SESYNC Lesson: Sociological Approaches to the Environment Reading

Article: Global agricultural economic water scarcity
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Abstract:
Water scarcity raises major concerns on the sustainable future of humanity and the conservation of important ecosystem functions. To meet the increasing food demand without expanding cultivated areas, agriculture will likely need to introduce irrigation in croplands that are currently rain-fed but where enough water would be available for irrigation. "Agricultural economic water scarcity" is, here, defined as lack of irrigation due to limited institutional and economic capacity instead of hydrologic constraints. To date, the location and productivity potential of economically water scarce croplands remain unknown. We develop a monthly agrohydrological analysis to map agricultural regions affected by agricultural economic water scarcity. We find these regions account for up to 25% of the global croplands, mostly across Sub-Saharan Africa, Eastern Europe, and Central Asia. Sustainable irrigation of economically water scarce croplands could feed an additional 840 million people while preventing further aggravation of blue water scarcity.

Conclusions:
With continuing growth in food demand and limited potential for cropland expansion, sustainable irrigation becomes an increasingly important strategy to ensure a reliable and resilient global supply of food in a changing climate. This study maps global agricultural economic water scarcity (EWS) at unprecedented spatial and temporal resolution. We determine agricultural economic water scarce lands where investments in sustainable irrigation have the possibility to increase food production by expanding irrigation over currently rain-fed croplands. We find that 22% global calorie production happens under conditions of blue water scarcity (BWS). While irrigation currently consumes 1083 km^3 $year^{-1}$ of blue water resources, we estimate that only 810 km^3 $year^{-1}$ of blue water resources can be consumed sustainably by the global croplands. We estimate that cultivated lands affected by agricultural EWS account for 15 to 25% of the global croplands and could be irrigated sustainably contributing to future

food security. A sustainable irrigation expansion into these areas could increase global food production by 6 to 8% and feed an additional 620 to 840 million people while avoiding agricultural expansion into natural ecosystems. The findings of this study show that wise agricultural governance and interventions have the potential to contribute to global food and water security without negatively impacting natural ecosystems. Investigating and explaining the nexus, interlinkages, and trade-offs between environmental sustainability and human well-being are fundamental to orientate rural development toward a more sustainable trajectory.