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Role of green water in the water-energy-food nexus

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With continuous population increase and economic growth, challenges on securing sufficient water, energy, and food supplies to meet the human demand are also amplifying. The close linkages of the three sectors give rise to the need for tackling the challenges with a nexus approach. Addressing the WEF nexus is particularly relevant in water scarce regions, which cover more than 40% of the world's land surface and host about 2 billion people, 90% of which live in developing countries. In these areas physical water scarcity (concerning both blue and green water resources) is either already a constraint to economic development or will became a problem in the future due to population growth, climate change impacts, overexploitation and degradation of water resources. On the other hand, many of these areas are also those with substantial untapped potential in increasing their green water (soil water) use and productivity. However, few studies on the WEF nexus have so far considered the role of green water. This is due to the lack of systemic tools/frameworks which can incorporate green water in the complex systems presented by the WEF nexus. Moreover, different characteristics of the individual components in WEF on the economic dimension also present challenges to a systematic and quantitative analysis of trade-offs among the WEF elements. In general, the energy and food/land systems are operated in market conditions although different levels of interventions from governments present. In contrast, water management is mostly outside of the market. The economic values of blue water resources cannot be reflected in the market. Green water is completely ignored. Here we present case studies from China on biofuel production and transformation of physical green water to virtual water in the agricultural sector and flows of the virtual water to downstream sectors to address some of the relevant issues. The case studies demonstrate the importance of green water in supporting economic activities. They also show the need for complete and consistent information on trade-offs involved in all the elements, including green water, for operationalizing the WEF nexus approaches in practice.