Water footprint assessment

Evolution of the field and challenges for business

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Water footprint history

2002 Introduction of the concept & 1st global water footprint assessment
2004 2nd global water footprint assessment

2007 Start uptake of the concept by companies, ngo's, govt's
2008 Foundation of the Water Footprint Network

2011 Publication of the Global Water Footprint Assessment Standard
2012 3rd global water footprint assessment
2013 Launch of online Water Footprint Assessment Tool

2016 Global water scarcity assessment

The water footprint of a product

Green water footprint

volume of rainwater consumed (evaporated)

Blue water footprint

volume of surface or groundwater consumed (evaporated)

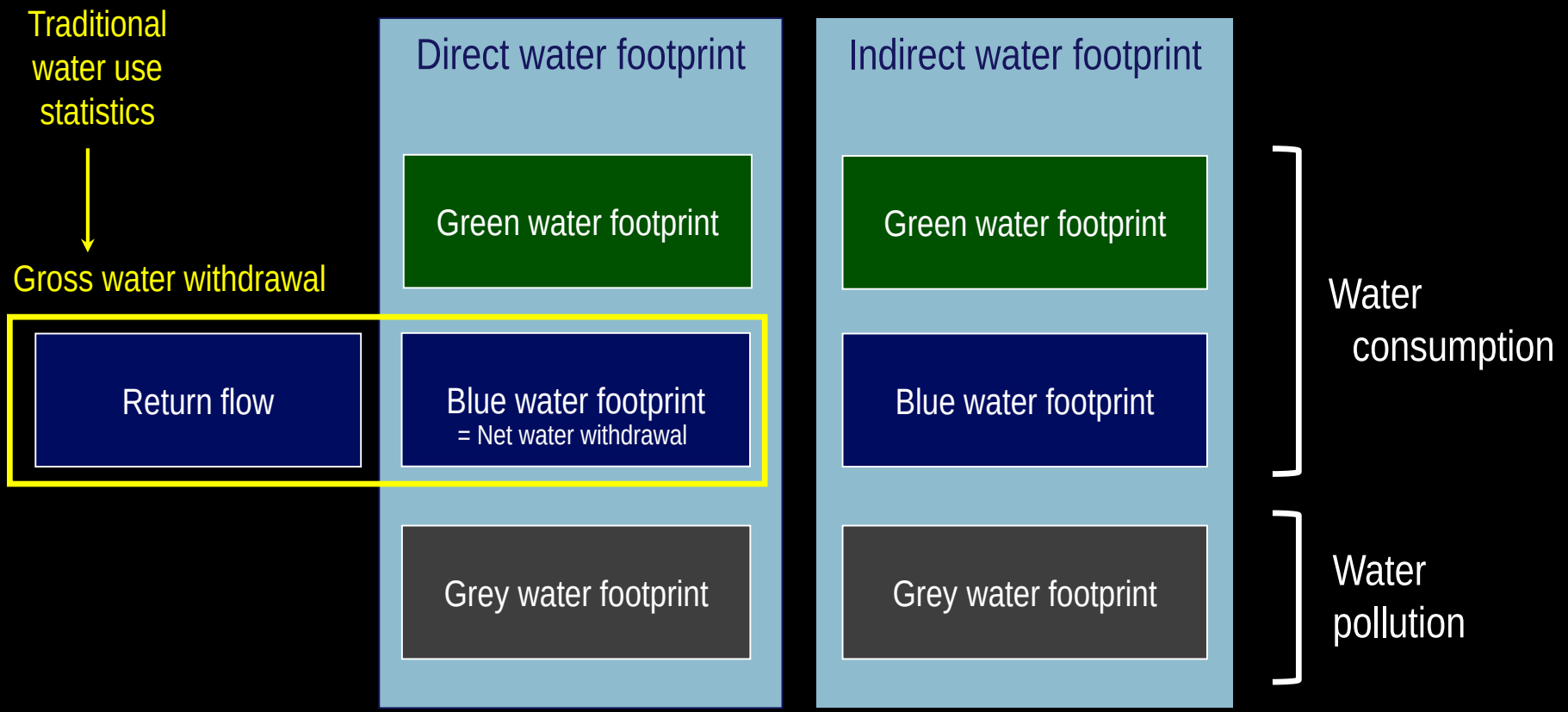
= net water abstraction

Grey water footprint

volume of surface or groundwater polluted

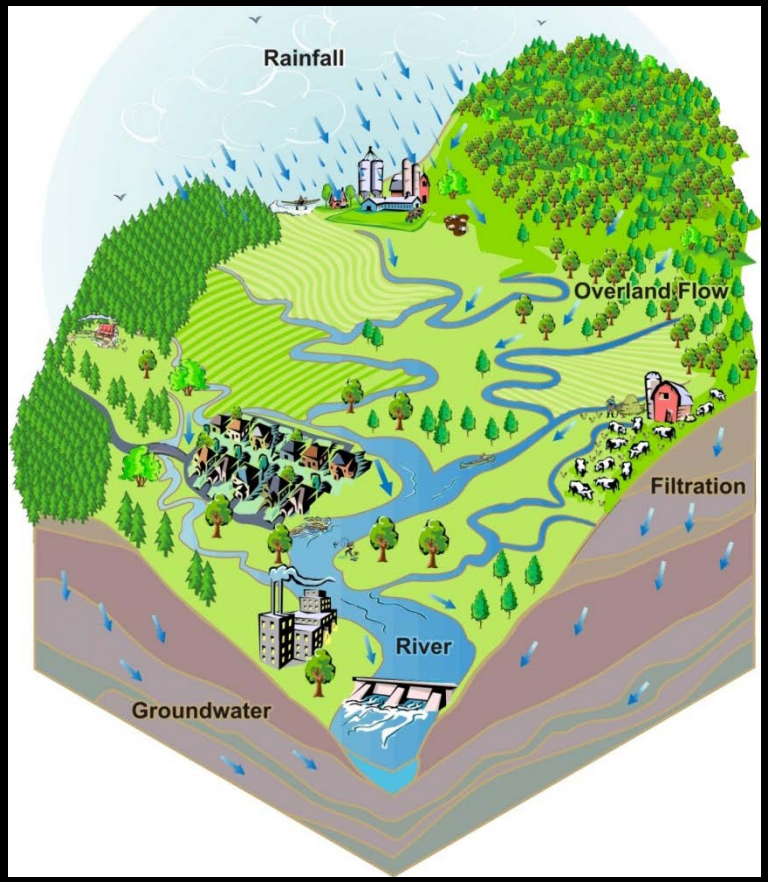
Source: Hoekstra et al. (2011) *The Water Footprint Assessment Manual*, Earthscan, London, UK

Components of a water footprint



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

The maximum sustainable green and blue water footprint in relation to the water balance of a catchment area



Precipitation in a catchment

Evapotranspiration (green water)

Runoff (blue water)

Environmental water needs

Green water availability

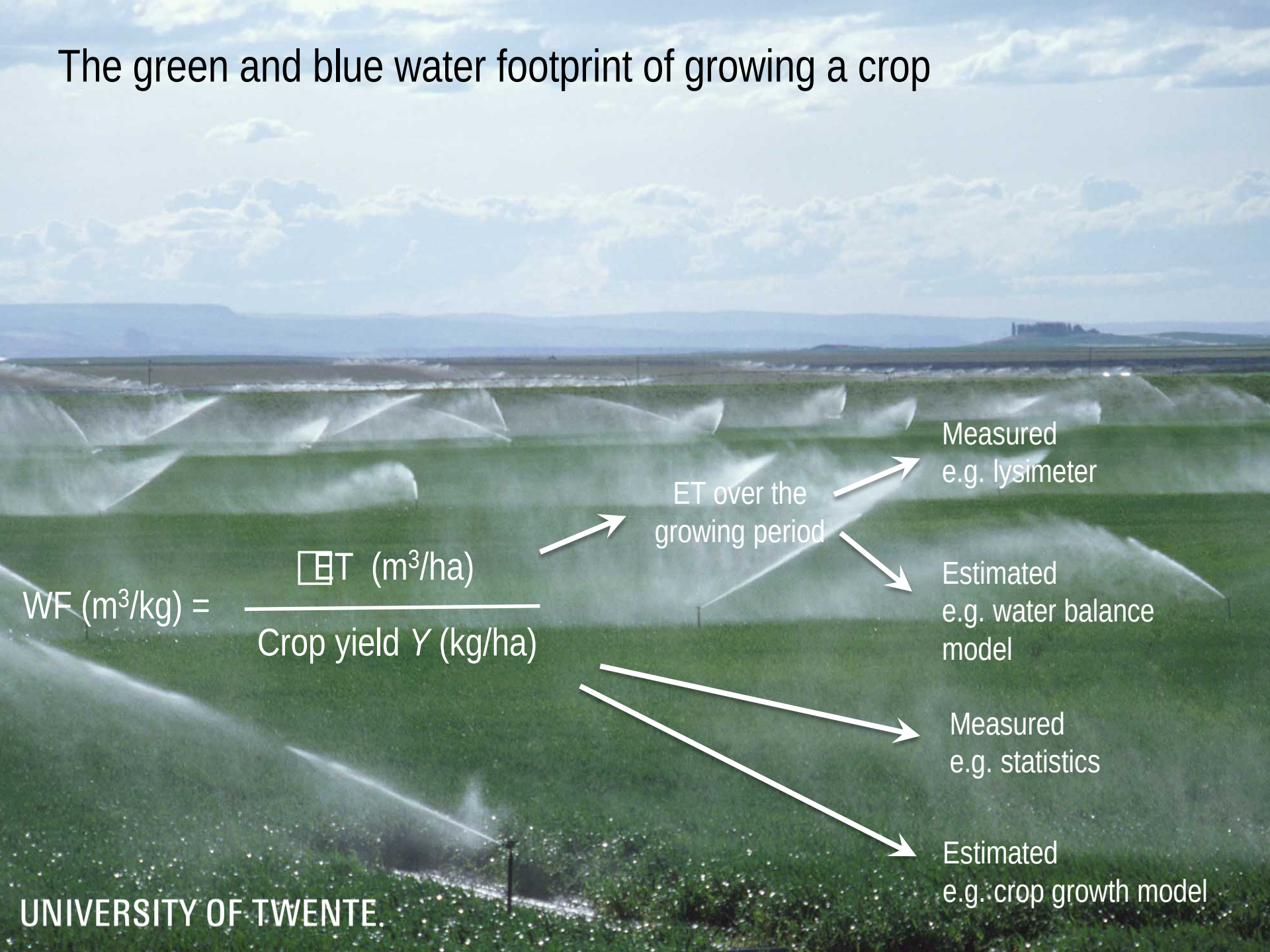
Blue water availability

Environmental water needs

Maximum sustainable Green WF

Maximum sustainable blue WF

The green and blue water footprint of growing a crop



Grey water footprint

Substance intake (IN)

= Water abstraction volume × c_{act}

Process

Substance output (OUT)

= Effluent volume × c_{effl}

Freshwater body

Load = OUT- IN

Critical load = Renewal rate × (c_{max} - c_{nat})

Grey water footprint = (Load / Critical load) × Renewal rate

= Load / (c_{max} - c_{nat})

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

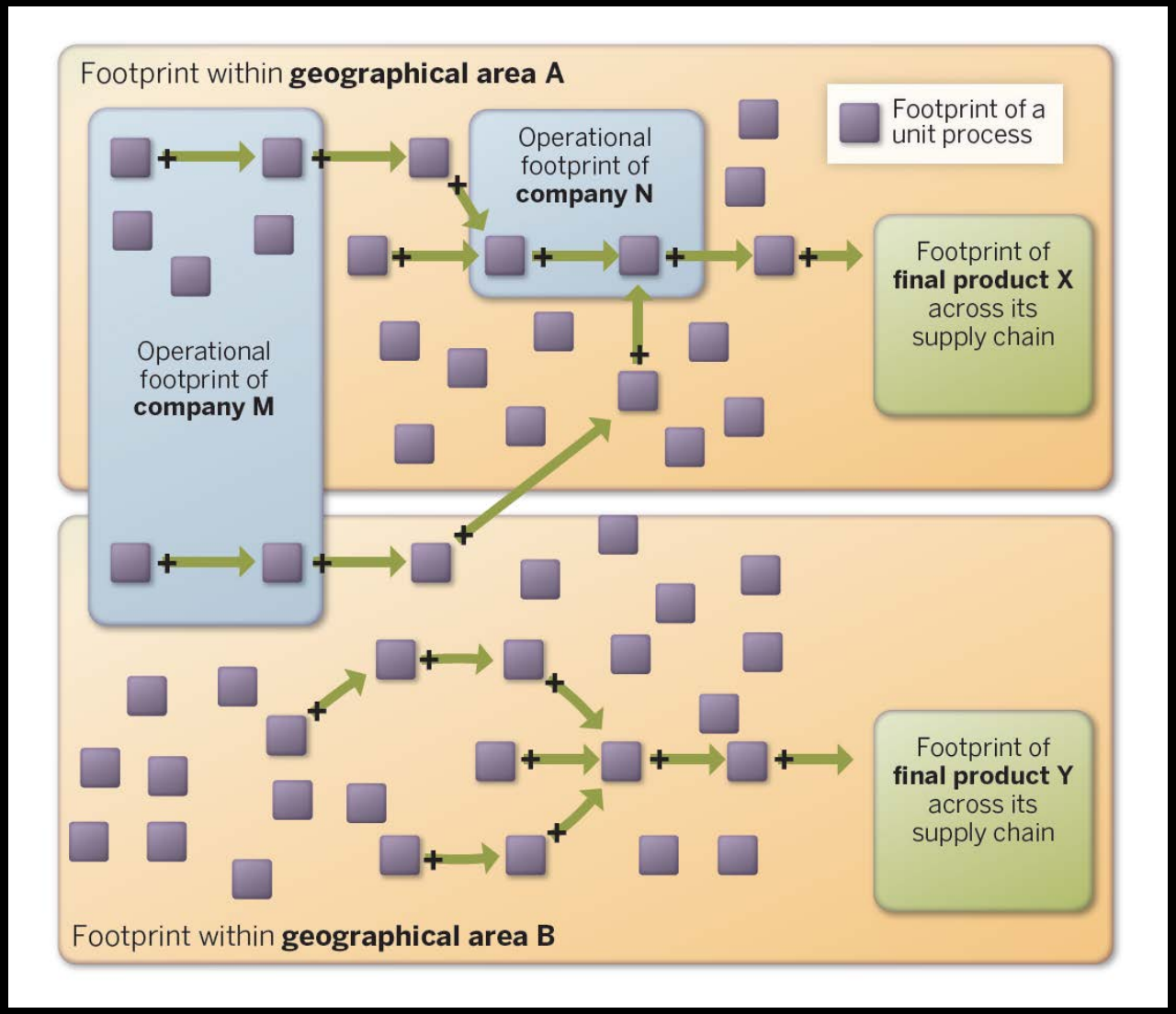
The grey water footprint of growing a crop

$$\text{Grey WF per hectare } (m^3/ha/y) = \frac{\text{Load } (kg/ha/y)}{(c_{max} - c_{nat})\ (kg/m^3)}$$

Leaching or runoff of fertilizer or pesticide to ground- or surface water

$$\text{Grey WF per unit crop } (m^3/kg) = \frac{\text{Grey WF } (m^3/ha/y)}{Y\ (kg/ha/y)}$$

Footprint accounting over supply chains



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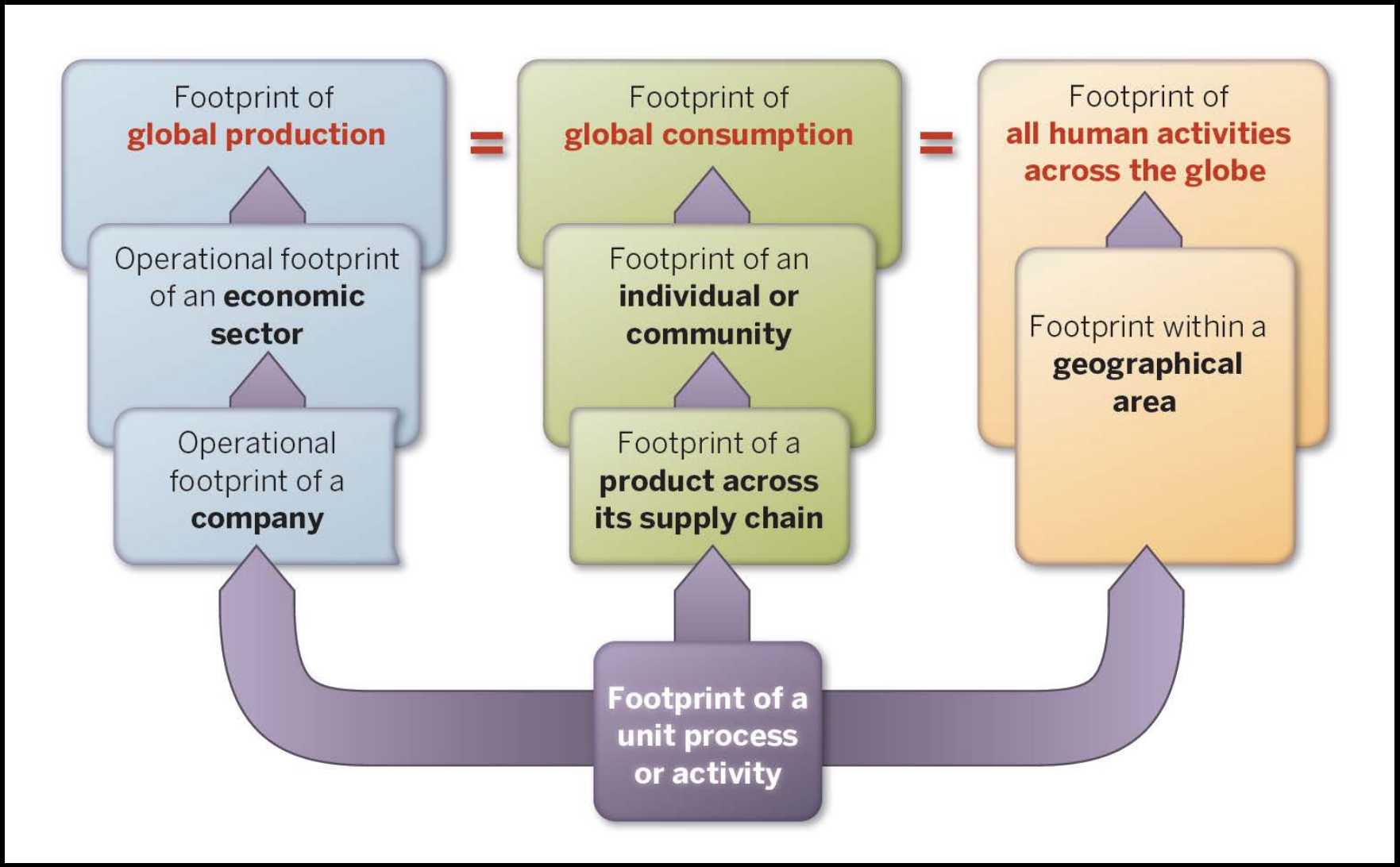
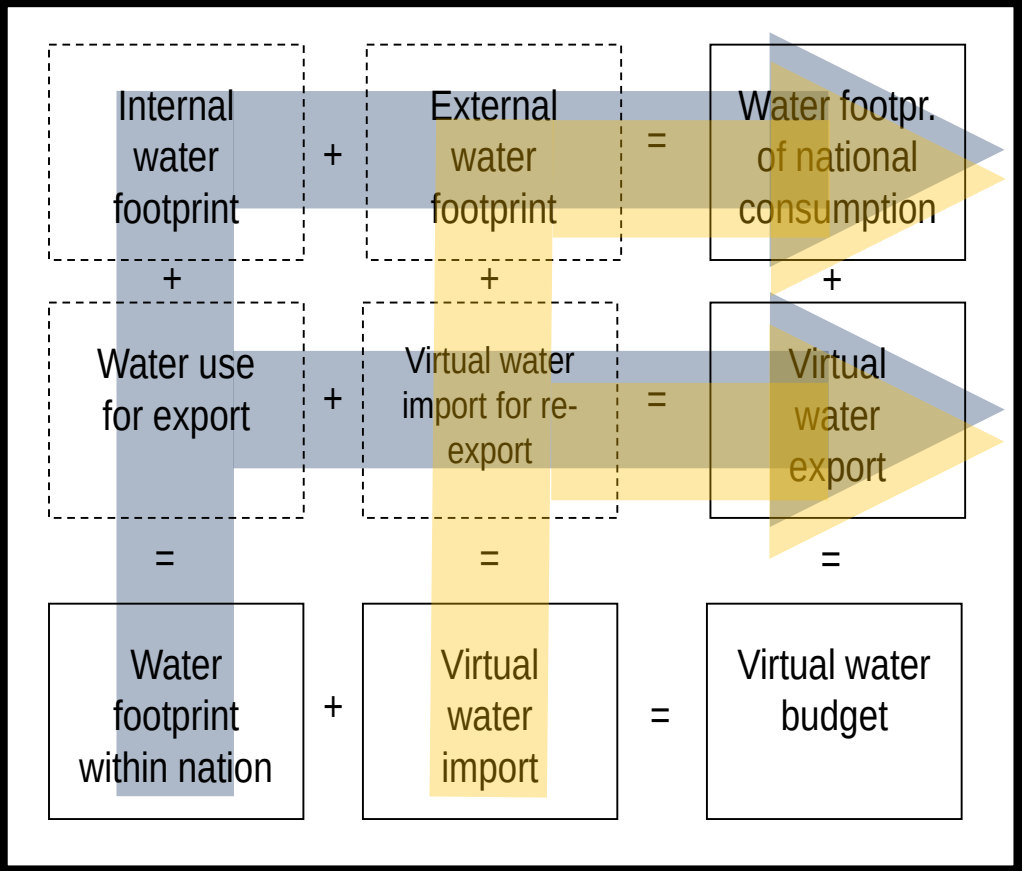
Source: Hoekstra and Wiedmann (2014) Humanity's unsustainable environmental footprint, *Science*

The relation between footprints of different entities



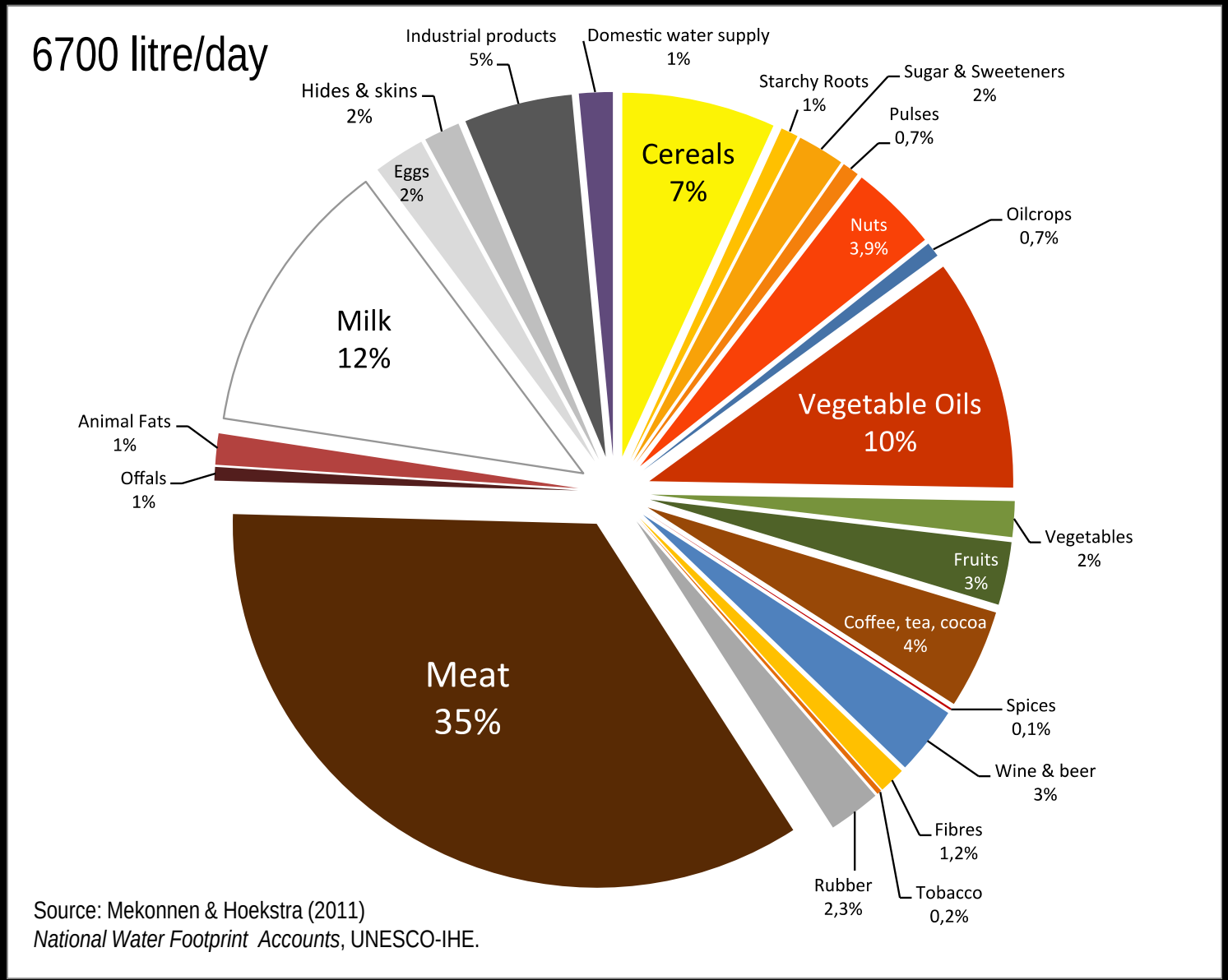
Source: Hoekstra and Wiedmann (2014) Humanity's unsustainable environmental footprint, *Science*

National water footprint accounting framework



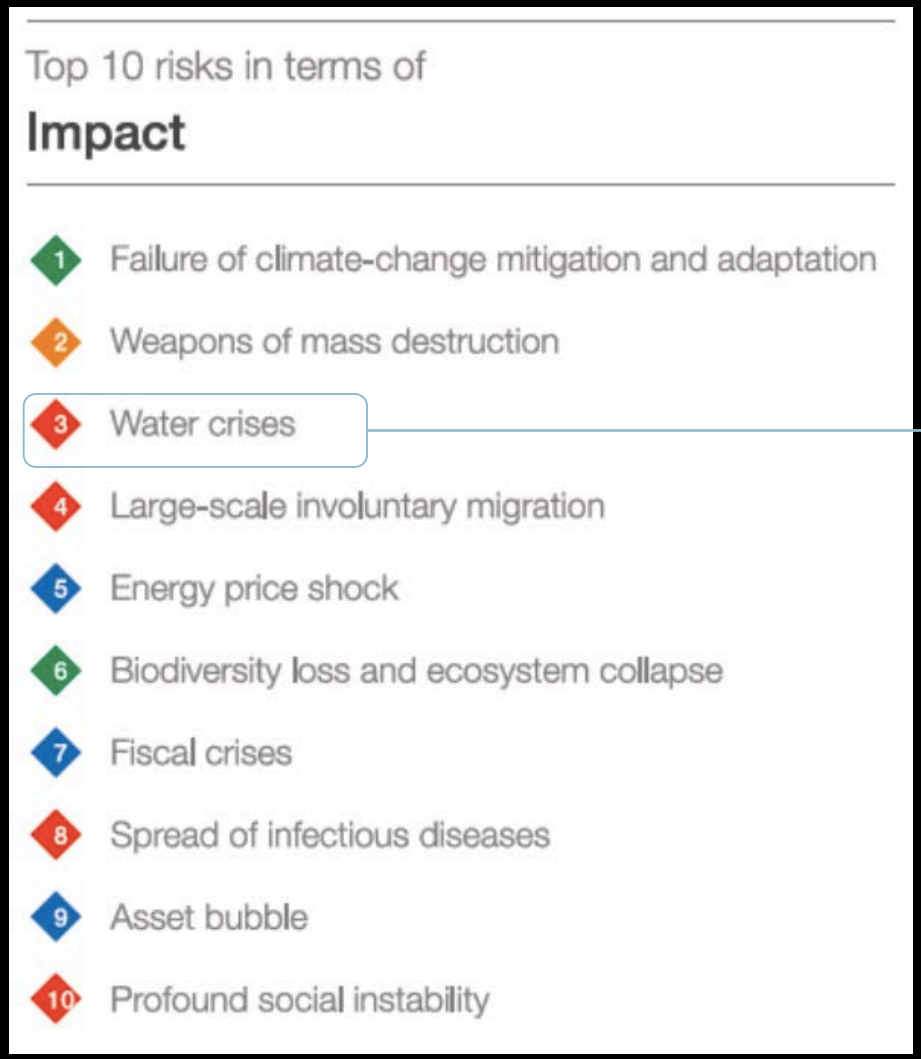
Source: Hoekstra et al. (2011) The Water Footprint Assessment Manual, Earthscan, London, UK

The average water footprint of a consumer in Spain



Source: Mekonnen & Hoekstra (2011)
National Water Footprint Accounts, UNESCO-IHE.

WEF's Global Risk Report 2016



→ Sustainability of water use

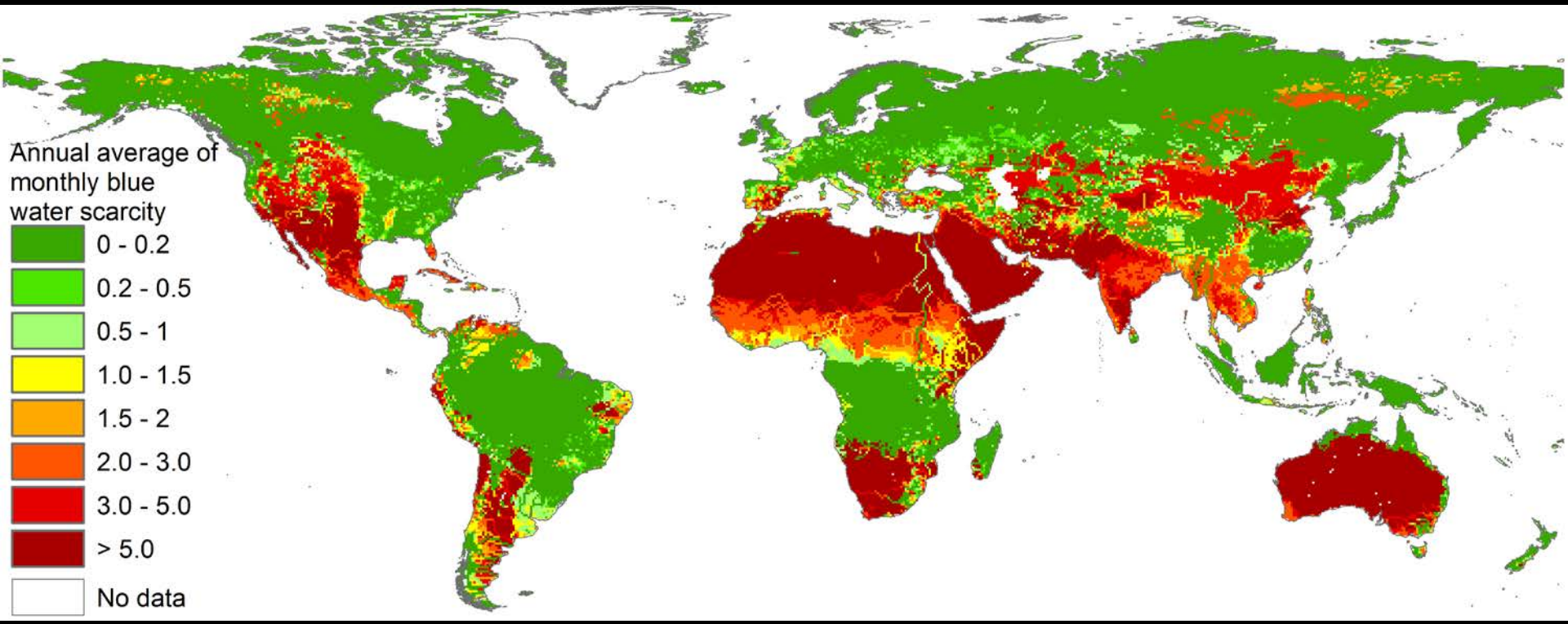
Water use efficiency

Fair sharing of water

Resource security

The blue water footprint of humanity: not sustainable

Blue water scarcity = blue WF / maximum sustainable blue WF

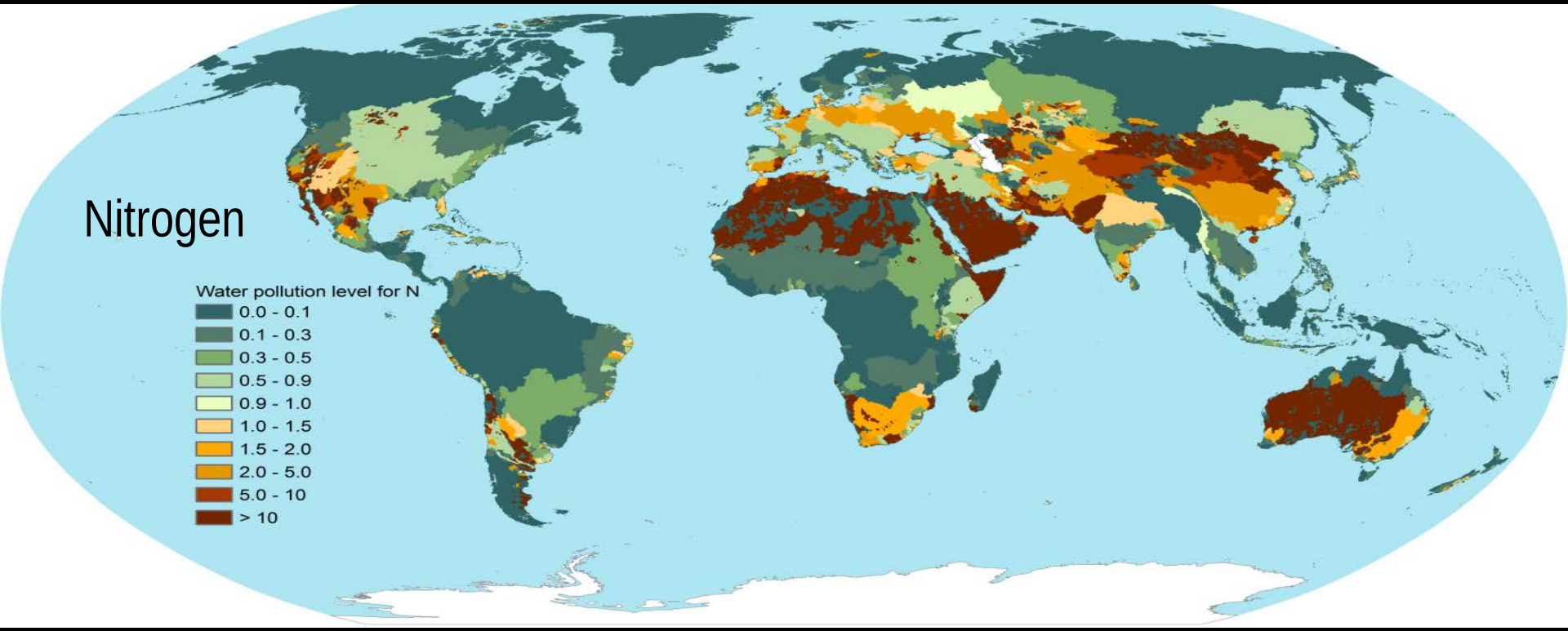


Source: Mekonnen & Hoekstra (2016)

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

The grey water footprint of humanity: not sustainable

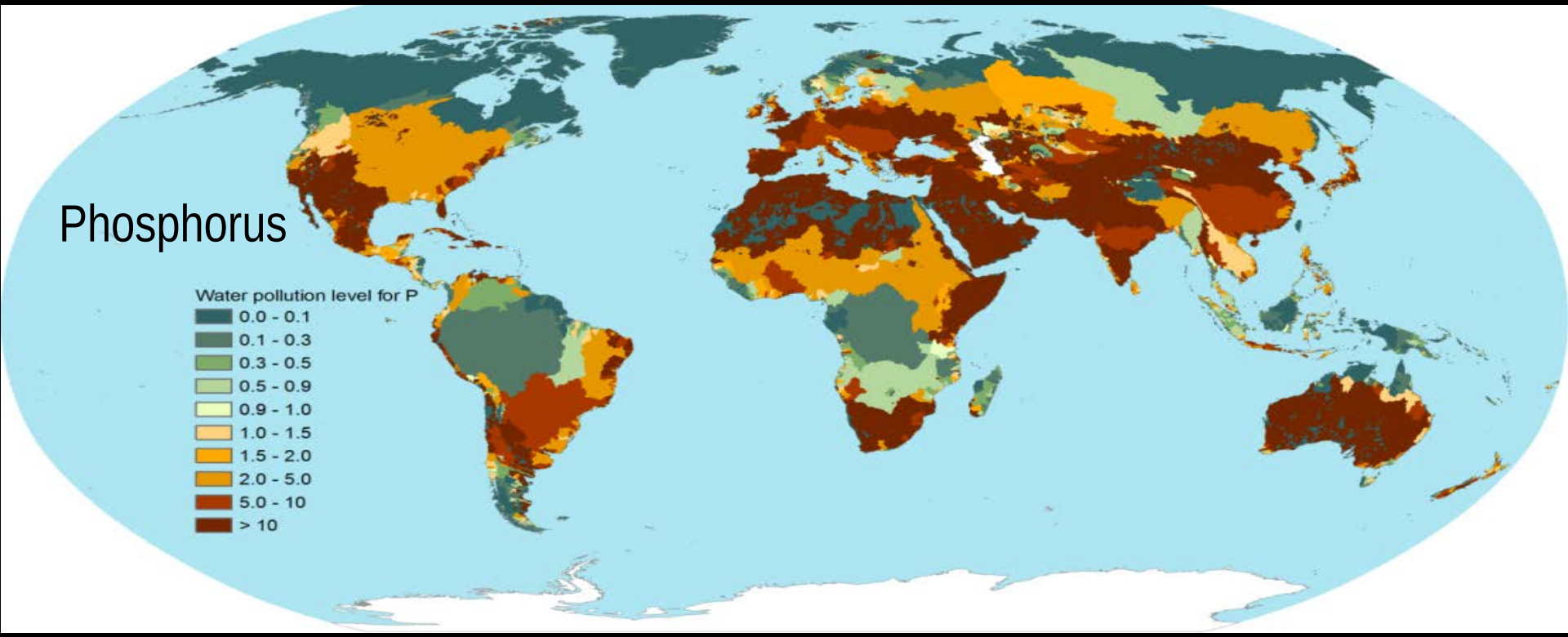
Water pollution level = grey WF / maximum sustainable grey WF



Source: Mekonnen & Hoekstra (2015)

The grey water footprint of humanity: not sustainable

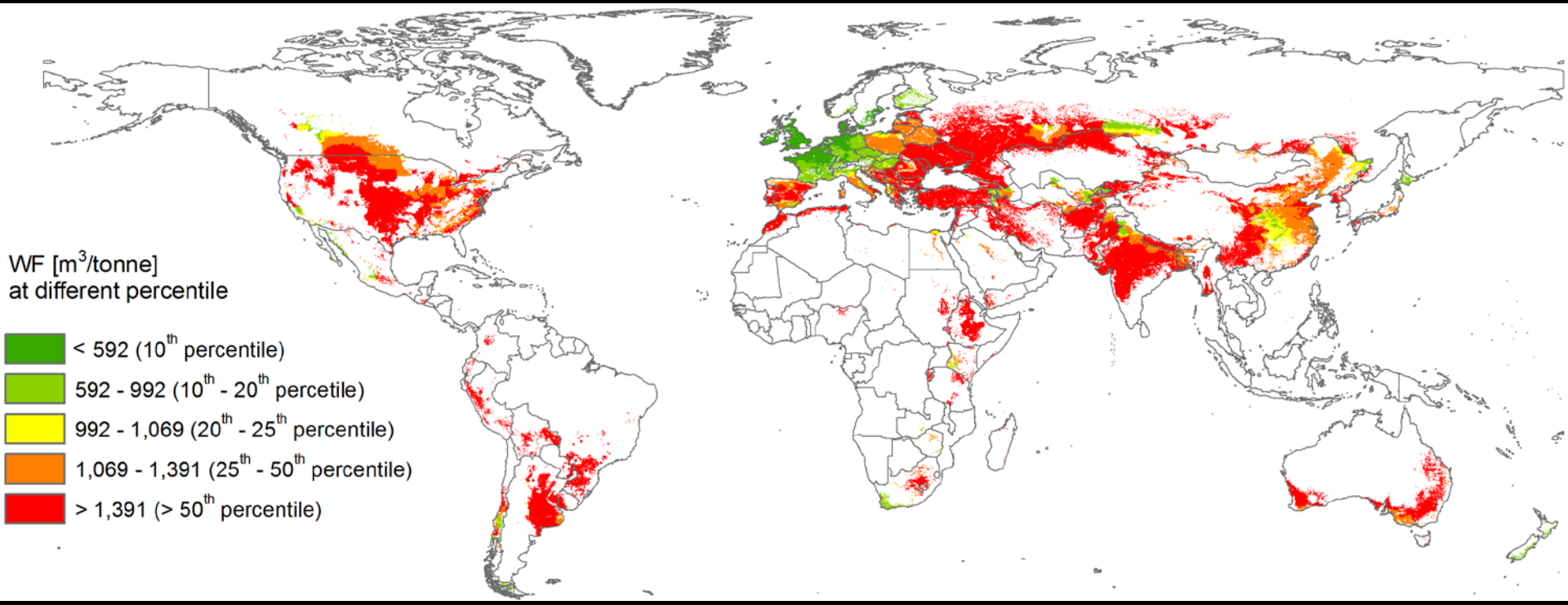
Water pollution level = grey WF / maximum sustainable grey WF



Source: Mekonnen & Hoekstra (2016)

The water footprint of humanity: not efficient

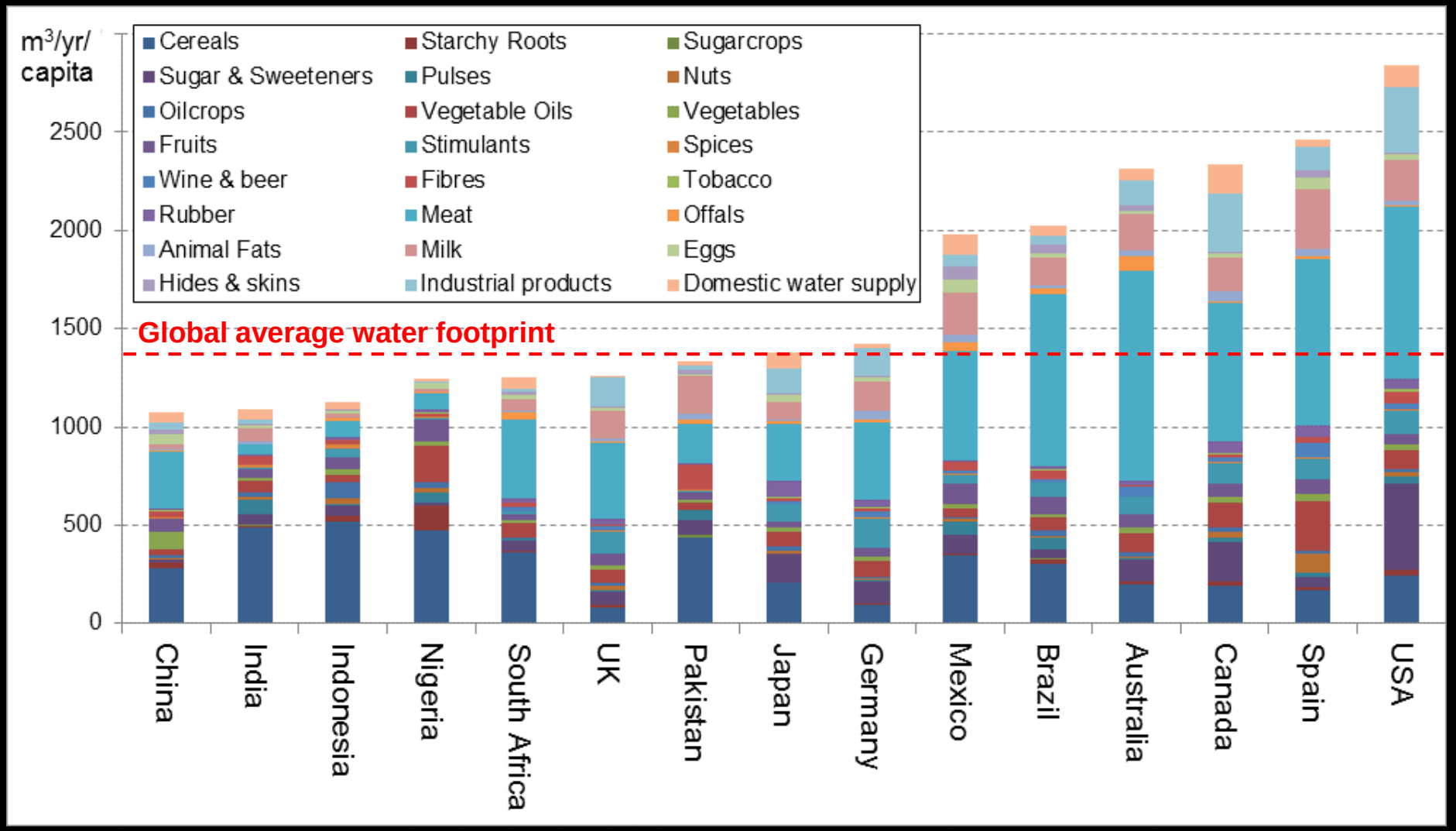
Spatial differences in the water footprint of wheat



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%.

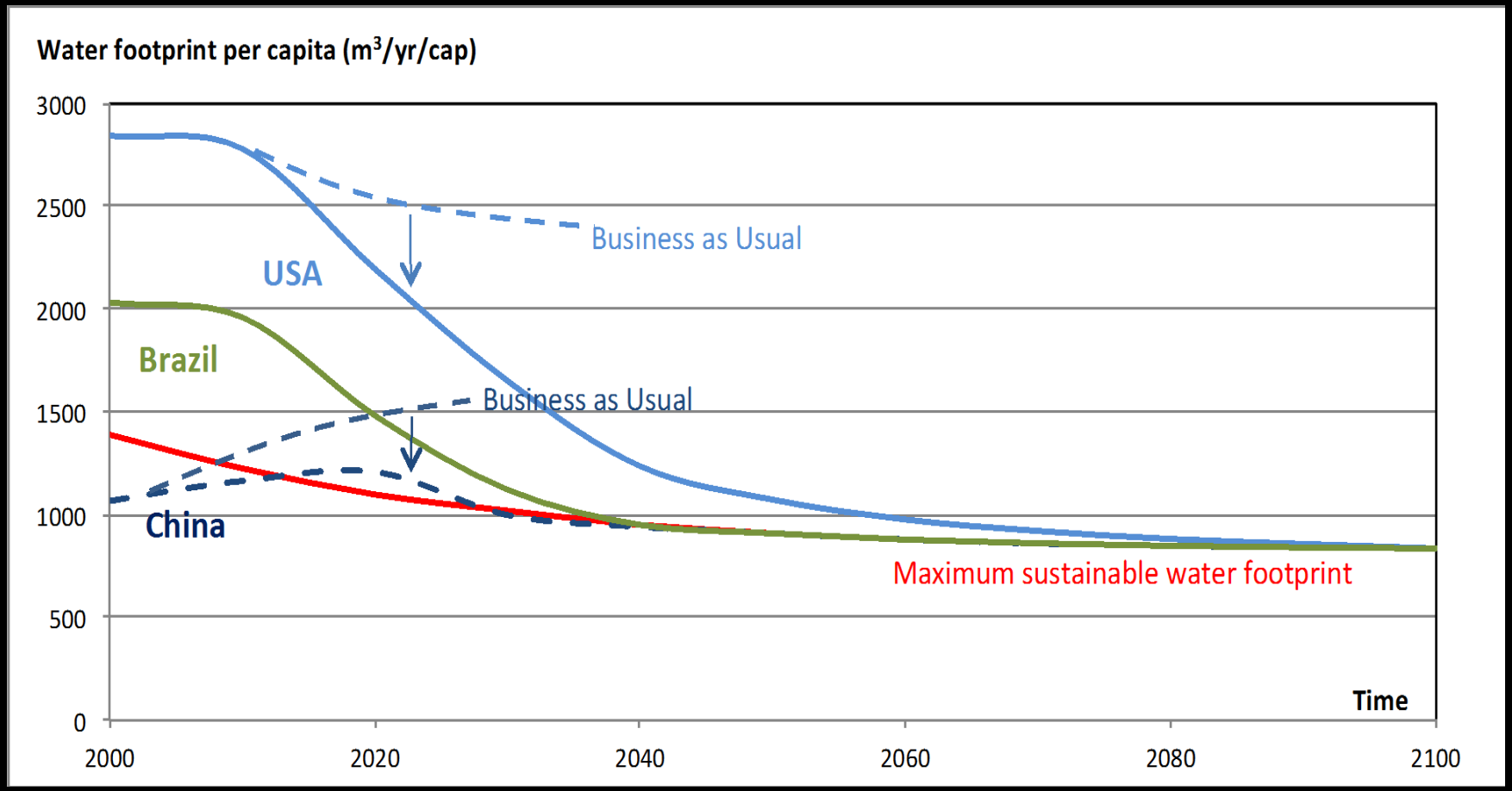
Source: Mekonnen & Hoekstra (2014)

The water footprint of humanity: not fairly distributed



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

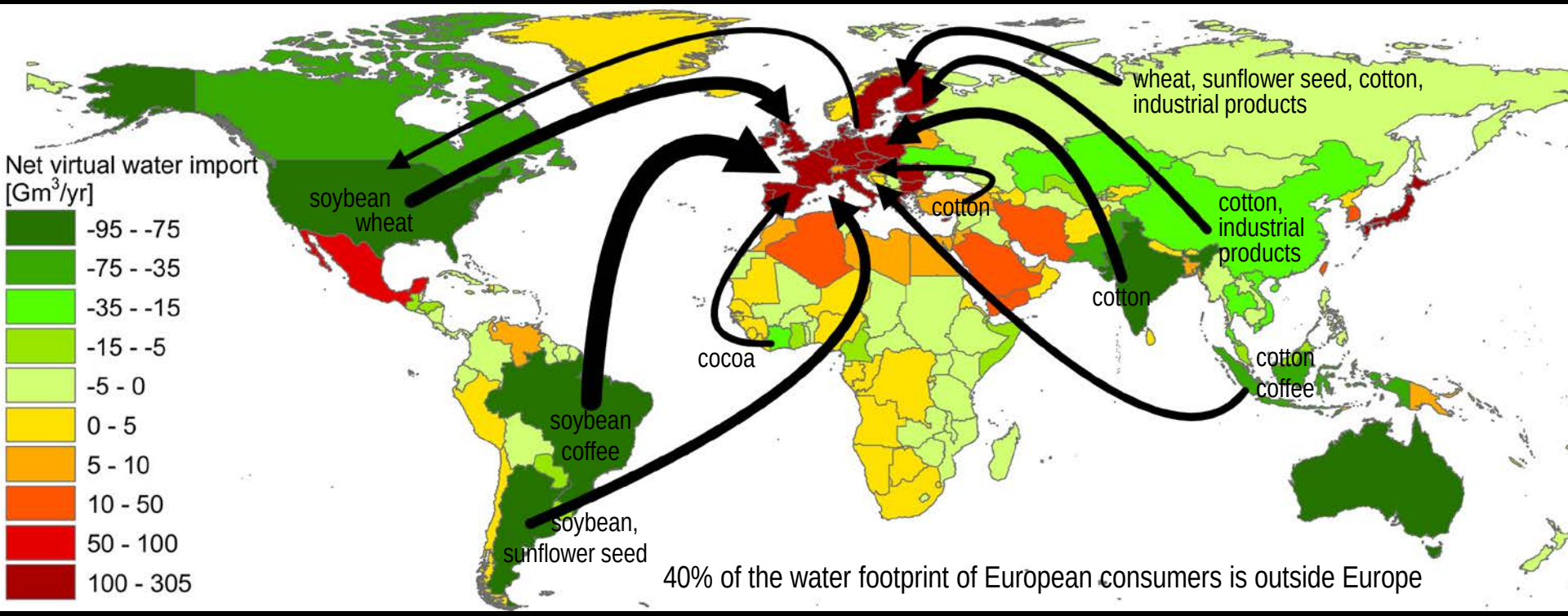
The need for contraction and convergence



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

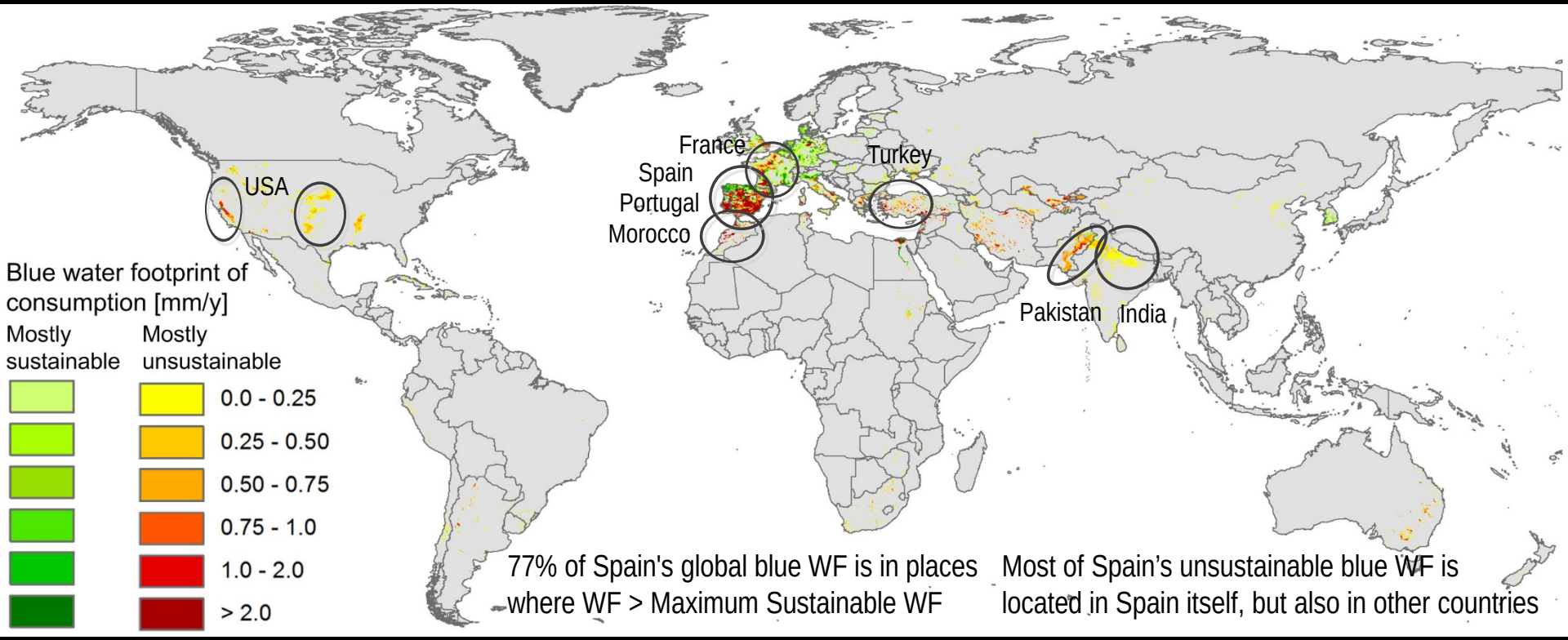
The water footprint of humanity: international dependencies

Example European Union



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

The sustainability of Spain's global blue water footprint



77% of Spain's global blue WF is in places where WF > Maximum Sustainable WF

Most of Spain's unsustainable blue WF is located in Spain itself, but also in other countries

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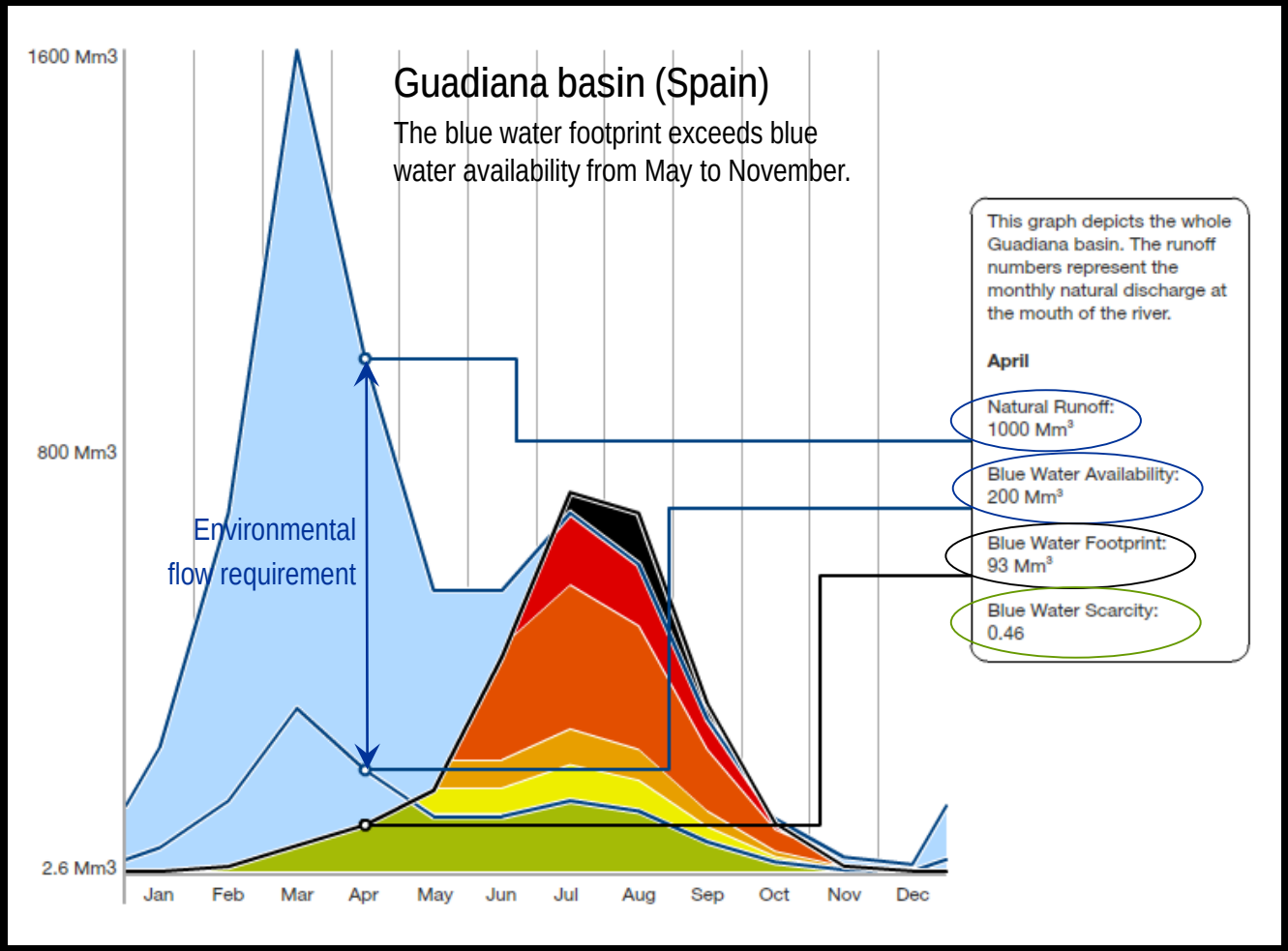
Source: Hoekstra & Mekonnen (2016)

Blue water footprint vs. blue water availability



Water footprint: why businesses are interested

Water risks for business

- Physical risk
- Reputational risk
- Regulatory risk
- Financial risk

Water opportunity for business

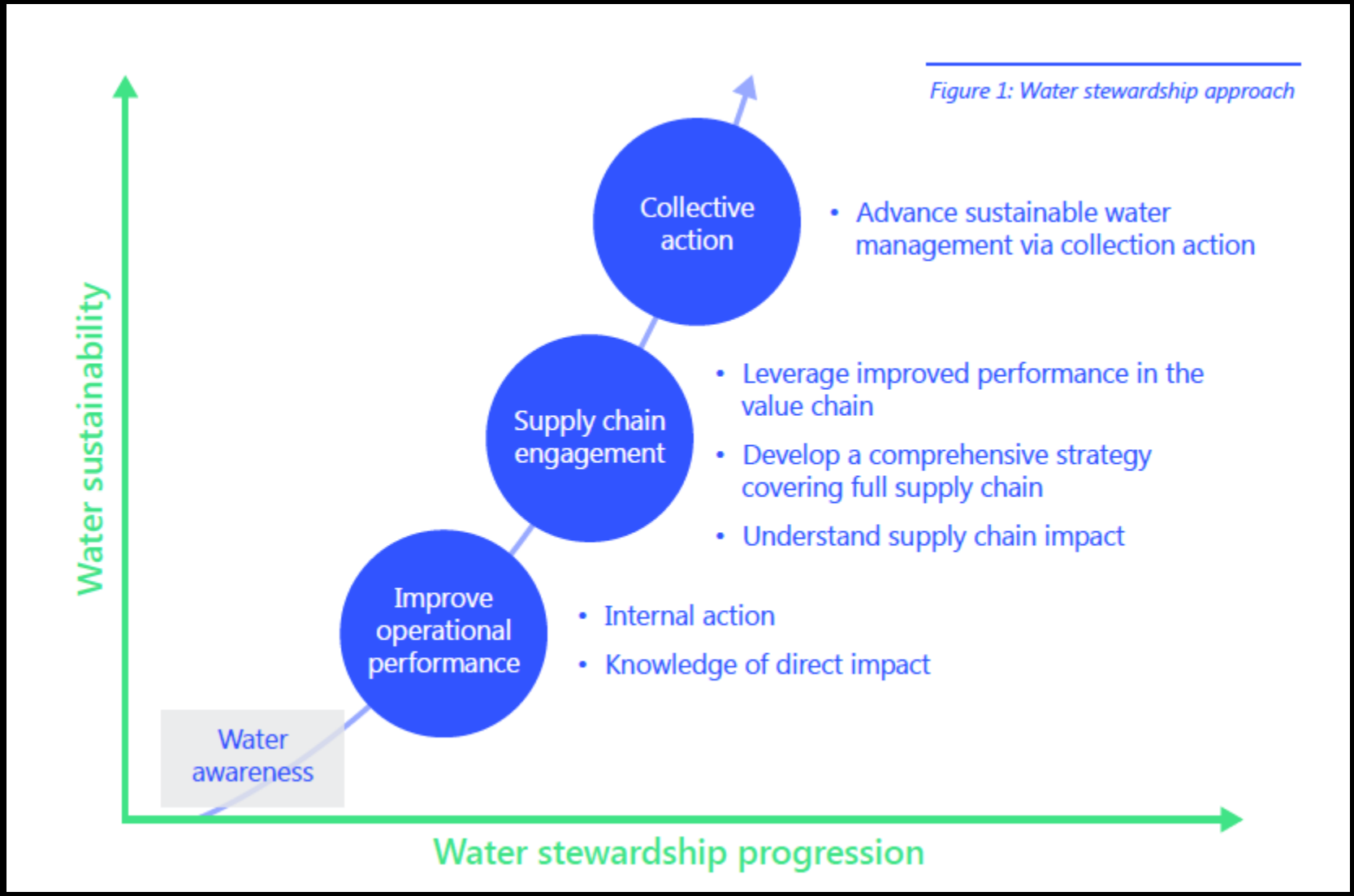
- frontrunner advantage
- corporate image

Corporate social responsibility

Water footprint: what's new for business

- From focus on own operations to
  supply-chain thinking
- From focus on water withdrawals to
  considering consumptive water use
- From securing the 'right to abstract' to
  assessing the actual sustainability of water consumption
- From meeting 'emission permits' to
  assessing the company's actual contribution to pollution

Developing a corporate sustainability strategy



Source: White et al. (2014)

Water Footprint Assessment – Examples from business

TATA

Steel, Automotive, Chemicals, Power

C&A

Apparel

CocaCola, SABMiller, Unilever, Nestlé

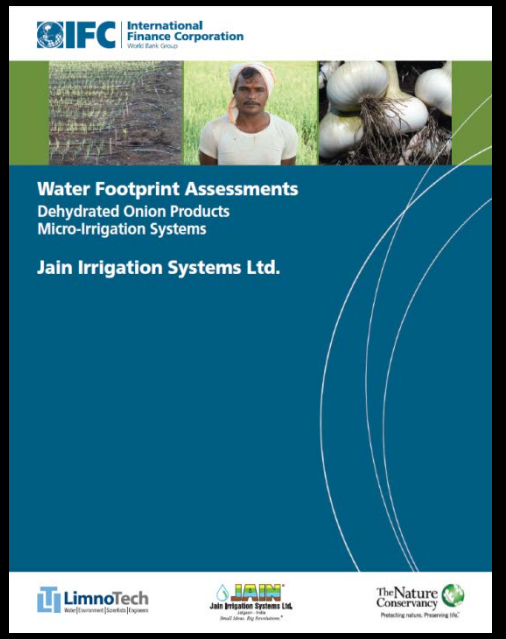
Food & Beverage

UPM

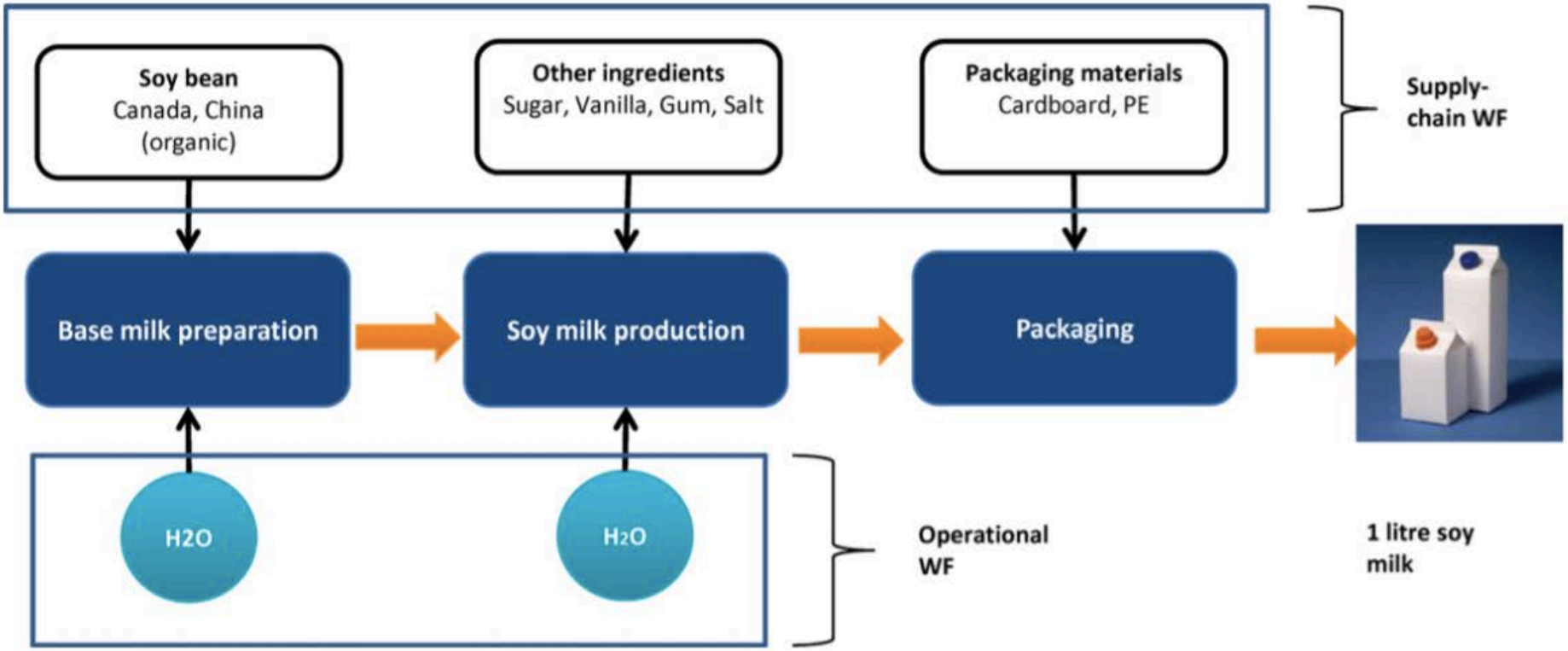
Pulp & Paper

Jain Irrigation, India

Water supply technology



The water footprint of soy milk



Source: Ercin et al. (2012)

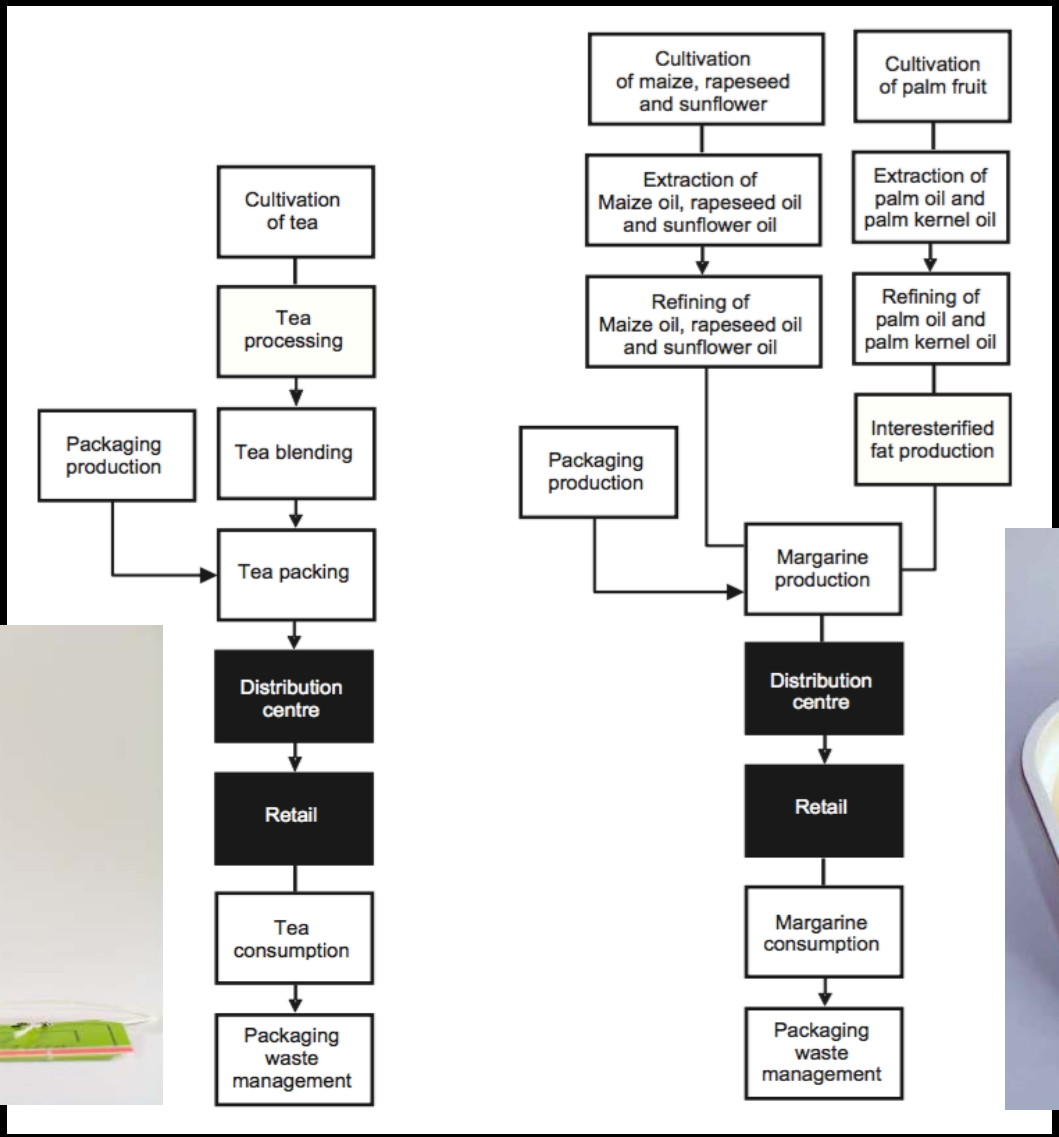
The water footprint of soy milk

Table 5
The water footprint of 1 l of soy milk.

	Water footprint (l)				
	Green	Blue	Grey	Total	% in total
Water incorporated into the soy milk	0	0.9	0	0.9	0.3
Water consumed during process	0	0	0	0	0
Wastewater discharge	0	0	0	0	0
Operational water footprint	0	0.9	0	0.9	0.3
Soybean (basemilk)	182.3	0	1.9	184.2	62
Cane sugar	71.1	9.9	0.4	81.5	27.5
Maize starch	0.2	0	0.1	0.4	0.1
Vanilla flavour	1.1	0.1	0	1.3	0.4
Ingredients total	254.7	10	2.4	267.4	90
Cardboard	15.4	0.0	4.5	19.9	6.7
Cap	0.0	0.0	0.5	0.5	0.2
Tray – cardboard	6.2	0.0	1.8	8.0	2.7
Stretch film (LDPE)	0.0	0.0	0.4	0.4	0.1
Other components total	21.6	0	7.2	28.8	9.7
Supply-chain water footprint	276.4	10.1	9.6	296	99.7
Total	276.4	11.0	9.6	296.9	

Source: Ercin et al. (2012)

The water footprint of tea and margarine – Unilever



Source: Jefferies et al. (2012)

The water footprint of tea and margarine – Unilever

Table 4
Water footprint results for the water accounting stage.

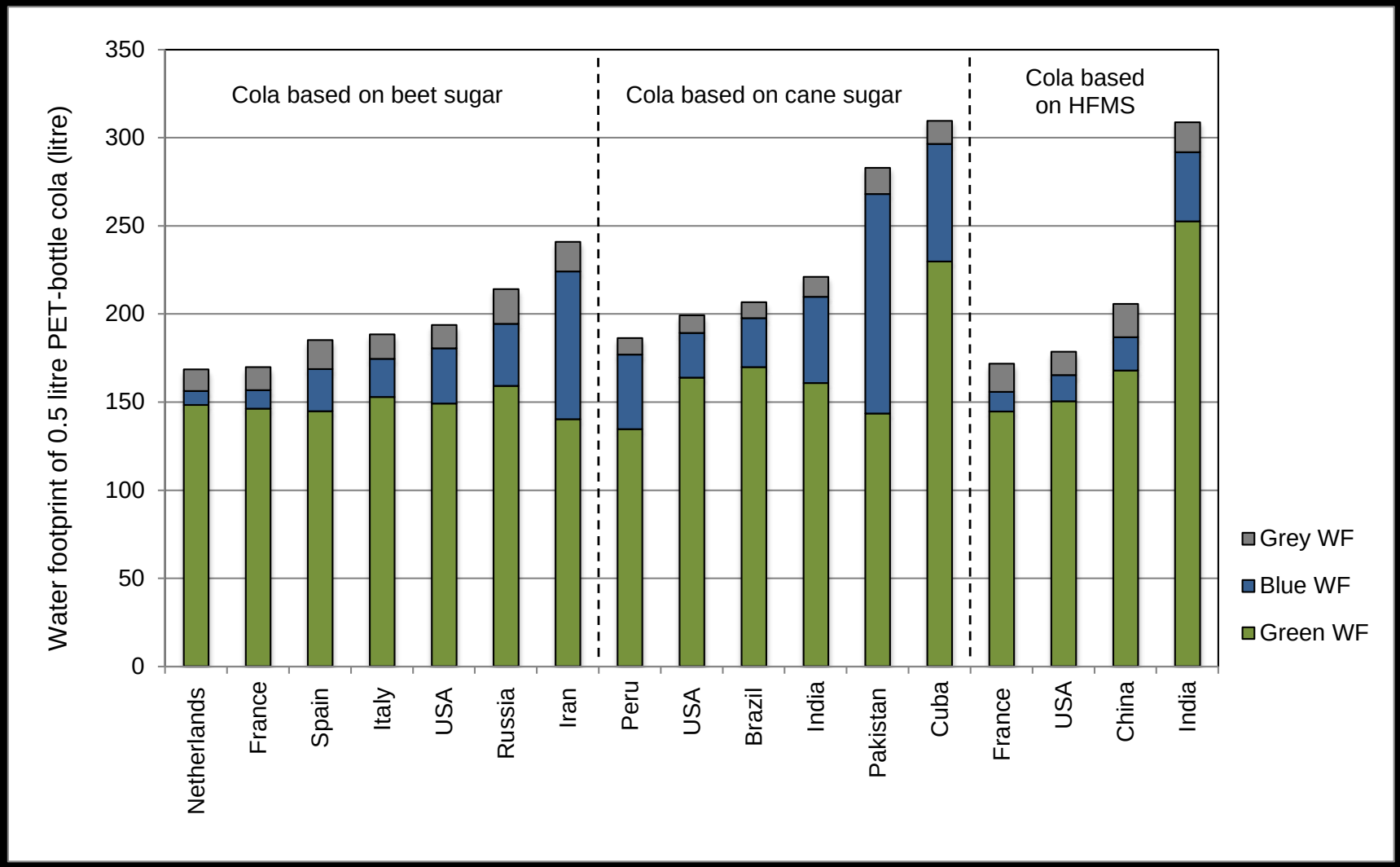
Process	Tea (L/50 g)			Margarine (L/500 g)		
	Green	Blue	Total	Green	Blue	Total
Supply Chain Water Footprint						
A) Ingredients	265	3.9	269	551	108	659
Black tea – Kericho plantation	46	0.002	46			
Black tea – Kericho smallholders	101	0.002	101			
Black tea – Nyeri smallholders	13	0.0004	13			
Black tea – Indonesia	85	0.001	85			
Black tea – India	20	3.9	24			
Rapeseed oil – Germany				91	0.2	91
Rapeseed oil – Poland				4.6	0.009	5
Rapeseed oil – Czech Republic				3.7	0.009	4
Maize oil – Hungary				5.3	6.9	12
Maize oil – France				4.3	2.3	7
Sunflower oil – Argentina				6.5	7.2	14
Sunflower oil – Ukraine				50	75	126
Interesterified fat of palm kernel oil and palm oil				385	16	402
B) Other components	29	0.6	30	1.7	0.4	2.1
Tea bag materials	18	0.3	18			
Packaging	11	0.3	11	1.7	0.4	2.1
C) Overhead water footprint[a]	0.9	0.7	1.5	0.2	0.2	0.4
Operational Water Footprint						
A) Water directly related to production	0	0.005	0.005	0	0.2	0.2
B) Overhead water footprint	0	0.003	0.003	0	0.03	0.03
Consumer Water Footprint						
A) Drinking water	0	2.2	2.2			
B) Electricity	0	2.8	2.8	0	0.3	0.3
Total Water Footprint	294	10	304	553	109	662

[a] Bulding materials, paper, and energy used in product factories.

Source: Jefferies et al. (2012)

The water footprint of a 0.5-litre PET bottle cola

depending on type and origin of sugar



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

The two separate worlds of water and energy

- The water sector is becoming more energy-intensive

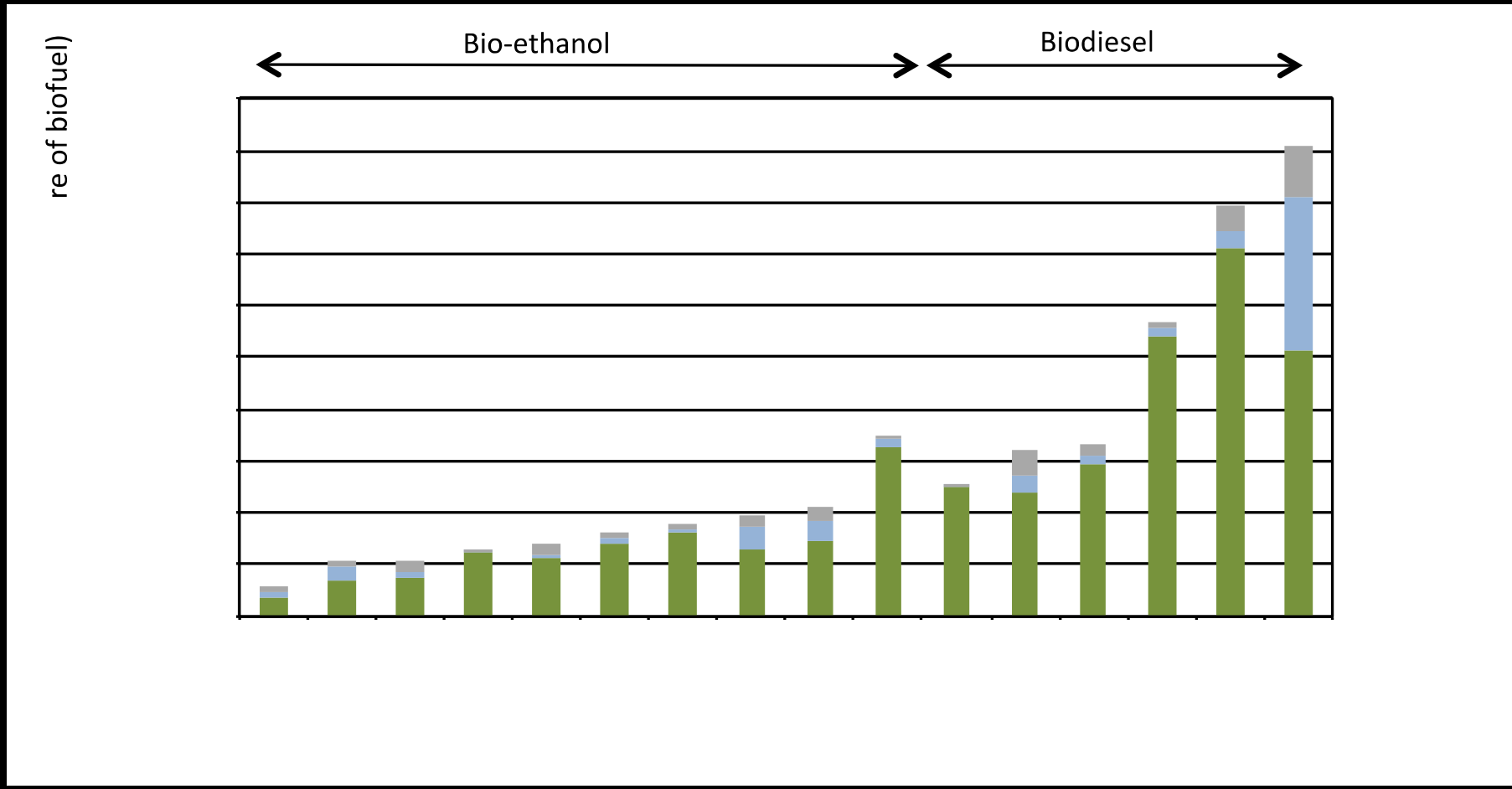
  - desalination
  - pumping deeper groundwater
  - large-scale (inter-basin) water transfers

- The energy sector is becoming more water-intensive

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

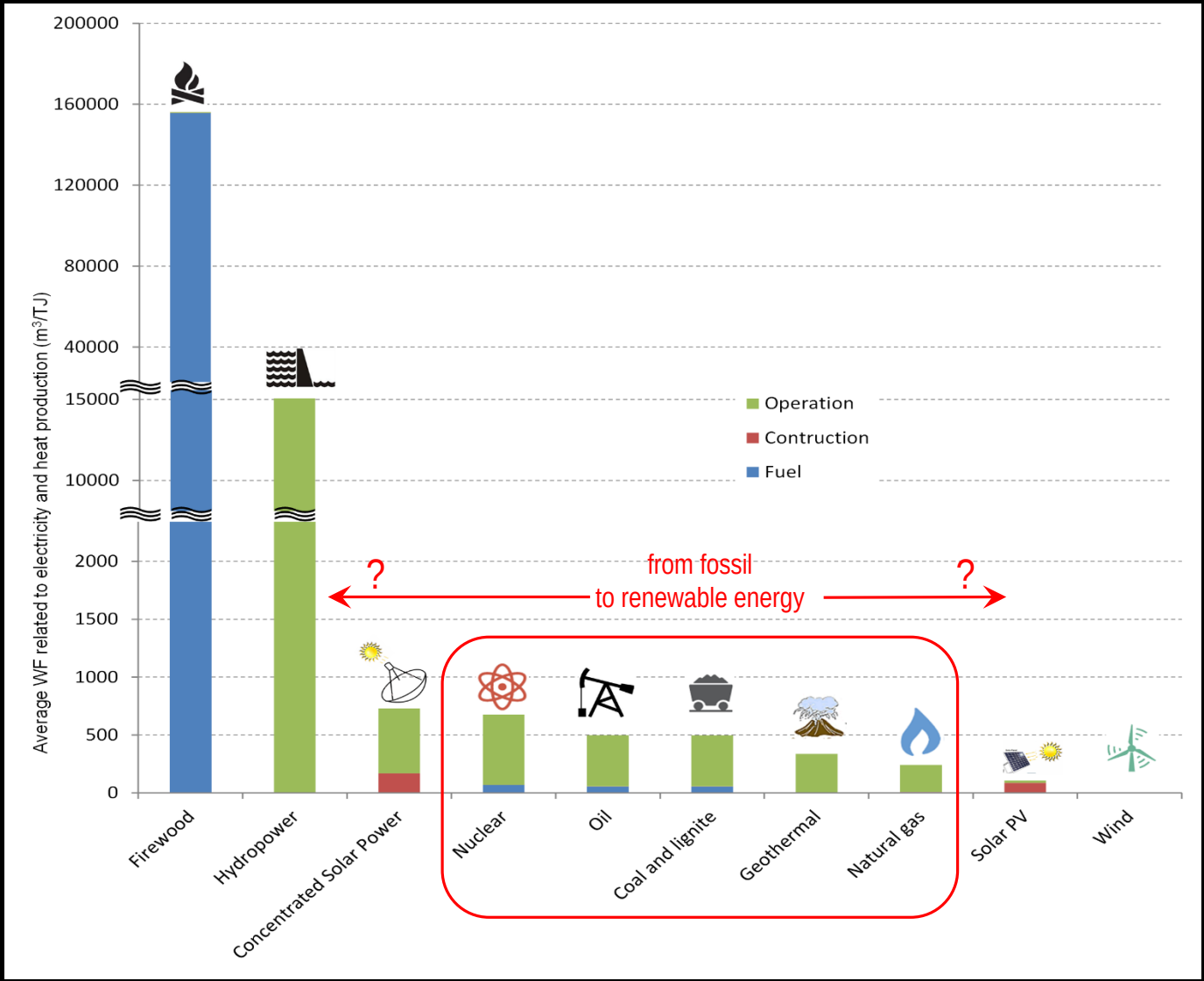
Source: Hoekstra (2013) *The Water Footprint of Modern Consumer Society*, Routledge, London, UK

The water efficiency of biofuels



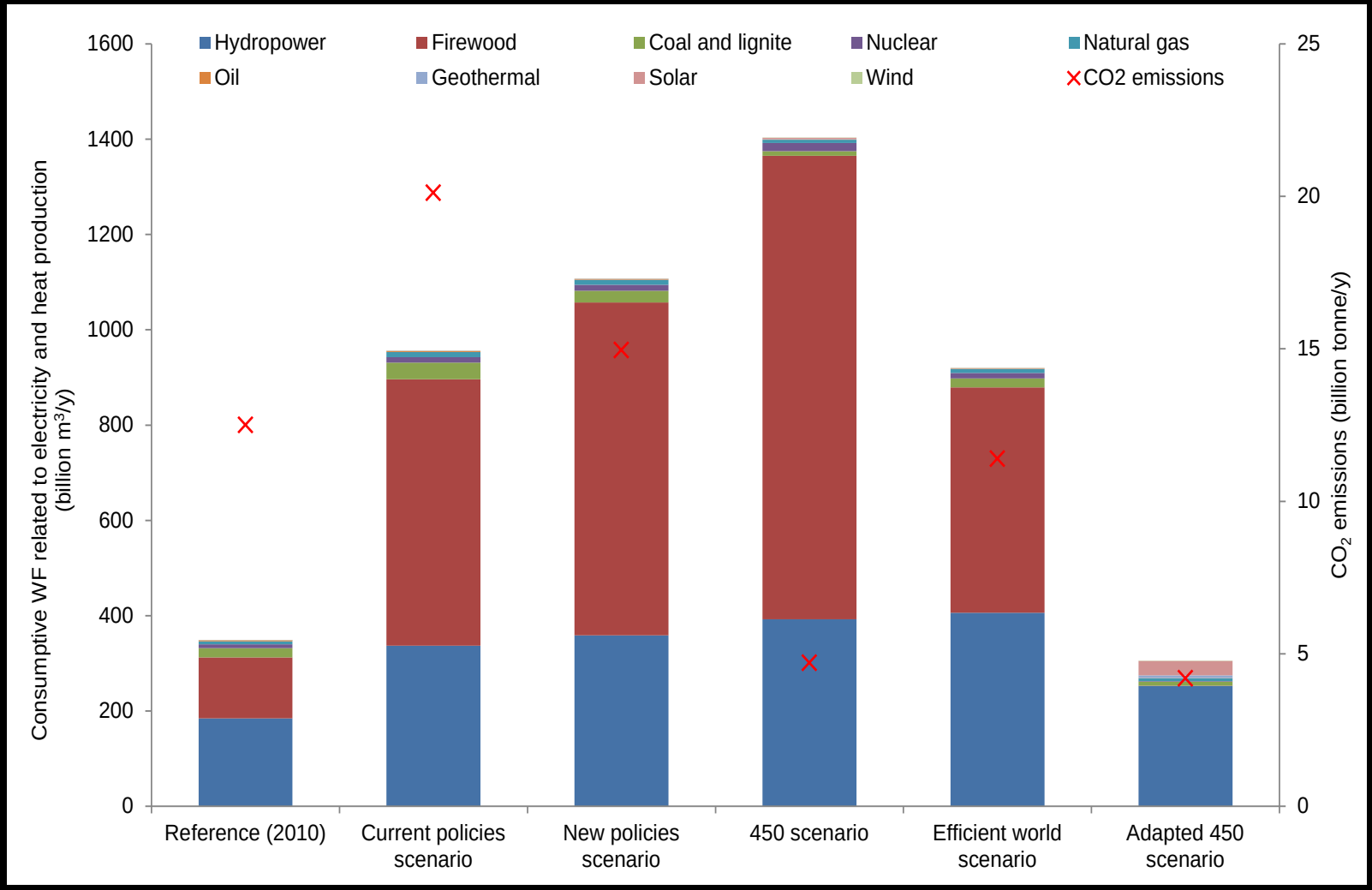
Source: Mekonnen & Hoekstra (2011)

The water efficiency of electricity



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

The water footprint of electricity in 2035 – IEA scenarios

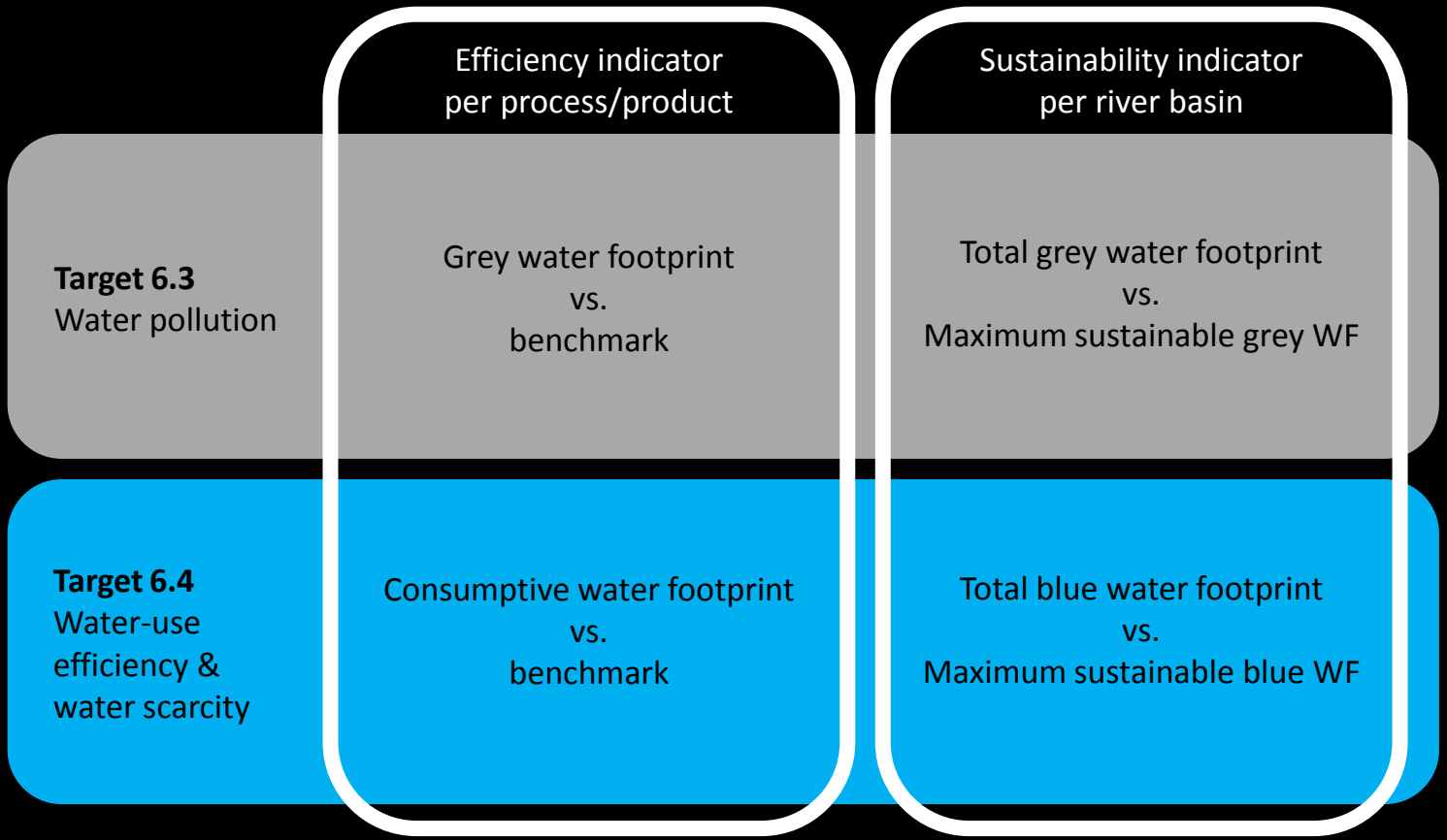


Source: Mekonnen, Gerbens-Leenes & Hoekstra (2016)

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
- coherence between water – energy – food – trade strategies

Sustainable development goals – measuring progress



The Water Footprint Network

Mission: Promoting sustainable, equitable and efficient water use through development of shared standards on water footprint accounting and guidelines for the reduction and offsetting of impacts of water footprints.

Network: bringing together expertise from academia, businesses, civil society, governments and international organisations.

www.waterfootprint.org

The Water Footprint Network – founding partners (2008)

University of Twente

UNESCO-IHE Institute for Water Education

World Business Council for Sustainable Development

International Finance Corporation (World Bank Group)

WWF – the global conservation organization

Water Neutral Foundation

Netherlands Water Partnership

The Water Footprint Network – first partners joining after launch

The Coca-Cola Company

Unilever

Nestlé

SABMiller

Alliance for Water Stewardship

Global Footprint Network

The Nature Conservancy

Pacific Institute

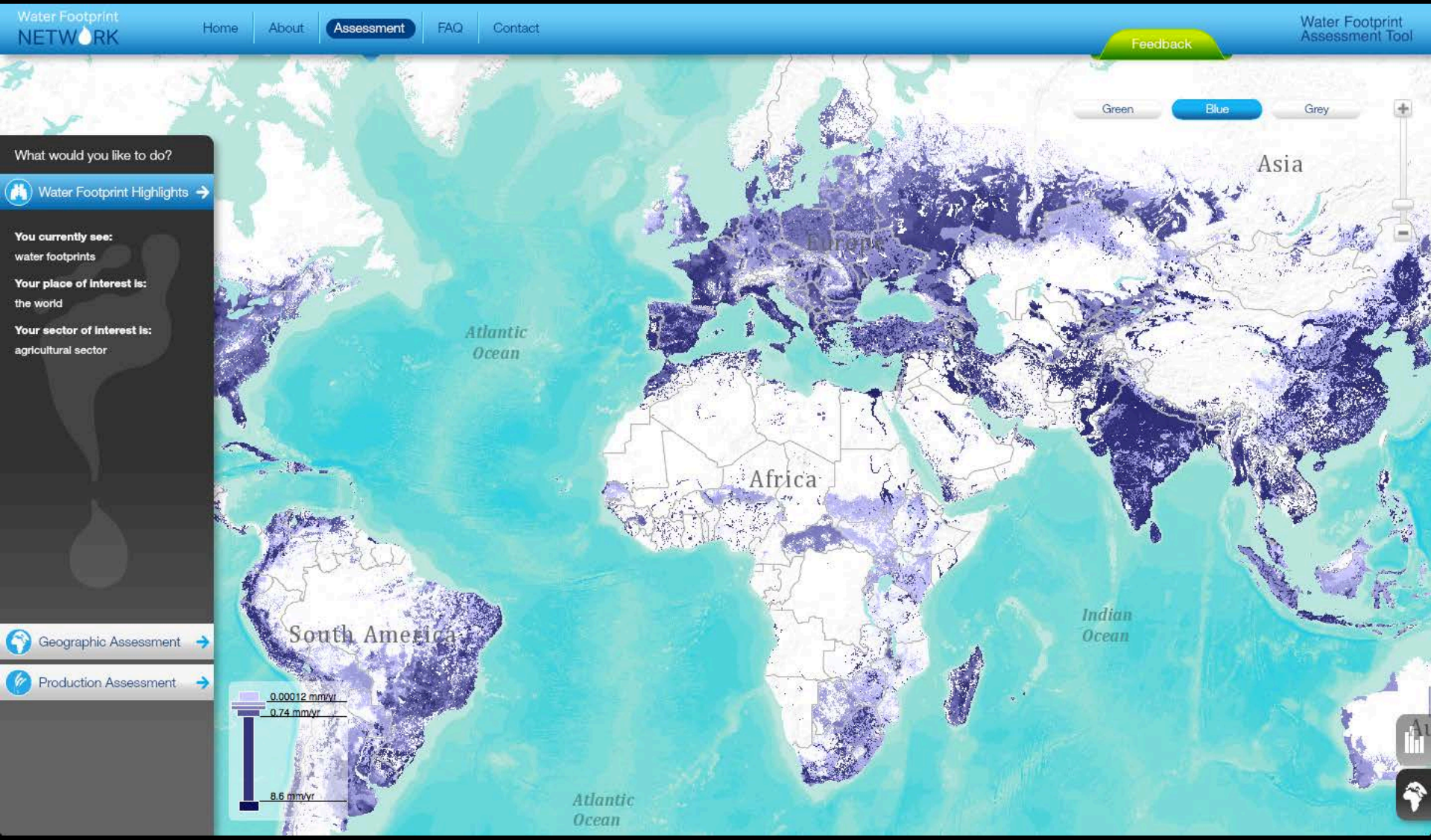
Swiss Federal Institute of Aquatic Science and Technology

U.S. Agency for International Development

The Water Footprint Network – partners from all continents

- universities & research institutions
- governmental institutions
- non-governmental organisations
- large companies
- medium and small companies
- sector/branch organisations
- consultants
- accountants
- international institutions

Water Footprint Assessment Tool



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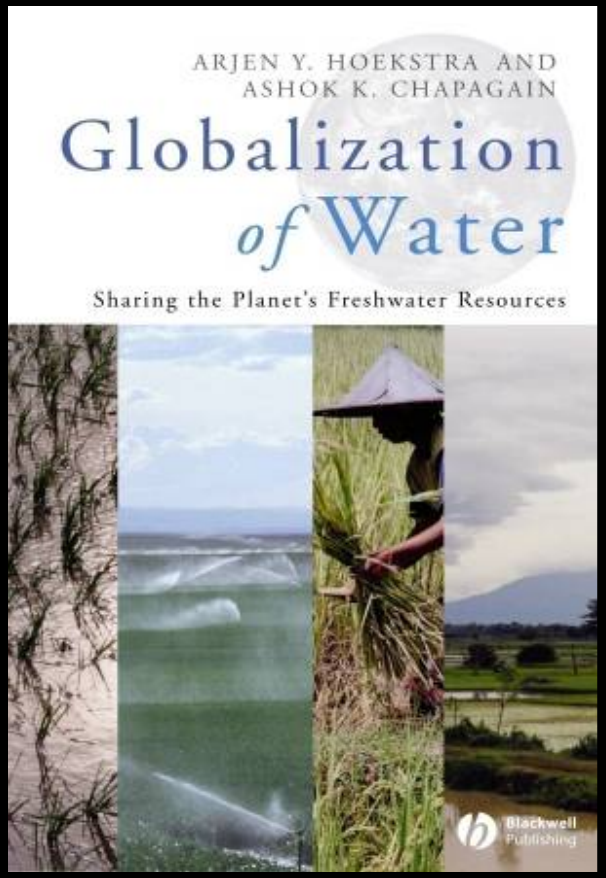

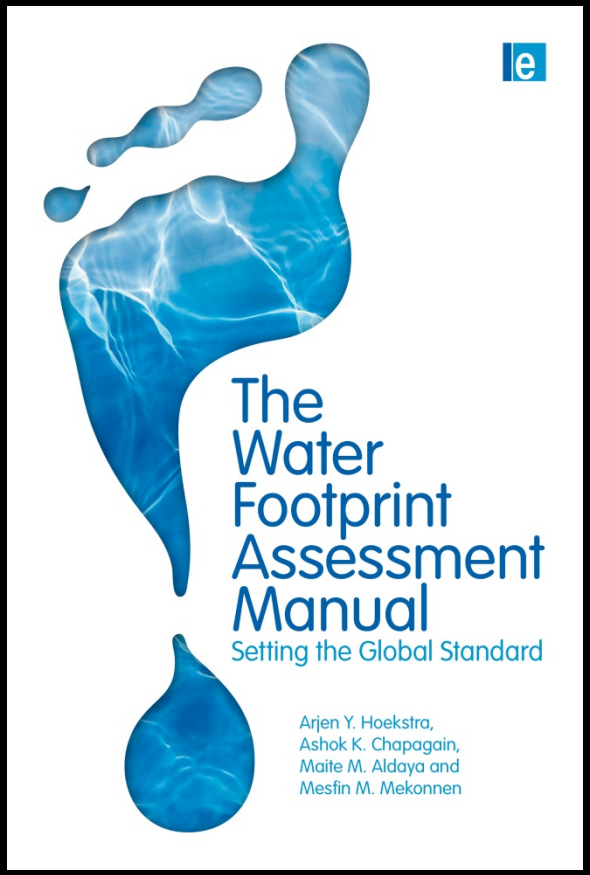

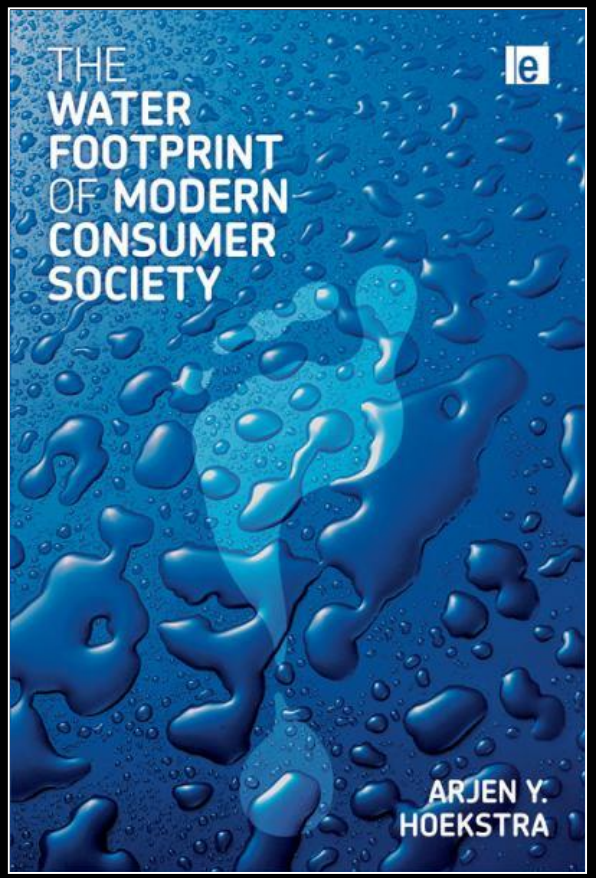

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