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Food loss & waste of staple crop products: mapping environmental impacts within the Nexus paradigm

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Over the last decade, a combination of economic uncertainty, supply shocks, and extreme climate events has led to a renewed prevalence of undernourishment, posing a serious threat to the realization of the *Zero Hunger* Sustainable Development Goal. Future scenarios are likely to be even more challenging to its accomplishment, based on projected trends of population growth and human-induced climate change impacts. There is urgent need for the development and implementation of sustainable transformation pathways to make agri-food systems worldwide more resilient and capable to sustain these pressures. These pathways should include a wide range of actions, targeting all stages of the value chain. Reducing food loss and waste (FLW), which currently accounts for approximately one-third of the food produced, is considered among those with the largest potential, with significant environmental co-benefits on the Water-Energy-Food-Ecosystem Nexus. The presence of complex and tele-coupled trade networks however, together with the lack of robust and granular datasets, make it difficult for researchers to run detailed analyses on this issue.

In this work we estimate the FLW associated to the consumption of a wide range of staple crops globally, disaggregating between the single food commodities and the different stages of the value chain. Moreover, we investigate the associated impacts on the water, land, and energy resources. The methodology applied allows us to trace the environmental impacts from the countries of production and manufacturing, where resources have been used, to the countries of consumption (from farm to fork) and backwards (from fork to farm), offering a dual perspective on the complex system. Our preliminary results show that over 20% of the quantities cultivated are wasted through FLW, globally. Transnational flows of FLW – and of associated virtual resources – compose a vast multi-layered network involving most of the countries worldwide. Differentiated impacts are observed, depending on the countries' role in the network: while large exporters bear substantial impacts of FLW occurring abroad on their resources, net-importing nations transfer large portions of the environmental effects of the FLW associated with their consumptions onto foreign stocks. The ability to discern between the single food commodities, without aggregating primary and derived products, increases the level of specificity from past research. This detailed data is valuable for informing public policies, providing a more fine-grained approach to prioritize efforts

in reducing FLW and its associated impacts.