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POLICYBRIEF
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Expanding Irrigation Could Enhance Child Nutrition but Risks Unsustainable Water Use

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Executive Summary

- Expanding irrigation is often championed as a solution to persistent undernutrition and food insecurity through increased agricultural production, job creation, and incomes, yet its local impacts on children's diets and water resources have been insufficiently scrutinized, especially at a global level.
- Our analysis across 26 low -and medium-income countries finds a clear, positive association between irrigation expansion and child dietary diversity.
- However, water-abundant areas tend to channel irrigation expansion into the production of export-oriented cash crops, yielding modest local child nutritional benefits.
- Instead, the most pronounced dietary gains for children occur in regions already experiencing water stress, where renewable water resources are insufficient to sustainably support irrigation.
- This highlights a tension between fulfilling the targets of SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 6 (Clean Water and Sanitation), underscoring the need for nutrition-sensitive irrigation policies that reconcile nutrition goals with long-term water sustainability.

Context

Malnutrition remains a stark global challenge. In 2023, an estimated 733 million people faced hunger across the world, and 148 million children under five suffered from stunting. Irrigation has long been viewed as a lever to bolster agricultural productivity and rural incomes, which in turn could improve diets. Yet these benefits depend critically on local agroecological and market contexts, including water availability, crop choices, and the extent to which increased production reaches the tables of local households rather than export markets.

The Policy Problem

Government and development agencies tend to implicitly assume that increased irrigation will directly translate into improved local nutrition through higher production and incomes. However, this overlooks two crucial dynamics. First, while irrigation can deliver substantial dietary improvements, it may do so by drawing on water resources beyond sustainable limits in arid and semi-arid regions. This process is often amplified by transitions towards more water-thirsty and higher-yielding crops. Second, irrigation investments frequently underpin expansion of cash-crop production for

export, with only limited spillover into local diets or incomes. Ignoring these divergent pathways risks pursuing irrigation expansion that either undermines water security or fails to alleviate local malnutrition, thereby compromising multiple SDGs.

Key Findings

Our analysis of georeferenced Demographic and Health Survey data from >70,00 households across 26 low -and medium-income countries reveals a global positive link between irrigation expansion and increased child dietary diversity, even after controlling for wealth, education, sanitation, and other factors that may affect dietary diversity. About two-thirds of the children in approximately 70,000 rural households included in the analysis fall below the FAO's minimum recommended threshold in terms of dietary diversity. On average, regions where irrigation expanded between 2000 and 2015 have slightly higher child dietary diversity scores as compared to non-irrigated areas. However, 36% of these locations are in water-stressed regions, where available freshwater demand already exceeded renewable supply in 2000, and it is within these water-stressed regions that the benefits of irrigation to dietary diversity were strongest. This suggests that achieving these nutrition benefits in children is coming at a cost for local water resources.

In contrast, locations in non-stressed, water-abundant regions show weaker, though still positive, associations between irrigation and children's dietary diversity. In these regions with abundant water for irrigation, however, we found an increased probability that the produced crop will be exported. This association reflects a tendency for irrigation to support a transition towards commercially oriented enterprises and export-bound cash crops such as soybean, coffee, and palm oil. In these contexts, export-bound crops do not necessarily translate into locally consumed, nutrient-rich food, and may even crowd out staple food cultivation needed for household diets.

Policy Recommendations

Irrigation expansion policies should consider nutrition-sensitive planning, which would allow for an explicit recognition of the potential trade-off between food and water security that emerges when irrigating water-scarce lands. Such nutrition-sensitive irrigation approaches can enable assessments that could consider the following to aid in understanding potential impacts of irrigation expansion on child nutrition, household income, and water scarcity:

- Governments and development agencies should first assess the current state of water stress in a region to understand whether irrigation expansion can be sustainably supported, and if so, what the feasible options are to minimize impacts on shared water resources.
- Policies should seek to evaluate the crops likely to be grown through expanded irrigation, how their water requirements compare to existing crops, and what the potential effects on overall water demand may be. If certain crops are undesirable from a water perspective, such policies can restrict their cultivation.
- Policies should also clearly define who will be the intended beneficiaries of this irrigation expansion (e.g., local communities, children, women, and those with the greatest poverty) and specify mechanisms to ensure participation of these groups in the decision-making processes.

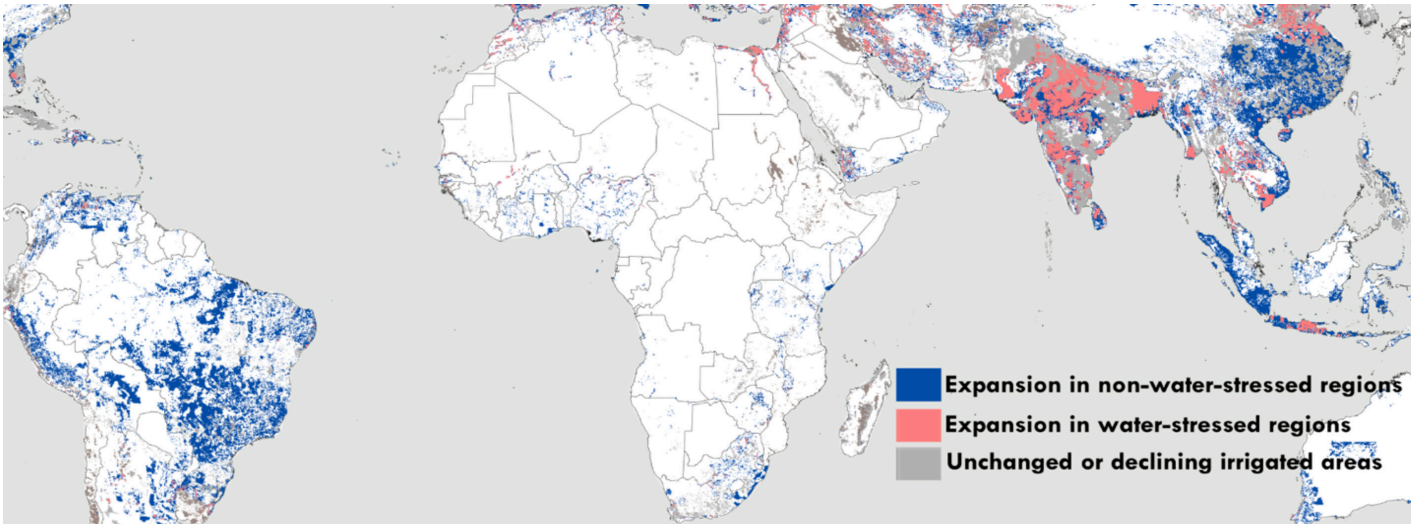

Figure 1. Global Irrigation Expansion (2000-2015) in water-stressed (red) and non water-stressed (blue) areas.

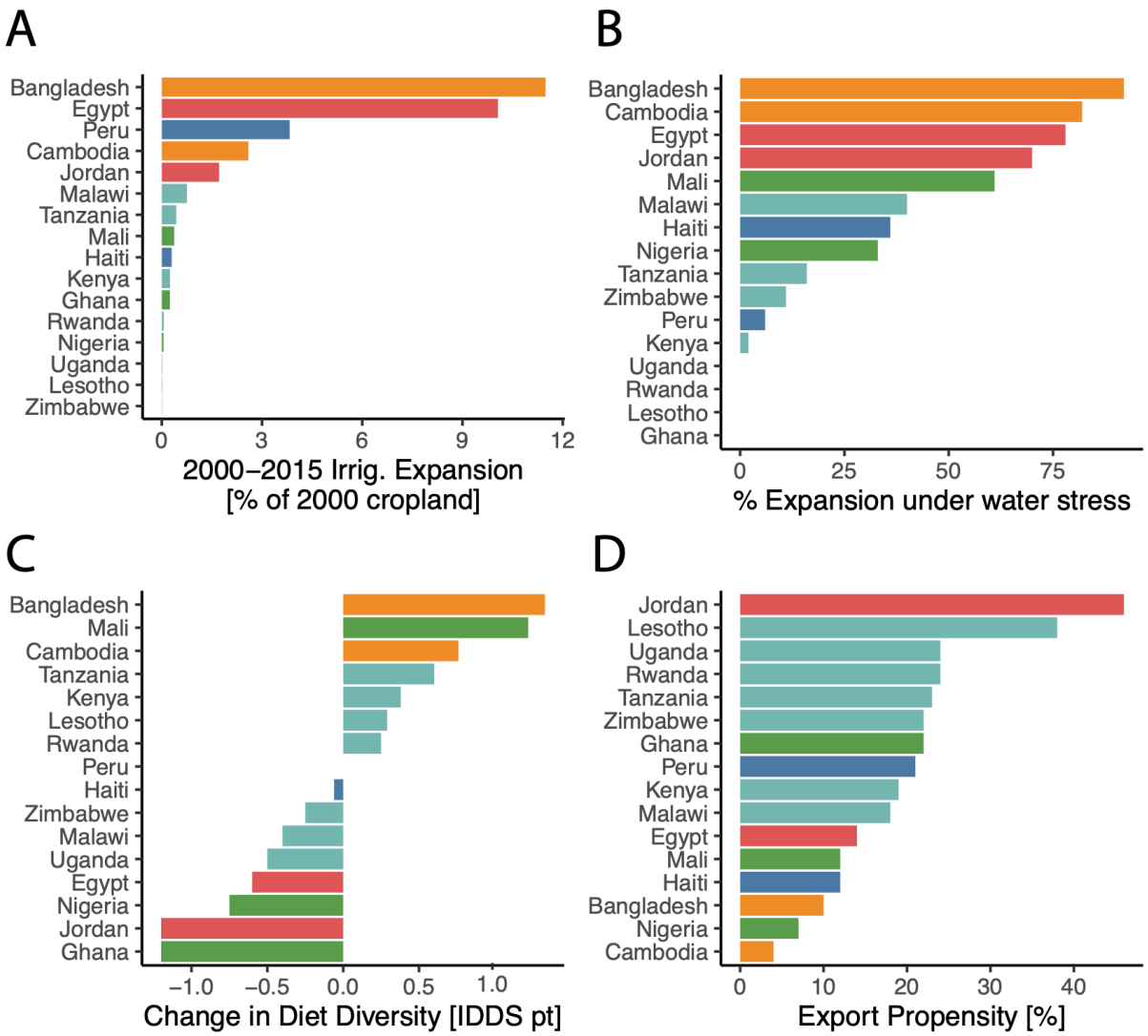

Figure 2. Countries included in the study with dietary diversity data available for two or more years. A. Irrigation expansion between 2000 and 2015 given as a percentage of cropland area in 2000. B. Percentage of irrigation expansion taking place in areas of pre-existing water stress. C. Average change in child dietary diversity measured on the 10-point scale Individual Dietary Diversity Score. D. Propensity of export of crop grown on expanded irrigation. Colors indicate world regions: South and Southeast Asia (Orange), Middle East and North Africa (Red), Southern and East Africa (Teal), West Africa (Green) and the Americas (Blue).

- Policies should consider child nutrition metrics, including stunting, wasting, and dietary diversity, as a key metric to monitor household nutrition outcomes, recognizing dietary diversity as a sensitive and early indicator of dietary adequacy. Because poor nutrition in young children can impact the entire lifespan, attention in this area is critical for long-term well-being.
- Similarly, policies should clearly outline the intended consumers of the produced crops (i.e., if they will be consumed locally or exported) and if exported, define clear mechanisms to compensate for any impacts on local food availability and abundance, in addition to fair compensation for the labor, water, and environmental costs.
- In addition, policies must pre-emptively assess the potential impact of irrigation expansion on local incomes and describe how irrigated crop production will – either directly or indirectly – support local farmers or employ local people. In addition to nutrition-sensitive irrigation expansion, continued investment in rigorous, data-driven monitoring—using metrics such as water-use efficiency, crop mix diversity, and local food security and nutrition assessments should continue to accompany all irrigation projects to enable adaptive management and ensure that nutritional co-benefits materialize as intended.

Final Remarks

Irrigation expansion holds significant promise for improving child nutrition, increasing crop production, and expanding job creation and markets. Yet, without strategic integration of water stewardship and nutrition objectives through nutrition-sensitive irrigation, it can inadvertently erode the water base upon which agriculture depends or by-pass the very communities it aims to nourish. To harmonize SDG 1, SDG 2, and SDG 6, policy makers must adopt holistic, context-specific approaches that secure both sustainable water resources and equitable nutrition outcomes for children and vulnerable populations.

Further Reading

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