Water Footprint as Part of a Sustainability Indicators Framework

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Water Demand

Products and activities have “virtual water content” – the volume of water used in the directly (operations) or indirectly (supply chain) in the process resulting in the product/activity (Allan, 1993)

Water footprint = total volume of water used to produce goods and services used by individual or jurisdiction (e.g., state, country; Hoekstra and Chapagain, 2008)

Virtual water trading is the process of trading water embedded in imported/exported goods. Water stressed countries can save water by importing goods with high water content, rather than producing them.

Water Supply

Existing and new sources

-- water “development”
-- water conservation
-- water recycling

“Gray water” = amount of water needed to assimilate pollutants to meet water quality standards

“Blue water” = surface or ground water evaporated as a result of production

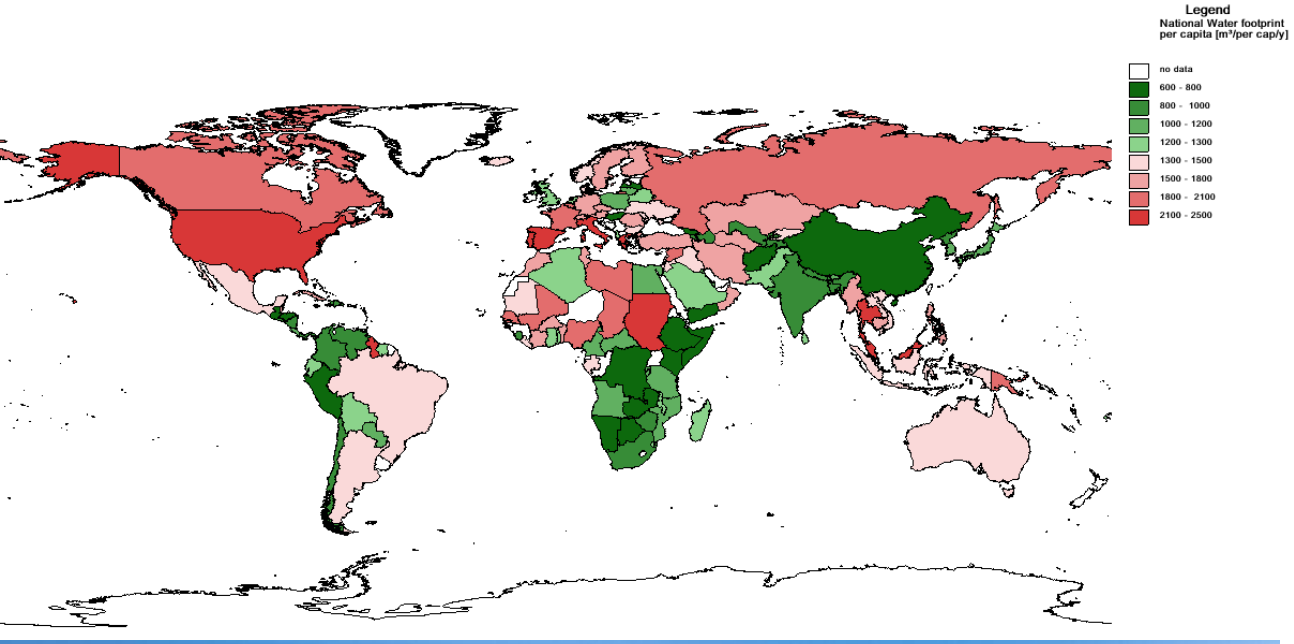
“Green water” = rainwater /soil moisture evaporated during production process

Economic benefits per unit water is way to measure economic efficiency of water use

But virtual water volume per unit of product and water footprint measures the total impact, regardless of economic benefits

Where have Water Footprints been estimated?

Indonesia
Greece
China
Tunisia
UK
Cyprus
Germany
Canada
Spain (includes WF in government policy)
…



Global Water System Project

People Powered Machines.com

Include Water Footprint Calculation as Index of Water Use and Impacts

World Wildlife Fund

Working assumption

Water Footprint ~ Water Sustainability

Compare water footprints of water consuming and polluting activities/sectors with the water available in a given geography

Water footprints are tied to responses – “right actions” as part of water demand management

$$WF_{area} = \sum_{q} WF_{proc}[q]$$

where $WF_{proc}[q]$ refers to the water footprint of a process q within the geographically delineated area. Can also be applied to a single entity in an area.

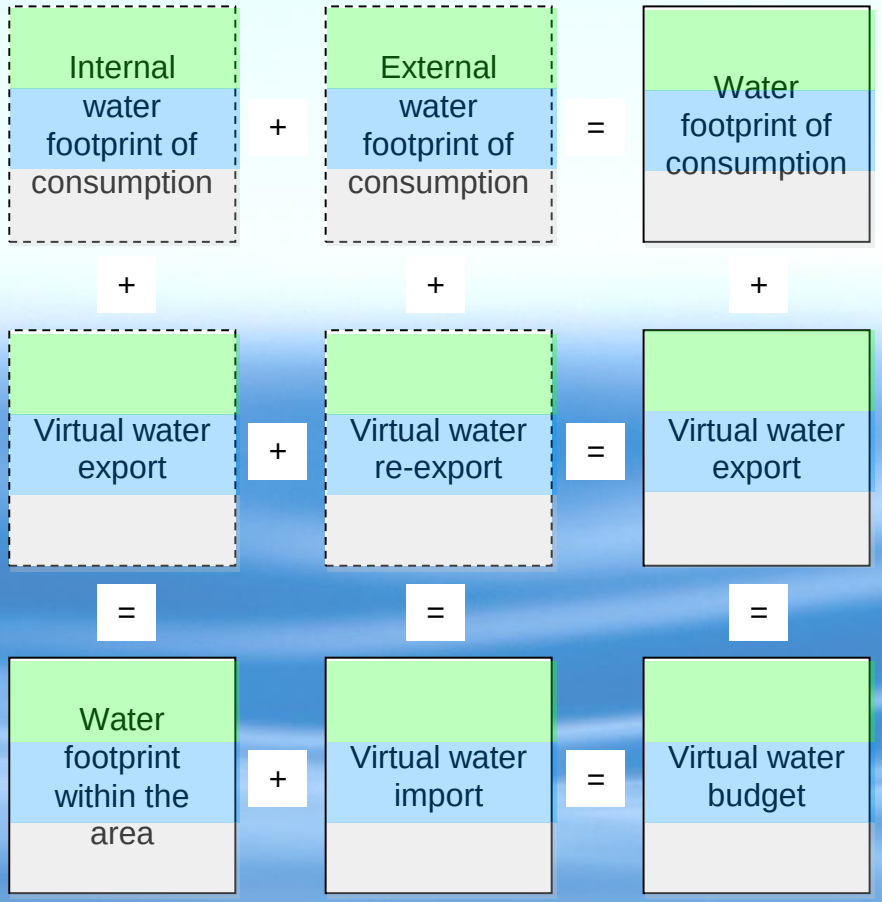
$$V_{i,net} = V_i - V_e$$

net import of virtual water over this period ($V_{i,net}$), which is equal to the gross import of virtual water (V_i) minus the gross export (V_e)

WF of the consumers in a nation ($WF_{cons,nat}$) has two components: the internal and the external WF

$$WF_{cons,nat} = WF_{cons,nat,int} + WF_{cons,nat,ext}$$

(Kuiper et al., 2010)



Water footprint accounting for a given geographic area (Hoekstra et al., 2009, in Kuiper et al., 2010)

We can use the water footprint index (aggregation of indicators of consumptive-impact) as a complementary index to withdrawal, ecosystem needs, natural processes, equitable distribution of benefits, and other indices of water sustainability.

Measuring sustainability: We can compare the footprint to other measures in a region (e.g., economic productivity, or ecosystem needs) and to the water available as part of impact assessments, where *available water* = *runoff* – *environmental flow requirements*

Sustainability Indicator Framework

Sectoral water footprints

Region footprint

United Nations World Water Assessment Programme

Water Footprint Network (www.waterfootprint.org)

Hoekstra, A.Y., Chapagain, A.K., Aldaya, M.M. and Mekonnen, M.M. (2009) Water footprint manual: State of the art 2009, Water Footprint Network, Enschede, the Netherlands. Available from: http://www.waterfootprint.org/downloads/WaterFootprintManual2009.pdf

Kuiper, D., E. Zarate, and M. Aldaya (2010) Water footprint assessment, policy, and practical measures in a specific geographic setting. Water Footprint Network and UNEP, Technical Paper

Allan, J.A. (1993). Fortunately there are substitutes for water otherwise our hydro-political futures would be impossible. In: ODA, Priorities for water resources allocation and management, ODA, London, pp. 13-26.

Chapagain, A.K. and Hoekstra, A.Y. (2004). Water Footprints of Nations. Value of Water Research Report Series. No. 16. UNESCO-IHE: The Netherlands.

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