BRI Benefits Series

FOOD SECURITY

This analysis is part of a series of policy briefs on a high-quality, sustainable low-carbon transition in the BRI countries. To view the other briefs, please visit our webpage. Technical background information regarding the model and scenario(s) used in this analysis are provided in methodological appendix.

Summary

Many Belt and Road Initiative (BRI) partner countries face challenges to meet increasing food demand from a growing population. BRI countries are more vulnerable to various climate change impacts on agriculture production, through both long-term temperature and precipitation changes and more frequent and intense extreme weather events, and a low-carbon transition is necessary to alleviate these risks. Meanwhile, certain land-based climate mitigation strategies, such as bioenergy and afforestation, may bring undesirable consequences to food production and food access due to competition on land and water resources. Here, we assess changes in food security in BRI countries under four alternative 1.5°C aligned scenarios, using indicators of absolute trade value and trade value as the percentage of GDP at the national level, and total calorie intake and non-staple food consumption share at the consumer level. Our results suggest that 1) agricultural imports grow significantly in BRI regions from 2020 to 2050, mainly driven by growing demand from a larger and richer population; 2) consumers' total calorie intake and non-staple food consumption share improve in all BRI regions, but large regional variations remain; and 3) specific land-based mitigation strategies, in particular through large-scale afforestation, tend to have large impacts on consumer food security in BRI regions.

Background and motivation

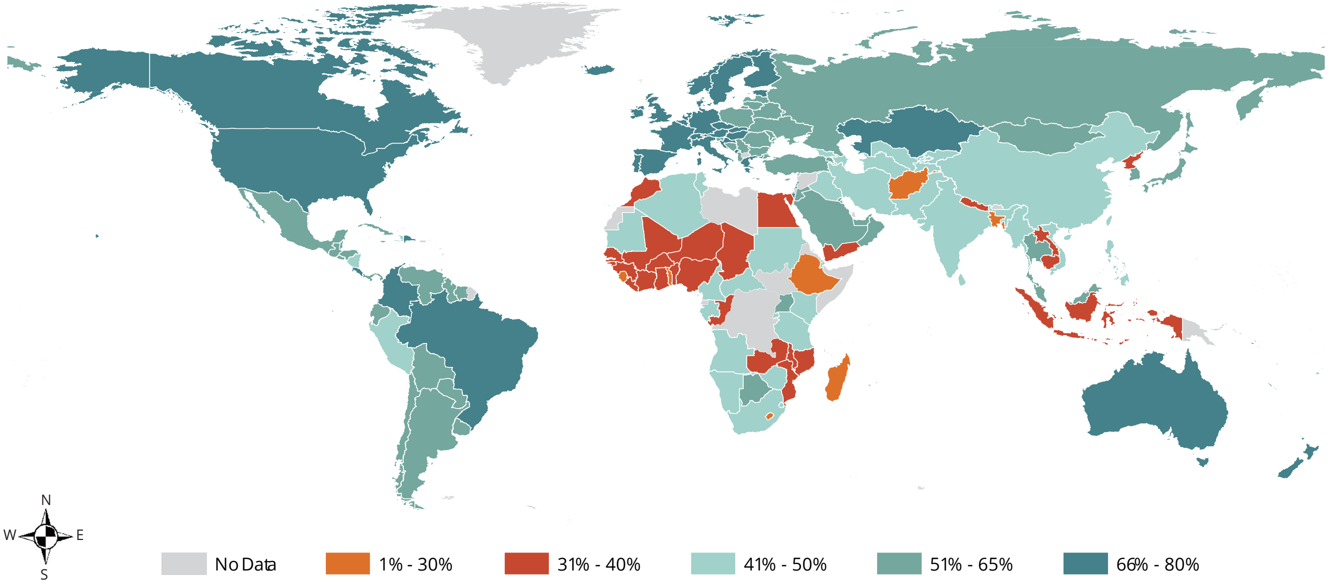
Hunger remains a critical issue for many of the countries involved in the Belt and Road Initiative (BRI), with sub-Saharan Africa (SSA) and South Asia being particularly affected. These regions are experiencing alarmingly high levels of hunger,[1,2] with more than half of the world's undernourished populations are in Asia (418 million) and over one-third in Africa (282 million).[3] Shockingly, historical data shows that the prevalence of undernourishment is five times higher in BRI countries compared to non-BRI countries (8% vs. 1.6%).[4] Given this concerning situation, urgent action is needed to eliminate all forms of malnutrition, which makes the Sustainable Development Goals (SDGs) Target 2 a top priority on the global development agenda.

Food insecurity is a pressing global health and nutrition issue,[3] associated with high-level malnutrition in many BRI counties. Food security is defined as a situation where everyone has ongoing access to adequate amounts of safe, nutritious food that meets their dietary needs and preferences for a healthy life.[5] In this brief, we assess food availability and access at the national level [6] using indicators of absolute trade value and trade value as the percentage of GDP and at the consumer level using indicators of total caloric intake and the share from non-staple food.[7]

At the national level, many BRI countries rely on agricultural imports, which may continue to grow due to three reasons. First, BRI countries are expected to experience a significant increase in food demand due to rapid population growth and economic developments. Second, urban expansion and development, associated with economic growth, may prompt the conversion of agricultural and forested lands to urban uses, further limiting cropland availability. Third, agriculture production in many BRI countries tends to be highly impacted by climate change. Studies suggest that global climate change will result in reduced crop yields in many parts of the world, especially in Asia [8] and Sub-Saharan African [9] countries that are key partners of the BRI.[10] Combining all three forces, domestically, less cropland is available to meet a higher food demand with potentially reduced crop yields. These countries may further increase the reliance on global agricultural trade.

At the consumer level, total caloric intake is an important metric to evaluate hunger. Several BRI countries in SSA and South Asia have about 16.9-23.2% of population still living under hunger.[11] Moreover, non-staple food share, which refers to the proportion of total energy obtained from non-staple food,[12,13,14] is an indicator that can more effectively assess malnutrition in its various forms.[15] Current data presented in Figure 1 indicates that many BRI countries, particularly those in SSA and South Asia, are experiencing high-level of malnutrition as of today. Globally, over 40% of the total calorie consumption of an average consumer is met by non-staple food, and the share is over 60% for an average consumer in non-BRI countries. By contrast, consumers in many SSA and South Asian countries on average take less than 40% of total calories from non-staple food, and in particular, less than 30% in Madagascar, Bangladesh, Ethiopia and Afghanistan (Figure 1).

Figure 1: Share of calorie intake from non-staple food, country average in 2021 (data source: FAO).

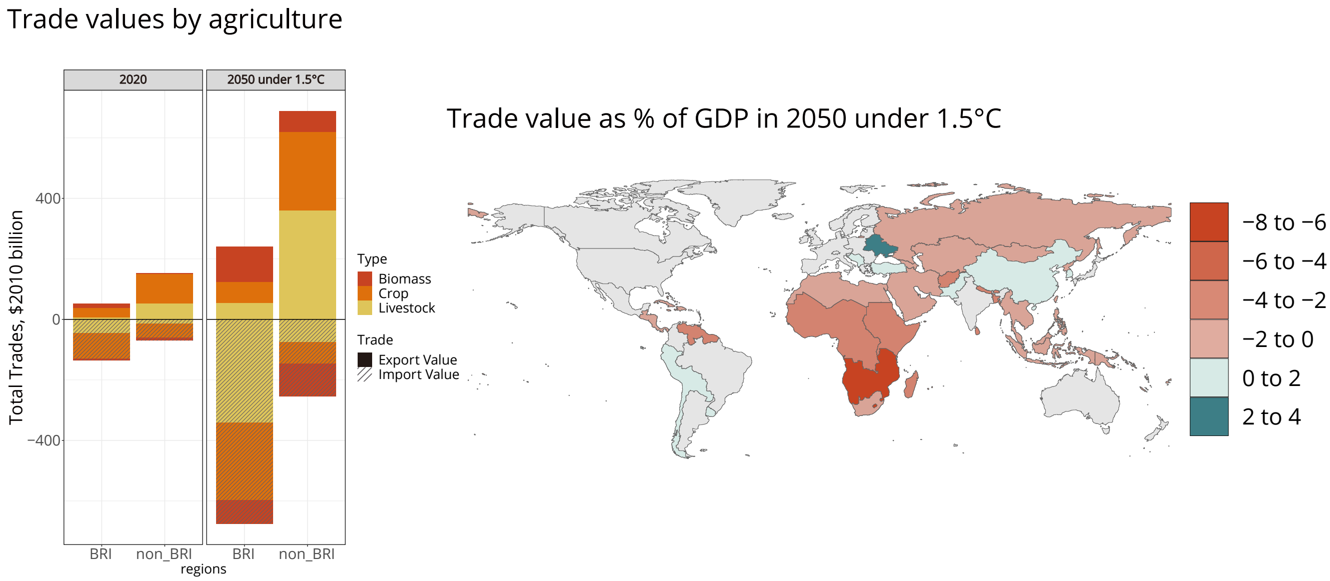


Results

We find that, under the core 1.5°C scenario (see the Methodology Appendix for scenarios definition), imports of agricultural commodities increase significantly from today to 2050 in the BRI GCAM regions, in particular, with a 210% increase in crop imports and an over 650% increase in livestock imports.[16] Correspondingly, trade values of agricultural imports increase by a six-fold in the BRI regions from 2020 to 2050, while non-BRI regions largely expand agricultural exports (Figure 2 Panel A).

The trade value of agriculture in some BRI regions may become an economic burden for certain BRI regions. For instance, in 2050, regions such as Southern Africa may spend almost almost 7% of their GDP on agriculture imports, which may cost 2% to 4% of GDP in other regions like Western Africa, South Asia, Eastern Africa, and Northern America (Figure 2 Panel B). Global agricultural trade may help address food production issues in these regions, such as limited land and water resources, as well as extreme weather-related issues of climate change,[17] at the same time, a high dependence on food imports increases the exposure to global market fluctuation, which these regions tend to lack the institutions and infrastructure to deal with. It highlights the importance of complementary policies and investments to improve resilience of the food supply chain, and help ensure food security for BRI regions.

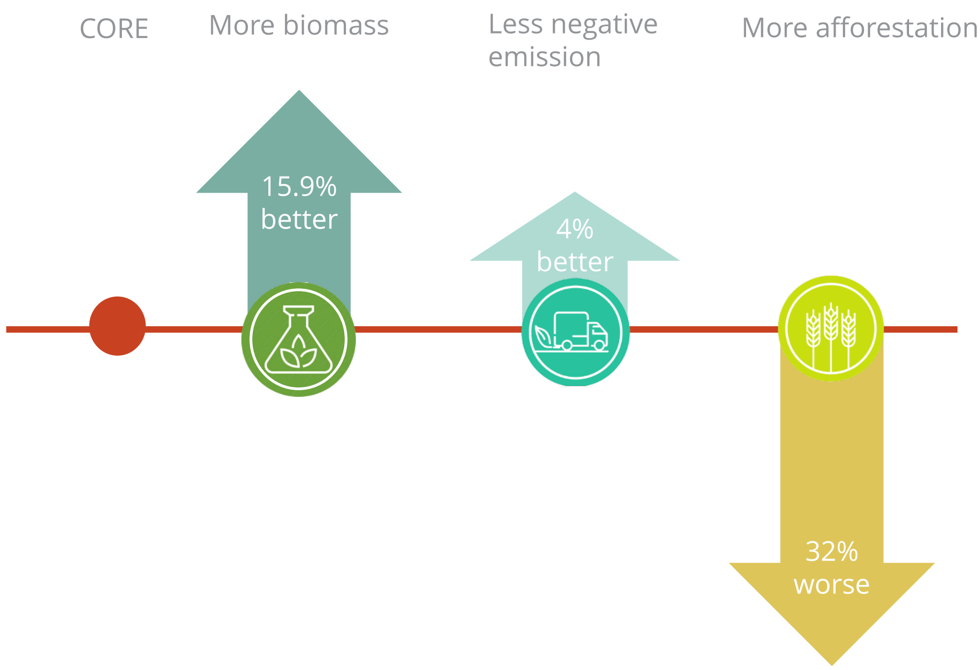
Figure 2: Panel A: Absolute trade value between BRI and non_BRI in 2020 and 2050. Panel B: trade value as the percentage of GDP in our core 1.5°C scenario in 2050.



Our results show that food security at the consumer level improves in all BRI regions from 2020 to 2050, but some regions still fall below the world average as of today. Total calorie intake increases by 2.5% - 14.7% across BRI regions, but the average value in most of the African BRI regions, Pakistan, and South Asia is below the world average of 2800 Kcal.[18] Non-staple calorie share increases by 2.4% - 63.9% from 2020 to 2050, and reaches above today's world average of 40% in all BRI regions. Therefore, with the help of global agriculture trade and large increases in agricultural imports, consumer food security, in terms of average total calorie intake and non-staple share, improves across BRI regions.

Last but not least, we find that the transition pathways feature different mitigation strategies that show different impacts on food security in the BRI regions. Specifically, we explored three alternative pathways that vary from the core scenario in terms of the reliance on different approaches for negative emissions (see Methodology Appendix for scenario design). When negative emissions are largely achieved through land sinks with afforestation, food prices increase due to increased land competition, resulting in an average of 32% reduction in non-staple food share for consumers in the BRI regions (Figure 3 right bar). When less negative emissions are needed to achieve 1.5°C, land demand for afforestation or bioenergy declines in the BRI regions, and consumer food security improves (Figure 3 middle bar). When negative emissions in a 1.5°C scenario are mostly delivered through bioenergy and carbon capture and storage (BECCS) and no incentive is provided to maintain or increase the land sinks, we find a large improvement in consumer food security in the BRI region (Figure 3 left bar), but this is achieved at the expense of deforestation, which has other important implications on the local environment and biodiversity (see the brief on land use and water for more results).

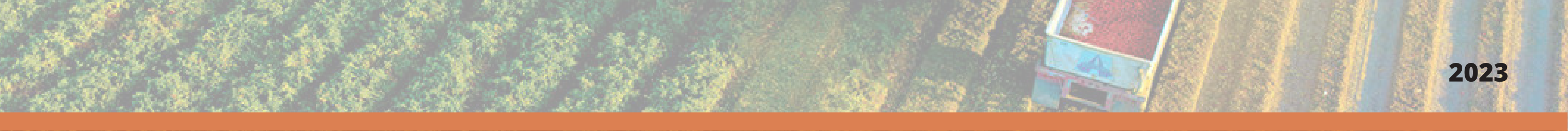
Figure 3: Changes in share of average consumer calorie intake from non-staple food between different mitigation pathways towards 1.5°C. Note: the alternative scenarios we used from left to rights are: Core scenario, 1p5-FFICT-limbo, 1p5-sct-limbo, and 1p5-UCT-limbo.



Policy implications

Recent projections show that hunger will persist beyond 2030 unless significant action is taken to accelerate progress, particularly in addressing unequal access to food.[19] To this end, the BRI can play a crucial role in reducing the negative impact of climate change on global agriculture and improving regional hunger issues. However, the challenge of meeting rising food demand from a growing population while also reducing carbon emissions requires an enabling trade policy environment. At the same time, countries must develop and implement trade policies that support improved food security domestically and through international engagement. This includes formulating trade agreements that foster practical cooperation and contribute to enhancing food security.

To effectively tackle climate change and achieve mitigation targets, it is important to consider the social and economic implications of different mitigation measures. While certain measures may achieve the same targets, they can have vastly different impacts on communities and livelihoods. For instance, a high deployment of biomass for bioenergy would require a large-scale transformation of agricultural practices, with significant implications for both environmental sustainability and social change.[20]



Therefore, it is crucial to integrate equity and livelihood considerations into policy design and scenario selection. This will involve engaging with local communities and stakeholders, particularly those most affected by agricultural and land use changes, to ensure that mitigation measures are implemented in a socially just and sustainable manner. It will also require a careful balancing of trade-offs between different policy objectives, such as reducing emissions, improving food security, and protecting biodiversity and ecosystem services. By taking a holistic and inclusive approach to policy design and implementation, we can work towards achieving both climate and development goals in a way that benefits all members of society.

References

1. von Grebmer, K., Bernstein, J., Delgado, C., Smith, D., Wiemers, M., Schiffer, T., Hanano, A., Towey, O., Ní Chéilleachair, R., Foley, C., Gitter, S., Ekstrom, K., Fritschel, H., 2021. 2021 Global Hunger Index: Hunger and Food Systems in Conflict Settings. Bonn: Welthungerhilfe; and Dublin: Concern Worldwide
2. GHI, 2022. Global Hunger Index (GHI) [WWW Document]. Glob. Hunger Index. URL https://www.globalhungerindex.org/ (accessed 5.2.22).
3. FAO, 2021. The State of Food Security and Nutrition in the World 2021, 2021st ed. FAO, IFAD, UNICEF, WFP and WHO. https://doi.org/10.4060/cb4474en
4. Authors' own calculation based on FAO data (Number of undernourished people (millions).
5. FAO, 1996. Declaration on World Food Security. World Food Summit, Rome: FAO
6. Jones, A.D., Ngure, F.M., Pelto, G., Young, S.L., 2013. What Are We Assessing When We Measure Food Security? A Compendium and Review of Current Metrics. Advances in Nutrition 4, 481–505. https://doi.org/10.3945/an.113.004119
7. Bashir, M.K., Schilizzi, S., 2012. Measuring food security: Definitional sensitivity and implications. Contributed paper prepared for presentation at the 56th AARES annual Conference.
8. Shiferaw, B., Prasanna, B.M., Hellin, J., Bänziger, M., 2011. Crops that feed the world 6. Past successes and future challenges to the role played by maize in global food security. Food Secur. 3, 307–327. https://doi.org/10.1007/s12571-011-0140-5
9. IFPRI, I.F.P., 2009. Climate change: Impact on agriculture and costs of adaptation. International Food Policy Research Institute, Washington, DC. https://doi.org/10.2499/0896295354
10. Wheeler, T., von Braun, J., 2013. Climate Change Impacts on Global Food Security. Science 341, 508–513. https://doi.org/10.1126/science.1239402
11. FAO, IFAD, UNICEF, WFP, and WHO. "The State of Food Security and Nutrition in the World 2022. Repurposing Food and Agricultural Policies to Make Healthy Diets More Affordable." Rome: FAO, July 6, 2022. https://doi.org/10.4060/cc0639en.
12. Staple foods cover cereals, roots, and tubers, and the rest of the foods are defined as non-staple foods (INDDES, 2022; Smith and Subandoro, 2007).
13. INDDES, 2022. Household share of energy consumed from non-staples. International Dietary Data Expansion Project.
14. Smith, L.C., Subandoro, A., 2007. Measuring Food Security Using Household Expenditure Surveys. International Food Policy Research Institute. https://doi.org/10.2499/0896297675
15. Pingali, P., 2015. Agricultural policy and nutrition outcomes – getting beyond the preoccupation with staple grains. Food Secur. 7, 583–591. https://doi.org/10.1007/s12571-015-0461-x
16. The cost of importing crops in 2020 and 2050 is $82.91 and $256.73 billion, respectively. The cost of importing livestock in 2020 and 2050 is $45.08 and $339.89 billion,respectively.

17. United Nations, 2018. The Sustainable Development Goals Report 2018. United Nations, New York.
18. FAO, 1996. Declaration on World Food Security. World Food Summit, Rome: FAO
19. FAO, 2021. The State of Food Security and Nutrition in the World 2021, 2021st ed. FAO, IFAD, UNICEF, WFP and WHO. https://doi.org/10.4060/cb4474en
20. Creutzig, F., Corbera, E., Bolwig, S., Hunsberger, C., 2013. Integrating place-specific livelihood and equity outcomes into global assessments of bioenergy deployment. Environ. Res. Lett. 8, 035047. https://doi.org/10.1088/1748-9326/8/3/035047

Suggested citation: J. Lou, R. Cui, B. Gu, A. Zhao, J. Behrendt, Y. Wang, X. Tan, K. Zhu, Y. Sheng, H. Zhai, L. Kong, Y. Cheng, N. Hultman (April 2023). "Food security: a series of policy briefs on a high-quality, sustainable low-carbon transition in the BRI countries." Center for Global Sustainability, College Park; Chinese Academy of Sciences, Beijing.