Conceptualizing climate change impacts on Water-Energy-Food (WEF) security

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Project description

The assistant's work is part of the project "Spatial inequality in water-energy-food security in South Africa – Implications for public health and the consequences of climate change" (see here). This project aims to identify priority areas across South Africa that are most vulnerable to poor WEF security and health outcomes, communicate synergies and trade-offs between water, energy, food and health practices and outcomes, and assess interventions to enhance rural resilience. The impacts of climate change on water, energy, and food (WEF) security represent a critical challenge for South Africa, where vulnerabilities are exacerbated by socio-economic and environmental inequalities. A better understanding of these impacts paves the way for tailored interventions and impactful solutions. The assistant will be a piece of this puzzle, by conceptualizing climate impacts on WEF security. Though we know that climate change affects the water (e.g., [1]), energy and food systems, and ultimately security (see Figure 1), the exact pathways are not reviewed consistently across these systems.

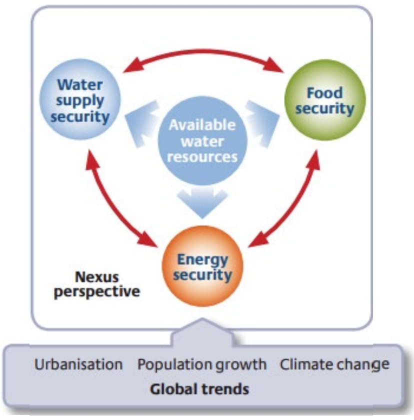

Figure 1. The interlinkages between water, energy and food security, and the impacts of global trends, taken from [2].

Therefore, the assistant will perform a thorough literature review on climate change and WEF security on a global scale, identifying both direct and indirect pathways between climate impacts and its ultimate effects on resource security. This includes effects of general climate change (temperature, precipitation, etc.), as well as climate extremes (e.g., floods, droughts) and their impacts on individual components of the WEF nexus. If there is enough time, the conceptualization could be substantiated with evidence from case-study research on South Africa. Ongoing work within the project has quantified the current state of WEF security for South Africa, delving into these "components" by decomposing WEF security into twelve domains [3]. Ultimately, the assistant's work forms the base of the next steps in the project, where we aim to quantify the change in availability of WEF resources by changes in climate by employing process-based modelling (thus quantifying the qualitative pathways that the assistant has highlighted). If successful, the assistant can become co-author for the scientific publication that is an output thereof.

Job requirements

The student must have an good understanding of climate change and climate change projections.

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[1] Sukanya, S., & Joseph, S. (2023). Climate change impacts on water resources: An overview. *Visualization techniques for climate change with machine learning and artificial intelligence*, 55-76. https://doi.org/10.1016/B978-0-323-99714-0.00008-X

[2] Hoff, H. (2011). Understanding the Nexus. Hoff, H. (2011). Understanding the Nexus. Background Paper for the Bonn2011 Conference: The Water, Energy and Food Security Nexus. Stockholm Environment Institute, Stockholm. Downloaded from: Understanding the Nexus.

[3] Ossentjuk, I., Straatsma, M., Karssenberg, D., & van der Hilst, F. (2025). *Spatial quantification framework for Water-Energy-Food security–Applied to South Africa* (No. EGU25-4755). Copernicus Meetings. https://doi.org/10.5194/egusphere-egu25-4755