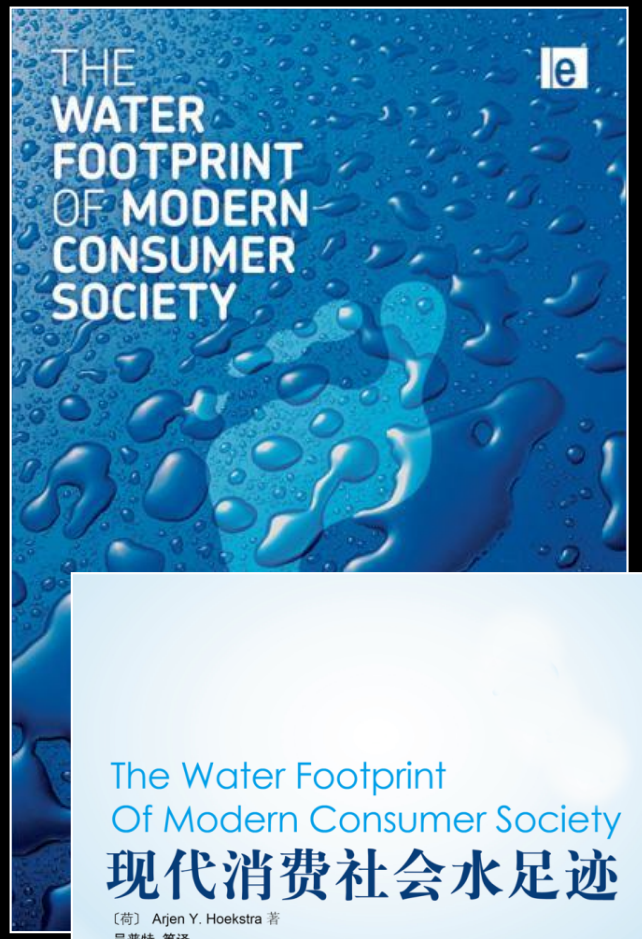
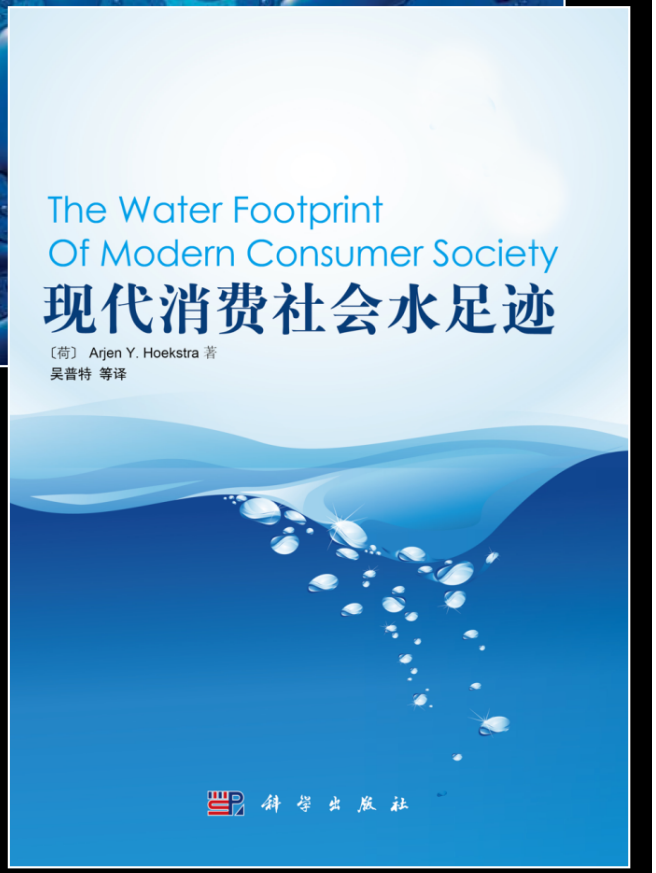
Source: Hoekstra (2014) *Wise freshwater allocation*, UNESCO-IHE

Thanks









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