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# Editorial: Curbing global warming with multi-scale and multi-sectoral Water-Energy-Food nexus

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Editorial on the Research Topic
Curbing global warming with multi-scale and multi-sectoral Water-Energy-Food nexus

Food, energy, and water play fundamental roles in human life and development. The rapid growth of global population requires increasing demand for agriculture product, renewable energy, and water resource supplies. Such demands echo with the United Nation's Sustainable Development Goals (SDGs), especially zero hunger (Goal 2), clean water and sanitation (Goal 6), and affordable and clean energy (Goal 7) in the shared blueprint for people and planet's future.

There are compelling challenges, interdependencies, and trade-offs arising from interactions of food, energy, and water (FEW) systems, given the spatial heterogeneity of population distribution, resources (such as water, arable land, energy endowment), economic development, urban forms (involving enterprises, buildings, and transportation) worldwide (see Figure 1). Systematically improving the efficiency of FEW nexus is vital to the global sustainability. An integrated and optimized Food-Energy-Water system would help to mitigate and adapt to global climate change.

The trilemma synthesizes the competition and cooperation within Food-Energy-Water system, including the limited available freshwater, growing agriculture product production, and clean energy supply (see Figure 1). Peng et al. (2023) used large-scale resident survey data to estimate the environmental impacts due to the shifting diets towards higher shares of non-starchy foods from 1997 to 2011 in China. They quantified the contributions of the changes in meat and oil consumption (and other non-starchy foods) to environmental consequence and nutritional quality. Results showed that the increasing consumption share of meat, cooking oil, and non-starchy foods has led to more $CO_2$ emissions, water consumption, and land appropriation. They identified the trade-offs and synergies by assessing the nutrition–environment nexus in the changing diet. Guo et al. (2022) used scenario analysis to investigate four potential Chinese dietary shifts (including Chinese Dietary Guideline, EAT-Lancet diets, westernized diet, and SRRM diet) on the environmental impacts, water use, and human health. They found that the CDG and EAT diets would significantly reduce premature deaths, while SRRM diet achieves

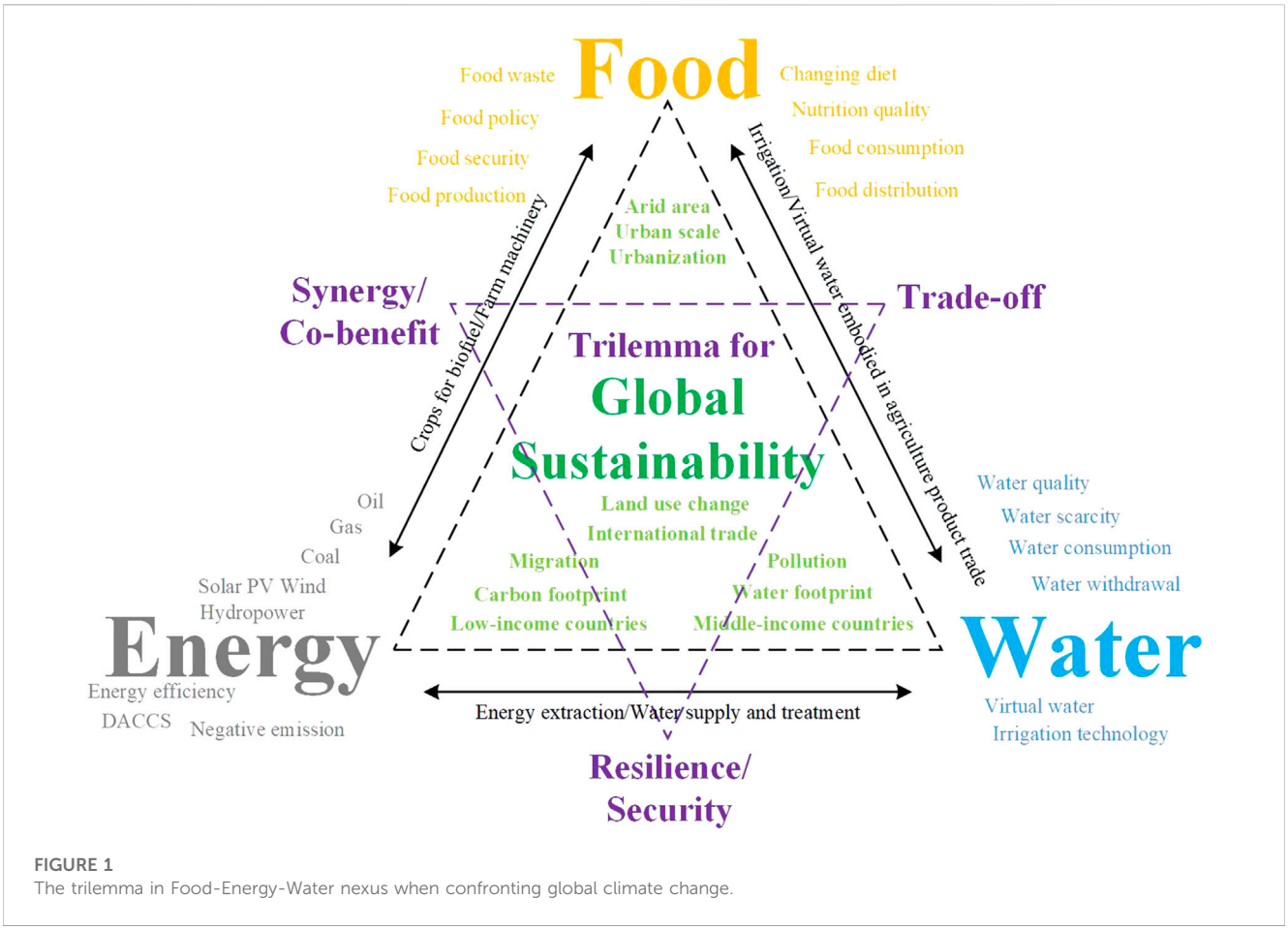


FIGURE 1
The trilemma in Food-Energy-Water nexus when confronting global climate change.

moderate dietary benefits and slightly reduces premature deaths. In addition, they investigated the impacts of dietary shifts on $NH_3$, $PM_{2.5}$, food production GHG, land use GHG, and water footprint. Huntington et al. (2021) used the Food-Energy-Water nexus concept to apply for a renewable energy project in rural Alaska communities. They used the economics, climate change, transportation, and governance as the drivers of Food-Energy-Water system and tried to identify the cross-domain interactions in FEW to achieve the sustainability and resilience. Specifically, they used community-level data to investigate the impacts of changes in modular systems to FEW securities, provided the specific connections regarding trade-offs/synergies within the FEW domains, took effective actions at local level, and helped us better understand the nexus thinking of FEW.

In this Research Topic, we focused on global warming with multi-scale and multi-sectoral food-energy-water nexus. The objectives of this Research Topic include:

1) Integrating combined solutions into Food-Energy-Water systems to achieve food security and hunger eradication, ensure availability of water resource, and foster cost-competitive and reliable renewables supply.
2) Providing insights for the design of sustainable, affordable, and efficient Food-Energy-Water systems.
3) Investigating potential impacts of food security, energy poverty, and water scarcity on human's living, for example, the vulnerable communities.
4) Quantifying the interconnection and interaction of FEW nexus to achieve the synergistic effects at different spatial scales.

Peng et al. conducted an interesting study about the farmer's behaviors when confronting climate change. They built a theoretical model for the farmer's behavior preference and used structural equation model to quantify the impacts of trust, risk perception and severity, and psychological distance on climate mitigation and adaptation behaviors. They found that risk perception is positively correlated with farmers' climate mitigation behavior.

Yu et al. showed that there are contradictions between energy and water resources. The China's "dual carbon" goal might influence its economic growth. They used the modified Romer' model and what-if scenario to estimate the impacts of energy-water constraints on economic growth with drag effect and the spatiotemporal characteristics at provincial level in 2025 and 2030, respectively. They found that energy and water resources could be constraints for China's economic growth under the "dual carbon" goal.

Qin et al. used spatial econometric and mediating effect models to investigate the role of green credit of agricultural sector in the global climate mitigation. They found agricultural green technology innovation, spatial spillover effect, and resource reallocation could reduce the greenhouse gas emission.

Gu et al. used the quantile regression and threshold model to investigate the impacts of green finance on the regional low-carbon transition and its mechanism. They found green finance could

promote the energy transformation through the green investment, environment-friendly capital allocation, and green consumption by optimizing industrial structure, improving energy efficiency, and promoting green innovation.

We encourage more researchers to consider this Research Topic as their research interests. The consumption habits and patterns in FEW might change at various scales from the local to global in the post-Covid-19 era. There are still many important unknown research gaps regarding the Food-Energy-Water nexus in the context of global climate change.

## Author contributions

XP: Conceptualization, Investigation, Writing-original draft, Writing-review and editing. HC: Methodology, Writing-original draft, Writing-review and editing. HZ: Conceptualization, Investigation, Writing-original draft. JH: Investigation, Writing-original draft, Writing-review and editing. KS: Conceptualization, Investigation, Writing-review and editing.

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## Conflict of interest

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## Reference

Peng, X., Chen, H., Zhong, H., Long, R., Zhang, C., Zhao, D., et al. (2023). Water-saving co-benefits of $CO_2$ reduction in China's electricity sector. *iScience* 26 (2), 106035. doi:10.1016/j.isci.2023.106035

Guo, Y., He, P., Searchinger, T. D., Chen, Y., Springmann, M., Zhou, M., et al. (2022). Environmental and human health trade-offs in potential Chinese dietary shifts. *One Earth* 5.3, 268–282.

Huntington, H. P., Schmidt, J. I., Loring, P. A., Whitney, E., Aggarwal, S., Byrd, A. G., et al. (2021). Applying the food–energy–water nexus concept at the local scale. *Nat. Sustain.* 4.8, 672–679.