Responsibility for regional sustainability of water resources

– Findings from the national water footprint analysis of Japan –

Masaharu Motoshita[1], Stephan Pfister[2], Takahiro Sasaki[3], Keisuke Nansai[4], Seiji Hashimoto[3], Ryosuke Yokoi[1], Matthias Finkbeiner[5]

1:National Institute of Advanced Industrial Science and Technology (AIST), Japan 2: ETH Zurich, Switzerland 3: Ritsumeikan University, Japan
4: National Institute for Environmental Studies (NIES), Japan 5: Technische Universitaet Berlin, Germany

Key takeaways

- The induced freshwater consumption in the global supply chains could be the hotspots for sustainability of water resources.
- ***The magnitude of induced freshwater overconsumption*** is a key aspect in terms of **global sustainability** of water resources.
- For **local sustainability** of freshwater use, ***the severity of overconsumption pressure*** and ***contribution rate to the total overconsumption*** should be considered to identify the hotspots.

Research questions

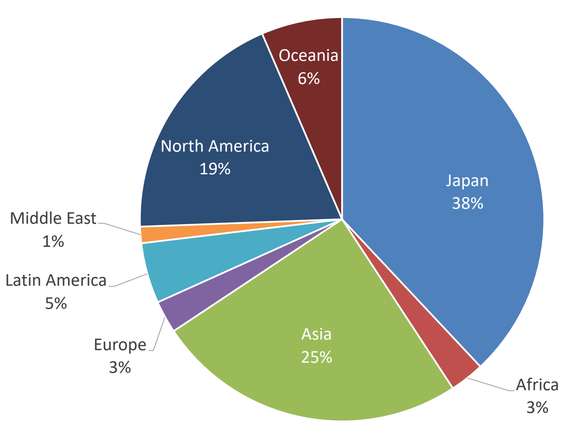
- How much does the developed economy depend on water resources in the global supply chains?
- What degree does the induced water consumption threaten the sustainability of freshwater use in global watersheds?
- What should be considered when identifying the hotspots of sustainable freshwater use in the global supply chains?

Method overview

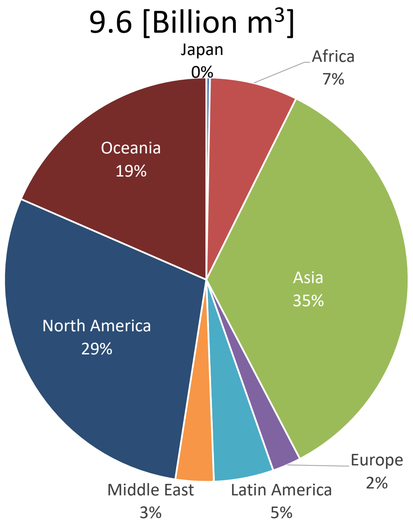
1. Calculate the national water footprint of Japan
   - Direct water consumption: Consumption data for irrigation[1)], domestic[2)], industrial[2)], livestock[2)], electricity[2)] is used.
   - Induced water consumption: Adopt the GLIO model[3)] (one of the MRIO models) covering 231 countries
2. Estimate the overconsumption amount (the induced freshwater consumption beyond the regional carrying capacities[4)])
3. Identify the hotspots of sustainable freshwater use in the global supply chains

Japan induced fresshwater consumption and hotspots of sustainable freshwater use at global level

Induced freshwater consumption
85.8 [Billion m^3]

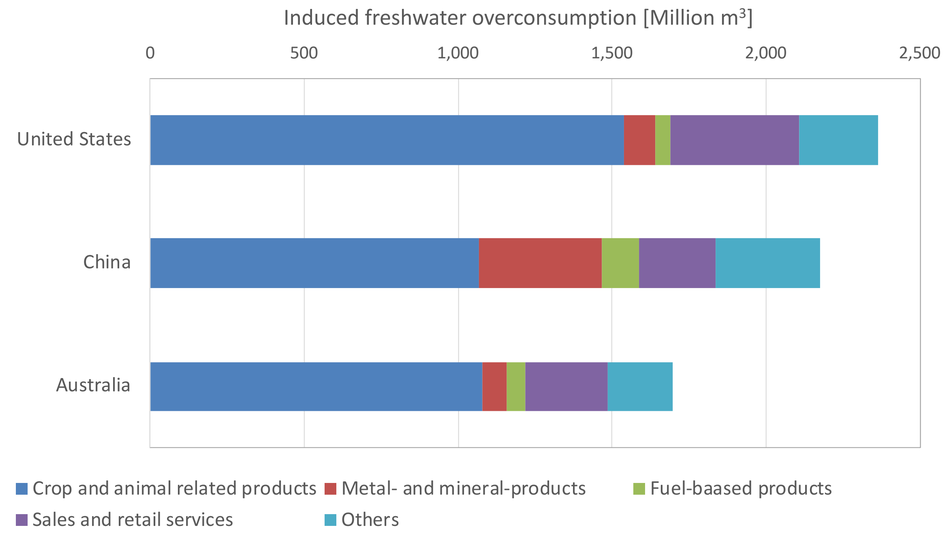


Induced overconsumption
9.6 [Billion m^3]



- Japanese final demand induce 62% of the total freshwater consumption outside Japan.
- Overconsumption beyond the carrying capacity occurs mostly outside Japan, which accounts for 11% of the total induced freshwater consumption (global average of overconsumption rate: 24%).

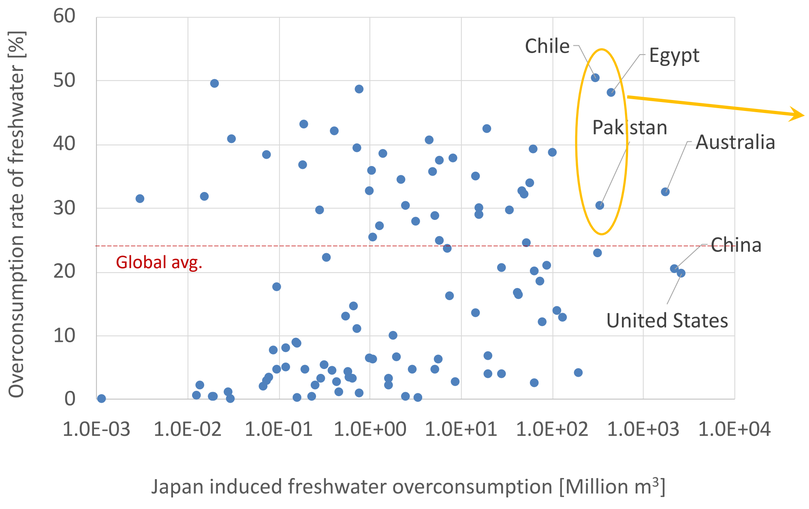
From <u>global perspective</u>, **the significance of the overconsumption amount** should be prioritized.



Top 3 countries (US, China, Australia) accounts for 69% of the total.
Food related goods (incl. service at restaurants) are crucial in all cases, and metal/mineral related goods as well in the case of China.

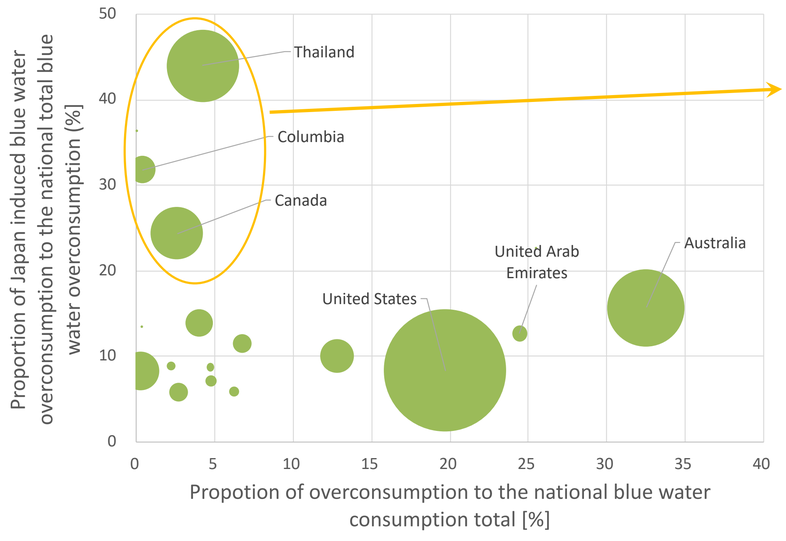
Responsibility for the local sustainability of freshwater resources

Not only the amount of induced overconsumption but **the severity of overconsumption pressure** is of concern for <u>local sustainability of water resources</u>.



Inuced amounts of freshwater overconsumption are relatively smaller, but their pressure of overconsumption is of high concern from the perspective of local sustainability.

In addition to the severity of overconsumption pressure, **the contribution to the national overconsumption** should be considered for <u>local sustainability of water resources</u>.



The pressure of overconsumption is low, but Japan contributes to the large proportion of the total overconsumption in these countries.

References

1) Pfister and Bayer (2014) Monthly water stress: spatially and temporally explicit consumptive water footprint of global crop production. J. Clean. Prod., 73(15), 52-62.
2) Müller et al. (2014) Sensitivity of simulated globalscale freshwater fluxes and storages to input data, hyrdrological model structure, human water use and calibration. Hydrol. Earth Syst. Sci., 18, 3511−3538.
3) Nansai et al. (2012) Estimates of Embodied Global Energy and Air-Emission Intensities of Japanese Products for Building a Japanese Input-Output Life Cycle Assessment Database with a Global System Boundary. Environ. Sci. Technol., 46(16), 9146-9154.
4) Motoshita et al. (2020) Regional Carrying Capacities of Freshwater Consumption—Current Pressure and Its Sources. Environ. Sci. Technol., 54(14), 9083-9094.

LCM 2021