Letter from the Co-Chairs

The climate crisis is fundamentally reshaping how we produce, distribute, and consume food. As such, food systems transformation is now essential to delivering on Sustainable Development Goals.

Many of the solutions required to transform food systems are already well-established — grounded in science, driven by innovation, and informed by the lived experiences of producers, consumers, and communities. However, the window to trigger the process of food systems transformation at a global level is rapidly closing.

What is needed now is a decisive shift toward coordinated, large-scale implementation — rooted in research and evidence, responsive to local priorities, and supported by shared investment.

To address this challenge, the COP30 Presidency has made food systems transformation a priority for action. In support of this agenda, Embrapa, Community Jameel and CGIAR have convened the COP30 Food Systems Transformation – Science and Philanthropy Advisory Group (COP30 FST-SPAG), bringing together scientific institutions with multilateral and private sector actors to advance rigorous, scalable, and investment-ready solutions.

This technical brief represents the first collective output of our group. It identifies four strategic priorities for food systems transformation, grounded in the best available science and in line with COP30's Food and Agriculture Axis.

Across the identified areas, this brief offers a clear roadmap for how climate finance, philanthropy, and public-private collaboration can unlock transformative impact, reducing emissions, enhancing resilience, and improving nutrition and equity.

Guided by shared principles and evidence, we are now developing an investable pipeline of solutions aligned with this vision. The goal is not only to identify promising innovations, but also to accelerate their deployment through strategic partnerships and targeted investment.

We are deeply grateful to the members of the COP30 FST-SPAG for their leadership, insight, and commitment. We hope this brief provides a strong foundation for action and a signal to the global community that food systems transformation must be central to climate solutions.

We look forward to working together in the lead-up to COP30 and beyond. With appreciation,

Co-Chairs, COP30 FST-SPAG

		
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Introduction

The COP30 Presidency has placed food systems transformation at the heart of its climate agenda, recognizing that climate change threatens the livelihoods of millions of small-scale producers [1] and worsens the risk of hunger for more than 700 million people already facing food insecurity.[2] Food systems also generate nearly a third of annual greenhouse gas emissions while receiving around 3% of climate finance.[3] Catalysing investment in science-backed solutions offers an opportunity to strengthen resilience, reduce emissions, and enhance global food security.

The COP30 Food Systems Transformation – Science and Philanthropy Advisory Group (FST-SPAG) was launched in Brazil in March 2025 to support the COP30 Presidency's food systems agenda. Co-chaired by Embrapa, Community Jameel, and CGIAR, the group convenes leading scientific organizations and philanthropic partners to identify and elevate rigorous, investable, and scalable programs.

Through multi-institutional consultation, the COP30 FST-SPAG identified four priority areas that directly support the COP30 Food and Agriculture Axis:

- Harnessing data science, AI, and emerging technologies
- Scaling sustainable inputs for agricultural resilience
- Developing climate-resilient and climate-friendly crops
- Supporting sustainable livestock systems and aquaculture systems

Guided by these priority areas, the COP30 FST-SPAG is developing a pipeline of investable projects that are supported by science and rigorous evidence.

This pipeline will be informed by the following four principles:

- Healthy diets and nutritional security should be central to climate goals.
- Women, vulnerable farmers, and Indigenous Peoples and Local Communities must benefit directly from innovation.
- Innovations should be scalable and work in coordination with the wider ecosystem.
- Farmer perspectives and traditional knowledge must inform policies and innovations.

Strategic priorities

Harnessing data science, AI, and emerging technologies

Digital technologies, especially AI, have significant potential to accelerate food systems transformation. They can help anticipate climate risks, guide adaptive practices, improve resource use efficiency, and open new market opportunities for farmers. Yet deployment remains uneven, with rural connectivity gaps and the digital divide limiting progress.[4]

Strategic recommendations are as follows:

Scale risk assessment and crop yield forecasting models: Expand the use of satellite and geospatial technologies, climate and weather forecasts to anticipate climate risks and enable proactive adaptation.[5] [6] [7]

Build research and data integration platforms: Establish platforms that combine open data with cutting-edge research, bridging science, farming communities, and policy.[8] Invest in systems that integrate diverse datasets to enhance their use in decision-making, from the local to the global level.[9] [10]

Expand digital market platforms: Invest in farmer-facing tools that combine climate advisories with market functions, such as price information, direct buyer

connections, and access to finance, to reduce transaction costs and strengthen farmers' bargaining power.[11] [12]

Monitor food and nutritional security: Deploy digital tools to track local food insecurity levels,[13] generate data on dietary diversity, and inform targeted subsidies and policy interventions.[14] [15] [16]

Develop cost-effective AI and monitoring tools: Advance affordable AI-driven applications and data collection tools for monitoring, evaluation, and impact assessment.[17] [18]

Scaling sustainable inputs for agricultural resilience

Sustainable inputs, including biofertilizers, biopesticides, and bioherbicides, are central to reducing chemical dependency while improving soil and ecosystem health. These solutions are cost-effective and scalable, but adoption remains limited. At the same time, transforming the broader fertilizer supply chain is critical;[19] including embedding it within integrated land-use approaches that can amplify impact, linking soil regeneration, biodiversity, and climate goals.

Strategic recommendations are as follows:

Strengthen the scientific foundation: Invest in soil microbiome research to enhance plant resilience, soil health, carbon sequestration, and water retention; advance field pilots and translational initiatives to inform scalable solutions.[20]

Build evidence for policy and investment: Support research programs and data platforms that quantify bioinputs' contribution to mitigation, adaptation, and soil health improvement, to ensure financial incentives that can help inform policy and finance.[21] [22]

Strengthen farmer adoption systems: Expand farmer-facing capacity-building networks, technical assistance, and rural extension, while linking adoption efforts to evidence and financing mechanisms.[23] [24]

Incentivise soil regeneration: Support programs that restore degraded land, and reduce pressure on new arable areas, reinforcing food security, climate resilience, and environmental conservation.[25]

Develop sustainable markets and value chains: Empower agrodealer networks and other supply chain actors as distribution and service providers. Pair training and digital tools with certification schemes and premium markets, rewarding sustainable practices.[26] [27]

Developing climate-resilient and climate-friendly crops

Strategic investment in resilient crops is essential to safeguard food security and build resilience in agriculture. Advances in genomics and breeding can produce stress-tolerant and nutrient-rich varieties.[28] These innovations must align with local livelihoods and production systems, while also addressing weak seed systems and fragile markets.

Strategic recommendations are as follows:

Deepen the scientific foundation for crop resilience: Advance the understanding of genetic traits in gene banks and their role in adaptation, and expand the use of genomics-based research to accelerate breeding for resilience.[29]

Expand nutritious and diverse crop supply: Develop resilient crop varieties, with yield stability and resistance to drought and heat. Prioritize nutrient-rich, culturally relevant crops and promote neglected and underutilized species.[30] [31] [32]

Mobilize climate finance for resilient crops: Position resilient crops within blended finance frameworks that attract investment and scale innovation for adoption and scaling.[33]

Supporting sustainable livestock and aquaculture systems

Although livestock and, to a lesser extent, aquaculture systems, contribute to greenhouse gas emissions, they are also vital to global nutrition, rural livelihoods, and environmental responsibility. Livestock, for instance, can produce food in areas crops cannot grow. Yet, they remain largely underemphasized in climate and food security frameworks. A coordinated, sustainable approach, grounded in existing knowledge and scalable technologies, can unlock livestock and aquaculture's full potential.

Strategic recommendations are as follows:

Support responsible land use: Promote livestock systems that improve soil and water conservation, reduce land degradation, and lower greenhouse gas emissions, while easing pressure on forests.[34] [35]

Protect native biomes through agropastoral models: Advance integrated crop-livestock systems in natural biomes to improve land use efficiency, conserve and restore native vegetation, and enhance biodiversity.

Embed livestock in policy and finance agendas: Position livestock as a cornerstone of nutrition, renewable energy, rural economies, biodiversity conservation, and GHG mitigation.[36]

Strengthen market access for low-emission animal products: Expand labeling schemes and retailer partnerships to create sustainable consumer demand of animal products as part of healthy diets and stable purchasing agreements.[37]

Promote sustainable protein sources: Advance alternative proteins (cultivated meat, fermentation, improved plants, algae) and expand sustainable aquaculture as complementary pathways to meet nutrition and climate goals.[38] [39]

Table | Strategic priorities at a glance

PRIORITY AREA	WHY THIS MATTERS	GAPS & BARRIERS	FUNDING OPPORTUNITIES
Harnessing data science, AI, and emerging technologies	Digital tools can forecast risks, support farm decisions, and expand market access.	Technical: fragmented datasets Institutional: lack of governance and trust in AI Equity: rural connectivity gaps, women and youth excluded	• Fund rural connectivity pilots • Support open-data platforms linking farmers, science, and policy • Target digital inclusion for women/youth • Build governance & trust frameworks
Scaling sustainable inputs for agricultural resilience	Biofertilizers, biopesticides, and soil enhancers reduce chemical dependence while restoring soils.	Technical: weak R&D; limited local production; low farmer adoption Market: fragile supply chains Equity: limited access for women and small-scale producers	• Catalyze microbiome & bioinput R&D • Finance adoption networks & extension • Support local production hubs • Demonstrate climate & yield impact with large-scale field trials
Developing climate-resilient & climate-friendly crops.	Stress-tolerant, nutrient-rich varieties safeguard food security and health under climate variability and extremes.	Technical: long breeding cycles Market: weak seed systems; fragile seed markets Institutional: limited policy/finance	• Digitize gene bank accessions and integrate with global research • Support participatory & genomic breeding • De-risk seed distribution and strengthen local enterprises • Invest in biofortified crops, and neglected and underutilized crops

Supporting sustainable livestock and aquaculture systems	Integrated systems, adapted breeds, and low-emission feeds cut emissions while improving nutrition.	Technical: neglected small ruminants; weak feed innovation; poor animal health networks Market: weak input supply chains, limited consumer demand Institutional: livestock underemphasized in policy/finance	• Pilot methane-reducing feeds • Strengthen small-ruminant systems, and camelids • Expand integrated crop-livestock / crop-fish models • Fund vaccine and animal health networks • Scale no- / low-input aquaculture production

Conclusion

The four strategies outlined here represent key entry points where targeted private sector and philanthropic investment in science-led solutions can drive transformative change, to support the COP30 Presidency's agenda to deliver resilient and equitable food systems.

We recognize that additional areas are also critical for long-term transformation, such as reducing food loss and waste, expanding small-scale mechanization and integrating renewable energy and sustainable biofuels into agrifood systems. By aligning science with catalytic finance, COP30 can set a global precedent for food systems as engines of climate resilience.

References

1. Lowder, S. K., Sánchez, M. V. & Bertini, R. Which farms feed the world and has farmland become more concentrated? World Development 142, 105455 (2021);

2. FAO, IFAD, UNICEF, WFP & WHO. The State of Food Security and Nutrition in the World 2025. (FAO, IFAD, UNICEF, WFP, WHO, 2025);

3. Climate Policy Initiative (CPI). Landscape of Climate Finance for Agrifood Systems. (CPI, 2025);

4. Tzachor, A., Devare, M., King, B., Avin, S. & Ó hÉigeartaigh, S. Responsible artificial intelligence in agriculture requires systemic understanding of risks and externalities.

5. Burlig, F., Jina, A., Kelley, E. M., Lane, G. & Sahai, H. The value of forecasts: Experimental evidence from India. (May 2025).

6. Kim, Y.-U., Ruane, A., Finger, R. & Webber, H. Robust assessment of climatic risks to crop production. Nat. Food 6, 415–416 (2025);

7. Park, J. & Choi, S. LLMs for Enhanced Agricultural Meteorological Recommendations. arXiv preprint doi:10.48550/arXiv.2408.04640 (2024);

8. Schneider, K. R. et al. The state of food systems worldwide in the countdown to 2030. Nat. Food 4, 1090–1110 (2023);

9. Rosenstock, T. S. et al. Decision support tools for agricultural adaptation in Africa. Nat. Food 5, 186–188 (2024);

10. FAO. Hand-in-Hand (HIH) Geospatial Platform. (FAO, Rome)

11. Fabregas, R., Kremer, M. & Schilbach, F. Realizing the potential of digital development: The case of agricultural advice. Science 366, (2019);

12. Mehrabi, Z. et al. The global divide in data-driven farming. Nat. Sustain. (2020). ;

13. Lamanna, C. et al. Strengths and limitations of computer-assisted telephone interviews (CATI) for nutrition data collection in rural Kenya. PLoS One (2019);

14. IPC Global Partners. Integrated Food Security Phase Classification (IPC) standards. Technical Manual: Version 3.1. (IPC Global Support Unit, Rome, 2021).

15. Foini, P., Tizzoni, M., Paolotti, D. & Omodei, E. On the forecastability of food insecurity. Sci. Rep. 13, 2793 (2023);

16. Manners, R. et al. Leveraging digital tools and crowdsourcing approaches to generate high-frequency data for diet quality monitoring at population scale in Rwanda. Front. Sustain. Food Syst. 5, 804821 (2022);

17. Brandt, M. et al. Severe decline in large farmland trees in India over the past decade. Nat. Sustain. (2024);

18. Geyman, E. C. et al. An Africa-wide agricultural production database to support policy and satellite-based measurement systems. Sci. Data 12, 1087 (2025);

19. Mingolla, S. & Rosa, L. Low-carbon ammonia production is essential for resilient and sustainable agriculture. Nat. Food 6, 610–621 (2025);

20. Hartmann, M. & Six, J. Soil structure and microbiome functions in agroecosystems. Nat. Rev. Earth Environ. 4, 4–18 (2022);

21. FAO. Bioinputs: Investment Opportunities in Latin America. (FAO, 2024);

22. Zhao, G. et al. Development of biofertilizers for sustainable agriculture over four decades (1980–2022). Geogr. Sustain. 5, 19–28 (2024);

23. Soliman, A. How to climate-proof crops: scientists say the secret's in the dirt. Nature (2024);

24. Sánchez Bogado, A. C. et al. Farming for the Future: Understanding Factors Enabling the Adoption of Diversified Farming Systems. (FAO, Rome, 2023)

25. FAO. Echoes of the Great Green Wall: Science, Technology and Innovation for Land Restoration and Sustainable Management. (FAO & Pan-African Agency of the Great Green Wall, Rome, 2024)

26. J-PAL. Increasing Small-Scale Farmers' Access to Agricultural Markets. (J-PAL Policy Insight, 2023)

27. J-PAL. Incentivizing Higher-Quality Agricultural Outputs. (J-PAL Policy Insight, 2023).

28. Mushtaq, W., Li, J., Liao, B., Miao, Y. & Liu, D. Unlocking crop resilience: How molecular tools enhance abiotic stress tolerance. Plant Stress 17, 100950 (2025);

29. Bailey-Serres, J., Parker, J. E., Ainsworth, E. A., Oldroyd, G. E. D. & Schroeder, J. I. Genetic strategies for improving crop yields. Nature 575, 109–118 (2019);

30. Van Zonneveld, M. et al. Forgotten food crops in sub-Saharan Africa for healthy diets in a changing climate. Proc. Natl. Acad. Sci. U.S.A. 120, e2205794120 (2023);

31. FAO. Compendium of Forgotten Foods in Africa – A Companion Publication for "Integrating Africa's Forgotten Foods for Better Nutrition." (FAO, Accra, 2024)

32. FAO. Integrating Africa's Forgotten Foods for Better Nutrition – A Companion Publication for the "Compendium of Forgotten Foods." (FAO, Accra, 2024)

33. Acevedo, M. et al. A scoping review of adoption of climate-resilient crops by small-scale producers in low- and middle-income countries. Nat. Plants 6, 1231–1241 (2020);

34. Herrero, M. et al. Greenhouse gas mitigation potentials in the livestock sector. Nat. Clim. Change (2016).;

35. Bilotto, F. et al. Costs of transitioning the livestock sector to net-zero emissions under future climates. Nat. Commun. 16, 3810 (2025);

36. Mehrabi, Z., Gill, M., van Wijk, M., Herrero, M. & Ramankutty, N. Livestock policy for sustainable development. Nat. Food 1, 160–165 (2020);

37. FAO. Contribution of Terrestrial Animal Source Food to Healthy Diets for Improved Nutrition and Health Outcomes – An Evidence and Policy Overview on the State of Knowledge and Gaps. (FAO, Rome, 2023)

38. Gephart, J. A. & Golden, C. D. Environmental and nutritional double bottom lines in aquaculture. One Earth 5, 324–328 (2022);

39. Crona, B. I. et al. Four ways blue foods can help achieve food system ambitions across nations. Nature 616, 104–112 (2023).