

KEY MESSAGES

Diversify agricultural investments. A diversified investment strategy targeting horticulture, pulses (such as cowpea and other beans), cereals, small ruminants, groundnuts, and cocoa can collectively drive national objectives of poverty reduction, job creation, growth, nutrition, and climate resilience more effectively than would investment in any single value chain.

Promote climate-smart crops. A case study of Navrongo shows that investment in one of the highlighted value chains, cowpea, can significantly improve farm incomes, reduce poverty, and enhance dietary diversity and resilience to climate change in northern Ghana, demonstrating the potential of adaptation strategies tailored to specific contexts.

Integrate national and sub-national assessments. The project advanced a framework that could help policy and decision makers to anticipate climate risks by integrating sub-national assessments (which inform national projections based on the diversity of conditions across Ghana and guide local action) and national assessments (which refine analyses of sub-national outcomes and support national policy).

Demand for information. Policy and decision makers are asking for information that evaluates the impacts of adaptation strategies on policy-relevant outcomes such as growth, poverty, employment, and food security under different climate futures, with results specific to regional conditions and relevant to targeted national policy opportunities.

Improve data. Investment in accessibility, availability, and spatial and temporal coverage of data on rainfall, soils, crops, livestock, pests, diseases, and socio-economic factors is critical to support integrated studies that can provide the information that policy and decision makers are asking for.

CONTEXT AND MOTIVATION

In Ghana, climate change threatens livelihoods, food security, the attainment of national development goals, and the achievement of international commitments such as the Sustainable Development Goals (SDG). National policy decision processes remain inadequately connected to research outputs; research information is often fragmented or not relevant for policy decisions.

The study titled “AgMIP Demand-Scoping Study in Sub-Saharan Africa,” conducted by the Agricultural Model Intercomparison and Improvement Project (AgMIP) and led by the University of Ghana, engaged representatives from government, including the Ministry of Food and Agriculture and the National Development Planning Commission, research institutions, academia, farmer-based organizations, and development partners through interviews and a workshop held in Accra, Ghana, in May 2025. The interviews asked policy and decision makers what science-based information they need. The workshops prioritized the science needs communicated in interviews and discussed how to improve collaborations between researchers and stakeholders to co-produce the science.



This policy brief summarizes insights from the interviews and the workshop. It illustrates how AgMIP's Integrated National to Regional Assessments (INaRA) framework can be advanced by integrating the Rural Investment and Policy Analysis (RIAPA), a national economic model developed by the International Food Policy Research Institute (IFPRI). This enhanced framework can provide the evidence base that policy and decision makers are asking for to help advance policy and investment responses to the urgent climate crisis and growing food insecurity challenges.



STAKEHOLDER DEMAND

Interviewees and workshop participants prioritized specific topics, highlighted in the green circle in Figure 1, on which they need improved scientific information. Participants also proposed criteria that information on these topics should meet, outlined in the blue circles in Figure 1, in order to effectively support transformation towards climate resilience in agriculture. For example, information about climate-resilient crop varieties and livestock breeds should assess their resilience over time as the climate changes, target specific policy and decision opportunities to introduce the new varieties or breeds, and evaluate return on investment and impacts on growth, poverty, food security, and equity.

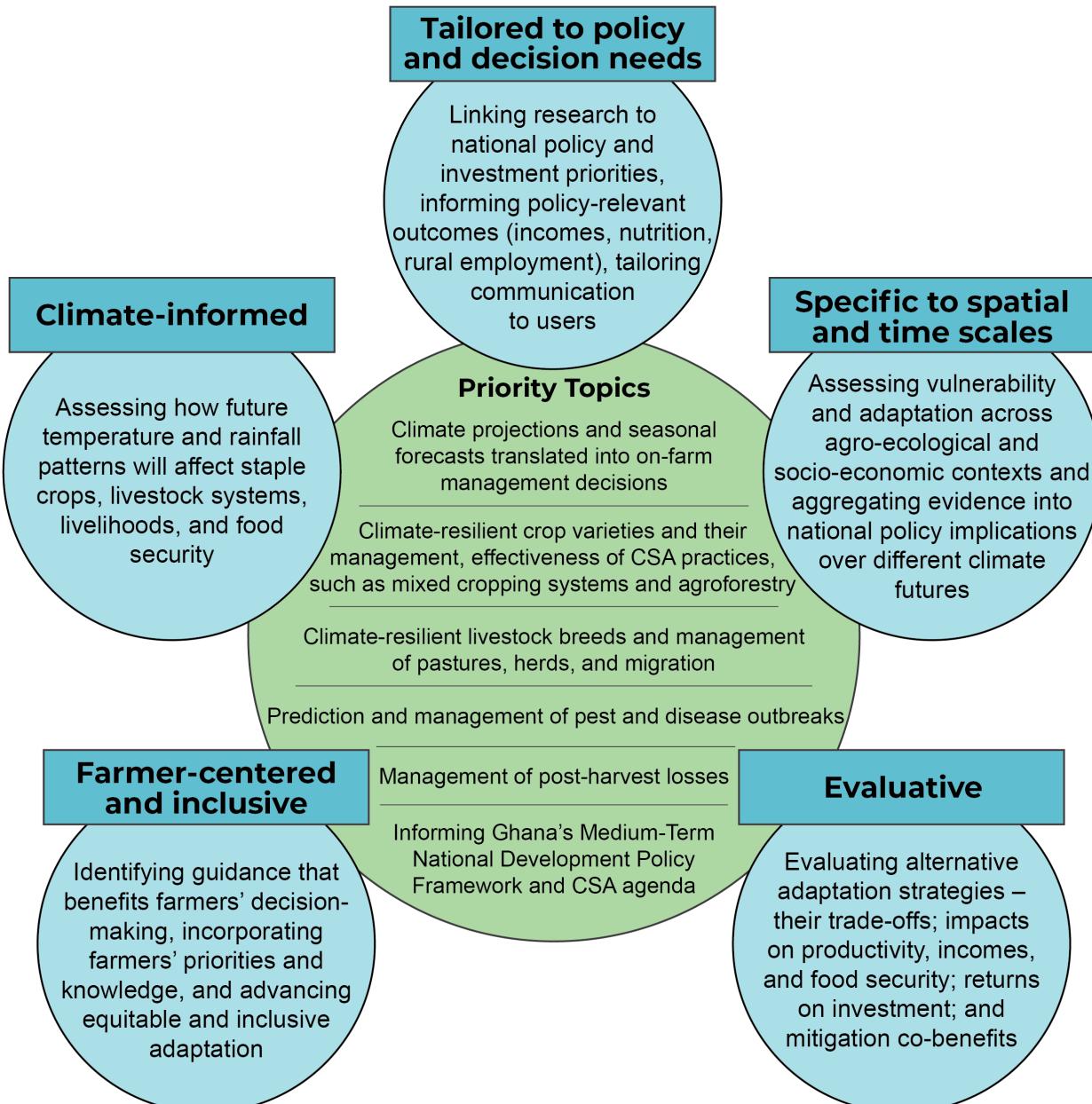


Figure 1. Stakeholder criteria and priority topics for foresight tools. CSA = Climate-smart agriculture. Blue outside circles show the criteria that all information should satisfy. Green circle in the center shows priority topics that require improved information that satisfies those criteria.

INaRA: Integrated National to Regional Assessment Framework

AgMIP's Integrated National to Regional Assessment (INaRA) framework is well-suited to co-creating with stakeholders' information relevant to their priority topics and satisfying the information criteria, such as being climate-informed, tailored to policy and decision needs, spatially and time explicit, and evaluative. The INaRA framework links national and sub-national analyses in a coordinated, protocol-based process. The process begins with an assessment of current conditions, country visions, and policy commitments (NAPs, NDCs, national plans), and the co-development of national Representative Agricultural Pathways (RAPs) that define plausible futures and policy options (see top green box in the middle column in Figure 2). A national economic model, such as RIAPA, then translates the national RAPs into economy-wide drivers and outcome indicators, including projected commodity prices, household incomes, investment priorities, and interactions across sectors such as agriculture, trade, energy, and manufacturing, that matter for agri-food systems and rural livelihoods (orange box in the center).

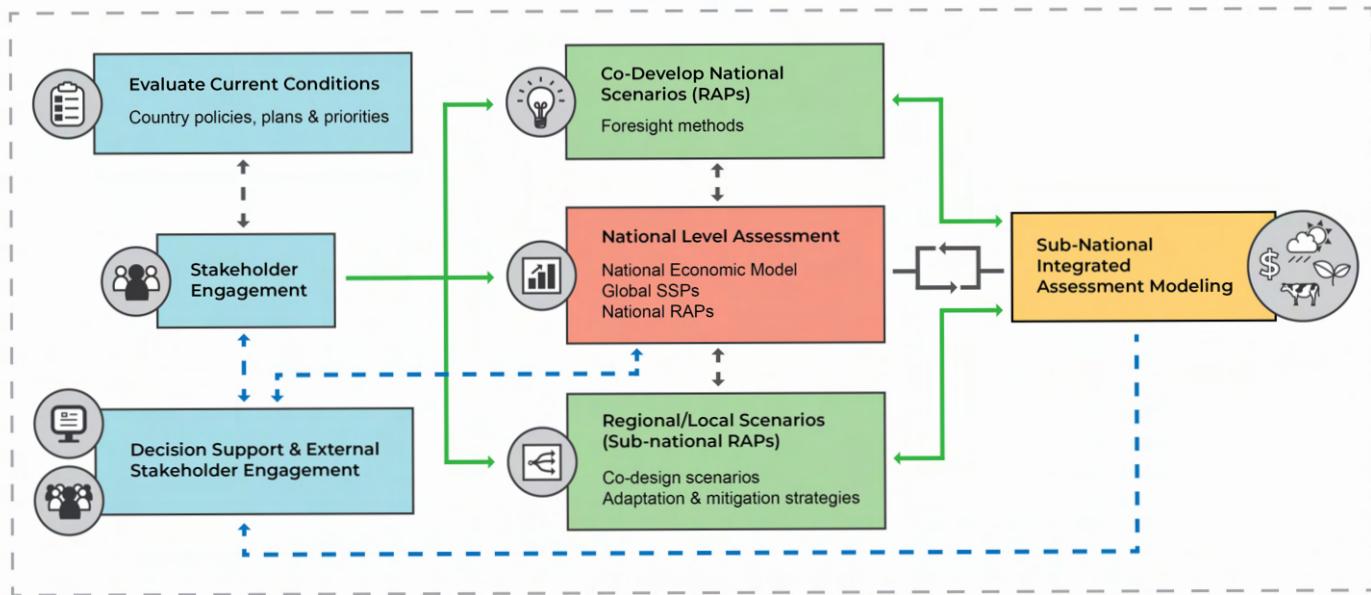


Figure 2. AgMIP INaRA Framework. SSPs = Shared Socioeconomic Pathways.

National outputs inform regional teams as they co-develop with stakeholders sub-national RAPs and adaptation packages for priority production systems, crops, and livestock (bottom green box in the middle column). Climate, crop, livestock, and economic simulations assess how farmers may be affected by climate change, adaptation options, or policy interventions under alternative socio-economic and climate scenarios. The Multi-Dimensional Trade-off Analysis (TOA-MD) model then quantifies impacts on farmers' vulnerability and livelihoods, while also evaluating trade-offs among socio-economic, environmental, and biophysical outcomes at the sub-national level (yellow box on the right).

Integration with RIAPA ensures that farm-level productivity shocks can be traced through to macroeconomic outcomes most relevant for policy, such as GDP, household incomes, employment, and poverty. This two-way exchange of scenarios, data, and results creates a cross-scale evidence loop: regional findings update national projections, and national signals refine regional scenarios.

Aligned with the stakeholder insights described above, the INaRA approach is demand-driven, with research questions defined by stakeholders and aligned with national development objectives. National modeling captures economy-wide linkages within and across the agri-food system, while regional assessments deliver the local, actionable evidence needed to target value-chain investments and policy measures. Stakeholders in Ghana identified this cross-scale capability as a major strength. The INaRA framework provides a foresight platform that helps decision makers anticipate risks and trade-offs.

CASE STUDY: Linking National Priorities and Local Adaptation to Strengthen Ghana's Agri-Food Systems



RIAPA: National Value-Chain Prioritization

Ghana's future agricultural growth depends on directing research and investments towards value chains that deliver the greatest returns for people and the economy. To explore these options, the study applied the RIAPA model to evaluate how accelerated growth in different agricultural value chains - driven by agricultural investments - could reduce poverty, improve diets, and create jobs and raise incomes in the country's agri-food system. The analysis shows that no single value chain can meet all policy objectives, making a diversified strategy essential.

Among the most promising investment areas are maize, horticulture (including tomatoes), small ruminants (including goats), and pulses (including cowpea), shown in Figure 3. Pulses stand out for their potential to raise incomes for poor farmers while also improving diets, thus offering an opportunity to expand production of crops like cowpea that fit well into northern Ghana's farming systems. Other sectors such as rice and groundnuts also show strong potential. These findings highlight the importance of supporting a broad mix of value chains while recognizing the special promise of pulses to reduce income risks from climate change.



Figure 3. Index ranking value chains (VCs) based on how effective they are at reducing poverty, growing agrifood systems, creating jobs, and improving diet quality. Source: RIAPA model results adapted from Diao et al. 2023.



AgMIP: Regional Integrated Assessment

At the sub-national level, AgMIP's Regional Integrated Assessment focused on smallholder systems in Navrongo, northern Ghana, where current yields of main crops such as maize and sorghum remain low, and about half of the population cannot afford a nutritionally adequate food basket. Climate change is expected to further reduce yields and exacerbate food insecurity. The study tested the introduction of cowpea as an "opportunity crop" to enhance resilience to hotter, drier future climates (Valdivia et al., 2023). Cowpea adoption strengthens household income and food security while reducing climate risks that are due to reliance on temperature- and rainfall-sensitive crops like maize (Maccarthy et al., 2025, In revision). Adoption rates of 60-70% could increase farm profits by 23-32%, reduce poverty by up to 15%, and lower the share of households unable to afford a nutritionally adequate food basket by 16-23% (Valdivia et al., 2021). These results highlight cowpea's potential as both a cash crop and a staple food that improves income, nutrition, and climate resilience (Figure 4).

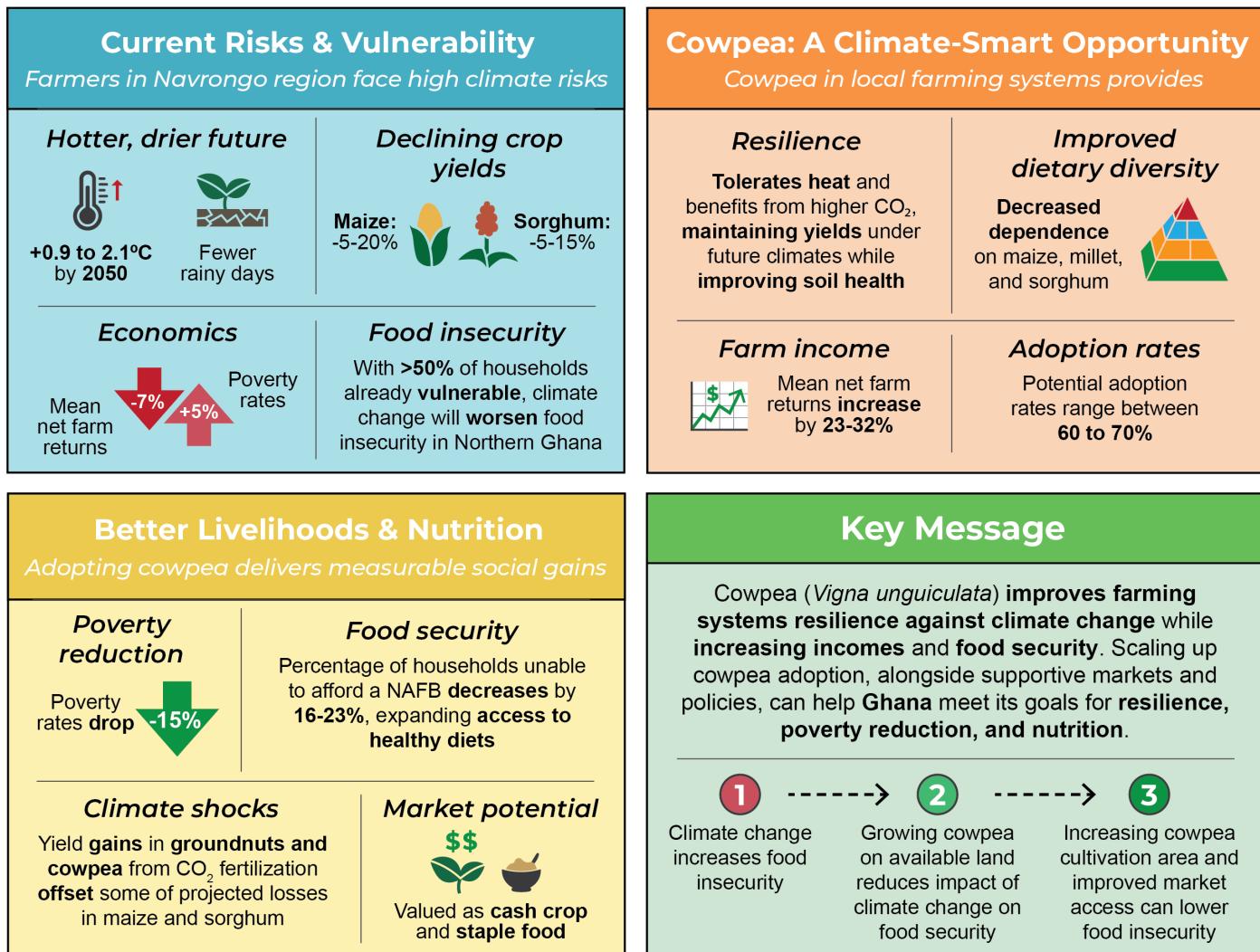


Figure 4. Building Climate-Resilient Farming with Cowpea in Northern Ghana: Insights from the Navrongo Regional Assessment. NAFB = Nutritionally Adequate Food Basket.

INTEGRATING RIAPA INTO INaRA

Bringing the RIAPA national model into AgMIP's INaRA framework would provide Ghana with a stronger evidence base for policy decisions under a changing climate. RIAPA captures the full economy, showing how investments in agriculture interact with other sectors and influence poverty, jobs, and diets. INaRA's goals are to connect these national strategies to the realities of different regions and farming systems, where the interplay between climate change pressures, farmer vulnerabilities, and the implementation of adaptations unfolds. RIAPA also considers the costs of different investments and the implications of financing needs. RIAPA therefore can play a key role in INaRA's cross-scale analysis: linking economy-wide priorities with local realities and ensuring that national policies are both evidence-based and context-specific.

The RIAPA study on value-chain prioritization showed that no single value chain can meet all of Ghana's goals, highlighting the need for diversified investment strategies that balance poverty reduction, job creation, nutrition, and resilience. At the same time, the AgMIP regional assessment in Navrongo demonstrated how introducing cowpea as an "opportunity crop" could enhance farm incomes, nutrition, and resilience in northern Ghana.

In future research, integrating RIAPA within the INaRA framework will facilitate coherence between sub-national and national assessments, ensuring that regional analyses align with national policies and outcomes, while national-level results remain grounded in locally specific and context-dependent conditions. Consistent scenarios developed through national and subnational RAPs can also provide evidence to test key drivers and interactions across scales. Using climate-resilient crops as an

example, regional integrated assessments can capture the socioeconomic, biophysical, and environmental heterogeneity across locations, allowing us to estimate the impacts of environmental changes, such as climate change or new technologies, on yields, income, and livelihoods. This enables the estimation of the proportion of households that are vulnerable, as well as potential economic gains and losses, and benefits and trade-offs associated with adopting improved or adaptive farming systems tailored to local conditions, while maintaining consistency with national-level drivers such as investments, policies, and prices. Further, sub-national analyses can inform national assessments by highlighting potential land-use changes that may affect markets, poverty, and food security outcomes.

For Ghana, this means decision makers can design investments and policies that deliver on poverty reduction, food security, and climate resilience while aligning with broader commitments such as the Comprehensive Africa Agriculture Development Programme (CAADP) targets and the Kampala Declaration.

FUTURE DIRECTIONS

The following investment areas emerged from discussions between researchers and stakeholders during the workshop and the interviews as critical to improving the linkages between science, policy, and practice to accelerate progress toward climate-resilient agriculture in Ghana:

Strengthen science-policy linkages. National policy processes in Ghana remain weakly connected to research. Strengthening the link between scientific evidence and decision making is essential to address climate risks, support agricultural transformation, and achieve national and global development goals.

Data. Investment is needed to improve access to reliable, well-documented data, with high spatial and temporal resolution. Data should be housed on a coordinated platform in standard formats.

Capacity and coordination. Stakeholders and researchers need improved capacity to co-create decision-relevant foresight tools and apply them in policy development and decision making, particularly at the sub-national level. Stronger coordination and collaboration between stakeholders and with researchers are also critical.

Ongoing dialogue. Stakeholders overwhelmingly called for continued dialogue and collaboration with researchers.

Funding. Funding should focus on priority policy and decision problems defined by stakeholders.

Authors: MacCarthy, D.S., Valdivia R. O., Madajewicz M., Kozlowski N., Homann-Kee Tui, S., Ankrah, D., Tall, L., Amoah, A. B., Amoako K. K., Williams, P. A., Thurlow J., Karl, K., Haris, S., Kimball, J., Contreras, E., Rosenzweig, C.

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