Faculty of World Economy and International Affairs

Master's Programme Environmental Economics and Sustainable Development

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Introduction to Environmental Economics

Part 8: Water Resources & Systems

Lecture 6: Potential of water markets

Mikhail Kozeltsev, HSE

Alexandre MARTUSEVICH, Guest Senior Research Scholar, IIASA

CONTENT

Potential of water markets:

- in WSS: competition **on** the marker vs competition **for** the market. Delegated management (see lecture 4)
- In WRM: **Ownership rights vs the right** to use water resources; specification of the rights to water; quotas for water abstraction & water trading

Pollution norms and quotas & Pollution quotas trading

Water & international trade: water footprint, virtual water and virtual water trade

Potential of water market in WSS

As a general introductory remark. Specificities of the water sector (see Lecture 2) put tough limits for the possibility of creating a competitive market for water resources and services (except some specific cases & niches, and forms of competition).

In WSS, the foresaid specificities forced countries to prohibit privatization of immobile part of fixed assets. This makes Competition **on** the market hardly possible, leaving, however, quite a few opportunities for Competition **for** the market - for the right to serve the whole market over certain period of time (from 5-15 to 49 years), on the basis of a delegated management contract. Such contracts are effective in Yerevan (Arm), Rostov-on Don, Perm (Rus), Kant (KR) and a few other cities.

The origin of the ***competition for the market*** concept can be found in **Sir E Chadwick** works (mid-19th century). It was then rediscovered by Demsetz.

(**a sever outbreak of typhoid in London, in 1838**. **Sir Chadwick insisted on careful investigation & study.**
The UK Law on hydrotechnical structures, 1847, limited the profit margin of water utilities to 10%;
then the UK Law on public health, 1848, was adopted)

Potential of water market in WSS -2

Alternative **options for private sector participation (PSP)** : management, lease or concession contracts. Typically, the private partner is selected through competitive bidding

Criteria:

- Technical (experience, quality of staff and of tech. proposal etc.)
- Financial (for fully-fledged concessions): the theory recommends: minimal tariff profile over the concession period

Risk sharing: each risk is levied on the Party best placed to manage it, at least costs.

Selection of appropriate legal form (affordability constraints):

- Management contract: if the tariff fully covering O&M costs will not be affordable to a large proportion of the population
- Lease contract: the tariff fully covering O&M costs will be affordable but not the tariff covering also capital costs
- *Affirmage* (Fr.: lease with some investment obligations), BOT etc.: tariff will fully covers O&M and capital costs (+ ENV + resource costs)

Performance-based contracts & most relevant KPIs: site specific, 3-5 max. Not 40-50 KPIs, please (more details in next lectures)

!! Prevention of the monopoly rent appropriation & Objective function of water system operator: ***no profit maximisation*** (as per Micro - 1, 2)

The objective is to fully cover financial costs of the operator who should get also a fair return on the capital it has invested (in the utility sector: regulated return at some 10-15% per annum. Alternatively, the tariffs as per contract, with regular adjustments to reflect the recent inflation)

Potential of water market in WRM

Ownership rights vs the right to use WR: many countries prohibit privatization of most water bodies (lakes, rivers, GW reserves) - they belong to the whole nation (or several nations, in case of trans-boundary water bodies)

The right to use water, on the legal basis of:

- **water license or special water use permit** (разрешение/лицензия/договор специального водопользования). Except water use for own needs of households and small family farms (no special permit, often free use) – it reflects the social dimension, human right to water;
- **quotas for water abstraction.**

Allocation rules and regime (prioritized uses: Env flow, potable water supply to the population; irrigated agriculture; industries)

Economic rent extracted from using water resources & bodies (natural resource & nature based systems) and Instruments to appropriate the rent: water use fee, water tax. Fines for over-abstraction (see lectures 4 and 5).

Potential of water market : the case of Trading in quotas for water abstraction in Australia

Theory: Sectors which **have excess water quotas** over a particular period may then sell their rights to the ones who **need extra water** and this is actually **water trading**.

Case-study. Such trading does exist in Australia where most water trading occurs in the Murray–Darling Basin. Water in the basin can be bought and sold, either permanently or temporarily. This water is traded on markets – within catchments, between catchments (where possible) or along river systems. This form of trading allows water users to buy and sell water in response to their individual needs. In the 2021–22 hydraulic year the value of such trade amounted to $1.8 billion.

Governmental support to water trading

Darling Basin water sharing plan is one of the most important and decisive policy instruments. Its main aim is to redress the over allocation of water licenses and basically to return 2750 gigalitres of water from irrigated agricultural land to the river system. Since it has been working on the concept of water trading, farmers get a certain amount of water for their properties on the basis of water licenses. They are of two main classes: **high security**, which means that a property has permanent right to some amount of water; and **low security**, which means that the rights will depend upon the water availability. Water users which have excess water quotas at a particular period may then sell their rights to the ones who need extra water. Some water licenses could be sold permanently. This is a very common practice within the agricultural sector as well as between the industrial sector and the agricultural sector.

The water market helps local communities **to allocate the resource in the most efficient way**. In periods of drought, farmers struggling to grow certain water-intensive crops or make a profit will choose to give up their water and sell it to another farmer who can use it more efficiently. This means that certain unprofitable, water-intensive crops, such as rice and cotton, are supplanted with higher value crops like fruit trees (avocado, orange, grape & vines). In Kerang, Victoria, an over-cultivated region that had problems with soil salinity, many farmers began selling their water to grape growers elsewhere in the state.

The government also buys licenses to use water for environmental purposes such as reviving the dying trees in red gum forest areas.

Pollution norms and quotas & Pollution quotas trading

Pollution norms & quotas: Governments regulate wastewater discharges, volumes and pollution content, by establishing pollution norms - maximum allowable concentrations (MACs) or discharges (MAD) for specific pollutants, taking into account the absorptive capacity of the water body in question, and the total allowable pollution load (e.g. **Total Maximum Daily Load, TMDL**, a water-shed wide cap, in USA) from all polluters who discharge their wastewaters into this water body.

Pollution quotas trading:

- **Theory**: let us assume that ENV performance indicators of each polluter operating in a specific river (or lake) basin corresponds to BAT, i.e. they perform with minimal emissions. However, the total discharges of certain pollutants (say N, P, or BOD) in the basin much exceed the absorptive capacity of the water ecosystem, hence the task is to further reduce pollution down to a certain allowable threshold. The state has to issue pollution quotas forcing the polluters to further reduce discharges, even below BAT levels. **This may cost a lot**.
  But good news is that, typically, marginal pollution abatement costs vary significantly from one polluter to another: some can further reduce dischargers of this specific pollutant by 1 ton at substantially lower costs than other polluters. In such a case, it would make sense to reallocated pollution quotas so that **to achieve the desirable reduction in emissions of the pollutants in question at least costs for the society.** But polluters may not be willing to disclose their abatement costs.

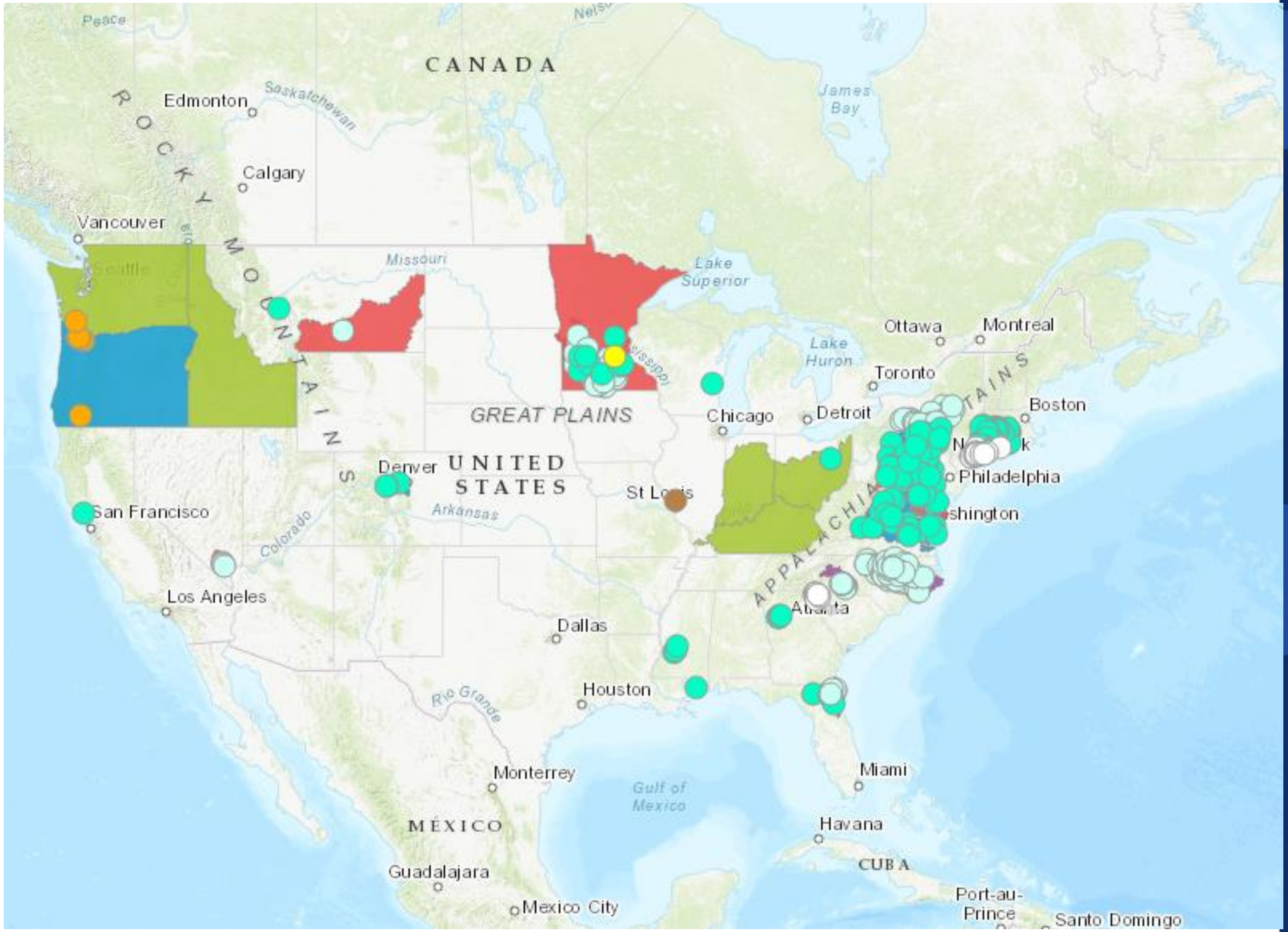
  Establishing the market for pollution quotas is a solution.

- The **case of Water Quality Trading (WQT) in the USA:** the point-source pollutants most commonly traded in the U.S. are nutrients such as phosphorus (P) and nitrogen (N), or heavy metals, and almost all offset and trading programs focus on one pollutant only. Results in faster than expected achieving the desirable reduction of emissions of the targeted pollutant(s).

- **Pre-requisites:** sufficient number of polluters with substantially different abatement costs; willingness to participate.

Pollution quotas trading: the case of Water Quality Trading (WQT), in the USA

Water quality trading is a market-based approach that states, tribes, and territories may wish to pursue as an effective means to attain water quality improvements. Water quality trading is an approach to control pollutants from multiple sources that collectively impact water quality conditions. When more stringent regulatory standards are put in place, water quality trading allows one source of pollution to control a pollutant at levels greater than required and sell "credits" to another source, which uses the credits to supplement their level of treatment in order to comply with regulatory requirements. Pollutant reductions achieved through water quality trading must result in water quality that is as good as—or better than—what would be achieved through treatment and must not create pollutant "hot spots." (US EPA)



Virtual Water concept

The "virtual water" term was introduced by Prof. Tony Allan in 1993. It is also known as:

embedded or *embodied water*

"The water is said to be virtual because once the wheat is grown, the **real water** used to grow it is no longer actually contained in the wheat."

Water footprint & Virtual Water Trade

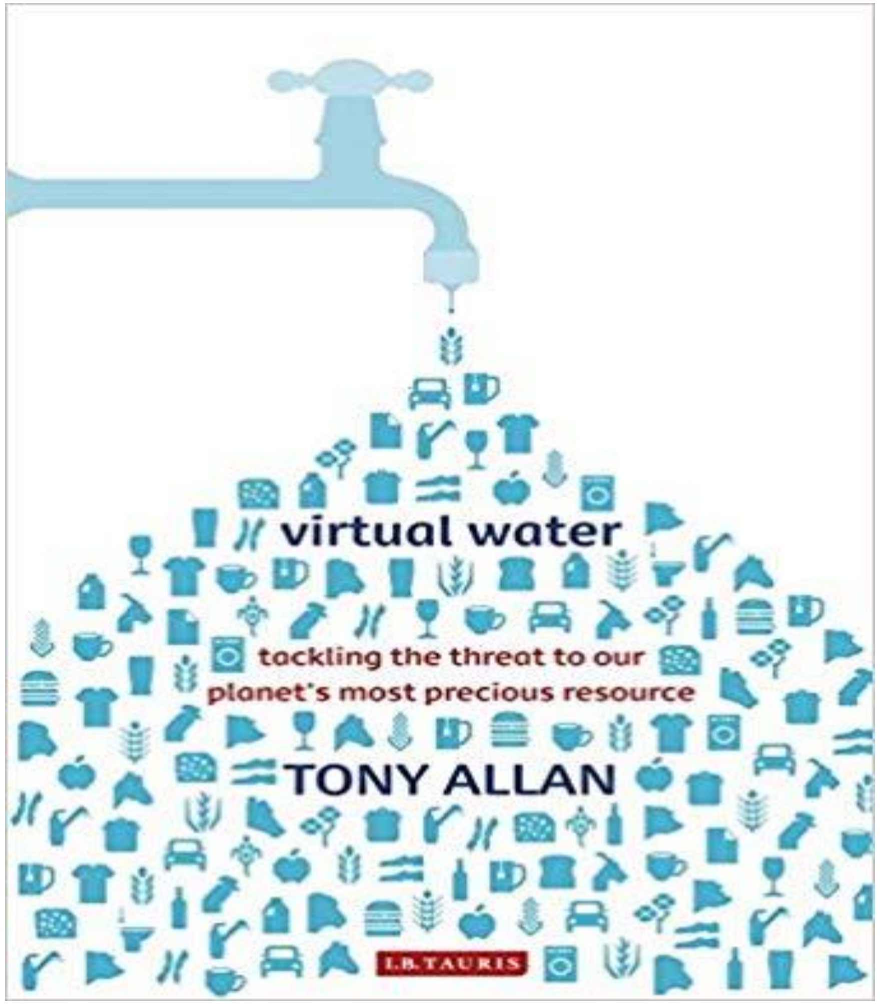
Water footprint is a measure of humanity’s appropriation of fresh water in volumes of water consumed and/or polluted

It can be measured for:

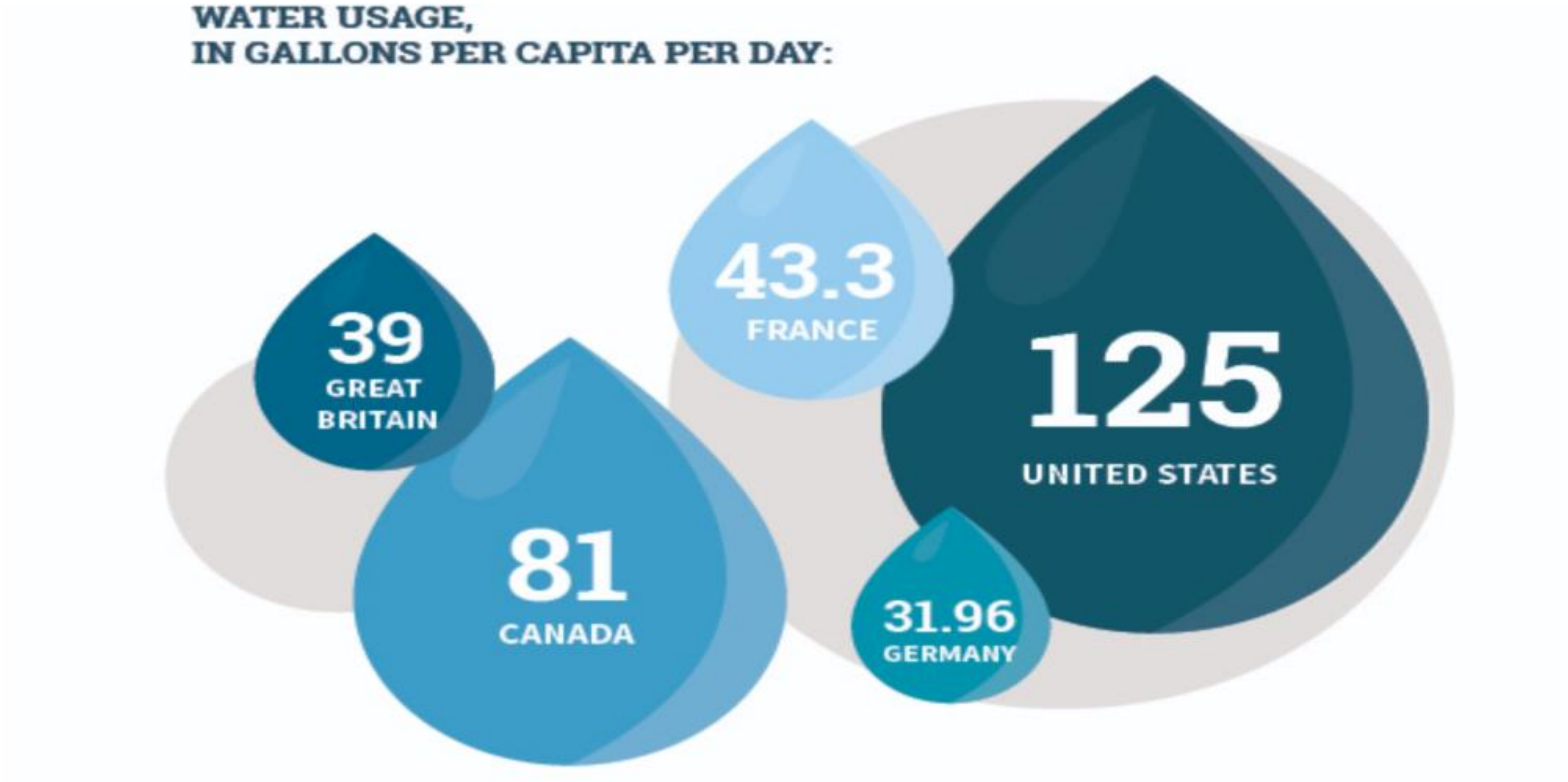
individuals (1), households (2), businesses (3) and countries (4)

Virtual water trade is considered as a water saving instrument

Import of virtual water (e.g. agricultural products, consuming 90% of water) can help reduce domestic water consumption



Compare your results with some national data



Virtual Water & and International trade

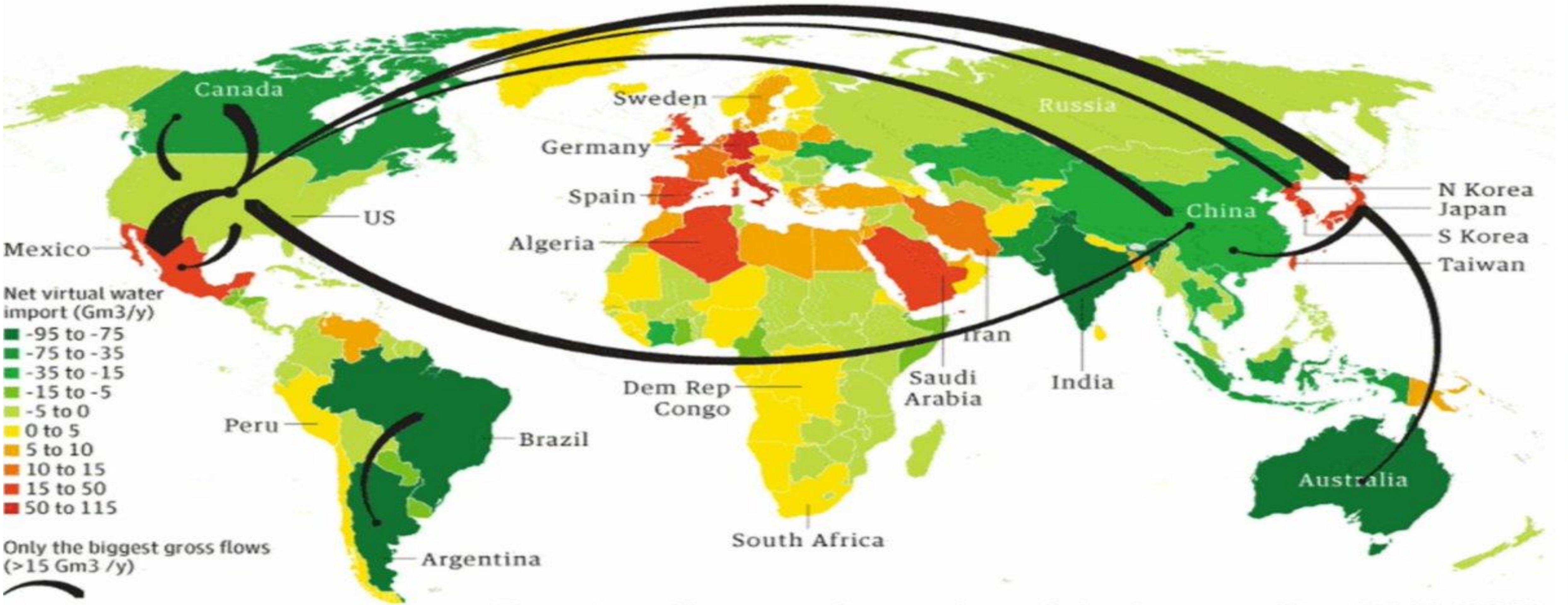
The global trade in water intensive goods has allowed countries with limited water resources to rely on the water resources in other countries to meet the needs of their inhabitants. As food and other products are traded internationally, their water footprint follows them in the form of virtual water.

Virtual water flows show how the water resources in one country are used to support consumption in another country

For water-scarce countries it can sometimes be attractive to import virtual water (through import of water-intensive products), thus relieving the pressure on the domestic water resources. This happens, for example, in Mediterranean countries, the Middle East and Mexico. Northern European countries import a lot of water in virtual form (more than they export), but this is not driven by water scarcity.

Countries can both import and export virtual water through their international trade relations. Globally, the major gross virtual water exporters are USA, China, India, Brazil, Argentina, Canada, Australia, Indonesia, France and Germany and the major gross virtual water importers are the USA, Japan, Germany, China, Italy, Mexico, France, the UK and the Netherlands.

Virtual water trade



Exports and imports of water through food commodities (1996-2005)
Waterfootprint.org data from Mekonnen 2012

Theoretical critics of the Virtual water concept

The neoclassical theory of international trade does not support the hypothesis that water availability can be an absolute advantage in trade

In practice, many other factors influence the trade with water-intensive products, much more significant than the water availability. Several studies showed that

- The economic &
- political interests of states and businesses, and
- The availability of land

affect specialization of nations in export or import of agricultural products, much more than

- water availability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Hydrology and Earth System Sciences

HESS Opinions: A planetary boundary on freshwater use is misleading

Maik Heistermann
Institute of Earth and Environmental Science, University of Potsdam, 14476 Potsdam, Germany
Correspondence to: Maik Heistermann (heisterm@uni-potsdam.de)

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Abstract. In 2009, a group of prominent Earth scientists introduced the "planetary boundaries" (PB) framework: they suggested nine global control variables, and defined corresponding *"thresholds which, if crossed, could generate unacceptable environmental change"*. The concept builds on systems theory, and views Earth as a complex adaptive system in which anthropogenic disturbances may trigger non-linear, abrupt, and irreversible changes at the global scale, and *"push the Earth system outside the stable environmental state of the Holocene"*. While the idea has been remarkably successful in both science and policy circles, it has also raised fundamental concerns, as the majority of suggested processes and their corresponding planetary boundaries do not operate at the global scale, and thus apparently lack the potential to trigger abrupt planetary changes.

This paper picks up the debate with specific regard to the planetary boundary on "global freshwater use". While the bio-physical impacts of excessive water consumption are typically confined to the river basin scale, the PB proponents argue that water-induced environmental disasters could build up to planetary-scale feedbacks and system failures. So far, however, no evidence has been presented to corroborate that hypothesis. Furthermore, no coherent approach has been presented to what extent a planetary threshold value could reflect the risk of regional environmental disaster. To be sure, the PB framework was revised in 2015, extending the planetary freshwater boundary with a set of basin-level boundaries inferred from environmental water flow assumptions. Yet, no new evidence was presented, either with respect to the ability of those basin-level boundaries to reflect the risk of regional regime shifts or with respect to a potential mechanism linking river basins to the planetary scale.

So while the idea of a planetary boundary on freshwater use appears intriguing, the line of arguments presented so far remains speculative and implicatory. As long as Earth system science does not present compelling evidence, the exercise of assigning actual numbers to such a boundary is arbitrary, premature, and misleading. Taken as a basis for water-related policy and management decisions, though, the idea transforms from misleading to dangerous, as it implies that we can globally offset water-related environmental impacts. A planetary boundary on freshwater use should thus be disapproved and actively refuted by the hydrological and water resources community.

1 The planetary boundaries framework

In 2009, a group of prominent scientists led by Johan Rockström introduced the "planetary boundaries"[1] (PB) framework (Rockström et al., 2009a, b). They identified nine Earth system processes – *climate change, rate of biodiversity loss, interference with the nitrogen and phosphorus cycles, stratospheric ozone depletion, ocean acidification, global freshwater use, land use change, chemical pollution, and atmospheric aerosol loading* –, each of which is represented by a control variable. Accordingly, planetary boundaries are defined as *"thresholds [of these control variables] which, if crossed, could generate unacceptable environmental change"*. Moving outside this *"safe operating space for humanity"* may be *"deleterious or even catastrophic for human well-being."*

[1] Not to be confused with the meteorological term "planetary boundary layer", i.e. the lowest part of the atmosphere.

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Water availability and trade specialization

Studies in different countries and regions did not reveal significant impact of water availability on the international **trade specialization**, e.g. studies on:

- South Africa (Earle, 2001)
- Uzbekistan (Bekchanov et al., 2012)
- Spain (Garrido et al.,2009)
- India (Verma et al., 2008)
- China (Ma et al., 2006)

Increasing scarcity of water resources led to an increase of import of food products only in the Middle East and Northern Africa

- Allan, 2002; Yang, Zehnder, 2002; El-Hamid et al., 2008

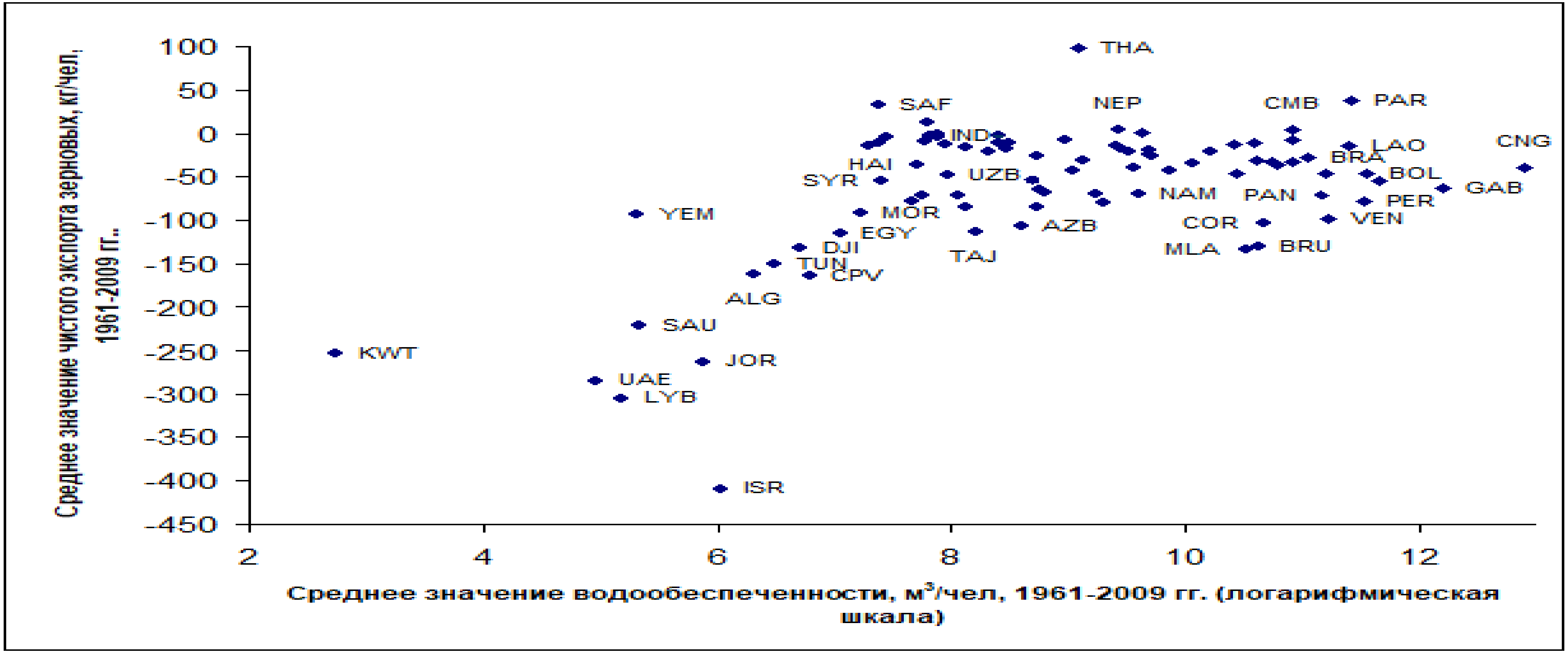
Water International

Virtual water: tackling the threat to our planet's most precious resource, by Tony Allen

The Theory of Virtual Water

Virtual water Content of the Main Crops in Chongqing

However, recent estimates demonstrate a correlation between crops export and water availability



In 1961-2009, the net-export of crops had been rising with higher water availability

THANK YOU FOR YOUR ATTENTION!

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WATER TRADING MECHANISM TO PROMOTE REUSE OF TREATED WASTEWATER. WATER AND LAND RESOURCES VERTICAL JULY 2023. NITI Aayog

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