Operationalizing USAID's Climate Strategy to Achieve Transformative Adaptation and Mitigation in Agricultural and Food Systems

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[Placeholder for Letter from Subcommittee to BIFAD]

Contents

Acronyms and Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use
BHA	Bureau for Humanitarian Assistance
BIFAD	Board for International Food and Agriculture Development
CCLC	Climate Change Leadership Council
CCTWG	Climate Change Technical Working Group
CDCS	Country Development Cooperation Strategies
CIL	Climate Integration Lead
CISR	Climate Information Services Research Initiative
DO	Development Objective
DFC	U.S. International Development Finance Corporation
DFIs	Development Finance Institutions
DRC	Democratic Republic of the Congo
EEI	Center for Environment, Energy, and Infrastructure
FEWS NET	Famine Early Warning Systems Network
FTF	Feed the Future
FLW	Food Loss and Waste
GEWE	Gender Equality and Women's Empowerment
GFSS	U.S. Government Global Food Security Strategy
GHG	Greenhouse Gases
ICT	Information Communications Technology
IPCC	Intergovernmental Panel on Climate Change
IR	Intermediate Result
LMICs	Low- and Middle-Income Countries
MRV	Measurement, Reporting, and Verification
NAP	National Adaptation Plan
NARS	National Agricultural Research Services
NDC	Nationally Determined Contribution
NGO	Nongovernmental Organization
NMS	National Meteorological Services
OU	Operating Unit
PES	Payment for Ecosystems Services

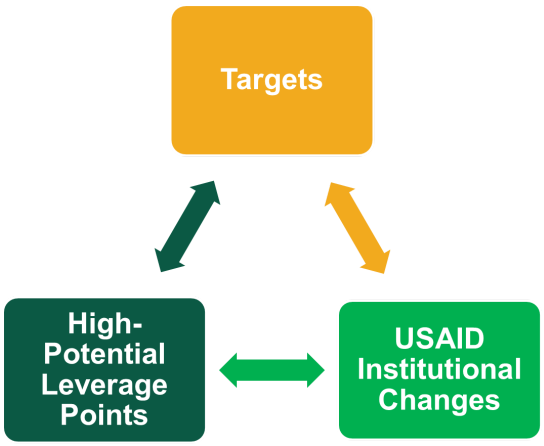
PHL	Post-Harvest Loss
PPP	Public–Private Partnership
PREPARE	President's Emergency Plan for Adaptation and Resilience
PREPARED	Planning for Resilience in East Africa through Policy, Adaptation, Research and Economic Development
PRO-IP USAID	Policy on Promoting the Rights of Indigenous Peoples
PSE	Private Sector Engagement Policy
R&D	Research and Development
RAA	Required as Applicable
RDO	Regional Development Objective
RFS	Bureau for Resilience and Food Security
UNEP	United Nations Environment Program
UNFCCC	UN Framework Convention on Climate Change
USAID/DDI	Bureau for Development, Democracy, and Innovation
VSLA	Village Savings and Loan Association
ZOI	Zone of Influence

Executive Summary

The goal of this report is to identify and recommend ambitious action for climate change adaptation and mitigation related to USAID's agricultural and food security programs. Transformative change across the agrifood system is required to meet global climate policy targets, including the 1.5°C warming threshold.[1,2] Agrifood systems contribute nearly a third of anthropogenic greenhouse gas (GHG) emissions[3] and agriculture is the sector most vulnerable to climate change, particularly in USAID's focal countries, where poor and underrepresented groups carry the burden of climate change impacts.

The USAID Climate Strategy (2022–2030) puts forward a broad vision for a resilient, prosperous, and equitable world with net-zero greenhouse gas emissions and specifies ambitious high-level targets for whole-of-agency action. Guided by the Climate Strategy, this report develops recommendations specific to USAID's agricultural and food security programs. The report develops targets, high-impact leverage points, and USAID operational changes as a three-pronged strategy to encourage target-driven action leading to large-scale change while matching USAID organizational capacities to needs. Targets ensure ambitious goals and accountability in tracking progress; leverage points focus attention on where USAID investment can yield the most impact globally; and operational changes enable the resources and processes needed to achieve climate goals (Figure 1). Ongoing attention to these three strategic elements is needed for successful implementation of the Climate Strategy.

Figure ES1: Elements for achieving large-scale climate change impacts



This report was commissioned by the presidentially appointed advisory committee to USAID, the Board for International Food and Agricultural Development (BIFAD), and developed with guidance from the BIFAD Subcommittee on Systemic Solutions for Climate Change Adaptation and Mitigation in Agricultural, Nutrition, and Food Systems, with research and implementation support from a BIFAD support mechanism implemented by Tetra Tech. The study is based on a desk review of the scientific literature and USAID documents, expert input from Subcommittee members, and interviews with key respondents and USAID staff, from both missions and headquarters. This draft has benefited from external peer reviews and several rounds of USAID and public feedback.

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[1]IPCC. (2018). Summary for Policymakers. In Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (Eds.), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* IPCC, pp. 3-24. https://doi.org/10.1017/9781009157940.001.

[2] Science Based Targets Initiative. (n.d.) Ambitious Corporate Climate Action. https://sciencebasedtargets.org/

[3] Tubiello, F. N., Karl, K., Flammini, A., Gütschow, J., Obli-Laryea, G., Conchedda, G., Pan, X., Qi, S. Y., Halldórudóttir Heiðarsdóttir, H., Wanner, N., Quadrelli, R., Rocha Souza, L., Benoit, P., Hayek, M., Sandalow, D., Mencos Contreras, E., Rosenzweig, C., Rosero Moncayo, J., Conforti, P., & Torero, M. (2022). Pre- and post-production processes increasingly dominate greenhouse gas emissions from agri-food systems. *Earth System Science Data*, *14*(4), 1795–1809. https://doi.org/10.5194/essd-14-1795-2022

Opportunities and challenges to achieving USAID's climate change ambitions

USAID has a comparative advantage to work on climate change and agrifood development at scale. The establishment of the Bureau for Resilience, Environment, and Food Security (REFS) in 2023 also creates opportunities to better integrate climate and food security programs.

However funding for climate change in the Agency remains low. Of the U.S. Department of State's and USAID's total FY 2023 enacted budget of $59.7 billion, less than one percent ($715 million[4]) was appropriated for USAID climate-focused work in adaptation ($270 million), sustainable landscapes ($185 million), and clean energy ($260 million).[34,5] USAID's global agricultural funding, meanwhile, was $1 billion in FY23.[35,6] In addition, congressionally determined food security and climate funding is not always aligned with the technical or geographical priorities defined by USAID climate change experts.

While there is strong buy-in for the Climate Strategy across the Agency, climate change is not yet a core development objective in agrifood programming. Operating units lack ambitious targets. Climate change goals in agrifood systems, particularly related to mitigation, are unclear and technical expertise and capacity to use climate information in programming are limited. Operating units continue to treat climate change largely as a risk to programming rather than an imperative for action. USAID-supported research also has not generated the systematic evidence, approaches, and products needed to address climate impacts on agriculture and food security.

2030 Climate Change Targets

Building on the Climate Strategy and other targets in the literature, the report provides 2030 targets for USAID's agrifood system programming. The targets contribute to the whole-of-agency adaptation, mitigation, and finance targets in the Climate Strategy. See Figure ES2.

Adaptation Target: Enable the improved climate resilience of at least 180 million people who depend on agriculture. This target was calculated as a proportion of the Climate Strategy's target of 500 million people based on the percentage of individuals employed in agriculture within the countries where USAID operates. USAID should also develop at least one impact-based target to assess the effectiveness of Agency adaptation efforts.

Mitigation Target: Reduce emissions from agrifood systems by 1.2 GtCO2e/yr while supporting initiatives to avoid net conversion of forest, grasslands, or peatlands to agricultural use. The target is based on the mitigation needed in countries where USAID currently works and in other low- and middle-income countries to stay below a 2 °C increase by 2100.

Finance Target: Mobilize $36 billion in finance for climate change adaptation and mitigation in agrifood systems, with at least 30 percent of direct financing used for gender- and socially inclusive investments.This target reflects the share of the agrifood sector's global need for finance relative to other sectors, as a proportion of USAID's whole-of agency target of $150 Billion.

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[4]U.S. House Committee on Appropriations. (2023). *State, Foreign Operations, and Related Programs.* U.S. House of Representatives. https://appropriations.house.gov/sites/democrats.appropriations.house.gov/files/documents/FY23%20SFOPS%20Summary.pdf#:~:text=The%202023%20State%2C%20Foreign%20Operations%2C%20and%20Related%20Programs,above%202022%20%E2%80%93%20an%20increase%20of%2015%20percent

[5]U.S. House Committee on Appropriations. (2023). *Consolidated Appropriations Act, 2023: Summary of Appropriations Provisions by Subcommittee.* U.S. House of Representatives.

[6]U.S. House Committee on Appropriations. (2023). *State, Foreign Operations, and Related Programs.* U.S. House of Representatives. https://appropriations.house.gov/sites/democrats.appropriations.house.gov/files/documents/FY23%20SFOPS%20Summary.pdf#:~:text=The%202023%20State%2C%20Foreign%20Operations%2C%20and%20Related%20Programs,above%202022%20%E2%80%93%20an%20increase%20of%2015%20percent

How: USAID Institutional Change

Effective operationalization of the Climate Strategy within USAID's agrifood portfolio requires significant organizational change. This should include setting ambitious adaptation, mitigation, and finance targets; better integrating climate change goals in Country Development Cooperation Strategies, geographic priorities, projects, activities, and monitoring systems; and making climate change a priority in the Agency's research investments, funding decisions, staffing, and capacity building. See Figure ES2 for a summary of recommendations.

What: Leverage Points

The study presents leverage points within agrifood systems that drive transformative shifts to net-zero and climate-resilient pathways compatible with Agency food security and nutrition goals. Eight leverage points were identified through discussion with the Subcommittee, expert input from key informant interviews, public meeting feedback, and the literature review, and prioritized based on their potential for large-scale systems impact; technical potential for adaptation, mitigation, and food security; and alignment with USAID strategy and investments. See Figure ES2 for a summary of these leverage points.

Where: Focus Geography

The urgency of mitigation and adaptation investments differs by region. While the entire world needs to adapt to a changing climate, regions with low resilience should be prioritized immediately for adaptation interventions. Similarly, while mitigation is a global effort, regions with high emissions or rapidly-growing emissions should be prioritized immediately to support with mitigation. USAID planners must work closely with partner governments and counterparts to design appropriate programs for the local context, balancing adaptation needs and mitigation potential while meeting development objectives.

Geographic Prioritization of Adaptation, Mitigation, and Integrated Approaches

Prioritization	Description	Illustrative Geographic Examples
Adaptation	Regions that have low overall contributions to GHG emissions but are facing early and significant climate impacts	East and Horn of Africa, Sahel, Southern Africa, Central America and the Caribbean, Pacific Islands, South Asia
Mitigation	Regions that are high GHG emitters or are key contributors to sequestration efforts (or both); and/or areas which emphasize certain agricultural commodities that produce methane (livestock and rice)	South Asia (India), Indonesia, Amazon rainforests, Latin American peatlands
Fully Integrated	Regions that have high potential for maximizing adaptation and mitigation benefits within agricultural and food security investments	Congo Basin, Ethiopia, Nigeria, Madagascar, Mozambique, Zambia, Colombia, Guatemala, India, Brazil

USAID has the opportunity to drive systems change across agrifood systems that is both deeply impactful and broadly shared. With bold realignment of agency priorities and better integration of climate and agrifood system efforts, the Agency is better positioned than ever to bring its many strengths and assets to bear on the defining challenge of our time.

Figure ES2: Summary of Recommended Targets, Operational Changes, and Leverage Points

2030 Targets		
Adaptation: ● Enable the improved climate resilience of at least 180 million people who depend on agriculture. ● Develop at least one impact-based target to assess the effectiveness of adaptation efforts.	**Mitigation:** ● Reduce emissions from agrifood systems by 1.2 $GtCO_2e/yr$ ○ .6 $GtCO_2e/yr$ on-farm ○ .6 $GtCO_2e/yr$ food system (off-farm) ● Reduce the conversion of forest, grasslands, or peatlands into agricultural use	**Finance:** Mobilize $36 billion in climate finance for agrifood systems, with at least 30 percent used for gender- and socially-inclusive investments.

USAID Institutional Changes				
Recommendation 1: Strategy, Design, and Implementation in the Program Cycle	**Recommendation 2: Measurement and Reporting**	**Recommendation 3: Research**	**Recommendation 4: Resource Allocation**	**Recommendation 5: Human Resources**
● Data: climate risk, project, and impact data used throughout the program cycle ● Design: adaptation and mitigation objectives required in all agrifood system strategy and activity design ● Monitoring, Evaluation, and Learning (MEL): climate data required in all agrifood system MEL plans and in Mission Midcourse Stocktaking exercises; strategic evaluations expand the evidence base	● Missions and Bureaus set defined contributions to Climate Strategy adaptation, mitigation, and finance targets by 2024 ● Standardized indicators track progress in a unified and transparent data system ● Accountability incentives (e.g., budget, performance review) ensure compliance	Research Priorities ● Longer-term focus on food security pathways and climate resilient agricultural production ● Systems and behavioral change, including governance and markets Partnerships ● Communities ● Local universities and institutes ● Private Sector	● Longer-term investments (beyond 5 years) to inform both design and implementation ● Stronger collaborations with other U.S. federal agencies, including the DFC to better leverage finance	● Assessments of staffing needs and gaps ● Increased trainings, technical assistance, and overall staffing ● Recognition and opportunities for collaboration

Leverage Points			
Recommendation 6: High-Potential Leverage Points			
Empowering Women, Youth, and Other Underrepresented Groups ● Remove structural barriers impeding underrepresented groups' participation and leadership in climate-resilient agrifood systems ● Elevate Indigenous knowledge ● Increase gender-disaggregated data, analysis, and evidence of gender equality investment impacts in climate change-focused agrifood system interventions	**Local Research and Innovation Systems** ● Strengthen National Agricultural Research Systems, including public research institutes, universities, private and public experiment stations, and laboratories. ● Build understanding of climate risks at a local level, feeding into mitigation and resilient adaptation efforts	**Inclusive Climate Finance** ● Catalyze inclusive public and private finance, linking local production systems to international financial markets ● Support country-led efforts to develop bankable pipelines of inclusive agrifood systems climate finance projects ● Build capacity of national institutions to directly access climate finance that builds agrifood system resilience ● Partner with financial institutions to incentivize investment and de-risk adaptation and mitigation products and services ● Strengthen oversight bodies to standardize an approach to measure and value the impact of climate finance across heterogeneous contexts	**Integrated Soil and Water Management** ● Improve soil quality and health, water preservation, erosion mitigation, nutrient circulation, and biodiversity ● Facilitate better water management and irrigation, erosion control, and sound fertilizer application ● Study and build upon Indigenous soil health and broader food systems practices
Integrated Forest and Agricultural Land Management ● Strengthen land use governance ● Reduce the conversion of natural ecosystems for agriculture ● Integrate trees and tree crops into agricultural land ● Improve information on land use change and the effect of agriculture supply chains on land use	**Food Loss and Waste (FLW) Reduction** ● Refocus FLW reduction efforts on climate change impacts ● Improve FLW research that accounts for climate impacts; enhance local research partnerships ● Invest in stakeholder capacity to implement technical solutions ● Advocate for greater policy attention and national budgetary allocations	**Low-Emissions Animal Production** ● Improve livestock production efficiency ● Clarify methane emissions reduction commitments and frame them as a priority outcome rather than a co-benefit ● Prevent cattle-driven deforestation	**Weather and Climate Services** ● Invest in public and private climate services that prioritize user needs ● Equip agricultural stakeholders and end users to act on the basis of climate services ● Improve agricultural productivity and resilience through the use of time-sensitive information

Recommendations

The analysis identifies six recommendations for USAID to drive transformative change and accelerate progress towards Climate Strategy targets.

Recommendation 1: Strategy, Design, and Implementation in the Program Cycle. The Agency should require the use of climate-related data (such as climate risk, climate variability and projection, and impact data) across the full program cycle for agrifood system investments to balance the potential for long-term climate-resilient agricultural gains with immediate food security needs. It should also consider the potential co-benefits and trade-offs among mitigation, adaptation, and agricultural or food security outcomes:

- *Strategy Design* - the Agency should fully embed data on how agrifood systems are impacted by climate change and identify pathways to reduce a) vulnerability to current and projected climate change and/or b) GHG emissions (beyond what is currently required by Climate Risk Assessments). This information should be integrated into the text and Results Frameworks of Country Development Cooperation Strategies (CDCS) themselves, not just in Climate Annexes. USAID should also allow for flexibility around geographical focus areas–including FTF ZOIs–to address climate opportunities at an ecosystem level that goes beyond specific farming systems or agricultural landscapes;
- *Project and Activity Design* - the Agency should require climate adaptation and/or mitigation interventions within agricultural and food security programs, including those that do not specifically receive climate funding. It should require these activities to incorporate climate considerations across all development objectives within activity-level results frameworks. Agrifood system activity implementation should be measured against, and contribute to, the relevant OUs' committed contributions to Climate Strategy targets (whether or not the activity receives direct climate change funding). USAID should also undertake an informed appraisal of co-benefits or trade-offs between adaptation, mitigation, and agricultural or food security outcomes.
- *Monitoring, Evaluation, and Learning (MEL)* - the Agency should incorporate climate indicator reporting across all agricultural MEL plans and include climate change reviews within CDCS Midcourse Stocktaking exercises to assess the degree to which climate analysis, risks, opportunities, and assumptions proved to be accurate over time, and develop an action plan based on its findings. USAID should also increase investment in a) rigorous evaluations that measure the effects of agricultural programming on climate adaptation and mitigation; and b) implementation studies of agrifood system climate adaptation and mitigation efforts that help to improve and scale climate-smart interventions.

Recommendation 2: Measurement and Reporting. USAID should increase the speed of, and accountability for, OUs reaching their contributions to Climate Strategy targets by:

- Requiring OUs to set and own defined contributions to reaching the Agency's adaptation, mitigation, and finance targets by 2024.
- Finalizing standardized agrifood system-specific Climate Strategy indicators and introducing accessible approaches for all OUs to report on them, aggregating adaptation and mitigation benefits across agricultural investments by 2024.
- Developing a tracking and reporting system for OU-specific progress towards Agency targets across all agricultural activities by 2024, not just those with climate funding or a climate objective.
- Introducing accountability measures to ensure consistent and comprehensive OU reporting of Climate Strategy indicators, such as budgetary and performance review incentives.

Recommendation 3: Research. The Agency's agricultural research portfolio should increase investment in climate-focused research in the following areas:

- Longer-term climate-informed interventions, including food security pathways and production systems that are compatible with future climate conditions and impacts
- Maximizing co-benefits of agrifood system interventions for climate adaptation and mitigation, natural resource management, and biodiversity, including through varied governance and market-based approaches
- Social and behavioral change to develop approaches that support communities making difficult agricultural transitions

USAID should also strengthen research partnerships by identifying and supporting research organizations–especially local institutions–and require research to:

- Collaborate with Missions and communities to guide research priorities and ensure its utilization to scale innovations
- Work closely with partner country universities and research institutes, especially where agricultural research is underfunded and not linked to extension services, to promote R&D, develop research organizations focused on agrifood systems transformations, strengthen adaptive capacities at the local level, and support locally-driven and owned solutions
- Partner with nongovernmental/private donors to leverage diverse strengths and funding modalities for common goals
- Collaborate with other U.S. federal research institutions to share resources and expertise and increase collaboration on synergistic priorities
- Identify and work with private sector partners to crowd in investment, solicit complementary expertise, and set up interventions to scale

Recommendation 4: Resource Allocation. Increase investment levels and flexibility for climate adaptation and mitigation in agricultural and food security programming through:

- Longer or phased funding (beyond five-year cycles) in order to realize greater impacts through longer-term technical design and implementation continuity.
- Stronger collaboration and co-funding with other U.S. federal agencies, including:
    - Integrated and complementary investments across Mission portfolios with other in-country USG agencies, and
    - More flexible, headquarter-based, global funding to align with DFC's broader geographic scope and short investment timelines; and funding to de-risk DFC's agricultural investments in riskier, high-impact investments.

Recommendation 5: Human Resources. The Agency should accelerate fulfilling its commitments on climate-related staffing in the Climate Strategy, through:

- Detailed assessments of staffing needs and gaps across OUs
- Increased mandatory technical trainings for Missions on climate risks, adaptation, and mitigation opportunities, and on climate-related analysis and measurement
- Increased climate technical assistance and dedicated staffing across Missions and in Washington according to OU needs
- Expanded opportunities for Missions to share expertise, experience, and lessons learned related to the integration of climate, climate measurement, and reporting
- Development of awards and recognition programs to acknowledge and celebrate climate champions who drive action within the agency

Recommendation 6: High-Potential Leverage Points. USAID should invest more resources in high-potential leverage points within agrifood systems that drive transformative shifts to net-zero emissions and climate-resilient pathways while achieving Agency food security goals.

- Empowering Women, Youth, and Other Underrepresented Groups
- Local Research and Innovation Systems
- Inclusive Climate Finance
- Integrated Soil and Water Management
- Integrated Forest and Agricultural Land Management
- Food Loss and Waste Reduction
- Low-Emissions Animal Production
- Weather and Climate Services

I. Study Objectives and Background

The goal of this report is to identify and recommend actions that accelerate progress in climate change adaptation and mitigation related to USAID's agricultural and food security programming. As the most recent Intergovernmental Panel on Climate Change (IPCC) Assessment noted, pathways to a climate-resilient future require transformational changes to the systems in which we live.[1] Transformational changes are those that alter the fundamental attributes of systems in response to actual or expected climate conditions and their effects on people, often at a scale and ambition greater than incremental activities.Transforming key systems to reduce emissions, improve climate resilience, and achieve development goals challenges conventional approaches to development.

The report presents achievable 2030 targets for USAID and a set of recommendations to drive transformative change encompassing both Agency operations and social and technical leverage points that merit additional investment. Further details on both the study's objectives and its methodology can be found in Appendix H.

The report was commissioned by the Board for International Food and Agricultural Development (BIFAD) and developed in close collaboration with the BIFAD Subcommittee on Systemic Solutions for Climate Change Adaptation and Mitigation in Agricultural, Nutrition, and Food Systems.[2] It was written by a team of Tetra Tech and independent subject matter experts and contributing authors and guided by regular consultation with the subcommittee. It builds upon analysis presented in the 2022 Working Paper *Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems*.[3]

BIFAD is a presidentially appointed advisory board to USAID established in 1975 under Title XII of the Foreign Assistance Act. Its purpose is to ensure that USAID effectively utilizes the resources and expertise of U.S. universities to address development challenges in agriculture, nutrition, and food security.

II. Global Development Context

The Imperative of Agriculture to Address Climate Change Adaptation and Mitigation

The agrifood system is a significant contributor to climate change and is also deeply shaped by its impacts. The achievement of net-zero GHG emissions targets, food and livelihoods security, and broad-based nutrition outcomes is predicated upon transformative change across agricultural production, processing, and distribution systems as well as in governance standards to inform, and limit, the establishment of new agricultural land. Without ambitious and comprehensive adaptation and mitigation measures across the agricultural sector, the 1.5-degree warming target, the end of extreme poverty, and a sustainable future are out of reach.

[1]IPCC. (2022). Summary for Policymakers. In H. O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, & A. Okem (Eds.), Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 3–33). Cambridge University Press. https://doi.org/10.1017/CBO9781139177245.003

[2]https://www.usaid.gov/bifad/climatechange/subcommittee

[3]Carr, E. R., Diro, R., Hall T., Mbevi, L., Zook, D., Beggs, M., Benson, C., Aldredge, H., Allognon, L., Crocker T., Liming, K., and Mukupa, N. (2022). *Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems. Working Paper*. Tetra Tech under the USAID BIFAD Support Contract. https://www.usaid.gov/bifad/climatechangeworkingpaper

Globally, agrifood systems are a significant source of the greenhouse gases (GHG) that drive climate change. An estimated 31[4] to 37[5] percent of anthropogenic GHG emissions, or 16.5 to 19.1 billion tonnes, come from agrifood systems. The largest source of agricultural emissions, cattle, produce more methane than the oil and gas sectors combined.[6] Rice production and value chains, another major source of methane in particular, are responsible for approximately 11 percent of all GHG from agrifood systems, largely due to the crop's dependence on flooded soils.[7] Across crop types and value chains, agricultural emissions stem from on-farm production, pre- and post-production processes, transportation, storage, and land use change (i.e., the conversion of natural ecosystems for agricultural use). Both global commodity markets and local consumption needs drive deforestation and agricultural production trends, and the relative magnitude of these emissions sources varies significantly by country. For example, India and the Democratic Republic of the Congo (DRC) are the third and fourth largest national sources of global agricultural emissions. While India's emissions are almost exclusively produced by crops (e.g., rice) and livestock, the DRC's are dominated by land-use change.[8] Because of its substantial share of global GHG production, the agricultural sector can also play an outsized role in driving solutions. It is one of the few sectors that offers potential for both mitigating emissions and removing carbon from the atmosphere at scale, offering perhaps 12 $GtCO_2e/yr$ in aggregate carbon sequestration.[9]

The negative impacts of climate change on agrifood systems are already deep and widespread. These impacts fall disproportionately on people and regions that have contributed little to the climate crisis. Extreme and intensifying conditions, from protracted heat and drought to heavy precipitation[10] to sea level rise and saltwater intrusion,[11] stress production systems from Guatemala to Bangladesh, undermining both livelihoods and food and nutrition security.[12] Simple measures of growing season temperatures and precipitation have been shown to explain 30 percent or more of the annual variance in global crop yields.[13] Heat stress can be particularly harmful to dietary diversity: it reduces fruit set and accelerates the development of annual vegetables, resulting in yield losses, reduced quality, and increased food loss and waste.[14] Increased atmospheric CO_2 is also projected to lower crop nutritional quality (e.g., wheat grown at 546–586 ppm CO_2 can have 13 percent less protein, 7 percent less zinc, and 8

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[4]Tubiello, F. N., Karl, K., Flammini, A., Gütschow, J., Obli-Laryea, G., Conchedda, G., Pan, X., Qi, S. Y., Halldórudóttir Heiðarsdóttir, H., Wanner, N., Quadrelli, R., Rocha Souza, L., Benoit, P., Hayek, M., Sandalow, D., Mencos Contreras, E., Rosenzweig, C., Rosero Moncayo, J., Conforti, P., & Torero, M. (2022). Pre- and post-production processes increasingly dominate greenhouse gas emissions from agri-food systems. *Earth System Science Data*, *14*(4), 1795–1809. https://doi.org/10.5194/essd-14-1795-2022

[5]Rosenzweig, C., Mbow, C., Barioni, L.G. *et al.* (2020). Climate change responses benefit from a global food system approach. *Nat Food* 1, 94–97. https://doi.org/10.1038/s43016-020-0031-z

[6] USAID Low Emissions Agriculture and Food Systems Advisory Group. 2023.Technical Note: Low Emissions Agriculture and Food Systems Development Opportunities in Support of Food Security and Climate Action. https://www.climatelinks.org/sites/default/files/asset/document/2023-08/USAID-LEAFS-Technical-Note-Aug-2023.pdf

[7]Fleming, S. (2019). *This is how rice is hurting the planet.* World Economic Forum. https://www.weforum.org/agenda/2019/06/how-rice-is-hurting-the-planet/

[8]FAO. (2021). *Emissions due to agriculture: Global, regional and country trends 2008 - 2018.* (FAOSTAT Analytical Brief 18). https://www.fao.org/3/cb3808en/cb3808en.pdf

[9]IPCC. (2022). Summary for Policymakers. In P.R. Shukla, J. Skea, A. Reisinger, R. Slade, R. Fradera, M. Pathak, A. Al Khourdajie, M. Belkacemi, R. van Diemen, A. Hasija, G. Lisboa, S. Luz, J. Malley, D. McCollum, S. Some, P. Vyas, (Eds.), *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* (p.38). https://doi.org/10.1017/9781009157926.001

[10]U.S. EPA. (2021, April). *Climate Change Indicators: Heavy Precipitation*. https://www.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation

[11]Ekins, P. (2021, December 23). *Climate change and food: The potential impact on production and prices*. World Economic Forum. https://www.weforum.org/agenda/2021/12/climate-change-extreme-weather-food-shortages-rise-prices/

[12]IPCC. (2022). Summary for Policymakers. In H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (Eds.), *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.*

[13]Lobell, D. B., and Field, C. B. (2007). Global scale climate–crop yield relationships and the impacts of recent warming. *Environ. Res. Lett. 2,* 014002. https://doi.org/10.1088/1748-9326/2/1/014002.

[14]Mbow, C., Rosenzweig, C., Barioni, L.G., Benton, T.G., Herrero, M., Krishnapillai, M., Liwenga, E., Pradhan, P., Rivera-Ferre, M.G., Sapkota, T., Tubiello, F.N., & Xu, Y. (2019). Food Security. In P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (Eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.* Cambridge University Press. (pp. 437–550). https://www.ipcc.ch/site/assets/uploads/sites/4/2021/02/08_Chapter-5_3.pdf

percent less iron).[15] Climate change drives an increased risk of correlated production shocks across major food producing regions (breadbaskets). Recent analysis suggests that wheat, maize, and soybean crops may be particularly vulnerable to simultaneous failure,[16] with severe implications for a globally interdependent food system.

Approximately 735 million people were affected by hunger in 2022, while 2.4 billion, nearly 30 percent of the world's population, were moderately or severely food insecure.[17] Regional disparities are pronounced: nearly a third of East Africans faced hunger last year while the prevalence in Latin America and the Caribbean was under 7 percent. The countries facing the highest levels of food insecurity today are also typically those where increasing temperatures have the greatest negative impacts on agricultural production systems.[18] For countries in the tropics, increased temperature and heat stress will lead to hard limits of adaptation for agricultural production even in a 1.5°C warming scenario.[19,20]

The burdens of climate change on subsistence and survival are not equally shared: vulnerable groups such as women, children, youth, Indigenous Peoples, and other underrepresented populations face the greatest impacts due to unequal access to and control over information, resources, and decision-making processes. The social and economic drivers of vulnerability are visible in the fact that climate impacts usually reinforce preexisting patterns of marginalization.[21,22] In times of climate crisis, underrepresented groups suffer disproportionately from insufficient caloric intake and poor dietary quality as well as from reduced access to actionable information in public fora.[23,24,25,26,27,28]

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[15]Mbow, C., Rosenzweig, C., Barioni, L.G., Benton, T.G., Herrero, M., Krishnapillai, M., Liwenga, E., Pradhan, P., Rivera-Ferre, M.G., Sapkota, T., Tubiello, F.N., & Xu, Y. (2019). Food Security. In P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (Eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.* Cambridge University Press. (pp. 437–550). https://www.ipcc.ch/site/assets/uploads/sites/4/2021/02/08_Chapter-5_3.pdf

[16]Gaupp, F., Hall, J., Hochrainer-Stigler, S., & Dadson, S. (2020). Changing risks of simultaneous global breadbasket failure. *Nat. Clim. Chang.* 10, 54–57 (2020). https://doi.org/10.1038/s41558-019-0600-z

[17]FAO, IFAD, UNICEF, WFP and WHO. (2023). *The State of Food Security and Nutrition in the World 2023: Food Security and Nutrition Around the World*. FAO. https://www.fao.org/3/cc3017en/online/state-food-security-and-nutrition-2023/food-security-nutrition-indicators.html

[18]Agnolucci, P., Rapti, C., Alexander, P. *et al.* (2020). Impacts of rising temperatures and farm management practices on global yields of 18 crops. *Nat Food* 1, 562–571. https://doi.org/10.1038/s43016-020-00148-x

[19]Pörtner, H.-O., Roberts, D.C., Adams, H., Adelekan, I., Adler, C., Adrian, R., Aldunce, P., Ali, E., Ara Begum, R., Bednar-Friedl, B., Bezner Kerr, R., Biesbroek, R., Birkmann, J., Bowen, K., Caretta, M.A., Carnicer, J., Castellanos, E., Cheong, T.S., Chow, W., … & Zaiton Ibrahim, Z. (2022). Technical Summary. In H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (Eds.), Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 37–118). Cambridge University Press. doi:10.1017/9781009325844.002.

[20]Ericksen, P., Thornton, P., Notenbaert, A., Cramer, L., Jones, P., & Herrero, M. (2011). *Mapping hotspots of climate change and food insecurity in the global tropics*. (CCAFS Report 5). CCAFS. https://hdl.handle.net/10568/3826

[21]United Nations Environment Programme. (2021). *Emissions Gap Report 2021: The Heat Is On – A World of Climate Promises Not Yet Delivered.* United Nations. https://www.unep.org/emissions-gap-report-2021

[22]Carr, E. R., & Thompson, M. C. (2014). Gender and Climate Change Adaptation in Agrarian Settings: Current Thinking, New Directions, and Research Frontiers. *Geography Compass, 8*(3), 182. https://doi.org/10.1111/GEC3.12121

[23]Herforth, A., Bai, Y., Venkat, A., Mahrt, K., Ebel, A. & Masters, W.A. (2020). C*ost and affordability of healthy diets across and within countries. Background paper for The State of Food Security and Nutrition in the World 2020.* FAO Agricultural Development Economics Technical Study No. 9. FAO. https://doi.org/10.4060/cb2431en

[24]Nguyen, P. H., G. Strizich, A. Lowe, H. Nguyen, H. Pham, T. V. Truong, U. Ramakrishnan. (2013). Food Consumption Patterns and Associated Factors among VietNamese Women of Reproductive Age. Nutrition Journal 12(1): 126. https://doi.org/10.1186/1475-2891-12-126

[25]Huyer, S., Simelton, E., Chanana, N., Mulema, A.A., & Marty, E. a. (2021). Expanding opportunities: Scaling up gender and social inclusion in Climate-Resilient Agriculture. An equality and empowerment approach. [AICCRA Info Note]. CGIAR, Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA). https://hdl.handle.net/10568/114223

[26]Tall, A., Kristjanson, P., Chaudhury, M., McKune, S. and Zougmore, R. (2014). Who gets the Information? Gender, power and equity considerations in the design of climate services for farmers. [CCAFS Working Paper No. 89.] CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). https://hdl.handle.net/10568/49673

[27]Carr, E. R., Goble, R., Rosko, H. M., Vaughan, C., & Hansen, J. (2020). Identifying Climate Information Services Users and Their Needs in Sub-Saharan Africa: A Review and Learning Agenda. Climate and Development 12, no. 1 (2020): 23–41. https://doi.org/10.1080/17565529.2019.1596061

[28]Nyasimi, M., & Huyer, S. (2017). Closing the gender gap in agriculture under climate change. Agriculture for Development 30:37-40. https://hdl.handle.net/10568

In many regions, livelihood shifts and climate-driven migration are well underway. Multi-seasonal droughts have displaced 1.8 million people in the Horn of Africa in just two years.[29,30] By 2050, over 200 million people[31] are projected to be displaced by shifting climate conditions, including water scarcity, reduced crop productivity, and sea level rise or storm surge.[32] The migration of crop production areas has moderated the most damaging impacts of rising temperatures for rainfed maize, wheat, and rice but continued migration may incur significant environmental costs.[33] Trends in climate-induced crop failure and migration also raise difficult questions about the viable livelihoods pathways and resilience of producer communities the world over.

The need to limit the agrifood system GHG emissions, maximize carbon sequestration, safeguard production, conserve forests and water resources, and enhance adaptation and resilience is acute and unprecedented. The requisite scale of immediate change needed, aggregated across many technical, institutional, and social domains to yield results by 2030, cannot be achieved through incremental progress alone.[34]

The Scale of USAID's Ambitions

At the launch of the USAID Climate Strategy (2022–2030)[35] on April 21, 2022, Administrator Samantha Power stated, "President Biden has boldly said that every agency must become a climate agency, and [...] we are urgently taking up that call." Months later, Administrator Power underscored that climate change affects all aspects of the Agency's work, and that the "climate agenda really is permeating [...], not only all bureaus, to speak bureaucratically, but all programmatic decisions, or needs to be."[36]

To achieve its ambitious Climate Strategy goals, the Agency will need to implement a variety of operational and technical tools at local, national, and global levels, and plan strategically for their mutual reinforcement. This report outlines strategic operational and technical shifts to support Climate Strategy success within agrifood systems and presents seven recommendations to bolster them.

III. USAID Climate Operations and Challenges

Climate Change Policies, Funding, and Priorities

USAID has the foundational policies and structures in place to drive scalable results at the nexus of climate and agrifood system work. Funding remains a significant challenge, underscoring the importance of synergistic investments.

The Climate Strategy outlines a "whole-of-agency" approach to its two strategic and interdependent objectives: direct targeted action and systems change, each with an attendant set of Intermediate Results (nine in total) that include focused adaptation and mitigation efforts. USAID aims to maximize the impacts of these efforts by targeting locations with the most urgent

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[29]IOM. (2022, November). *Horn of Africa Drought 2022: Human Mobility Snapshot*. The UN Migration Agency, International Organization for Migration. https://displacement.iom.int/sites/g/files/tmzbdl1461/files/reports/IOM_DTM_EHoA_Drought_Snapshot_Nov22.pdf

[30]Funk, C., Pedreros, D., Nicholson, S., Hoell, A., Korecha, D., Galu, G., Artan, G., Segele, Z., Tadege, A., Atheru, Z., Teshome, F., Hailermariam, K., Harrison, L., & Pomposi, C. (2019). Examining the Potential Contributions of Extreme "Western V" Sea Surface Temperatures to the 2017 March–June East African Drought. *Bulletin of the American Meteorological Society, 100*(1), S55–S60. https://doi.org/10.1175/BAMS-D-18-0108.1

[31]This figure includes 86 million displaced people in Africa and 49 million in East Asia and the Pacific.

[32]Clement, V., Rigaud, K. K., de Sherbinin, A., Jones, B., Adamo, S., Schewe, J., Sadiq, N., and Shabahat, E. (2021). *Groundswell Part 2: Acting on Internal Climate Migration*. World Bank. http://hdl.handle.net/10986/36248.

[33]Sloat, L.L., Davis, S.J., Gerber, J.S. *et al.* (2020). Climate adaptation by crop migration. *Nat Commun* 11, 1243. https://doi.org/10.1038/s41467-020-15076-4

[34]IPCC. (2022, April 4). *The evidence is clear: The time for action is now. We can halve emissions by 2030.* [Press release]. https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/

[35]USAID. (2022). *USAID Climate Strategy 2022-2030*. U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy

[36]Power, S. (2022, July 18). *The State of Global Food Security and Nutrition*. [Speech]. Center for Strategic and International Studies. https://www.csis.org/events/usaid-administrator-power-state-global-food-security-and-nutrition

needs and the most immediate and promising opportunities. At the same time, the Strategy acknowledges that fully addressing the climate crisis requires long-term, transformative changes that permeate every aspect of society. USAID will take a systems approach to these larger transformations while centering equity and local leadership. The Strategy also identifies four areas of comparative advantage for the Agency: its global presence, its longevity as a trusted partner, its breadth of expertise, and its convening power.

USAID's global agricultural investments are informed by the U.S. Government Global Food Security Strategy (GFSS),[37] based on legislation first authorized in 2016. The GFSS, updated in 2022, aims to sustainably reduce global poverty, hunger, and malnutrition and operationalizes Feed the Future. It has three main objectives: (1) inclusive and sustainable agriculture-led economic growth; (2) strengthened resilience among people, communities, countries, and systems; and (3) a well-nourished population, especially among women and children. Feed the Future has targeted specific countries for over a decade and currently focuses investments in 20 countries across Central America, sub-Saharan Africa, and South Asia[38] The GFSS identifies climate change as a significant risk to achieving agriculture-led economic growth while emphasizing adaptation and mitigation co-benefits.[39] Its accompanying Research Strategy similarly incorporates climate-smart agricultural innovation as a primary theme.[40] Other sources of funding that shape agricultural investment priorities include Sustainable Landscapes, Economic Growth, and Climate Adaptation.

Despite the ambition of these strategies to elevate adaptation and mitigation across the Agency's portfolio, funding challenges are acute. In September 2021, at the United Nations General Assembly, President Biden stated his intent to double U.S. financing, to $11.4 billion per year, to help developing countries tackle the climate crisis—"to support the countries and people that will be hit the hardest and that have the fewest resources to help them adapt."[41] Progress towards that target has been stalled. At the 15th Conference of Parties (COP) in 2009, developed countries collectively targeted the mobilization of $100 billion U.S. per year to accelerate climate action in developing countries by 2020.[42] The OECD estimates that donors, including the United States, fell nearly $17 billion short of that shared goal.

Building on the publication of the Climate Strategy in 2022, the Fiscal Year (FY) 2023 budget request sought to double State and Foreign Operations climate funding from a $2 billion base, but funding flatlined.[43] Of the total FY23 enacted budget of $59.7 billion, less than one percent ($715 million[44]) was appropriated for climate-focused work in adaptation ($270 million), sustainable landscapes ($185 million), and clean energy ($260 million).[45] Global agricultural funding, meanwhile, summed to $1 billion in FY23.[46] Such direct funding limitations underline the critical role of efficient, demand-driven partnerships.

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[37]U.S. Government. (2022). *U.S. Government Global Food Security Strategy, 2022–2026.* https://www.usaid.gov/what-we-do/agriculture-and-food-security/us-government-global-food-security-strategy

[38]Feed the Future. (n.d.) *Countries*. U.S. Government. https://www.feedthefuture.gov/countries/

[39]U.S. Government, *U.S. Government Global Food Security Strategy, 2022–2026, p.27.*

[40]U.S. Government. (2022). *U.S. Government Global Food Research Security Strategy, 2022–2026.*

[41]"U.S. International Climate Finance: FY2024." *CRS Reports*, 24 Apr. 2023, crsreports.congress.gov/product/pdf/IF/IF12036.

[42]OECD. (2022). *Climate Finance Provided and Mobilised by Developed Countries in 2016-2020: Insights from Disaggregated Analysis*. Climate Finance and the USD 100 Billion Goal, OECD Publishing. https://doi.org/10.1787/286dae5d-en.

[43]USAID. (2023). Fiscal Year (FY) 2023 President's Budget Request for the United States Agency for International Development (USAID). [Fact Sheet]. https://www.usaid.gov/news-information/fact-sheets/fiscal-year-2023-presidents-budget-request-usaid

[44]U.S. House Committee on Appropriations. (2023). *State, Foreign Operations, and Related Programs.* U.S. House of Representatives. https://appropriations.house.gov/sites/democrats.appropriations.house.gov/files/documents/FY23%20SFOPS%20Summary.pdf#:~:text=The%202023%20State%2C%20Foreign%20Operations%2C%20and%20Related%20Programs,above%202022%20%E2%80%93%20an%20increase%20of%2015%20percent

[45]U.S. House Committee on Appropriations. (2023). *Consolidated Appropriations Act, 2023: Summary of Appropriations Provisions by Subcommittee.* U.S. House of Representatives.

[46]U.S. House Committee on Appropriations. (2023). *State, Foreign Operations, and Related Programs.* U.S. House of Representatives. https://appropriations.house.gov/sites/democrats.appropriations.house.gov/files/documents/FY23%20SFOPS%20Summary.pdf#:~:text=The%202023%20State%2C%20Foreign%20Operations%2C%20and%20Related%20Programs,above%202022%20%E2%80%93%20an%20increase%20of%2015%20percent

Coordination and deployment of climate and agricultural budgetary resources will be enhanced by the ongoing reorganization of the Bureau for Resilience and Food Security (RFS), which leads the Agency's GFSS implementation. The 2023 establishment of the Bureau for Resilience, Environment, and Food Security (REFS) brings Agency offices in climate mitigation, energy, environment, and biodiversity together with the Bureau's existing expertise in agricultural growth and food security. The new structure creates specific opportunities to align Climate Strategy and GFSS priorities, to better leverage co-benefits across their respective technical domains, and to standardize measurement and reporting to accelerate progress in their overlapping mandates.

With USAID's new structure merging cadres of technical experts, networks, and data to better integrate climate and agricultural investments, it is better positioned than ever before to bring its many strengths and assets to bear on the defining challenge of our time. The Agency's comparative advantages in leading a global climate change response include its global presence, relationships with local government and civil society, a vast network of implementing and research partners to learn from, deep technical knowledge, and an unparalleled ability to influence other donors and multilateral organizations.

Challenges

The Agency faces a variety of operational challenges to meeting ambitious Climate Strategy targets. Although the Strategy is designed as a whole-of-agency approach, climate is not yet integrated operationally as a core, universal development objective (DO). Analysis of USAID program guidance documents (such as Country Risk Profiles), tools (such as Climate Risk Assessments), and key informant responses revealed that Climate change is still largely treated by the Agency as a risk to programming rather than an imperative for action. The Agency's focus on climate change continues to emphasize managing risks to ensure that investments are not disrupted by climate shocks. While important, this approach fails to identify and prioritize climate adaptation and mitigation interventions that will achieve the Strategy's targets. Most current climate-focused efforts remain siloed into specific development objectives, rather than integrated across them.

Although the Agency has developed helpful and relevant tools and processes such as the Climate Risk Management Screening,[47] Initial Environmental Examinations,[48] and Market Systems Resilience Framework,[49] the degree to which these resources are used is inconsistent across Operating Units (OUs)[50] in part due to inadequate investment in testing, adapting, validating, and integrating them into USAID processes and protocols.

While analyses such as Climate Annexes are required inputs in Country Development Cooperation Strategies (CDCS),[51] they lack broader integration into development objectives and CDCSs for a number of reasons. First, key informant interviews (KIIs) revealed a lack of technical expertise to fully utilize climate information. They also showed a lack of clarity around both climate information integration requirements and goals for development objectives that are not primarily focused on climate change and/or do not receive climate funding. In addition, the climate information used for CDCS, program, and activity design, such as Country Risk Profiles, is not always fit-for-purpose and often lacks the necessary precision.

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[47]USAID. (2017). Climate Risk Screening and Management Tools. https://www.climatelinks.org/resources/climate-risk-screening-and-management-tools

[48]USAID. (n.d.). Initial Environmental Examination. https://ecd.usaid.gov/repository/pdf/50497.pdf

[49]Downing, J., Field, M., Ripley, M., & Sebstad, J. (2018). *Market Systems Resilience: A Framework for Measurement.* USAID Bureau of Food Security. https://www.marketlinks.org/sites/default/files/media/file/2020-09/Market-Systems-Resilience-Measurement-Framework-Report-Final_public-August-2019.pdf

[50]USAID operating units are the Agency's major organization units and include bureaus and Missions.

[51]USAID (n.d.). Country Development Cooperation Strategies (CDCS). https://www.usaid.gov/results-and-data/planning/country-strategies-cdcs

The Agency has comprehensive guidance and reporting on its inventory of climate indicators. However, directives for comprehensive reporting on Climate Strategy target progress remain unclear and limited to climate-related programs and activities (see text box below for specific Climate Strategy language). Agencywide Strategy target indicators and guidance on data collection, measurement, reporting accountability, and leadership are still under development. Despite the Climate Strategy requirement, to date, not all OUs have set targets that align with and contribute to the Climate Strategy. Furthermore, many OUs underreport their climate-related contributions because staff lack clarity on which climate-related indicators they are required to report on, especially if activities do not receive direct climate change-related funding. Staff are not sufficiently trained on the collection of climate data, specifically as it pertains to mitigation outcomes.

From the USAID Climate Strategy:

*"*To ensure continued and rapid implementation of the Strategy, all Operating Units across the Agency must consider how they will contribute to the Strategy's Strategic Objectives, Intermediate Results, and Targets in forthcoming strategic planning processes….

- USAID Missions and field Operating Units must incorporate their contributions to the Climate Strategy Intermediate Results and Targets in forthcoming Regional and Country Development Cooperation Strategies (R/CDCS) or equivalent planning documents, as appropriate to their unique circumstances. In the near term, if a new R/CDCS is not under development, Missions and other field Operating Units must identify opportunities and programming priorities aligned with the Strategy's Intermediate Results and Targets by reviewing and adding a short section to their existing R/CDCS Climate Annex as appropriate to their context." (page 39)

As evidenced through its research investments and partnerships, USAID maintains a strong agricultural and food security research portfolio, including, but not limited to, the Feed the Future Innovation Labs.[52] However, analysis of publicly available information about USAID's research investments, interviews with USAID staff, and a poll of external researchers revealed that climate change is not sufficiently integrated across these research investments. While USAID has made investments in research at the intersection of agriculture, food security, and climate change,[53] more prospective research on future climate impacts and climate-resilient pathways relevant to agriculture and food security programmatic and geographic priorities was an identified gap. Analysis also revealed insufficient focus on the full agrifood system (between production on one end and consumption on the other), and a lack of clear pathways to scale research and innovation. As a result, the Agency has not generated the systematic evidence, approaches, and products needed to address climate impacts on agriculture and food security. Research efforts are often insufficiently coordinated with Missions, other U.S. federal agencies, academic and research institutions, partner country research efforts, and the private sector, undermining USAID's potential to address the climate crisis.

Budgetary allocations limit the resources available for targeted climate efforts. Less than 1 percent of the State Department and USAID budget is allocated for Agency climate work in adaptation, sustainable landscapes, and clean energy—an insufficient amount to meet Climate Strategy targets. In addition, Congressionally determined climate funding is not always aligned with the technical or geographical priorities defined by USAID climate change experts. Staff also report that underinvestment in human resources results in insufficient expertise, training, and staffing to reach Agency climate goals.

[52]U.S. Government. Feed the Future Innovation Labs. https://www.feedthefuture.gov/feed-the-future-innovation-labs/
[53]See, for example, the 2011-2015 research project "Improved Modeling of Household Food Security Decision Making and Investments Given Climate Change Uncertainty," funded by USAID. https://pdf.usaid.gov/pdf_docs/PA00KQB7.pdf

Missions are geographically constrained by USAID focus areas, such as Feed the Future (FTF) Zones of Influence (ZOI), that do not always align with environmental and natural resource potential, reducing their capacity to make opportunistic funding and programmatic decisions for climate mitigation or adaptation activities that extend beyond ZOI borders. Earmarked funds also limit multi-sectoral resilience programming within climate activities. Despite the five-year CDCS and activity cycles, Missions have the potential to provide consistent investment in climate change adaptation and mitigation at the time scales necessary to realize targeted long-term outcomes, in addition to short-term or incremental changes that may be necessary for food security or humanitarian objectives. However, these efforts are hampered when the political mandate and, therefore, the funding priorities, fluctuate significantly from one programming cycle to the next, and could lead to unsustainable or maladaptive changes that do not align with or contribute to longer-term climate goals. Furthermore, the Agency is not fully leveraging its ability to co-fund and de-risk climate investments across other U.S. government entities, including the U.S. International Development Finance Cooperation.

There is strong buy-in for the Agency's Climate Strategy across Bureaus and Missions. However, there is not yet consensus on how to meet both food security goals and climate change adaptation and mitigation targets. In a time- and funding-constrained environment, these objectives can also be perceived as being at odds. Those outside of climate-specific initiatives lack clarity on the degree to which their work should incorporate climate. Those focused on climate-specific initiatives, on the other hand, believe that climate is insufficiently integrated. There is a need for the new B/REFS to reach a strategic consensus among Agency staff about the prioritization of climate adaptation and mitigation (and their integration) within USAID agriculture and food security investments.

IV. Targets

The recommendations presented here for transformative change across operational and technical domains and within broader systems serve the ultimate goals of driving measurable impact and enhancing accountability. USAID's Climate Strategy puts forward six 2030 targets to measure progress, including the prevention of six billion metric tons of carbon dioxide-equivalent ($MtCO_2e$) emissions, the improved resilience of 500 million people, and the mobilization of $150 billion in public and private finance. The current targets cut across all sectors. In alignment with the Agency's approach to hold itself accountable, the report presents disaggregated targets within these same categories for the agrifood sector. The proposed targets may require further refinement in addition to clear management and tracking systems. The methodologies behind the development of these targets are laid out in Appendix F.

2030 Adaptation Target

> ***Enable the improved climate resilience of at least 180 million people who depend on agriculture.***

To instigate a transformation in agrifood systems, USAID should enhance its resilience initiatives and extend its reach.The Climate Strategy has an adaptation target of supporting 500 million people with improved climate resilience. Within the bounds of the whole-of-agency Climate Strategy adaptation target, USAID should aim to improve the climate resilience of 180 million people who depend on agriculture by 2030. USAID investments (disbursements) were assessed across 134 countries where the Agency worked in between 2014 and 2022[54] (see

[54]USAID. (2022). *Dollars to Results: USAID investments and illustrative results.* All sectors, FY21. U.S. Agency for International Development. https://results.usaid.gov/results/sector?fiscalYear=2021

Appendix F for a detailed methodological approach to country selection and target calculation). Across those countries, 1.8 billion people rely on agriculture for their livelihoods. The proposed target of 180 million is informed by the order of magnitude of the Climate Strategy target, applying the share of those working in agriculture across these 134 countries (36 percent) to the Strategy's 500 million-person goal.

USAID should also develop at least one impact-based target to assess the effectiveness of Agency adaptation efforts. The Climate Strategy adaptation target is not well defined or linked to a clear, standardized indicator. This definition and associated measurement transparency are overdue. Climate resilience is both challenging to measure directly and consistently and is itself a means to the end of protecting and improving human well-being. While outcome targets are commonly used as a proxy for impacts, they fall short of indicating a transformative result. To capture the ambition of broad-based impacts, USAID should develop at least one impact-based target. An illustrative target that could be adopted or modified to track the impact of USAID agrifood system investments is the following.

> *Illustrative Impact Target: Reduce the number of additional people pushed into extreme poverty because of climate impacts on agrifood systems by 50 million, at least half of whom are women.*

This target aims to effectively reduce the number of additional people pushed into extreme poverty because of climate change impacts on agrifood systems by 50 million by the year 2030. At least half of the target should comprise women. This impact target focuses on the reduction of extreme poverty as a result of enhanced resilience, with income as the measurement against progress. Considering USAID works in regions where poverty levels are high, an examination of extreme poverty can inform approaches to strengthening the resilience of vulnerable populations to withstand climate-specific shocks and stressors. A detailed methodology of this illustrative approach is provided in Appendix F.

While this illustrative impact target focuses on economic capability vis-à-vis poverty levels, other dimensions of adaptive capacity should also be acknowledged. These encompass social capabilities (such as involvement in social groups), human resource capabilities (like educational attainment), and institutional capabilities (e.g., access to financial services, markets, transportation, healthcare facilities).[55] In formulating targets centered on generating positive impact, we recommend that USAID take into account these additional dimensions of adaptive capacity.

2030 Mitigation Target

> ***Reduce emissions from agrifood systems by 1.2 GtCO_2e/yr while supporting initiatives to reduce the conversion of forest, grasslands, or peatlands into agricultural use.***

The Climate Strategy has a mitigation target of 6 $GtCO_2e$ over the eight-year strategy lifespan. This is an important marker of USAID's net contributions to mitigation, but mitigation will be an ongoing effort as the Agency seeks to shift agrifood systems toward resilient, low emissions futures. To capture ongoing impact, USAID should set an annual agrifood systems emissions reduction target of 1.2 $GtCO_2e$ by 2030 and in each year thereafter. This target would be achieved as follows:

- 0.6 $GtCO_2e$/yr in reduced on-farm emissions in USAID operating countries

[55] Jamshidi, O., Asadi, A., Kalantari, K., Movahhed Moghaddam, S., Dadrass Javan, F., Azadi, H., ... & Witlox, F. (2020). Adaptive capacity of smallholder farmers toward climate change: evidence from Hamadan province in Iran. Climate and Development, 12(10), 923-933.

- 0.6 $GtCO_2e$/yr in reduced food system emissions
- Initiatives to reduce the conversion of forest, grasslands, or peatlands into agricultural use

The ambitious level of this target represents an annual reduction in GHG emissions equivalent to the total emissions of Brazil, Indonesia, or Japan. If targeted through locally appropriate pathways, these emissions reductions are compatible with improved production, incomes, and nutrition. This target could make a particularly meaningful impact on reducing anthropogenic methane, which traps roughly 80 times as much heat as carbon dioxide over 20 years[56] and of which agriculture is the main source.[57] USAID can also draw from its significant experience exploring the efficacy of multiple approaches to reducing land conversion for agricultural purposes.[58] Reaching the target will require time and resources for startup, but could generate a cumulative emissions mitigation of approximately 3.5 $GtCO_2e$ across the lifespan of the Climate Strategy, with the majority achieved in its final years as projects begin to yield benefits. This prospective total is equivalent to approximately 7 percent of all US emissions over the same period.[59] It constitutes less than 1 percent of global GHG emissions across the strategy lifespan. A detailed methodology is presented in Appendix F.

2030 Climate Finance Target

> ***Mobilize $36 billion in climate finance for agrifood systems, with at least 30 percent used for gender- and socially inclusive investments.***

USAID's Climate Strategy sets a goal of mobilizing $150 billion in additional public and private climate finance across all sectors by 2030 and aims to catalyze an investment of $10 in partner financing for every dollar of its own.[60] In the Climate Strategy's first year of implementation, the Agency reports having mobilized more than $340 million.[61] There is currently no agrifood systems-specific climate finance target within the broader strategy. By assessing the share of the agrifood system's climate finance requirement relative to the total climate finance needed across all sectors, and extrapolating this proportion to the Agency-wide climate strategy finance target of 150 billion, this study proposes a target of mobilizing $36 billion for agrifood systems by 2030.Detailed methodology is presented in Appendix F.

Given the environmental, social, and political importance of addressing climate in the sector, the authors consider this target to be significantly below what is needed. To put it in perspective, this target is equivalent to approximately $5 billion per year, or only about 2 percent of the $212 billion annual sectoral need estimated by the most conservative scenario.[62] This is disproportionately low, taking into account USAID's global positioning. Public sector climate finance should account for at least 70 percent of the overall recommended climate finance target (see Text box). Private sector finance should account for approximately 30 percent of the total target.

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[56]USAID. (2023). *Low Emissions Agriculture and Food Systems Development Opportunities in Support of Food Security and Climate Action.* [Technical note]. U.S. Agency for International Development. https://www.climatelinks.org/sites/default/files/asset/document/2023-08/USAID-LEAFS-Technical-Note-Aug-2023.pdf

[57]CLEAR Center. (2023, January 6). *A Summary of the UN FAO Methane Emissions in Livestock and Rice Systems.* Clarity and Leadership for Environmental Awareness and Research, University of California, Davis. https://clear.ucdavis.edu/news/summary-un-fao-methane-emissions-livestock-and-rice-systems#:~:text=According%20to%20the%20UN%E2%80%99s%20Environment%20Program%2C%20agriculture%20is,accounting%20for%20roughly%2032%25%20of%20anthropogenic%20methane%20emissions.

[58]ProLand. (2021). *Agriculture's Footprint: Designing Investment in Agricultural Landscapes to Mitigate Tropical Forest Impacts*. Report of the ProLand Project, implemented by Tetra Tech and funded by the US Agency for International Development. https://www.climatelinks.org/resources/agricultures-footprint-designing-investment-agricultural-landscapes-mitigate-tropical

[59]Assuming constant emissions at current levels

[60]USAID. (2022). *USAID Climate Strategy 2022-2030*. U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy

[61]USAID. (2023). *USAID Climate Strategy: Year 1 Review.* U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy/jun-2023-progress

[62]Chiriac, D., Vishnumolakala, H., & Rosane, P. (2023). *Landscape of Climate Finance for Agrifood Systems*. Climate Policy Initiative. https://www.climatepolicyinitiative.org/wp-content/uploads/2023/07/Landscape-of-Climate-Finance-for-Agrifood-Systems.pdf

USAID's 10:1 co-investment target can apply to agricultural and food systems. This higher ratio could be achieved by partnering with national governments to realign public funds going into agriculture to systematically incorporate climate adaptation and mitigation practices, redirecting a portion of the approximately $USD 670 billion per year[63] that goes annually to producers, while also supporting countries NAPs and NDC.

The purpose of this finance is to improve farmer and agribusiness resilience through adaptation as well as mitigation efforts (e.g., promoting forest conservation, reducing deforestation). USAID can catalyze climate finance using a variety of tools, including grants, guarantees, PPP and alliances, and technical assistance facilitation. For example, USAID could de-risk private investment linked to agricultural programs that promote climate adaptation, forest conservation, and/or mitigation, or scale up blended finance mechanisms that promote adaptation and mitigation with impact investors and/or leverage multinational GHG commitments. See the Inclusive Climate Finance Leverage Point, below, for additional ideas and approaches.

To reflect the Agency's commitment to increasing equitable access to climate finance, USAID should establish agrifood system financing targets tailored for underrepresented groups, applying an intersectional lens (see Appendix A: Definition of Terms). For example, USAID could leverage its investment in the Climate Gender Equity Fund. A significant gap in financing for businesses with leadership from traditionally underrepresented groups, including youth and Indigenous Peoples, persists across agriculture and sectors despite indications that loans to more inclusive businesses may carry less risk of default, yield higher returns, and unlock greater access to other funding.[64] In alignment with the criteria of the 2X Challenge,[65] a joint commitment of DFIs to increase global investment in women, USAID should consider a target of investing at least 30 percent of its direct climate financing into gender-inclusive businesses and initiatives.

V. Recommendations for Transformation

Institutional Change: Opportunities within the Agency

Effective operationalization of the Climate Strategy within USAID's agricultural and food security portfolio requires significant organizational change. It will depend on intentional and thoughtful shifts in the development of CDCSs, focus geographies, projects, and activities. It further relies on the consolidation of climate activity results, measurement, and reporting, and a reassessment of Agency research investments, funding decisions, and staff capacity building.

The following recommendations describe changes that will better position USAID to achieve Climate Strategy objectives through its agrifood systems programming based on an informed understanding of the status quo, the ambition of the Climate Strategy, and significant consultation with USAID staff across the Agency.

[63]World Bank. (2023). *Detox Development: Repurposing environmentally harmful subsidies*. World Bank. https://www.worldbank.org/en/topic/climatechange/ publication/detox-development

[64]Naeve, K., & Moehler, V. (2022). *Inclusion Pays: The Returns on Investing in Women in Agriculture*. Root Capital. https://rootcapital.org/inclusion-pays/

[65] https://www.2xchallenge.org/

Recommendation 1: Strategy, Design, and Implementation in the Program Cycle

The Agency should require the use of climate-related data (such as climate risk, climate variability and projection, and impact data) across the full program cycle for agrifood system investments to balance the potential for long-term climate-resilient agricultural gains with immediate food security needs. It should also consider the potential co-benefits and trade-offs among mitigation, adaptation, and agricultural or food security outcomes:

- *Strategy Design* - the Agency should fully embed data on how agrifood systems are impacted by climate change and identify pathways to reduce a) vulnerability to current and projected climate change and/or b) GHG emissions (beyond what is currently required by Climate Risk Assessments). This information should be integrated into the text and Results Frameworks of Country Development Cooperation Strategies (CDCS) themselves, not just in Climate Annexes. USAID should also allow for flexibility around geographical focus areas–including FTF ZOIs–to address climate opportunities at an ecosystem level that goes beyond specific farming systems or agricultural landscapes;
- *Project and Activity Design* - the Agency should require climate adaptation and/or mitigation interventions within agricultural and food security programs, including those that do not specifically receive climate funding. It should require these activities to incorporate climate considerations across all development objectives within activity-level results frameworks. Agrifood system activity implementation should be measured against, and contribute to, the relevant OUs' committed contributions to Climate Strategy targets (whether or not the activity receives direct climate change funding). USAID should also undertake an informed appraisal of co-benefits or trade-offs between adaptation, mitigation, and agricultural or food security outcomes.
- *Monitoring, Evaluation, and Learning (MEL)* - the Agency should incorporate climate indicator reporting across all agricultural MEL plans and include climate change reviews within CDCS Midcourse Stocktaking exercises to assess the degree to which climate analysis, risks, opportunities, and assumptions proved to be accurate over time, and develop an action plan based on its findings. USAID should also increase investment in a) rigorous evaluations that measure the effects of agricultural programming on climate adaptation and mitigation; and b) implementation studies of agrifood system climate adaptation and mitigation efforts that help to improve and scale climate-smart interventions.

Strategy Design

To fully leverage USAID's agricultural and food security investments to address the climate crisis, climate considerations need to be integrated from the start into CDCS development, geographic prioritization (at both the country and subnational levels), project and activity design, and MEL efforts. USAID should incorporate climate data and plans from partner country governments, including National Adaptation Plans (NAPS) and Nationally Determined Contributions (NDCS), to ensure priority alignment.

CDCSs require a Climate Risk Management approach to assess and integrate climate data,[66] included in a Climate Change Annex. The OU addresses climate change risks with support from regional and pillar Bureaus. Despite wide compliance, there is variation in the quality and timeliness of the underlying climate data–especially data related to how agrifood systems contribute to or are affected by climate change–and the use of data from partner country governments. Climate data, particularly medium-term projections that extend beyond a 5-year CDCS period, are inconsistently incorporated into country strategies, development objectives, and intermediate results. USAID key informant interviews reflect wide-ranging perspectives on the challenges in applying required climate tools and approaches. Some key informants noted a lack of Mission expertise and capacity to fully utilize these resources and a perception that climate analysis is only relevant for climate-specific development objectives. Capacity development and a clear mandate of climate data use will be key to its successful agrifood sector and program integration.

[66]USAID. (2022). *Climate Risk Management for USAID Projects and Activities: Mandatory Reference for ADS Chapter 201.* [ADS Reference 201mal]. https://www.usaid.gov/about-us/agency-policy/series-200/references-chapter/201mal

Geographic boundaries offer both opportunities and challenges to better integrate climate change considerations into agrifood system programming. FTF target country selection is based, by law, on: level of need; potential for FTF programs to spur growth; opportunities for partnership; opportunities for regional efficiencies; host government commitment; and resource availability.[67] To align FTF funding with Climate Strategy goals, USAID should invest in opportunities for climate adaptation and mitigation within selected FTF countries and ensure that food security and productivity improvements contribute to climate goals rather than potentially undermining them (for example, through the release of irrecoverable carbon via land conversion for agriculture[68]). Recognizing that countries targeted based on levels of food insecurity and undernutrition are not generally those with the greatest emissions mitigation potential, USAID should also leverage agricultural funding outside of FTF countries where significant adaptation and mitigation potential and co-benefits exist.

Within FTF countries, the Zone of Influence (ZOI) selection process should consider the potential scope of adaptation and mitigation potential and seek to align climate change benefits with conventional development objectives. This includes expanding programmatic areas to better encompass farming systems, market sheds, and policy jurisdictions. Where ZOI or other programmatic boundaries limit the implementation of climate adaptation and/or mitigation activities, exceptions to those geographic boundaries should be considered. Geographic selection should also address the projected effects of longer-term climate change on the suitability of certain crop and livestock production systems (for example, by identifying where current systems may no longer be viable, and planning for transitions[69]).

Agrifood System Activity Design

Project and activity design should focus on reducing the potential for maladaptation (see text box) while addressing crop, livestock, and livelihood diversification and transitions, even and especially where these transitions are most challenging. USAID designers should extend the timescale of both climate analysis and expected investment outcomes beyond the activity implementation period to avoid potential maladaptations that more incremental approaches could engender. Expanded timescales would include near-term climate variability and change as well as medium-term projections. When designing an intervention, planners should review and address current variability and change, consider how durable and effective project outputs and outcomes will be under expected conditions up to 2040, and consider how these output and outcomes might result in path dependencies that make adaptation to conditions in the longer term (2041–2060) more difficult.

> Maladaptations "are actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future."[70]

It is difficult—sometimes impossible—to retrofit requirements into Agency processes once underway. To strengthen accountability, all procurement-related documents (such as RFPs and ensuing contracts) should include specific requirements around climate risks, opportunities, and

[67] U.S. Government. *About.* Feed the Future. https://www.feedthefuture.gov/about/
[68] ProLand. (2021). *Agriculture's Footprint: Designing Investment in Agricultural Landscapes to Mitigate Tropical Forest Impacts*. Report of the ProLand Project, implemented by Tetra Tech and funded by the US Agency for International Development. https://www.climatelinks.org/resources/agricultures-footprint-designing-investment-agricultural-landscapes-mitigate-tropical
[69] Carter, R., Choularton, R., Ferdinand, T., Ding, H., Ginoya, N., & Preethan, P. (2021). *Food Systems at Risk: Transformative Adaptation for Long-Term Food Security.* World Resources Institute. https://doi.org/doi.org/10.46830/wrirpt.19.00042
[70] IPCC. (2022). Annex II: Glossary. In Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger, (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* (p.2915), pp. 2897–2930. https://doi.org/10.1017/9781009325844.029

objectives to ensure their incorporation into core intervention design, targeted results, and monitoring and evaluation frameworks.

USAID activity planners and CORs must make complex decisions with finite resources around adaptation, mitigation, and development objectives. All projects and activities with the potential for adverse climate impacts must undertake an Initial Environmental Examination, but the quality of these assessments varies.[71] Activity designers, CORs and implementing partners need guidance and clear processes on how to use data and weigh outcomes and impacts across multiple considerations alongside host country partners, and on how to adjust assumptions and priorities based on changing circumstances during implementation. At a minimum, climate assumptions should be updated on an annual basis, alongside year end reporting with an eye towards managing negative unintended impacts as well as maladaptions as climate assumptions change, and the ability to track information at a very localized level increases. For some activities, these assumptions and outcomes should be monitored more frequently (e.g., quarterly, semiannually).

At both the CDCS development and activity design stages, USAID should carefully appraise and manage the potential co-benefits and trade-offs among adaptation, mitigation, and agricultural or food security outcomes. Every activity will not address adaptation, mitigation, and development goals equally. Therefore, an adaptation activity designer should consider potential mitigation impacts and co-benefits as well as potential negative impacts (for example, scaling up new technologies based on non renewable energy sources) and be able to justify the proposed intervention in light of those synergies and/or trade-offs. For example, mitigation actions that shift land use away from agricultural production or reduce access to non-timber forest products can alter local population's access to land and other livelihoods assets, reducing local populations' capacity to adapt to ongoing impacts of variability and change.

This balance between co-benefits and trade-offs will vary by geography and timeline. USAID planners must understand and elevate the mitigation potential of proposed climate-smart agriculture programming while exploring whether adaptation activities could also support mitigation (e.g., forest-friendly agricultural value chains to promote livelihoods diversification and forest conservation[72]). Table 1 describes where adaptation, mitigation, or an integration of the two may be relevant.

Table 1: Geographic Prioritization of Adaptation, Mitigation, and Integrated Approaches

Prioritization	Description	Illustrative Geographic Examples
Adaptation	Regions that have low overall contributions to GHG emissions but are facing early and significant climate impacts	East and Horn of Africa, Sahel, Southern Africa, Central America and the Caribbean, Pacific Islands, South Asia
Mitigation	Regions that are high GHG emitters or are key contributors to sequestration efforts (or both); and/or areas which emphasize certain agricultural commodities that produce methane (livestock and rice)	South Asia (India), Indonesia, Amazon rainforests, Latin American peatlands
Fully Integrated	Regions that have high potential for maximizing adaptation and mitigation benefits within agricultural and food security investments	Congo Basin, Ethiopia, Nigeria, Madagascar, Mozambique, Zambia, Colombia, Guatemala, India, Brazil

A similar approach should be used by USAID planners to consider different contexts and needs within a country. For example, a country like Uganda has wide-ranging geographic zones, from

[71]USAID. (n.d.). Initial Environmental Examination. https://ecd.usaid.gov/repository/pdf/50497.pdf
[72]USAID is currently implementing this approach in USAID Malawi Modern Cooking for Health Forests and USAID Cambodia Greening Prey Lang.

semi-arid grasslands to tropical forests to prime agricultural lands. Countries with very different conditions, like Uganda, need a tailored approach, based on analytics, to ensure overall climate adaptation and mitigation goals are met.

Monitoring, Evaluation, and Learning

USAID's MEL approach for agrifood systems investments should align with the Agency's Climate Strategy goals and targets. Climate adaptation and mitigation indicators should be reported across all agrifood systems activities, not only those receiving specific climate-related funding. In addition, monitoring efforts should assess the degree to which climate analyses, risks, opportunities, and assumptions used for strategy and activity design proved to be accurate over time during CDCS Midcourse Stocktaking exercises. The results of these exercises should then be used to inform action plans to update or improve the use of climate change information in agrifood systems activities. Finally, USAID should invest in rigorous evaluations and studies of its agrifood systems activities to measure their climate adaptation *and* mitigation impacts in addition to conventional sectoral outcomes. Such learning will contribute to both the improvement and the scalability of adaptation and mitigation efforts across the USAID agrifood systems portfolio. Recommendation 2 provides more detail on how USAID can better align aspects of its MEL and reporting systems to support Climate Strategy goals.

Recommendation 2: Measurement and Reporting

USAID should increase the speed of, and accountability for, OUs reaching their contributions to Climate Strategy targets by:

- Requiring OUs to set and own defined contributions to reaching the Agency's adaptation, mitigation, and finance targets by 2024.
- Finalizing standardized agrifood system-specific Climate Strategy indicators and introducing accessible approaches for all OUs to report on them, aggregating adaptation and mitigation benefits across agricultural investments by 2024.
- Developing a tracking and reporting system for OU-specific progress towards Agency targets across all agricultural activities by 2024, not just those with climate funding or a climate objective.
- Introducing accountability measures to ensure consistent and comprehensive OU reporting of Climate Strategy indicators, such as budgetary and performance review incentives.

Although USAID set forth overall Agency targets in the Climate Strategy, OUs have not consistently defined their contributions to those targets. A system to capture and report on OU-specific progress does not currently exist, inhibiting ownership and accountability. All OUs with agricultural and food security programming should define their contributions to Agency targets and track progress towards them. These contributions should be measured across all agricultural and food security projects and activities, not just those with an explicit climate objective or climate funding.

From the USAID Climate Strategy:

"Monitoring, Evaluation, and Learning (MEL) and Reporting

To meet the objectives of the Strategy, all missions and sectors will be asked to contribute to the Strategy's Objectives and Targets, as applicable. New and improved reporting methodologies and procedures and increased capacity in monitoring, evaluation, reporting, and learning are essential to support expanded climate action across the Agency and track progress toward Strategy Objectives and Targets. USAID will increase investment in Agency-wide MEL capacity building and peer-support

working groups. All Operating Units will have identified in a strategic planning document (see Strategic Planning) which of the Strategy's Targets they will contribute to. OUs will subsequently set their own Climate Strategy Targets and report progress on meeting those Targets via their Performance Plan and Report (PPR). USAID will develop an Agency Climate Strategy Monitoring, Evaluation, and Learning Plan. The Agency will also produce a Progress Report presented to the Administrator, Congress, and the general public at a minimum every three years to track progress toward the Targets." (page 40)

To report on progress towards Climate Strategy targets, OUs need standardized climate indicators that are easy to use. The development of these indicators is underway but overdue; existing indicators are inconsistent across Bureaus and funding streams. For example, the Center for Environment, Energy, and Infrastructure (EEI) within the Bureau for Development, Democracy, and Innovation (USAID/DDI) uses indicators from the *USAID 2022 Climate Change Standard Indicator Handbook*,[73] and Feed the Future uses indicators from the *Feed the Future Indicator Handbook*.[74] The divergence of these two sets of indicators for similar measurement goals results in reporting that makes comparisons or aggregation difficult. The *FTF Handbook* indicates that climate indicators should be "required as applicable (RAA)." In practice, OUs have significant discretion in determining indicator applicability and often lack embedded expertise in climate change adaptation and mitigation approaches to make a consistent determination.

Appendix C illustrates the differences between climate indicators across the two sources. For example, although the *FTF Handbook* includes indicators on improved land management practices (which may result in carbon sequestration), it contains no indicators that specifically measure mitigation. The *Climate Change Standard Indicator Handbook*, however, includes three indicators related to the reduction, sequestration, or avoidance of carbon through sustainable landscapes activities. In another example, the FTF indicator for the number of hectares under improved management practices requires that those practices "promote improved climate risk reduction and/or natural resources management," whereas the *Climate Change Handbook* refers to the number of hectares under improved management "expected to reduce GHG emissions."

In addition to the development and use of consistent indicators, Agency leadership should introduce a unified data tracking system, ongoing capacity building functions, and accountability measures to ensure OU reporting on climate indicators in a timely, standardized, and comprehensive manner across all activities and regions. The Agency should also ensure that climate indicator data collection tools are regularly reviewed and updated to ensure measurement precision, accuracy, and uniformity.

Recommendation 3: Research

The Agency's agricultural research portfolio should increase investment in climate-focused research in the following areas:

- Longer-term climate-informed interventions, including food security pathways and production systems that are compatible with future climate conditions and impacts
- Maximizing co-benefits of agrifood system interventions for climate adaptation and mitigation, natural resource management, and biodiversity, including through varied governance and market-based approaches
- Social and behavioral change to develop approaches that support communities making difficult agricultural transitions

[73]USAID. (2022). Climate Change Standard Indicator Handbook. https://www.climatelinks.org/resources/gcc-standard-indicator-handbook
[74]U.S. Government. (2019). Feed the Future Indicator Handbook. https://agrilinks.org/post/feed-future-indicator-handbook

It should also strengthen research partnerships by identifying and supporting research organizations–especially local institutions–and require research to:

- Collaborate with Missions and communities to guide research priorities and ensure its utilization to scale innovations
- Work closely with partner country universities and research institutes, especially where agricultural research is underfunded and not linked to extension services, to promote R&D, develop research organizations focused on agrifood systems transformations, strengthen adaptive capacities at the local level, and support locally-driven and owned solutions
- Partner with nongovernmental/private donors to leverage diverse strengths and funding modalities for common goals
- Collaborate with other U.S. federal research institutions to share resources and expertise and increase collaboration on synergistic priorities
- Identify and work with private sector partners to crowd in investment, solicit complementary expertise, and set up interventions to scale

USAID's agriculture- and food security-related research has long addressed climate risk, and represents a significant portion (15 percent on average) of the Feed the Future annual funding.[75] However, the Agency is not fully harnessing its capacity, and that of its research partners, to proactively anticipate and address challenges and opportunities related to climate adaptation and mitigation. Its agricultural and food security research portfolio is weighted towards technical and productivity-focused near-term solutions and the development of innovations that are more responsive to current and historical climate risk than to longer-term projections. It is also insufficiently focused on getting innovations to markets or users at scale, given the urgency and rapid pace of climate impacts.

The Agency's research portfolio can better support its climate goals with accessible contributions to understanding and measuring co-benefits (such as the benefits to production, adaptation, and mitigation of improved soil health), return on investment, and the risk of maladaptive outcomes,such as agricultural expansion into forests and other natural ecosystems. A 2023 USAID Technical Note points to the fact that pairing increased productivity with effective land governance and market-based interventions "is essential to prevent increased profitability from driving agricultural expansion and deforestation."[76] This focus would help USAID to steer its strategy and programming efforts towards mutually beneficial interventions and outcomes, leveraging the integration of EEI into RFS.

Agricultural and food security research should include longer time horizons to project the impact of future climate conditions and develop and assess the viability and effectiveness of potential interventions to address those likely conditions. Research efforts with a longer-term focus are better aligned with ecological timescales, can reduce maladaptive outcomes in the near term, address risks to crop viability and production systems, and illuminate the appropriateness and prospective impacts of interventions beyond a five-year period (such as the carbon sequestration impacts of reforestation).

In addition to technical research in agricultural science and nutrition (see the discussion of high-potential research and development under Recommendation 6), non-USAID researchers consulted for this study noted that Agency research should build understanding of the social, behavioral, economic, and governance aspects of climate-sensitive programming. Successful climate adaptation and mitigation will require changes in incentive structures and the support for social and behavioral transformation within agricultural communities. USAID research should focus on building evidence to guide interventions aimed at fostering shifts in incentives and

[75] Presentation delivered to BIFAD by USAID Bureau for Resilience and Food Security Chief Scientist Robert Bertram on March 13, 2023.
[76] USAID. (2023). *Low Emissions Agriculture and Food Systems Development Opportunities in Support of Food Security and Climate Action.* [Technical note]. https://www.climatelinks.org/sites/default/files/asset/document/2023-08/USAID-LEAFS-Technical-Note-Aug-2023.pdf

social behavior, particularly those that facilitate transitions within the agrifood sector. Researchers consulted for this study also noted the need for more locally-led research to address the various levels of structural barriers to sustainability.

Finally, the Agency's research initiatives should look beyond what they achieve directly and better leverage partnerships to increase collaboration and co-funding, build a pipeline of locally driven and owned solutions, and bring scalable innovations to market. USAID can also help strengthen research partners focused on agrifood system transformations that advance adaptation and mitigation. External researchers consulted for this study highlighted the need to further invest in and empower national and subnational research institutions in target countries. More detail on how USAID can strengthen local research and innovation systems can be found with the related Leverage Point under Recommendation 6, below.

Recommendation 4: Resource Allocation

Increase investment levels and flexibility for climate adaptation and mitigation in agricultural and food security programming through:

- Longer or phased funding (beyond five-year cycles) in order to realize greater impacts through longer-term technical design and implementation continuity.
- Stronger collaboration and co-funding with other U.S. federal agencies, including:
    - Integrated and complementary investments across Mission portfolios with other in-country USG agencies, and
    - More flexible, headquarter-based, global funding to align with DFC's broader geographic scope and short investment timelines; and funding to de-risk DFC's agricultural investments in riskier, high-impact investments.

The Agency cannot achieve its ambitious Climate Strategy targets without sufficient investment. However, USAID climate-related funding currently makes up less than 1 percent of the USAID and U.S. State Department budget. Although climate funding has increased, the Agency must allow for greater flexibility in its agriculture and food security investments to advance climate goals while also requiring better integration of the two resource streams.

USAID can also maximize climate resources by increasing collaboration and co-funding with whole-of-government initiatives, including both FTF (led by USAID) and the President's Emergency Plan for Adaptation and Resilience (PREPARE),[77] an initiative co-led by USAID and the State Department. This includes the expansion of contracts and awards that blend cross-program funding (e.g., coastal and marine systems projects that pool agricultural and biodiversity resources). While collaborative channels between USAID and the U.S. International Development Finance Corporation (DFC) are well established, climate-related partnerships could be expanded. In particular, the creation of a headquarters-based budget or global first-loss facility could address the lack of alignment between USAID priority countries and the DFC's different risk tolerance for impactful investment in climate-smart agricultural enterprises. USAID could also leverage its funding to further de-risk DFC's riskiest, but highest-impact, agrifood system investments.[78]

[77] U.S. Agency for International Development. (2022). Action Plan Released for the President's Emergency Plan for Adaptation and Resilience (PREPARE). https://www.usaid.gov/news-information/press-releases/sep-15-2022-action-plan-released-presidents-emergency-plan-adaptation#:~:text=Announced%20last%20year%20at%20COP26%20and%20co-led%20by,manage%20the%20impacts%20of%20climate%20change%20by%202030.

[78] U.S. International Development Finance Corporation. (2023). *Debt Financing*. U.S. International Development Finance Corporation. https://www.dfc.gov/what-we-offer/our-products/debt-financing#:~:text=Mission%20Transaction%20Unit%20DFC%E2%80%99s%20Mission%20Transaction%20Unit%20%28MTU%29,investment%20to%20advance%20DFC%E2%80%99s%20and%20USAID%E2%80%99s%20development%20objectives

Finally, USAID should invest in the potential of carbon markets, described in detail under Recommendation 6. USAID could leverage these investments to crowd in other funders and increase market integrity, transparency, and equity.

Recommendation 5: Human Resources

The Agency should accelerate fulfilling its commitments on climate-related staffing in the Climate Strategy, through:

- Detailed assessments of staffing needs and gaps across OUs
- Increased mandatory technical trainings for Missions on climate risks, adaptation, and mitigation opportunities, and on climate-related analysis and measurement
- Increased climate technical assistance and dedicated staffing across Missions and in Washington according to OU needs
- Expanded opportunities for Missions to share expertise, experience, and lessons learned related to the integration of climate, climate measurement, and reporting
- Development of awards and recognition programs to acknowledge and celebrate climate champions who drive action within the agency

USAID has created critical climate-focused roles at all levels, including Chief Climate Officer and Climate Integration Leads (CILs), to champion climate priorities throughout its OUs. It has also developed the Climate Change Leadership Council (CCLC), a decision-making body chaired by the Chief Climate Officer that provides strategic leadership and facilitates broader coordination of adaptation and mitigation efforts throughout Agency programming. The complementary Climate Change Technical Working Group (CCTWG), composed of experts from all Bureaus and representatives of each Climate Strategy pillar, advises the CCLC and provides technical guidance and tools to support effective Climate Strategy implementation. The Agency has also invested in expertise at the intersection of climate change and social inclusion, including the Gender, Environment, Climate, and Energy (GECE) team within its Gender Equality and Women's Empowerment Hub. In its Climate Strategy, USAID has also committed to creating a staffing plan aligned with its climate ambitions (see excerpt below), but it lacks a timeline for the plan's development and implementation.

From the USAID Climate Strategy:

"**Staffing, Roles, and Responsibilities**

USAID will develop an Agency-wide staffing plan to support the implementation of the Climate Strategy under the direction of the Chief Climate Officer. This plan will cover hiring, training, and retention of staff focused on climate change and climate equity, and staff with cross-sectoral expertise to integrate climate change and climate equity effectively into all sectors at USAID. All Operating Units must empower leadership and enable all staff, particularly those designing and managing programming, to take responsibility for implementation of the Strategy. All Operating Units are currently required to designate climate integration leads (CILs). Given many CILs have limited bandwidth, Operating Units should also strengthen support for CILs with the appropriate time, technical capacity, and authority to perform their CIL responsibilities." (page 39)

Beyond leadership structures, USAID has garnered buy-in for climate as a critical priority throughout the Agency. Staff from across Bureaus and Missions at all levels note widespread agreement on the critical importance of climate within food security and agricultural initiatives. Key informants identified the Climate Strategy as the impetus for this high level of awareness and acceptance.

Despite this recognized leadership and broad commitment, analysis revealed several barriers to increased integration of climate adaptation and mitigation. First, climate is seen as one of numerous priorities that are often perceived as competing. Staff, especially in Missions, must balance those priorities with the time and resources available to them. Second, despite the high quality and increased number of Agency climate experts, human resources remain insufficient to operationalize the Climate Strategy. CILs are designated from among staff who already have full-time primary responsibilities. Key informants raised the need for more climate expertise embedded in Missions, as well as across Washington OUs, to support them.

The Agency should elevate climate as a priority among priorities and communicate it clearly from the highest levels of leadership. It should also assess and increase staff capacity through required technical trainings relevant to specific roles throughout the Agency. It should facilitate cross-Mission engagement on climate to share successful strategies and best practices for integrating climate into CDCS development and activity design. Finally, it should also celebrate the efforts of staff that champion and drive climate-related activities and results through awards and recognition.

Leverage Points: Opportunities for Transformative Change

Recommendation 6: High-Potential Leverage Points

USAID should invest more resources in high-potential leverage points within agrifood systems that drive transformative shifts to net-zero emissions and climate-resilient pathways while achieving Agency food security goals.

- Empowering Women, Youth, and Other Underrepresented Groups
- Local Research and Innovation Systems
- Inclusive Climate Finance
- Integrated Soil and Water Management
- Integrated Forest and Agricultural Land Management
- Food Loss and Waste Reduction
- Low-Emissions Animal Production
- Weather and Climate Services

The study presents leverage points within agrifood systems that drive transformative shifts to net-zero and climate-resilient pathways while contributing to Agency food security and nutrition goals. The Climate Strategy's second objective identifies the importance of investing in key systems to drive climate action. Many of the systems-oriented leverage points presented here, and discussed in detail below, are technical in nature. However, systems transformation also requires substantial social change, ranging from individual behavioral change to shifts in deeply held cultural norms and institutional standards. To accelerate agrifood systems transformation, USAID should focus on supporting the social conditions that enhance and protect the agency of women, youth, Indigenous Peoples, and other underrepresented groups, in all their diversity. Fostering these conditions requires partnership with key agrifood system actors who experience marginalization, with a shared goal of ensuring their equitable access to resources and opportunities.[79] Understanding the dynamics of marginalization also helps to avoid maladaptation, which can exacerbate inequities as well as climate impacts.

[79]Carr, E. R. (2020). Resilient livelihoods in an era of global transformation. Global Environmental Change, 64(August), 102155. https://doi.org/10.1016/j.gloenvcha.2020.102155

Key Definitions
Transformative change: Change to the "fundamental attributes of systems in response to actual or expected climate impacts, at a scale and/or ambition greater than incremental activities."[80]
Leverage points: Elements**,** processes, or interactions of a system or systems where targeted actions could lead to transformational change.
Intervention: An activity or set of activities designed to influence positive economic, environmental, social, and/or behavioral change.

Through discussion with the Subcommittee, expert input from key informant interviews, public meeting feedback, and a literature review, ten leverage points were identified that have high potential for transformative change. From the ten potential leverage points identified in the preliminary research for this report,[81] the set presented here was prioritized based on its transformational impact; technical potential for adaptation, mitigation, and food security; and alignment with USAID strategy and investments. The first leverage point recognizes that the empowerment of women and other underrepresented groups is a precondition to achieve the full impact of the remaining leverage points and their associated technical interventions. The first three leverage points, relating to social, research and learning, and financial systems transformation, were identified through Subcommittee guidance and key informant interviews. They are Empowering Women, Youth, and Other Underrepresented Groups; Local Research and Innovation Systems; and Inclusive Climate Finance. The next five leverage points were prioritized based on their technical potential for global contributions to mitigation, adaptation, and food security goals (as outlined in the IPCC Sixth Assessment Report[82]). They are Integrated Soil and Water Management; Integrated Forest and Agricultural Land Management; Food Loss and Waste Reduction; Low-Emissions Animal Production; and Weather and Climate Services. A detailed overview of the methodological approach for technical prioritization of the leverage points is furnished in Appendix D. Illustrative interventions with recommendations for high-priority geographic applications are provided for each leverage point. Additional interventions are described in Appendix E.

The most effective leverage points and interventions for a specific geographic and socioeconomic setting should be identified through country or local contextual analysis. Interventions should be co-identified and co-designed by USAID and partner country governments with the local partners and communities, in all their diversity, that will own and implement them. They should also be aligned with NAPs and NDCs. USAID should draw upon existing tools for systems thinking and locally led development[83] to determine an appropriate balance of climate-targeting investments that advance development objectives for agricultural programming, including inclusive market systems approaches. The Agency should incorporate political economy analysis and enabling environment assessments into the design of climate change interventions to better understand the formal and informal rules driving behavior, and the legal and political frameworks that will support or inhibit advancement of the leverage points.

[80]Ferdinand, T., Tye, S., Gebregziabher, D., Suberi, B., & Carter, R. (2020). *Driving System Shifts for Climate Resilience: Case Studies of Transformative Adaptation in Bhutan, Ethiopia, and Costa Rica*. Working Paper. pp.1. World Resources Institute. https://doi.org/10.46830/wriwp.19.00048

[81]Carr, E. R., Diro, R., Hall T., Mbevi, L., Zook, D., Beggs, M., Benson, C., Aldredge, H., Allognon, L., Crocker T., Liming, K., and Mukupa, N. (2022). *Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems. Working Paper*. Tetra Tech under the USAID BIFAD Support Contract. https://www.usaid.gov/bifad/climatechangeworkingpaper

[82]Shukla, P. R., Skea, J., Calvo Buendia, E., Masson-Delmotte, V., Pörtner, H. O., Roberts, D. C., ... & Malley, J. (2019). IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.

[83]E.g., USAID Local Capacity Strengthening Policy, Inclusive Framework for Inclusive Market Systems Development, and 5R Framework, etc.

Leverage Point: Empowering Women, Youth, and Other Underrepresented Groups

Definition: Empowerment related to climate-resilient development is a priority leverage point in which targeted actions can lead to transformative change. Empowerment involves increased agency of underrepresented individuals and groups in decisions and actions.

There are no gender-neutral, age-neutral, or socioeconomic-neutral systems, leverage points, or interventions within the agrifood system. Four dimensions of in/equality include: 1) participation in decision-making at different levels; 2) work burden; 3) access to and use of productive resources; and 4) collective action.[84] Broadening the ability to take climate change adaptation and mitigation actions in global agrifood systems requires that women, youth, Indigenous communities, and other underrepresented groups have access to and agency over resources (e.g., finance, land and natural resources, technology, and information) and can participate meaningfully in decision-making and leadership.[85,86] Agency is often influenced by intersecting dynamics of power structures and social constructs around age, socioeconomic status, gender, ethnicity, rural or urban residence, and other factors.

Impact Pathway: Increased agency of women and other underrepresented groups is foundational to the success of agrifood system technical interventions that address the climate crisis. Supporting the empowerment of these groups, and the elevation of Indigenous knowledge, in climate change policy and programming results in more successful, sustainable, and equitable climate change action.[87] Transformative changes will require the recognition of the potential for women, youth, and other underrepresented groups to be leaders with unique insights and assets rather than passive victims of climate impacts.[88]

Empowered women are more likely to make decisions and take actions that improve household food security and nutrition.[89] For example, farming households in which women are empowered to make decisions are more likely to adopt climate-resilient agricultural practices and environmental management.[90,91,92] Women and other underrepresented groups are also

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[84] Huyer, S., Simelton, E., Chanana, N., Mulema, A.A., & Marty, E. a. (2021). *Expanding opportunities: Scaling up gender and social inclusion in Climate-Resilient Agriculture. An equality and empowerment approach.* [AICCRA Info Note]. CGIAR, Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA). https://hdl.handle.net/10568/114223

[85] Huyer, S., & Partey, S. (2020). Weathering the storm or storming the norms? Moving gender equality forward in climate-resilient agriculture. *Climatic Change, 158*(1), 1–12. https://doi.org/10.1007/s10584-019-02612-5.

[86] United Nations. (2022). Achieving gender equality and the empowerment of all women and girls in the context of climate change, environmental and disaster risk reduction policies, and programmes: Report of the Secretary-General.

[87]Steiner A, Aguilar G, Bomba K, Bonilla JP, Campbell A, Echeverria R, Gandhi R, Hedegaard C, Holdorf D, Ishii N, Quinn K, Ruter B, Sunga I, Sukhdev P, Verghese S, Voegele J, Winters P, Campbell B, Dinesh D, Huyer S, Jarvis A, Loboguerrero Rodriguez AM, Millan A, Thornton P, Wollenberg L, Zebiak S. (2020). *Actions to transform food systems under climate change*. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). https://www.cgiar.org/research/publication/actions-to-transform-food-systems-under-climate-change

[88]Steiner, A., Aguilar, G., Bomba, K., Bonilla, J. P., Campbell, A., Echeverria, R., Gandhi, R., Hedegaard, C., Holdorf, D., Ishii, N., Quinn, K., Ruter, B., Sunga, I., Sukhdev, P., Verghese, S., Voegele, J., Winters, P., Campbell, B., Dinesh, D., Huyer, S., Jarvis, A., Loboguerrero Rodriguez, A. M., Millan, A., Thornton, P., Wollenberg, L., Zebiak, S. (2020). *Actions to transform food systems under climate change*. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). https://cgspace.cgiar.org/bitstream/handle/10568/108489/Actions%20to%20Transform%20Food%20Systems%20Under%20Climate%20Change.pdf

[89]Smith, L., & Haddad, L. (2014). Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era. (IDS Working Paper 441). Institute of Development Studies. www.ids.ac.uk/publications.

[90]Pamuk, H., van Asseldonk, M., Wattel, C., Ng'ang'a, S.K., Hella, J.P., Ruerd, R. (2021). *Farmer Field Business Schools and Village Savings and Loan Associations for promoting climate-smart agriculture practices: Evidence from rural Tanzania*. (CCAFS Working Paper no. 361). CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

[91]Huyer, S., Acosta, M., Gumucio, T., & Ilham, J. I J. (2020) Can we turn the tide? Confronting gender inequality in climate policy. *Gender & Development, 28*:3, 571-591. https://doi.org/10.1080/13552074.2020.1836817

[92]Huyer, S., Gumucio, T., Tavenner, K., Acosta, M., Chanana, N., Khatri-Chhetri, A., Mungai, C., Ouedraogo, M., Otieno, G., Radeny, M., Recha, J., and Simelton, E. (2021). From vulnerability to agency in climate adaptation and mitigation. IN: *Advancing gender equality through agricultural and environmental research: Past, present, and future*, eds. Rhiannon Pyburn, and Anouka van Eerdewijk. International Food Policy Research Institute: 261-294. https://doi.org/10.2499/9780896293915_07

potential agents of transformational change.[93,94] Insights from Indigenous groups, for example, suggest that change is transformative when women are provided with both opportunities to innovate and lead and also with the technical skills and financial capacity to move innovations forward. Similarly, investing in young people and engaging them in adaptation and mitigation strategies significantly increases their resilience.[95]

However, inequalities in climate change-related agrifood systems actions and outcomes remain.[96] Research shows that more gender-disaggregated data and evidence of impact are needed to improve the recognition of, and advance action towards, more egalitarian climate change solutions.[97] Drawing on the knowledge associated with their roles and responsibilities in society, women, youth, Indigenous Peoples, and other underrepresented groups are well positioned to identify barriers that impede transformation and ways to overcome them. Accordingly, some of the most critical development programming to facilitate a climate-resilient future may not entail technological responses to climate change but rather the resilience and capacity of these groups to respond and adapt effectively.[98]

Implications for USAID: Further work is needed to bring together Agency expertise on gender, youth, disability, and Indigenous knowledge,[99] and to meaningfully integrate gender and social inclusion in CDCSs and other country/regional-level approaches to climate change adaptation and mitigation efforts. The Climate Strategy calls for the Agency to "weave rights-based, gender-responsive, and socially inclusive approaches carefully throughout [its] efforts to ensure the ambitious climate actions of USAID and [its] partners achieve sustainable impacts." The Agency is already taking steps to "weave" investments in expertise, such as staffing the GECE team, and in programs specific to socially inclusive climate adaptation and mitigation. It is also making substantial investments in women's equality and economic empowerment, for example through the Gender Equality and Women's Empowerment Hub (GEEA, funded at $100 million annually from 2021–2024),[100] and the Climate Gender Equity Fund, which will provide finance for women-owned businesses, including work related to forest ecosystem services and agroforestry. Further USAID investments should include:

- More inclusive leadership in climate change decision-making (see Illustrative Interventions, below).
- Policy influence to remove structural barriers impeding underrepresented groups' participation in household, community, and business decision-making and in markets.
- Locally led and contextualized research to develop gender-responsive, socially inclusive, and transformative adaptation strategies that take Indigenous and local knowledge systems into account.
- More gender-disaggregated data, analysis, and evidence of the impact of investments in gender equality in climate change-focused agrifood system interventions.[101]

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[93]Carr, E. R. (2020). Resilient Livelihoods in an Era of Global Transformation. *Global Environmental Change* 64, no. 102155. https://doi.org/10.1016/j.gloenvcha.2020.102155

[94]Plan International Australia. (2018). *Gender Transformative Climate Change Action in the Pacific. Framework and Guidance Tool.* https://www.preventionweb.net/files/73972_gendertransformativeclimatechangeac.pdf

[95]Bullock, R., & Crane, T.A. (2020). *Youth opportunity spaces in low-emission dairy development in Kenya: Research findings and policy recommendations.* (CCAFS Info Note). CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS). https://hdl.handle.net/10568/107010

[96] Wright, P., Deering, K., Mikura, M., Swira, H., Tasew, A., Mohanraj, P., and Smith, E. (forthcoming). Scoping Review on Gender-Disaggregated Data in Climate Smart Agriculture. CGIAR GENDER Impact Platform.

[97] Wright, P., Deering, K., Mikura, M., Swira, H., Tasew, A., Mohanraj, P., and Smith, E. (forthcoming). Scoping Review on Gender-Disaggregated Data in Climate Smart Agriculture. CGIAR GENDER Impact Platform.

[98] Huyer, S., Gumucio, T., Tavenner, K., Acosta, M., Chanana, N., Khatri-Chhetri, A., ... & Simelton, E. (2021). From vulnerability to agency in climate adaptation and mitigation. Advancing gender equality through agricultural and environmental research: Past, present, and future, 261. https://doi.org/10.2499/9780896293915_07

[99] U.S. Agency for International Development. (2020). *Policy on Promoting the Rights of Indigenous Peoples.* https://www.usaid.gov/sites/default/files/2022-05/USAID-IndigenousPeoples-Policy-mar-2020.pdf

[100] U.S. Government. *About.* Gender Equity and Equality Action Fund. https://www.usaid.gov/geeafund.

[101]Wright, P., Deering, K., Mikura, M., Swira, H., Tasew, A., Mohanraj, P., and Smith, E. (forthcoming). Scoping Review on Gender-Disaggregated Data in Climate Smart Agriculture. CGIAR GENDER Impact Platform.

Illustrative Intervention: Empowering Women to Address Climate Change Through Local-Level Groups

Rationale: Women's networks, including Village Savings and Loan Associations (VSLAs), promote women's agency and access to resources which can increase their incomes and participation in household and community decision making.[102] Increased income and decision-making power can, in turn, facilitate the adoption of adaptive practices and technologies for more resilient, less emissions-intensive production[103,104] and improved food and nutrition security.[105,106,107,108] VSLAs have been transformational in facilitating the unbanked to pool financial resources that can address important issues such as climate change. Over time, they have transitioned from groups that meet basic household needs to groups investing in common interest areas, such as joint purchases of farming inputs.

Intervention: VSLAs are self-administered, informal financial service organizations that empower participants to increase access to and control over resources and use collective power to overcome social and financial barriers.[109] They also provide a forum for discussion of social issues and facilitate capacity building in areas such as small business management or agricultural practices.[110,111] VSLAs can produce multiple benefits through collective action, including increased resource generation and sharing, cooperative food production and processing, and increased voice and agency in communities, on farms, and in households.[112] Interventions aimed at climate-smart agricultural production through these groups, and their alignment with increased access to finance and decision-making, can support women's empowerment *and* their adoption of these practices, both of which contribute to their climate resilience.

Opportunity for USAID: USAID can support the development or strengthening of women's collective action and organizations, including VSLAs or other community savings and loan groups, women's producer associations or cooperatives, other types of groups or networks, and/or women's participation in mixed-gender cooperatives or associations.[113] Establishing a women-only producer group in Ghana supported members' ability to adapt to shocks and increased production and incomes. This led to families' greater allocation of productive land for the women-led businesses and created a platform for women's organizations to better communicate with the male-dominated village committee.[114] While USAID is already investing in these types of activities, program design should further emphasize the

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[102]Ferguson, H. & Kepe, T. (2011). Agricultural cooperatives and social empowerment of women: a Ugandan case study. *Development in Practice, 21*(3), 421-429, https://doi.org/10.1080/09614524.2011.558069

[103]Huyer, S., Acosta, M., Gumucio, T., & Ilham, J. I J. (2020) Can we turn the tide? Confronting gender inequality in climate policy. *Gender & Development, 28*:3, 571-591. https://doi.org/10.1080/13552074.2020.1836817

[104]Huyer, S., Simelton, E., Chanana, N., Mulema, A.A., & Marty, E. (2021). Expanding opportunities: Scaling up gender and social inclusion in Climate-Resilient Agriculture. An equality and empowerment approach. [AICCRA Info Note]. CGIAR, Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA). https://hdl.handle.net/10568/114223

[105]Larson, J., Castellanos, P., & Jensen, L. (2019). Gender, household food security, and dietary diversity in western Honduras. *Global food security, 20*, 170-179. https://doi.org/10.1016/j.gfs.2019.01.005

[106]Essilfie, G., Sebu, J., Annim, S.K. and Asmah, E.E. (2021). Women's empowerment and household food security in Ghana. *International Journal of Social Economics, 48*(2), pp. 279-296. https://doi.org/10.1108/IJSE-05-2020-0328

[107]Holland, C., & Rammohan, A. (2019). Rural women's empowerment and children's food and nutrition security in Bangladesh. *World Development, 124*, 104648. https://doi.org/10.1016/j.worlddev.2019.104648

[108]Heckert, J., Olney, D.K., & Ruel, M,T. (2019). Is women's empowerment a pathway to improving child nutrition outcomes in a nutrition-sensitive agriculture program?: Evidence from a randomized controlled trial in Burkina Faso. *Soc Sci Med., Jul, 233*. 93-102. https://doi.org/10.1016/j.socscimed.2019.05.016.

[109]CARE International. (2023). Village Savings and Loans Associations. CARE International. https://www.care-international.org/what-we-do/womens-economic-justice/village-savings-and-loans-associations

[110]Pamuk, H., van Asseldonk, M., Wattel, C., Ng'ang'a, S.K., Hella, J.P., Ruerd, R. (2021). *Farmer Field Business Schools and Village Savings and Loan Associations for promoting climate-smart agriculture practices: Evidence from rural Tanzania*. (CCAFS Working Paper no. 361). CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

[111]Huyer, S., Gumucio, T., Tavenner, K., Acosta, M., Chanana, N., Khatri-Chhetri, A., Mungai, C., Ouedraogo, M., Otieno, G., Radeny, M., Recha, J., and Simelton, E. b. (2021). From vulnerability to agency in climate adaptation and mitigation. IN: *Advancing gender equality through agricultural and environmental research: Past, present, and future*, eds. Rhiannon Pyburn, and Anouka van Eerdewijk. International Food Policy Research Institute: 261-294. https://doi.org/10.2499/9780896293915_07

[112]Huyer, S., Gumucio, T., Tavenner, K., Acosta, M., Chanana, N., Khatri-Chhetri, A., Mungai, C., Ouedraogo, M., Otieno, G., Radeny, M., Recha, J., and Simelton, E. b. (2021). From vulnerability to agency in climate adaptation and mitigation. IN: *Advancing gender equality through agricultural and environmental research: Past, present, and future*, eds. Rhiannon Pyburn, and Anouka van Eerdewijk. International Food Policy Research Institute: 261-294. https://doi.org/10.2499/9780896293915_07

[113] Mwambi, M., Bijman, J. & Galie, A. (2021). The effect of membership in producer organizations on women's empowerment: Evidence from Kenya. Women's Studies International Forum, 87, 102492. https://doi.org/https://doi.org/10.1016/j.wsif.2021.102492.CrossRefGoogle Scholar

[114]International Fund for Agricultural Development. (2016). *Ghana: Making value chains work for rural people*. IFAD. https://www.ifad.org/documents/10180/8c9fab0d-fc91-449a-b71f-2c303bc85f7c

provision of direct funding to women's organizations, streamlining the process for these bodies to access small grant funding as a priority component of the Agency's broader shift to locally led development.

Illustrative Example of Impact: A project in Daga Birame, Senegal, supported women's community organizations to plant fruit trees for vegetation cover and income generation; to maintain gardens for nutritional foods at home and for sale; and to process baobab fruit. The women farmers grew baobab trees on their own plots, using the fruit, leaves, and bark for household purposes. A newly established, women-run microenterprise processed, marketed, and sold fruit powder. A mixed-gender committee managed trees in community-protected areas and made decisions on when to harvest fruit, while a village savings pool invested in community resilience activities. The project increased women's access to and control over forest resources, raised incomes, and increased participation in community decision-making. Women farmers also controlled the funds used for community improvement.[115]

High-Potential Geographic Focus Areas: All regions where USAID projects are operational

Illustrative Intervention: Empowering Youth Through Increased Engagement in National, Regional, and Global Issues

Rationale: Empowerment of youth, particularly youth living below the poverty line or with other underrepresented intersectional identities, facilitates the identification of more effective and durable climate change adaptation and mitigation solutions in the context of agricultural development.

This empowerment can be achieved by increasing youth numbers at decision-making fora; growing their knowledge of national, continental, and global issues; increasing their capacity to articulate the issues they face; facilitating access to productive resources; and strengthening their ability to adopt leadership roles. Tapping into the growing movement of youth activists calling for measures to address climate change will also elevate the specific challenges and opportunities that climate change creates for youth in food and agricultural systems, including migration, and foster a more comprehensive understanding of climate-driven food security and nutrition challenges.

Intervention: Youth report that, although they have a large and engaged climate-focused online presence, their online activism is largely ignored.[116] For youth activism to generate transformative changes toward climate-resilient agricultural development, youth need greater representation in fora, summits, and leadership positions. To create durable change, young people need skills to push for their agenda and to hold their leaders accountable. When young people spotlight climate change issues, particularly in well-attended protests, some governments accede to their demands based on fear but, once the summit is over, they do not keep their promises.[117] In such cases, activists require connections to political allies who can lobby on their behalf. Youth may also benefit from enhanced skills related to public speaking, self-confidence, and negotiation when they have opportunities to speak at summits or address political gatherings on climate change. Beyond empowerment through advocacy and representation, new employment opportunities and skills development targeted at climate-vulnerable youth, particularly young rural women, are needed to drive progress toward equitable transformation.

[115]Huyer, S., Simelton, E., Chanana, N., Mulema, A.A., & Marty, E. a. (2021). Expanding opportunities: Scaling up gender and social inclusion in Climate-Resilient Agriculture. An equality and empowerment approach. [AICCRA Info Note]. CGIAR, Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA). https://hdl.handle.net/10568/114223

[116] Abnett, K. (2021, September 25). World's youth take to the streets again to battle climate change. Reuters. https://www.reuters.com/business/environment/worlds-youth-returns-streets-fight-climate-change-2021-09-24/

[117] Chironda, M. (2022, November 10). Africa: Young Activists Fight for Climate Justice and Survival. Earth Journalism Network. https://allafrica.com/stories/202211100106.html

Opportunity for USAID:
USAID can work with youth leaders to ensure they understand how their governments function, making it easier for them to approach and meaningfully engage powerful decision-makers. USAID projects should also strengthen youth skills to move beyond social media discussions on climate change to face-to-face project implementation.

USAID agriculture and livestock projects can also involve youth as leaders in climate change adaptation and mitigation, particularly through Climate Smart Agriculture (CSA). USAID programs can build youth resilience in CSA with an aim of promoting youth engagement through job creation and agribusiness opportunities and with support to peer-to-peer mentorship programs such as those led by the Climate Smart Agricultural Youth Network (CSAYN).[118,119] This will likely require extending finance to youth, particularly for the acquisition of land; expanding youth-focused loan programs; and de-complicating application procedures.[120]

Illustrative Example of Impact: An example of self-organized, youth-led movements for collective climate change action is Act4Food Act4Change.[121] Launched in 2021 by a group of about 30 youth leaders from 26 countries, the movement has grown to over 160,000 individuals pledging to advocate for "urgent large-scale action from decision-makers in government and business to reduce hunger, improve sustainable healthy diets, and improve our planet."[122,123]

High-Potential Geographic Focus Areas: All regions where USAID projects are operational

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Leverage Point: Strengthening Local Research and Innovation Systems

Definition: In the context of international development, research and development (R&D) is systematic work to expand and apply knowledge that solves development challenges.[124] At USAID, agrifood systems R&D is largely steered by the U.S. Government Global Food Security Research Strategy (GFSRS),[125] which calls for "research activities that collectively represent three themes: 1) climate-smart agricultural innovation; 2) nutrition and food systems; and 3) genetic improvement of crops and livestock."[126] This leverage point refers to the strengthening of National Agricultural Research systems, which include complex networks of public research institutes, universities, private and public experiment stations, and laboratories.

Impact Pathway: Given that many of the solutions, technologies, and frameworks for both adaptation and mitigation efforts in agrifood systems remain in early stages, or are embedded in local systems that may be overlooked, R&D investment is perhaps the most important leverage

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[118] Mugo, V., Kamau, H. & Samuel, S. (2019). Is climate-smart agriculture the silver bullet to attract youth to agriculture? CCASFS, Nouvelles, 28 June. https://ccafs.cgiar.org
[119] Organising for change: empowerment for farmers, women, youth, and communities, in Campbell, B., Thornton, P., Loboguerrero, A. M., Dinesh, D. & Nowak, A. (Eds.), Transforming Food Systems Under Climate Change Cambridge University Press (2023) 144-155. https://doi.org/10.1017/9781009227216.013
[120] Amsler, K., Hein, C. & Klasek, G. (2017). Youth decision making in agricultural climate change adaptations: Research findings from East Africa. CCAFS Info Note. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). http://hdl.handle.net/10568/80891.
[121] Act4Food. (n.d.). *About the Initiative*. https://actions4food.org/en/about-the-initiative/
[122] Act4Food. (n.d.). *About the Initiative*. https://actions4food.org/en/about-the-initiative/
[123] Organising for change: empowerment for farmers, women, youth, and communities, in Campbell, B., Thornton, P., Loboguerrero, A. M., Dinesh, D. & Nowak, A. (Eds.), Transforming Food Systems Under Climate Change Cambridge University Press (2023) 144-155. https://doi.org/10.1017/9781009227216.013
[124] National Science Foundation. (2018). *Definitions of Research and Development: An Annotated Compilation of Official Sources*. https://www.nsf.gov/statistics/randdef/rd-definitions.pdf
[125] U.S. Government. (2022). *U.S. Government Global Food Security Research Strategy: Fiscal Year 2022-2026.* https://cg-281711fb-71ea-422c-b02c-ef79f539e9d2.s3.us-gov-west-1.amazonaws.com/uploads/2022/10/U.S.-Government-Global-Food-Security-Research-Strategy-508c.pdf
[126] *Ibid.* pp.4

point for climate action. Research builds understanding of climate risks at a local level, feeding into mitigation and resilient adaptation efforts, and even into access to finance and investment decisions (e.g., with the passage of regulatory frameworks like the SEC's climate-related disclosures).[127] Systemic, transformative change also requires enhanced analysis of climate conditions that goes well beyond climate impacts on current production systems.

The returns on agricultural R&D investment, both financial and in terms of meaningful development outcomes, are significant. R&D investments by national agricultural research systems (NARS) and CGIAR in low- and middle-income countries (LMICs) have realized a 10-to-1 benefit-cost ratio when measuring increased agricultural productivity and the subsequent reduction of poverty.[128] USAID investments in agricultural research through U.S. universities since 1978, such as the Feed the Future Innovation Labs, have had an economic impact of $8.4B in today's dollars from a cumulative investment of $1.24B.[129] These benefits are notably pro-poor, with 80 percent accruing to individuals with incomes under $5.50 per day. Substantial increases to agricultural R&D funding focused on productivity, paired with related investments in infrastructure and water resource management, could offset adverse climate impacts and reduce the share of people projected to be at risk of hunger in Africa from 15 to 10 percent in 2030.[130] Between fiscal years 2011 and 2021, USAID funding to non-U.S. higher education institutions totaled $879 million.[131] In fiscal year 2021 (the latest for which data are available) this investment summed to $112 million, a notable increase over a COVID-19 pandemic dip but still short of the $115 million obligated in fiscal year 2017.[132]

Implications for USAID: R&D on agrifood system innovations for climate change adaptation and mitigation, including research on sustainable agricultural intensification, should consider not only potential productivity gains and environmental sustainability (e.g., pertaining to natural resource management and biodiversity) but also innovations aligned with the three other domains of the Sustainable Intensification Framework: social (e.g., gender dynamics, social cohesion, and collective action), economic (e.g., profitability, profit variability, and labor requirements), and human (e.g., health, nutrition, and food security).[133,134] Research programming must consider the question of scalability at the inception phase, developing and using "research to delivery" pathways that endeavor to bring innovations to market while recognizing that scalability is context-dependent and spatially variable. Public–private partnerships, collaboration across research systems (e.g., CGIAR, NARS, universities, and the private sector), and data systems development (e.g., monitoring, modeling, and analysis) are critical to drive change at scale.

Illustrative Intervention: Enable Locally Led Research and Development (R&D) Systems

[127]U.S. Securities and Exchange Commission. (2022, March 21). *SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors* [Press release]. https://www.sec.gov/news/press-release/2022-46
[128]Alston, J. M., Pardey, P. G., & Rao, X. (2020). The payoff to investing in CGIAR research. *Arlington, Virginia, USA: SOAR Foundation*.
[129]Dalton, T. J., & Fuglie, K. (2022). Costs, Benefits, and Welfare Implications of USAID Investment in Agricultural Research through US Universities. *Journal of Agricultural and Applied Economics*, *54*(3), 461-479.
[130]Mason-D'Croz, D., Sulser, T. B., Wiebe, K., Rosegrant, M. W., Lowder, S. K., Nin-Pratt, A., ... & Robertson, R. D. (2019). Agricultural investments and hunger in Africa modeling potential contributions to SDG2–Zero Hunger. *World development*, *116*, 38-53. https://doi.org/10.1016/j.worlddev.2018.12.006
[131]USAID. (2022). *Title XII Report to Congress for Fiscal Year 2021.* pp.14. U.S Agency for International Development. https://www.usaid.gov/reports/title-xii/fy-2021
[132] USAID. (2018). *Title XII Report to Congress FY2017.* U.S. Agency for International Development. https://www.usaid.gov/sites/default/files/2022-05/FY_2017_Title_XII_Report_to_Congress.pdf
[133]Musumba, M., Grabowski, P., Palm, C., & Snapp, S. (2017). *Guide for the Sustainable Intensification Assessment Framework.* Feed the Future, USAID.
[134]Feed the Future. (n.d.) *The Five Domains*. Sustainable Intensification Assessment Framework Toolkit, U.S. Government. https://sitoolkit.com/the-five-domains

Rationale: Underlying social and economic barriers limit research adoption among women, Indigenous communities, and others who are traditionally underrepresented. As the Sustainable Intensification Framework[135] suggests, this human domain should be integral to all R&D programs and explicit in the review of development innovations. Maladaptation is also known to impact vulnerable and underrepresented groups disproportionately. The IPCC Sixth Assessment Report[136] posits that maladaptation can be avoided with flexible, multi-sectoral, and inclusive planning, with benefits to many sectors and systems. Locally led research is a key component of this approach. Stronger coordination and collaboration between local and international research institutions ensures that solutions are context-specific and driven by local and Indigenous knowledge and technologies.

Intervention: Allocate resources to leverage Indigenous knowledge through local research systems, pairing capacity strengthening with greater direct investment in local institutions.

Opportunity for USAID: Much of the Agency's research spending, including the Feed the Future Innovation Labs, is managed by the pillar bureaus in Washington. While USAID's most recent progress report does not provide data on research funding specifically, less than three percent of all funding from pillar bureaus (such as RFS) in FY22 was directed to local partners.[137] USAID's commitment to shifting funding and decision-making power to the people, organizations, and institutions that are driving change in their own countries and communities"[138] should be reflected in its research investments. The ambitious targets for locally led programs and related changes to the Agency's awards and acquisition systems[139] and other processes (e.g., increased leadership opportunities for Foreign Service Nationals, guidance on a higher risk appetite, and expanded use of co-creation approaches) create a timely opportunity to reassess its agricultural research investments. An institutional-level focus can build and leverage local knowledge and capacity for agricultural research, especially where research systems are underfunded/underdeveloped and not linked to extension services.[140] Examples include:

- Strengthened partnerships and collaboration among international agricultural research institutions (CGIAR, U.S. universities, etc.), local NARS, and local organizations, including co-creation in program planning and implementation
- Accountability measures for local capacity strengthening in both new and existing research investments (e.g., Feed the Future Innovation Labs and CGIAR funding)
- Increased direct funding for local higher education institutions and NARS
- The elevation of gender and social inclusion in research programming
- Adaptation of the recent Agency guidance on Integrating Local Knowledge in Development Programming[141] as a resource for agricultural R&D-focused USAID activities

[135]Musumba, M., Grabowski, P., Palm, C., & Snapp, S. (2017). Guide for the sustainable intensification assessment framework. *Available at SSRN 3906994*.
[136]IPCC (2023). Climate Change 2023: Synthesis Report of the IPCC Sixth Assessment Report (AR6) [Core Writing Team, P. Aldunce et al.,]. IPCC, 85 pp.
[137]USAID. (2022). *Moving Toward a Model of Locally Led Development: FY 2022 Localization Progress Report*. U.S. Agency for International Development. https://www.usaid.gov/sites/default/files/2023-06/FY%202022%20Localization%20Progress%20Report-June-12-23_vFINAL_1.pdf
[138]Bullock, R., & Crane, T.A. (2020). *Youth opportunity spaces in low-emission dairy development in Kenya: Research findings and policy recommendations.* (CCAFS Info Note) pp.1. CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS). https://hdl.handle.net/10568/107010
[139]USAID Acquisition & Assistance Strategy
[140]USAID. (2023). *Moving Toward a Model of Locally Led Development: FY 2022 Localization Progress Report.* https://www.usaid.gov/localization/fy-2022-localization-progress-report
[141]Integrating Local Knowledge in Development Programming (usaidlearninglab.org)

Illustrative Example of Impact: Ghana's economic growth, with recent agricultural output growth attributed to total factor productivity (TFP), offers a country-specific example. In addition to public investments in transportation infrastructure, market access, and other conditions favorable to growth, Ghana's increased public investments in agricultural research and development (roughly 1 percent of total agricultural value-added and increasing tenfold between 1981 and 2013[142]) is credited for much of its economic success.[143,144]

High-Potential Geographic Focus Areas: This intervention is needed globally. However, particular opportunities for USAID investment may exist where:

- There are larger Indigenous populations, such as Bolivia, Ethiopia, India, Indonesia, Mexico, and the Philippines.
- There is evidence of local commitments to public investment in research and development.
- USAID already has a footprint in the R&D space, including the Feed the Future countries.

Leverage Point: Inclusive Climate Finance

Definition: In its Climate Strategy, USAID defines Climate Finance as "Using financial resources to assist developing countries to reduce and/or avoid greenhouse gas emissions and build resilience and adapt to the impacts of climate change." That definition–and USAID's climate finance target–includes both public and private funds. Catalyzing finance in a way that is inclusive means that funds will benefit all groups, including those that are traditionally underrepresented. In its efforts to facilitate inclusive finance, USAID plans to identify climate-friendly projects and promote enabling environment reforms (see box below).[145]

Impact Pathway: Despite the environmental, social, and political importance of addressing climate in food systems, cumulative mitigation financing for the Agriculture, Forestry, and Other Land Use (AFOLU) sector represents only about 3 percent of total climate finance.[146] Just half of those funds (approximately $10B) explicitly target small-scale agriculture (defined as small-scale producers, cooperatives or farmer associations, and other value chain actors that support food production through service provision, product aggregation, and market linkages). Underinvestment also thwarts methane abatement measures, which constitute only 2 percent of global climate finance flows for the source of nearly half of net global warming to date.[147] In Africa, the agricultural sector received only 8 percent ($2.7B) of total climate finance in 2019 and 2020,[148] most (93 percent) of which came from public financial sources.

Agricultural adaptation and mitigation goals can only be reached if both public and private climate finance are scaled. The barriers associated with mobilizing private climate finance into the AFOLU sectors are many, including real and perceived risks, high transaction costs, long repayment periods, and highly variable returns. These barriers drive the reliance on public

[142]Jayne, T. S., Fox, L., Fuglie, K., & Adelaja, A. (2021). *Agricultural Productivity Growth, Resilience, and Economic Transformation in Sub-Saharan Africa—Implications for USAID*. Association of Public and Land-grant Universities (APLU). 104.
[143]Benin, S. (2019). Public expenditure on agriculture and its impact. In Diao, X., Hazell, P., Kovalli, S. & Resnick, D. (Eds.), *Ghana's economic and agricultural transformation: Past performance and future prospects* (pp.170-209). International Food Policy Research Institute. https://doi.org/10.2499/9780198845348_07
[144]Mohan, G., Matsuda, H., Donkoh, S. A., Lolig, V., & Abbeam, G. D. (2014). Effects of research and development expenditure and climate variability on agricultural productivity growth in Ghana. *Journal of Disaster Research*, *9*(4), 443-451. https://doi.org/10.20965/jdr.2014.p0443
[145] USAID (2022). *USAID Climate Strategy 2022-2030*. U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy
[146]Chiriac, D., Vishnumolakala, H., & Rosane, P. (2023). *Landscape of Climate Finance for Agrifood Systems*. Climate Policy Initiative. https://www.climatepolicyinitiative.org/wp-content/uploads/2023/07/Landscape-of-Climate-Finance-for-Agrifood-Systems.pdf
[147] Rosane, P., Naran, B., Ortega Pastor, A., & Connolly, J. (2022). *The Landscape of Methane Abatement Finance*. Climate Policy Initiative. https://www.climatepolicyinitiative.org/wp-content/uploads/2022/07/Landscape-of-Methane-Abatement-Finance.pdf
[148]Chiriac, D., Vishnumolakala, H., & Rosane, P. (2023). *Landscape of Climate Finance for Agrifood Systems*. Climate Policy Initiative. https://www.climatepolicyinitiative.org/wp-content/uploads/2023/07/Landscape-of-Climate-Finance-for-Agrifood-Systems.pdf

financial sources (especially grants and concessional debt) for climate action. While these products will remain crucial in specific contexts, such as the riskiest markets or earlier-stage efforts, innovative public finance must be better utilized to catalyze the deployment of private sector capital and to generate evidence for blended and private finance opportunities that drive agrifood system adaptation and mitigation efforts.

Implications for USAID: Within USAID's $150 billion climate finance target, this report recommends that the Agency set a $36 billion target for agrifood systems by 2030 (See section IV. Targets). To achieve this target, USAID should scale up activities to strengthen the enabling conditions for climate finance and continue to support country-led efforts to develop bankable pipelines of inclusive climate finance projects. USAID activities should strengthen the linkages between local investments and international financial markets and build the capacity of national institutions to directly access climate finance in support of their NAPS and NDCs in ways that improve the resilience of agrifood systems. USAID has already launched a number of initiatives to support these efforts, including the US–UAE-led Agriculture Innovation Mission for Climate (AIM for Climate) and USAID-led Climate Finance Development Accelerator, and provided support to other mechanisms/funds.

From the USAID Climate Strategy:

"**INTERMEDIATE RESULT 1.3**: Increase the flow of and equitable access to finance to support adaptation and mitigation. Additional resources are needed across all sectors and at all levels, ranging from national government investments like electric grids that can handle extensive clean power sources, down to the community level for actions like reforestation to reduce food risks. Under this Intermediate Result, USAID will provide and mobilize public and private finance to support equitable climate actions in the areas of mitigation and adaptation in line with our partners' priorities. This greater focus on inclusive climate finance will deliver significant emissions reductions while increasing economic productivity, creating decent work, ensuring a just transition, and improving quality of life. It will also support interventions such as climate smart agriculture, accessible and sustainable water and sanitation services, inclusive health and education services, climate information services, resilient infrastructure, ecosystem protection, assistance to populations after climate shocks, and nature-based solutions." (page 19)

USAID should build on its long history of strengthening financial intermediation and scale its capacity to support financial institutions in offering financial products that are suitable to adaptation and mitigation approaches in agriculture. For example, USAID activities could partner with financial institutions (e.g., commercial banks, microfinance institutions, and non-bank financial institutions) to incentivize investment and de-risk products and services that better meet the adaptation needs of farmers and MSMEs (e.g., climate-smart technologies, improved inputs). Financial institutions could also make better use of agro-climatic risk assessment tools to more accurately assess climate risks by incorporating seasonal weather data and climate projections into decision-making frameworks. To complement these efforts, USAID should help countries strengthen their alignment with ESG frameworks that facilitate reporting of standardized environmental results and impacts (such as the International Sustainability Standards Board (ISSB) Sustainability Disclosures; EU taxonomy; and Science-based Target Initiative (SBTI) Forest, Land and Agriculture (FLAG) Science Based Target Setting Guidance). To facilitate the inclusion of youth, women, and other underrepresented groups, USAID should promote financial education and de-risk investments that address the priorities of communities traditionally excluded from financial services. For example, USAID could establish a youth climate fund, modeled after a challenge fund to scale youth-led business adaptation innovations for agriculture. The Agency should also deepen its

cooperation with equity investors, social impact funds, foundations, corporate social responsibility initiatives, and philanthropic funds that have made climate commitments in the agrifood space. It should continue to build partnerships with funds that have a climate adaptation or mitigation mission as well as with funds for project preparation facilities and advisory assistance for early-stage entities.

USAID can develop and offer climate finance products (e.g., carbon financing, results-based finance, and environmental impact bonds), risk mitigation instruments (e.g., guarantees, insurance), and structured finance mechanisms (standardization, aggregation, securitization),[149] and support experimentation with both inclusive and innovative financial products and markets (e.g., carbon markets, microinsurance, green bonds, results-based financing, and risk mitigation instruments).[150] However, these efforts are likely to require support until sufficient global economies of scale are achieved. USAID should strengthen oversight bodies to create a unified, consistent, and verifiable approach to measure and value the impact of climate finance across heterogeneous contexts, including external certification, proofs of concept, and policy and financial toolkits to support de-risking for low carbon investments (e.g., creating incentives for investments into climate-smart infrastructure to crowd in private capital). USAID should also ensure that its continued financial support to stimulate investments in the agricultural sector do not lead to adverse climate impacts, such as an increase in greenhouse gas emissions, or yield maladaptive outcomes.

In these efforts, USAID has committed to partnering with DFC, among other U.S. government institutions, to increase financing for climate-friendly projects.[151] However, several barriers impede the Agency's ability to derisk agricultural investments that address climate adaptation and mitigation. DFC operations are more global than USAID agricultural investments, and USAID's timelines to approve and disburse funding are too long to support timely DFC investment opportunities. USAID should therefore consider the creation of a headquarters-based budget or global first-loss facility to de-risk DFC's riskiest, but highest-impact, agriculture investments.

For a more in-depth review of these ideas, see the BIFAD-commissioned Working Paper *Systemic Solutions for Climate Change Adaptation and Mitigation*,[152] which features a deep dive on Private Climate Finance to Catalyze Adaptation and Mitigation in Agribusiness.[153]

[149] Blocher, K., Strinati, C., Balm, A., & Meattle, C. (2022). Climate Finance Innovation for Africa. Climate Policy Initiative. https://www.climatepolicyinitiative.org/publication/climatefinance-innovation-for-africa/

[150] Carr, E. R., Diro, R., Hall, T., Mbevi, L., Zook, D., Beggs, M., Benson, C., Aldredge, H., Allognon, L., Crocker T., Liming, K., and Mukupa, N. (2022). *Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems. Working Paper*. Tetra Tech under the USAID BIFAD Support Contract. https://www.usaid.gov/bifad/climatechangeworkingpaper

[151] USAID (2022). *USAID Climate Strategy 2022-2030*. U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy

[152] https://www.usaid.gov/bifad/climatechangeworkingpaper

[153] The Deep Dive on Climate Finance was led by ISF Advisors (https://isfadvisors.org/), an organization specializing in mobilizing capital to support a more sustainable, equitable, and productive global food system.

Illustrative Intervention: Support Inclusive Carbon Payments

Rationale: By creating incentives for climate-smart behaviors and approaches, and unlocking finance, carbon payments are an important tool for mitigation. The combination of the adoption of Article 6 of the Paris Agreement, multinational net zero commitments, and government NDCs has led to a rapid increase in the demand for carbon credits, and for verified and bankable carbon projects generating them. Despite very thin margins, carbon payments hold promise for supporting the adaptation efforts of smallholders, particularly if combined with targeted extension and technical service provision. However, significant work and research is still required to make carbon credits effective for more smallholders. Carbon payment projects should be designed in ways that consider and support the welfare of smallholders and acknowledge that incomes from carbon markets are not likely to be high, especially in fragile, dry environments. Farmers who are most vulnerable to climate change are not usually the best carbon market participants. Any efforts to advance carbon markets should factor in and monitor potential unintended consequences for smallholders in terms of labor, inputs, other costs, and gender equity involved with carbon sequestering practices/activities, as well as the potential for programs to be misused given power and information asymmetries. While challenges remain to ensuring that smallholders and small agribusinesses can capture the benefits of these markets, carbon payments are a potential source of additional income, and an incentive for the adoption of sustainable practices.

Intervention: USAID should support fair, transparent carbon markets and policy and innovations that incentivize action through, for example, the redirection of subsidies, public–private finance, or reduced transaction costs of Measurement, Reporting, and Verification (MRV). Carbon credits can be purchased and traded for the right to emit a certain amount (typically one ton per credit) of CO_2 or other GHG.[154] Connecting payments to the carbon generated or sequestered through specific practices can incentivize regenerative agriculture and improve soil health, forest conservation, and/or other nature-based solutions linked to agriculture (especially smallholder agriculture). Successful implementation faces many barriers, including insufficient standardization/certification processes, a high risk perception, high transaction costs, technical limitations, challenging unit economics (especially at scale), and a dearth of proven success cases at scale.[155] To move forward with carbon payments, USAID should consider interventions across the spectrum of constraints:

- Policy and standardization frameworks: Support governments in the establishment of carbon payment platforms. Build partner government capacity and develop tools and institutions for monitoring and measuring frameworks. USAID could also act as a convener to facilitate public–private dialogue around carbon markets and develop multi-stakeholder partnerships, and help to ensure that the design is structured in a way that works better for more vulnerable people.
- Carbon payment infrastructure: Support infrastructure that enables private markets to accurately understand the returns and risks associated with these opportunities.[156] Private markets have struggled to accurately do this and would benefit from the policy leadership, stakeholder convening, and market incentivizing activity that donors can support. Support enabling environment considerations that ensure third-party monitoring and consumer protection.
- Analytics: Include farmer-centered analysis that captures labor, cost, and other dimensions, along with robust monitoring, reporting, and verification to ensure agreement adherence and capture unintended consequences.
- Technology-enabled solutions: Incorporate technologies that have the potential to mitigate key technical risks and barriers, such as those that support remote monitoring or link to climate information services. For example, emerging technology-enabled data collection solutions from climate intelligence providers can help financial institutions monitor and evaluate smallholder carbon credits.[157]

[154]World Bank Group. (2022). *What You Need to Know About the Measurement, Reporting, and Verification (MRV) of Carbon Credits.* World Bank. https://www.worldbank.org/en/news/feature/2022/07/27/what-you-need-to-know-about-the-measurement-reporting-and-verification-mrv-of-carbon-credits

[155]World Bank Group. (2017). *Results-based climate finance in practice: Delivering climate finance for low-carbon development.* (Report No. 115053). World Bank. http://documents.worldbank.org/curated/en/410371494873772578/Results-based-climate-finance-in-practice-delivering-climate-finance-for-low-carbon-development

[156]Pettinotti, L., Feyertag, J., & Tyson, J. (2022). *Financing for Natural Capital in Africa.* Financial Sector Deepening Africa. https://www.fsdafrica.org/publication/financing-for-natural-capital-in-africa/

[157]ISF Advisors and International Finance Corporation, World Bank. (2022). *Tools to Assess Climate Risks in Lending to Agriculture.*

- Innovative financial mechanisms/business models: The creation of structured finance mechanisms that can aggregate and securitize fragmented agricultural producers to allow more efficient linkages with broader markets can solve fundamental issues created by the fragmented and often informal nature of agricultural markets.

Opportunity for USAID: USAID has invested for over a decade in natural climate solutions for mitigation, including the use of carbon finance and carbon markets to incentivize sustainable management and restoration of land.[158] To date, much (but not all) of USAID's research, standards-setting, and piloting has focused on forest protection and restoration. Soil carbon sequestration is an emerging area of focus for carbon markets. The Agency should devote resources to addressing the major barriers to carbon markets that benefit smallholders. By researching and testing low-cost technologies that will support monitoring and implementation, USAID can act as a catalyst to de-risk inclusive carbon markets in an effort to provide strong use cases and archetypes that provide evidence for further experimentation, uptake, and crowding in of capital.[159]

When facilitating interventions, USAID planners should also weigh whether carbon payments are the most appropriate method, versus other more direct mechanisms such as payment for ecosystem services (PES, see Appendix A for definitions and Appendix E for an illustrative PES intervention), which can also incentivize certain actions such as more sustainable land use and forest conservation but can be more easily structured in the absence of extensive MRV frameworks. PES may be more suitable for shorter-term activities, such as incentivizing agroforestry or regenerative agriculture practices.

USAID should invest in researching and piloting alternative avenues for carbon payments, beyond carbon markets and credits. As an early leader and consistent investor in fostering high-quality standards, USAID is well positioned to support the research and pilots necessary to enable credible accounting and exchanges of carbon payments through a variety of mechanisms. USAID should also pilot approaches to link carbon payments to programs that support other aspects of mitigation or adaptation. For example, the Agency could facilitate the establishment of carbon markets where a portion of the payments is used to support scale-up of climate-smart technologies combined with extension.

USAID should be cautious about promoting programs that solely incorporate credits in the sense of offsets (which allows firms to pay to continue to pollute), as opposed to more integrated approaches or those which include caps on pollution. It may consider facilitating a review of GHG emissions (including methane) in local agricultural value chains in order to direct investments that transform activities/processes that are not climate compliant.

While challenges with this intervention are continuously explored and resolved, USAID can act as a convener, knowledge transfer facilitator, de-risker, and provider of catalytic blended capital, ultimately allowing the private sector to develop the market.[160] USAID can build from similar past and ongoing work to achieve these goals in new geographies.

Illustrative Example of Impact: The Africa Carbon Markets Initiative (ACMI), a multistakeholder effort launched at COP27, is seeking to establish voluntary carbon markets and mobilize $6 billion in carbon credits in Africa by 2030 and $50 billion by 2050.[161] ACMI anticipates this exchange will sequester 1.5-2.5 gigatonnes of CO_2 by 2050. The organizers include Global Energy Alliance for People and Planet, Sustainable Energy for All, The Rockefeller Foundation, and the UN Economic Commission for Africa. USAID is on the steering committee as an advisor and the initiative has been supported by USAID missions at a country level. The intermediaries and financial institutions involved include M-PESA Africa, Hartree, MENA Voluntary Carbon Exchange, and Conservation International, with

[158]USAID (2023). Natural Climate Solutions. https://www.usaid.gov/climate/natural-solutions Access 18 July 2023
[159]Phillips, J., Plutshack, V., Fetter, T. R., Jeuland, M., Elisha, F., Vanover, A., & Yoder, E. (2022). *Catalyzing Climate Finance for Low-Carbon Agriculture Enterprises*. Shell Foundation. https://shellfoundation.org/app/uploads/2022/02/Climate_finance_Report-1.pdf
[160]Richmond, M., Choi, J., Padmanabhi, R., Lonsdale, A. (2021). *Financial Innovation for Climate Adaptation in Africa*. Global Center on Adaptation. https://gca.org/wp-content/uploads/2021/10/GCA-CPI-Financial-Innovation-for-Climate-Adaptation-in-Africa.pdf
[161] Sustainable Energy for All. (n.d.). *Africa Carbon Markets Initiative*. https://www.seforall.org/our-work/initiatives-projects/ACMI

Verra as the verification agent. Countries that have already signed up to participate include Kenya, Gabon, Malawi, Mozambique, Togo, Nigeria, Burundi, and Rwanda, with an estimated $200 million in market commitments and 13 identified initiatives.[162] While still in the early days of this initiative, the scale of the road map, the multi-stakeholder steering committee, and the country buy-ins make this a promising initiative to watch in terms of voluntary carbon markets.

High-Potential Geographic Focus Areas: Carbon markets have demonstrated success in established agroforestry systems and conservation offsets, with accessible credits from forest carbon offsets worldwide and from agricultural land in North America and Europe. Sub-Saharan Africa presents significant opportunities for carbon markets associated with agriculture.

Leverage Point: Integrated Soil and Water Management

Definition: Integrated soil and water management systems encompass a holistic approach, combining techniques and technologies to maximize the utilization of soil and water resources efficiently, including strategies for soil quality and health, water preservation, erosion mitigation, nutrient circulation, and biodiversity, while accounting for hydrological cycle interactions and environmental impacts.

Impact Pathways: Soil health is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.[163] Increasing soil organic content improves nutrient storage, water-holding capacity, aggregation, and sorption of organic and/or inorganic pollutants, leading to improved productivity, clean water supply, and biodiversity.[164,165,166,167] In addition, building resilience to extreme events requires an integrated approach to soil and water. Improved soil water infiltration and retention can be achieved with soil water management practices such as precision irrigation, water conservation, water harvesting, runoff reduction through contour bunds and minimal disturbance, and managing evapotranspiration through cover crops and mulches.[168] Scaling and strengthening integrated soil and water management practices has the potential to improve development outcomes related to productivity, incomes, and nutrition while also driving adaptation and, more cautiously, mitigation benefits related to soil carbon sequestration. While methodologies to practically measure mitigation benefits at the smallholder level are still being tested, healthier soil has the capacity to act as a carbon sink, effectively reducing GHG emissions. Soil carbon sequestration potential in croplands and grasslands has been estimated to range from 0.4 to 8.6 $GtCO_2e$ per year.[169]

Implications for USAID: USAID should provide support to scale implementable research[170] with consideration of private sector partnerships while also supporting governments to put

[162]Climate Champions. (2023, January 16). *Africa Carbon Markets Initiative announces 13 action programs.* Race to Resilience, UNFCCC. https://climatechampions.unfccc.int/africa-carbon-markets-initiative-announces-13-action-programs/
[163]Forest Service. U.S. Department of Agriculture. https://www.fs.usda.gov/nac/topics/soil-health.php
[164]Lal, R. (2020). Regenerative agriculture for food and climate. *J.Soil Water Conservation.* https://doi.org/10.2489/jswc.2020.0620A
[165]Lal,R. (2020). Soil organic matter and water retention. *Agronomy J.112*(5):3265-3277. https://doi.org/10.1002/agj2.20282
[166]Stewart, B.A., & Lal, R. (2018). Increasing World Average Yields of Cereal Crops: It's All About Water. In D. L. Sparks (Ed.), *Advances in Agronomy* (pp. 1-44). Academic Press, Vol. 151. https://doi.org/10.1016/bs.agron.2018.05.001.
[167]Parmesan, C., Morecroft, M.D., Trisurat, Y., Adrian, R., Anshari, G.Z., Arneth, A., Gao, Q., Gonzalez, P., Harris, R., Price, J., Stevens, N., and Talukdarr, G.H. (2022). Terrestrial and Freshwater Ecosystems and Their Services. In: H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Eds.) *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* (pp. 197–377). Cambridge University Press. https://doi.org/10.1017/9781009325844.004
[168]Cornelis, W., Waweru, G., & Araya, T. (2019). Building Resilience Against Drought and Floods: The Soil-Water Management Perspective. In R. Lal & R. Francaviglia (Eds.), *Sustainable Agriculture Reviews 29* (Vol. 29, pp. 125–142). Springer International Publishing. https://doi.org/10.1007/978-3-030-26265-5_6
[169]IPCC. (2019). Technical Summary. In Shukla, P.R., J. Skea, R. Slade, R. van Diemen, E. Haughey, J. Malley, M. Pathak, J. Portugal Pereira (Eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.* https://doi.org/10.1017/9781009157988.002
[170] Lal, R. (2020). Managing soils for negative feedback to climate change and positive impact on food and nutritional security. *Soil Science and Plant Nutrition*, *66*(1), 1-9. https://doi.org/10.1080/00380768.2020.1718548

integrated soil and water programs into practice. This includes restoring soil health (especially where it has been degraded) and facilitating better water management and irrigation, erosion control, and sound fertilizer application. Within the Climate Strategy target to "support the conservation, restoration, or management of 100 million hectares with a climate change mitigation benefit,"[171] USAID should set sub-targets that specifically address soil health, sustainable water use, and regenerative practices with the greatest combined impacts in adaptation, mitigation, and human health. USAID is also uniquely positioned to study, learn from, and build upon Indigenous soil health and broader food systems practices as a high-impact, trust-building measure. An illustrative intervention on Soil Water Management is detailed in Appendix E.

Illustrative Intervention: Regenerative Agriculture

Rationale: Regenerative agriculture is a strategy that encompasses a range of practices to restore soil health, such as agroforestry, conservation agriculture, improved carbon sequestration, and cover cropping.[172] Degraded land necessitates the use of inputs such as manure and fertilizer to restore lost nutrients. However, overuse of these nutrients in certain regions leads to N_2O emissions, excess nutrient acidification, and groundwater contamination. Healthy soils require fewer added nutrients and can therefore reduce N_2O emissions, while regenerative agriculture can aid in carbon sequestration and improve soil health.[173] The carbon sequestration potential of global regenerative agricultural technique adoption is estimated at 10 to 100 percent of current anthropogenic CO_2 emissions.[174,175]

Intervention: Regenerative agriculture generally includes complex crop rotation and diversification, integrated nutrient management, use of soil cover and cover crops, incorporation of organic materials such as compost into soil, and other practices that restore and maintain soil health.[176] Regenerative agriculture should be a part of an overall approach to sustainable land management, which includes considerations of forests, grasslands, multiple uses of land, biodiversity, and relative trade-offs. Regenerative agriculture is "crop neutral" and applicable to almost all farming systems.[177] Adoption can be incentivized by supporting integrated risk management approaches, facilitating partnerships and education, or providing Payment for Ecosystems Services (PES) and carbon credits. Activities could also test and scale adoption of small-scale farming technologies for soil carbon measurement and accounting, and the establishment of carbon credits.[178,179] In addition to private sector leadership, large-scale implementation of regenerative agriculture will likely require action from policy makers through something like a Soil Health Act.[180,181]

Opportunity for USAID: Regenerative agriculture must address soil needs through locally-based research and monitoring systems adapted to changing climate conditions. USAID should support efforts to identify regional soil variations and strengthen local research institutions' monitoring and adaptive capacity. This would build on previous BIFAD recommendations to support locally led agricultural policy research institutes[182] and is in line with USAID's Local Capacity Strengthening Policy.[183] Agricultural activities with policy components could also facilitate public–private dialogue on

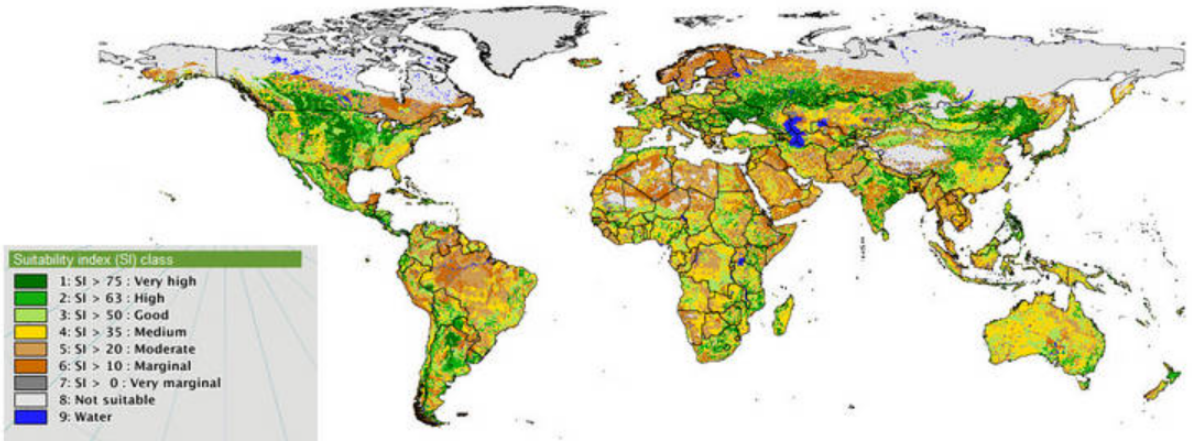
[171] (2022). *USAID Climate Strategy 2022-2030*. pp.2. U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy
[172]Lal, R. (2020). Regenerative agriculture for food and climate. *J.Soil Water Conservation.* https://doi.org/10.2489/jswc.2020.0620A
[173]Lal, R. (2016). Soil health and carbon management. *Food and Energy Security, 5*(4), 212–222. https://doi.org/10.1002/fes3.96
[174] Giller, K. E., Hijbeek, R., Andersson, J. A., & Sumberg, J. (2021). Regenerative agriculture: an agronomic perspective. Outlook on agriculture, 50(1), 13-25.
[175]Moyer J, Smith A, Rui Y, et al. (2020) *Regenerative Agriculture and the Soil Carbon Solution*. Kutztown, PA: Rodale Institute. Available at: https://rodaleinstitute.org/wp-content/uploads/Rodale-Soil-Carbon-White-Paper_v11-compressed.pdf.(accessed 1 February 2021)
[176]Lal,R. (2015). Sequestering carbon and increasing productivity by conservation agriculture. *J.Soil Water Conservation 70*(3):55A-62A. https://doi.org/10.2489/jswc.70.3.55A
[177]Dahm, M., & Listman, M. (May 9, 2022). *Q&A: Regenerative agriculture for soil health*. CIMMYT. https://www.cimmyt.org/news/qa-regenerative-agriculture-for-soil-health/
[178]England, J.R., and Viscarra Rossel, R.A. (2018). Proximal sensing for soil carbon accounting. *SOIL, 4*(2), pp. 101–122. https://doi.org/10.5194/soil-4-101-2018.
[179]Such measurement and accounting is important for United Nations Framework Convention on Climate Change (UNFCCC) reporting.
[180]Gewin, V. (2020, July 15). The World Food Prize Winner Says Soil Should Have Rights. *Civil Eats*. https://civileats.com/2020/07/15/the-world-food-prize-winner-says-soil-should-have-rights/
[181]Lal, R. (2020). Regenerative agriculture for food and climate. *J.Soil Water Conservation.* https://doi.org/10.2489/jswc.2020.0620A
[182]Jayne, T.S., Fox, L., Fuglie, K., & Adelaja, A. (2020). *Agricultural Productivity Growth, Resilience, and Economic Transformation in Sub-Saharan Africa: Implications for USAID.* USAID.
[183]USAID. (2022). *Local Capacity Strengthening Policy*. USAID. https://www.usaid.gov/sites/default/files/2022-10/LCS-Policy-2022-10-17.pdf

enabling environment reforms to support regenerative agriculture, particularly in the 47 percent of countries which include soil health in their 2022 NDCs.[184]

Illustrative Example of Impact: In addition to adaptation and mitigation benefits, regenerative agriculture is also anticipated to have food security benefits over time. A recent UN and International Union for Conservation of Nature report estimates that yields in Africa could increase by 13 percent by 2040 if regenerative agricultural practices were adopted on a large scale.[185] In Zambia, a study showed that combining varieties of legumes with maize increased productivity for both crops.[186,187] However, in the short term, productivity may be negatively impacted.[188]

[184]UNFCCC Secretariat. (2022). *Nationally determined contributions under the Paris Agreement: Synthesis report by the secretariat.* (Publication GE.22-17490(E)). UNFCCC. https://unfccc.int/sites/default/files/resource/cma2022_04.pdf
[185]Masterson, V. (2022). *What is Regenerative Agriculture?* https://www.weforum.org/agenda/2022/10/what-is-regenerative-agriculture/
[186]World Business Council for Sustainable Development. (2021). *These Regenerative Agriculture Trials Prove that Farming Can Improve Soil Health Without Sacrificing Yield.*
https://www.wbcsd.org/Projects/OP2B/News/These-regenerative-agriculture-trials-prove-that-farming-can-improve-soil-health-without-sacrificing-yield
[187]Mwila, M., Mhlanga, B., & Thierfelder, C. (2021). Intensifying Cropping Systems Through Doubled-Up Legumes in Eastern Zambia. *Sci Rep*, 11(8101). https://doi.org/10.1038/s41598-021-87594-0
[188]Martins, F., Atleo, T., Mbazima, G., and Israelit, S. (2021). *Helping Farmers Shift to Regenerative Agriculture.*
https://www.bain.com/insights/helping-farmers-shift-to-regenerative-agriculture/.

High-Potential Geographic Focus Areas: Soil health is important to consider in all agricultural programs, but some areas face more urgent challenges. Regions with large yield gaps would have adaptation benefits. Regions with a history of significant carbon loss, or a risk of future carbon loss, have mitigation potential. The FAO Soils Portal includes indicators on global soil health. The following map shows global soil suitability and indicates that many places in the world would benefit from strategies to maintain or restore soil health.[189]



Source: Soil Suitability at low input (IIASA/FAO)[190]

Implementation of specific regenerative agricultural approaches should be prioritized and tailored based on local soil conditions (requiring greater investment in soil mapping to inform decision-making[191]), priority cropping systems, potential for positive human and environmental impacts, and local production practices.[192] Examples of potential regenerative agricultural practices in countries or regions where USAID works include:[193]

- Organic residue management: Sub-Saharan Africa, Brazil
- Biochar application: Brazil, Columbia, South Asia, East Asia
- Soil management such as reduced or no-till systems, deep soil inversion, bed and furrow management: Democratic Republic of Congo, Ethiopia, India
- Mulching and cover cropping: Ethiopia

Leverage Point: Integrated Forest and Agricultural Land Management

Definition: Integrated forest and agricultural land management focuses on strengthening land use governance and maximizing the long-term productivity of land using proven solutions tailored to diverse context-specific challenges worldwide.

Impact Pathways: Land use and land-use change represent about 40 percent of global agricultural emissions. Those emissions are caused mainly by deforestation and drainage and

[189] FAO. FAO Soils Portal. https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/other-global-soil-maps-and-databases/en/.
[190] IIASA & FAO. (n.d.). *Soil suitability at low input* [map]. Harmonized World Soil Database v 1.2., FAO Soils Portal, FAO. https://www.fao.org/soils-portal/soil-degradation-restoration/global-soil-health-indicators-and-assessment/global-soil-health/en/
[191] FAO and ITPS. (2015). *Status of the World's Soil Resources (SWSR) – Main Report.* Food and Agriculture Organization of the United Nations and Intergovernmental Technical Panel on Soils. https://doi.org/978-92-5-109004-6
[192] IPCC. (2019). Summary for Policymakers. In P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (Eds.), *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.* Cambridge University Press. https://doi.org/10.1017/9781009157988.00
[193] Amelung, W., Bossio, D., de Vries, W., Kögel-Knabner, I., Lehmann, J., Amundson, R., ... & Chabbi, A. (2020). Towards a global-scale soil climate mitigation strategy. *Nature communications*, *11*(1), 5427.

burning of organic soils.[194] Forests and natural ecosystems are critical sources of water, food, and fuel needed for agriculture and food security, as well as for climate adaptation strategies in agriculture. For agrifood systems to be sustainable, food production cannot come at the expense of forests and other natural resources. Agricultural intensification (i.e., increased food production from the same unit area) is in itself not a solution as it stimulates natural ecosystem conversion[195] unless governance mechanisms are in place to manage incentives. Solutions to create synergies between climate and food security goals include effective land-use governance and the integration of trees, water, and soil conservation strategies on agricultural land.

Effective governance pathways include addressing risks to forest in local investments in land use,[196] framing political goals to explicitly include development objectives such as equity and conservation, and strengthening land governance domestically and internationally.[197] Complementing investments in land-use governance, investments to integrate trees and tree crops into agricultural land can improve yield resilience, the stability of long-term production and income, and incentives for sustainable management. Finally, governance can be effectively enhanced by improving provision of reliable information on land use change and the effect of agriculture supply chains on land use, using these monitoring tools to influence markets and policy-makers.

Implications for USAID: For decades, USAID has invested in applied research to learn from its investments in agriculture and natural resources management. Through those investments, USAID has learned how to integrate climate-adaptive development programming with biodiversity objectives[198] and developed program design strategies that reduce land-based greenhouse gas emissions.[199] The Agency's research has delivered broad solutions that manage the trade-offs and maximize the synergies between agriculture and natural resources.[200] If USAID and its partners apply these solutions, tailor them to the many context-specific challenges and enabling conditions necessary for their success,[201] and continue to learn and adapt through cross-sectoral collaboration, the Agency will make a unique and lasting contribution to both its climate and food security objectives.

Illustrative Intervention: Strengthen Policy Frameworks to Generate Incentives and Build Market Demand for Deforestation-Free Agriculture
Rationale: Strengthened land tenure and governance, improved policy frameworks, and increased market demand for forest-friendly products can create an enabling environment for deforestation-free agriculture and improved biodiversity. This is especially important in ecosystems containing high carbon stocks, such as tropical forests and peatlands.
Intervention: National governments need support to develop and implement legal and policy frameworks that create the enabling environment for zero-deforestation agriculture. Support should

[194] FAO. (2020). *Emissions due to agriculture. Global, regional and country trends 2000–2018.* FAOSTAT Analytical Brief Series No 18. https://www.fao.org/3/cb3808en/cb3808en.pdf

[195] IPCC. (2019) Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. https://doi.org/10.1017/9781009157988.001

[196] E.g., the development of infrastructure or siting and managing protected areas

[197] ProLand. (2021). *Agriculture's Footprint: Designing Investment in Agricultural Landscapes to Mitigate Tropical Forest Impacts*. Report of the ProLand Project, implemented by Tetra Tech and funded by the US Agency for International Development. https://www.climatelinks.org/resources/agricultures-footprint-designing-investment-agricultural-landscapes-mitigate-tropical

[198] USAID. (2015). *Integrating Biodiversity and Climate Change Adaptation in Activity Design*. https://www.climatelinks.org/resources/integrating-biodiversity-an. d-climate-change-adaptation-activity-design.

[199] USAID. (2021). *Productive Landscapes (PROLAND): Sustainable Landscapes Resource on Select Strategies to Reduce Land-Based Greenhouse Gas Emissions*. https://www.climatelinks.org/resources/sustainable-landscapes-resource-select-strategies-reduce-land-based-greenhouse-gas

[200] ProLand. (2021). *Agriculture's Footprint: Designing Investment in Agricultural Landscapes to Mitigate Tropical Forest Impacts*. Report of the ProLand Project, implemented by Tetra Tech and funded by the US Agency for International Development. https://www.climatelinks.org/resources/agricultures-footprint-designing-investment-agricultural-landscapes-mitigate-tropical

[201] See, for example: USAID. *Global Assessments of Promising Landscape Productivity Enhancement Approaches.* https://www.climatelinks.org/projects/proland/global-assessments-promising-landscape-productivity-enhancement-approaches

include the implementation of producer market measures, such as payments for ecosystem services (PES), and consumer market measures, such as certification schemes. Building market demand for certified products is an important medium-term priority that enables the continued growth of certification programs, which in turn support producer decisions to adopt intensification practices without contributing to additional deforestation. These efforts should also advocate for clean energy transitions, as unsustainable harvest of wood for fuel is another significant driver of deforestation and ecosystem degradation.

Opportunity for USAID: USAID can 1) build improved tools and systems to monitor land use and land-use change; 2) improve institutions' capacity to implement low-emissions development policies; 3) promote payment for ecosystem services; 4) promote community-based forest enterprises; 5) promote sustainable livestock production; 6) promote landscape restoration; 7) support sustainable supply chains; and 8) improve market demand for and supply of legal and sustainable agriculture products.[202]

Illustrative Example of Impact: An evaluation[203] of a payment for ecosystem services (PES) project in Uganda assessed impacts of offering households annual payments in return for not cutting trees on their forestlands. It found that villages receiving the payments saw half the tree cover losses of villages that did not receive the payments (4.2 percent in treatment villages compared to 9.1 percent in control villages), which equated to about 0.3 hectares of averted deforestation per household. The study estimated that the value of delayed carbon dioxide emissions from the program amounted to about 2.4 times the program implementation costs.[204]

High-Potential Geographic Focus Areas: Immediate action is needed in regions with high concentrations of deforestation hotspots and large areas of at-risk forests.[205] These areas exist across Latin America, sub-Saharan Africa, and Southeast Asia, including the Amazon, Central Africa, Mekong, and Indonesia. Additionally, emerging fronts in West Africa (Liberia, Ivory Coast, Ghana), East Africa (Madagascar), and Latin America (Guyana, Venezuela, Mexico, Guatemala) demand urgent attention.[206,207]

Leverage Point: Food Loss and Waste Reduction

Definition: Food Loss and Waste (FLW) refers to food intended for human consumption that is wasted or lost along the supply chain, including through production, post-harvest handling, or processing, or when discarded by consumers.

Impact Pathway: Nearly a third of food produced for human consumption is lost or wasted each year.[208] Globally, FLW contributes 8 to 10 percent of GHG emissions[209] and represents a tremendous lost opportunity to support global food security, nutrition, and income for smallholder producers, especially women, who produce the majority of staple crops in low-income countries.

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[202]USAID. (2021). *Productive Landscapes (PROLAND): Sustainable Landscapes Resource on Select Strategies to Reduce Land-Based Greenhouse Gas Emissions*. https://www.climatelinks.org/resources/sustainable-landscapes-resource-select-strategies-reduce-land-based-greenhouse-gas

[203] Jayachandran S, de Laat J, Lambin EF, Stanton CY, Audy R, Thomas NE. (2017). Cash for Carbon: A Randomized Trial of Payments for Ecosystem Services to Reduce Deforestation. *Science*. Jul 21; 357(6348):267-273. doi: 10.1126/science.aan0568.

[204] Tetra Tech. (2020). *Productive Landscapes (PROLAND): What do Experience and Research Tell Us About Using PES to Limit Deforestation? A Synthesis of the Evidence and Case Studies from Uganda and Colombia.* https://www.climatelinks.org/sites/default/files/asset/document/2021-02/2020_USAID_Proland_PES-Case-Study.pdf

[205]Pacheco, P., Mo, K., Dudley, N., Shapiro, A., Aguilar-Amuchastegui, N., Ling, P.Y., Anderson, C. and Marx, A. (2021). Deforestation fronts: Drivers and responses in a changing world. WWF, Gland, Switzerland.

[206]Pacheco, P., Mo, K., Dudley, N., Shapiro, A., Aguilar-Amuchastegui, N., Ling, P.Y., Anderson, C. and Marx, A. (2021). Deforestation fronts: Drivers and responses in a changing world. WWF, Gland, Switzerland.

[207]Steiner A, Aguilar G, Bomba K, Bonilla JP, Campbell A, Echeverria R, Gandhi R, Hedegaard C, Holdorf D, Ishii N, Quinn K, Ruter B, Sunga I, Sukhdev P, Verghese S, Voegele J, Winters P, Campbell B, Dinesh D, Huyer S, Jarvis A, Loboguerrero Rodriguez AM, Millan A, Thornton P, Wollenberg L, Zebiak S. (2020). Actions to transform food systems under climate change. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

[208]Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., Meybeck, A. (2011). Global Food Losses and Food Waste– Extent, Causes and Prevention. Food and Agriculture Organization of the United Nations (FAO).

[209]Zhongming, Z., Linong, L., Xiaona, Y., Wangqiang, Z., & Wei, L. (2021). UNEP food waste index report 2021. UNEP: Nairobi, Kenya.

The World Resources Institute estimates that reducing FLW by one quarter by 2050 would close the GHG mitigation gap by 15 percent.[210] The distribution of FLW along the supply chain varies meaningfully by region. Handling and storage, for example, represent 37 percent of FLW in South and Southeast Asia but just 6 percent in North America.[211] In sub-Saharan Africa, the annual magnitude of food loss is equivalent in value to annual cereal imports and exceeds the value of total food aid received over a decade.[212]

The improved efficiency of food production systems from reduced FLW serves to stabilize food availability in the face of climate and other shocks and stressors.[213,214,215] Reductions can prevent cropland expansion into standing forest, curtailing the release of carbon and leaving more land available for carbon sequestration.[216] Food waste is also nutrient waste and should thus be addressed as a risk to dietary quality and diversity. Addressing FLW within value chains associated with high production emissions (e.g., meat, milk) has the potential to yield particularly favorable results.

Implications for USAID: USAID has invested in the FTF Innovation Lab for the Reduction of Post-Harvest Loss and plans to invest $60 million over the next five years in FLW research.[217] It has also joined a coalition of leaders committed to cutting global per capita food waste at the retail and consumer level in half by 2030 while reducing supply chain losses.[218] However, investments to date have had limited emphasis on climate change. The Innovation Lab for the Reduction of post-harvest loss (PHL), for example, does not include a focus on the potential for climate-related outcomes.[219] The Agency's FLW research should prioritize solutions that focus on environmental sustainability, energy efficiency, and efficient composting or anaerobic digestion to prevent unintended increases in GHG emissions. FTF Innovation Labs should proactively integrate current and future climate impacts into FLW research efforts. Innovation Labs could, for instance, conduct research to understand the impacts of climate change on FLW across different temperature scenarios and contexts. Research efforts could also be more systematically integrated with USAID partner country national research systems, for example, through direct funding to enhance localized FLW mitigation research. USAID could also leverage its convening power to advocate for and influence larger allocations of resources for FLW reduction research in national budgets. Finally, USAID should invest in the capacity of stakeholders (smallholder farmers, government, the private sector, universities, research institutions, etc.) to implement technical solutions and share knowledge on FLW prevention and reduction at critical points along the value chain. For example, harvesting is a critical loss point for cereals and legumes, particularly in sub-Saharan Africa.[220] USAID could integrate training on

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[210]Ranganathan, J., Waite, R., Searchinger, T., & Hanson, C. (2018). *How to Sustainably Feed 10 Billion People by 2050, in 21 Charts*. World Resources Institute. https://www.wri.org/insights/how-sustainably-feed-10-billion-people-2050-21-charts

[211]Ranganathan, J., Waite, R., Searchinger, T., & Hanson, C. (2018). *How to Sustainably Feed 10 Billion People by 2050, in 21 Charts*. World Resources Institute. https://www.wri.org/insights/how-sustainably-feed-10-billion-people-2050-21-charts

[212]Affognon, H., Mutungi, C., Sanginga, P., and Borgemeister, C. (2015). Unpacking Postharvest Losses in Sub-Saharan Africa: A Meta-Analysis. *World Development, 66*: 49-68. https://doi.org/10.1016/j.worlddev.2014.08.002.

[213]Wijewardane, N. (2022). Sustainable Postharvest Management: The Key to Attaining Food Security. *Proceedings of the Sri Lanka Association for the Advancement of Science, 78*(2), 15-26. https://www.slaas.lk/images/annual_sessions/proceedings/Part_II_Presidential_Addresses_2022_SLAAS.pdf

[214]Kumar, D., & Kalita, P. (2017). Reducing Postharvest Losses during Storage of Grain Crops to Strengthen Food Security in Developing Countries. *Foods*, *6*(1), 8. https://doi.org/10.3390/foods6010008

[215]Kuiper, M. & Cui, H.D. (2021). Using food loss reduction to reach food security and environmental objectives – A search for promising leverage points. *Food Policy, 98*. 101915. https://doi.org/10.1016/j.foodpol.2020.101915.

[216]Global Panel on Agriculture and Food Systems for Nutrition. (2020). *Future Food Systems: For people, our planet, and prosperity.* https://foresight.glopan.org/

[217] USAID. (2021, September 23). *Administrator Power Announces $5 Billion in Food Systems Investments to Combat Global Hunger and Malnutrition.* [Press release]. https://www.usaid.gov/news-information/press-releases/sep-23-2021-administrator-power-announces-5-billion-food-systems-investments-combat-global-hunger-and-malnutrition#:~:text=%2460%20million%20over%20five%20years%20in%20new%20research,Future%20Innovation%20Lab%20for%20Food%20Systems%20for%20Nutrition

[218] USAID. (2021, September 23). *Administrator Power Announces $5 Billion in Food Systems Investments to Combat Global Hunger and Malnutrition.* [Press release]. https://www.usaid.gov/news-information/press-releases/sep-23-2021-administrator-power-announces-5-billion-food-systems-investments-combat-global-hunger-and-malnutrition#:~:text=%2460%20million%20over%20five%20years%20in%20new%20research,Future%20Innovation%20Lab%20for%20Food%20Systems%20for%20Nutrition

[219] USAID. (2017). *Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss*. https://www.k-state.edu/phl/what-we-do/PHL%20Brochure_1.23.17_Final.pdf

[220] FAO, IFAD and WFP. (2021). Food loss analyses to identify major causes of losses and to recommend solutions to reduce post-harvest loss –

stages of maturity, timing, and harvest methods in its value chain programming to minimize food loss. Such interventions offer another opportunity for the Agency to enhance the access of women and other underrepresented groups to transformative resources, in this case post-harvest technologies and facilities.

Illustrative Intervention: Post-harvest Service Centers (PSC)
Rationale: Annual post-harvest distribution losses amounting to nearly $400 million (15 percent of global production value) could be mitigated, according to the FAO.[221] A loss reduction of just 25 percent would result in a 4 percent increase in global food availability. Post-harvest loss results from inadequate access to facilities that ensure proper storage (e.g., protection from moisture and rodents).
Intervention: Post-harvest processing service centers are facilities where agricultural products are processed, packaged, and stored after harvest, improving their shelf lives and protecting them against spoilage. PSC interventions can improve supply chain and network coordination, optimizing the time between harvest, sales, and delivery. Frequently found in cash- or export crop-producing areas (e.g., coffee growing areas), post-harvest processing centers can attract smallholder farmers by providing a range of services, such as insurance, credit, climate information, and market linkages, in addition to processing. A comprehensive approach can increase center use and financial sustainability while providing farmers with access to services that can help them adapt to a changing climate. Addressing the post-harvest processing needs of women is particularly important (in food drying or smoking, use of solar power technologies, etc.) and can contribute to sustainable livelihoods.[222]
Opportunity for USAID: Where post-harvest processing service centers already exist, USAID could enhance their utility with linkages to other services such as banking/credit, insurance, and localized climate information. This facilitation could take the form of grants, technical assistance, support for public–private partnerships (e.g., contract farming schemes), cooperatives, or extension services. Where post-harvest processing centers are scarce or nonexistent, USAID could invest in infrastructure and advocate for their establishment as one-stop-service centers.
Illustrative Example of Impact: An improved maize storage facility in Uganda led to a 21 percent increase in the length of maize storage for consumption—which is associated with increased household food security—and a 75 percent reduction in reported storage losses.[223]
High-Potential Geographic Focus Areas: Most significant gains in food and nutrition security will come from minimizing FW-PHL in the initial stages of the supply chain (e.g., on farm operations) in sub-Saharan Africa and South Asia. The reduction of FLW further on in the supply chain will have significant implications for mitigation, particularly in Central and Southern Asia, which have the highest food loss and waste carbon footprint globally.

Leverage Point: Low-Emissions Animal Production

Definition: Low-emissions livestock development focuses on minimizing the carbon footprint of the livestock sector while meeting food security, nutrition, and livelihood needs in a more sustainable and climate-friendly manner.

Grain supply chains in Burkina Faso, the Democratic Republic of the Congo and Uganda - Technical brief. Rome.

[221]FAO. (2019). *The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction.* FAO. http://www.fao.org/3/ca6030en/ca6030en.pdf

[222]Eswara, A. R., & Ramakrishnarao, M. (2013). Solar energy in food processing—a critical appraisal. *Journal of Food Science and Technology, 50*(2), 209–227. https://doi.org/10.1007/s13197-012-0739-3

[223] Oluwatoba J. Omotilewa, Jacob Ricker-Gilbert, John Herbert Ainembabazi, & Gerald E. Shively (2018). Does improved storage technology promote modern input use and food security? Evidence from a randomized trial in Uganda. *Journal of Development Economics*, v135, 176-198. https://doi.org/10.1016/j.jdeveco.2018.07.006.

Impact Pathway: Globally, 600 million people depend on livestock for their livelihoods.[224] Livestock, one of the largest sources of non-CO_2 GHGs, are responsible for an estimated 6 percent of global emissions and 60 percent of agricultural emissions.[225] Current livestock emissions is primarily driven by beef and dairy consumption in developed countries. Yet, demand for animal protein is expected to grow in middle and low income countries alongside per capita income and global population growth. Shifting global diets is estimated to reduce agricultural emissions by two thirds.[226] It is also recognized that animal-sourced foods contribute to improved micronutrient status and dietary quality for regions such as sub-Saharan Africa, where food and nutrition gaps remain a priority.[227] The livestock sector, thus, presents substantial opportunities to address climate adaptation and mitigation outcomes while meeting food and nutrition security. Productivity-focused solutions can also lower rates of emissions growth while improving the supply of animal protein (protecting food security, nutrition, and incomes) while reducing the intensity of emissions required to do so. Improved management of grazing lands, for example, can amplify soil carbon sequestration, mitigate GHG emissions, and enhance food security by boosting productivity.[228]

Implications for USAID: USAID is currently investing in its second five-year Innovation Lab for Livestock Systems, which focuses on climate-smart research innovations related to livestock production.[229] USAID and USG support the UN-led Climate and Clean Air Coalition, including contributing to the Global Methane Pledge, which encourages countries to reduce methane emissions by 30 percent by 2030, and includes partner country methane emissions reductions in its Climate Strategy. USAID should make explicit its commitment and plans to address methane emissions from livestock systems, and strengthen its development of approaches to livestock productivity that address methane emissions as a priority outcome rather than a co-benefit. For example, no Innovation Lab for Livestock Systems research specifically targets methane reduction, and the Climate Strategy does not specifically mention a focus on reducing methane emissions from livestock. The Agency should increase its investments in the sector to pursue scalable and sustainable productivity solutions that complement existing innovations to address methane emissions across geographies and animal types. It should also work to address the potential perverse incentives associated with increased livestock productivity, including impact on biodiversity, water use, and environmental pollution. More importantly, the Agency should ensure that its livestock investments do not lead to cattle-driven deforestation. In addition, its private sector investments need to prioritize companies and projects that take into account value chain emissions.

Illustrative Intervention: Sustainable intensification of smallholder dairy production

Rationale: Intensification of smallholder dairy in many LMICs presents an opportunity to improve the livelihoods and nutrition of producers while reducing dairy sector emissions. Evidence suggests that it helps to develop local markets and has significant multiplier effects that benefit processors and retailers in relatively long value chains. Sustainable intensification increases milk yields of cattle with improved feeding, breeding, and health management while strengthening dairy markets to incentivize higher

[224]Thornton, P. K. (2010). Livestock production: recent trends, future prospects. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1554), 2853-2867.
[225]Climate Watch (2023). World Resources Institute. https://www.climatewatchdata.org/
[226]Steiner A, Aguilar G, Bomba K, Bonilla JP, Campbell A, Echeverria R, Gandhi R, Hedegaard C, Holdorf D, Ishii N, Quinn K, Ruter B, Sunga I, Sukhdev P, Verghese S, Voegele J, Winters P, Campbell B, Dinesh D, Huyer S, Jarvis A, Loboguerrero Rodriguez AM, Millan A, Thornton P, Wollenberg L, Zebiak S. 2020. Actions to transform food systems under climate change. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
[227] Adesogan, A. T., Havelaar, A. H., McKune, S. L., Eilittä, M., & Dahl, G. E. (2020). Animal source foods: sustainability problem or malnutrition and sustainability solution? Perspective matters. Global Food Security, 25, 100325.
[228] IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. 896 pp. https://doi.org/10.1017/9781009157988.
[229] USAID. (2021). *Feed the Future Innovation Lab for Livestock Systems.* https://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/LSIL-2021-Brochure-10.21.21.pdf

production. This improved package leads to more milk and reduced GHG emissions intensities per unit. Net GHG mitigation can be achieved by reducing livestock numbers to a point where constant or even increased production results from fewer cows, improving both livelihoods and environmental outcomes.
Intervention: Many dairy projects have achieved increased yields and improved livelihoods but have not incorporated environmental guardrails within the GHG emissions boundaries to which countries pledged adherence as part of their Paris Agreement commitments. Guidelines to implement dairy technology packages aligned with policies to achieve NDCs need to be developed. Such guidelines will incentivize projects that focus on both income and productivity objectives as well as emissions reductions. A key change is the recognition that pathways for achieving higher production matter, as net GHG mitigation is only possible with fewer, more productive animals. Sustainable intensification leads to a reduction in direct methane emissions and also in indirect emissions associated with land use change and feed production. It reduces pressure on all resources (e.g., human, capital, land, water, biomass), thus achieving important complementary gains.
Opportunity for USAID: USAID should align all livestock and dairy sector investments to include an environmental objective, and specifically a GHG mitigation target, in project design. There is significant international support to move in this direction, with the UN Framework Convention on Climate Change (UNFCCC) Koronivia Joint Work on Agriculture recognizing the unique potential of livestock to tackle climate change and large-scale initiatives led by the Global Dairy Platform and the Green Climate Fund. Although some activities, including the Feed the Future Kenya Crops and Dairy Market System Activity, report significant methane emissions intensity reductions, their objectives focus solely on productivity and market systems. By incorporating explicit emissions targets, USAID can bolster program effectiveness while ensuring sustainability.
Illustrative Example of Impact: A 2022 assessment of USAID's Dairy and Fodder Value Chain Activities in Kenya found that improved feeding and changes in the basal ration increased dairy production by an average of 43 percent. The assessment also observed a 27 percent decrease in methane emissions intensity in studied intervention areas due to increased milk productivity and more nutrient dense and digestible feedstuffs.[230]
High-Potential Geographic Focus Areas: Effective strategies are required in regions with dairy productivity below 1000 kg per animal, including most countries in Africa (Mali, Mauritania, Burkina Faso, Niger, Côte d'Ivoire, Senegal, Cameroon, Ghana, Benin, Chad, Sudan, Ethiopia, Kenya, Tanzania, Rwanda, Burundi, Malawi, etc.); Central and South America (Guatemala, Bolivia); and South Asia, Southeast Asia, and Pacific Islands (Bangladesh, Nepal, Bhutan, Laos, Cambodia, Indonesia, Papua New Guinea).[231]

Leverage Point: Weather and Climate Services

Definition: Climate services involve "the production, translation, transfer, and use of climate knowledge and information in climate-informed decision making and climate-smart policy and planning."[232]

Impact Pathway: Weather and climate services have a significant impact on enhancing food availability and ensuring stability of the food supply.[233] They also support the cultivation of a wider variety of crops and allow farmers and pastoralists to enhance their productivity, dietary

[230] RTI International. (2022). *Kenya Crops and Dairy Market Systems (KCDMS) Activity: Endline Methane Assessment of KCDMS Dairy and Fodder Value Chain Activities in Kenya*. https://www.usaid.gov/sites/default/files/2023-03/Endline%20Methane%20Assessment%20of%20KCDMS%20Dairy.pdf
[231] FAO STAT 2023. https://www.fao.org/faostat/en/#data/QCL
[232] The Climate Services Partnership. https://climate-services.org/
[233] Hansen, J., List, G., Downs, S., Carr, E. R., Diro, R., Baethgen, W., et al. (2022). Impact pathways from climate services to SDG2 ("zero hunger"): a synthesis of evidence. *Clim. Risk Manage. 35*, 100399. doi: 10.1016/j.crm.2022.100399

diversity, and income.[234,235] Additionally, climate services, particularly early warning systems, aid disaster preparedness and the prevention or minimization of losses.[236,237,238] Targeted investments in weather and climate services bundled with other products and services (extension, financial services, post-harvest processing, etc.) are essential to effectively transform agrifood systems and preserve development outcomes.

Implications for USAID: Over the past decade, USAID has funded more than 40 climate services-related activities, with a particular focus on African countries. The funding has primarily supported three areas: 1) enhanced data provision; 2) decision support; and 3) the promotion of learning initiatives. A 2021 evaluation of USAID's climate services activities found that most investments served as "proof-of-concept" projects.[239] USAID should increase investments to modernize climate services providers (e.g., National Meteorological Services) that assist governments to achieve climate adaptation and mitigation objectives through the provision of climate data and projections. The strengthening and utilization of climate services that prioritize user needs should be consistently integrated within agrifood systems projects (e.g., FTF), through either embedded interventions or external coordination. Where climate services are delivered efficiently as a public good by national agencies, USAID should focus its investments to develop complementary products and services in the private sector (taking care not to invest in private sector services that should be provided as a public good). However, it is not enough to provide technological and data solutions. USAID activities should ensure that stakeholders and end users are equipped to act on the basis of climate services to enhance development and resilience outcomes. Agency programs should take a systems approach and ensure that stakeholders, ranging from national governments to communities to smallholders, are supported to use information for time-sensitive decisions. The ability to take action well in advance of critical events reduces impacts and decreases recovery time. USAID can use its convening power to forge partnerships around the effective utilization of climate services with associations, input suppliers, offtakers/processors, and extension workers and universities.

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[234]Hansen, J., List, G., Downs, S., Carr, E. R., Diro, R., Baethgen, W., et al. (2022). Impact pathways from climate services to SDG2 (“zero hunger”): a synthesis of evidence. *Clim. Risk Manage. 35*, 100399. doi: 10.1016/j.crm.2022.100399

[235]Vaughan, C., Hansen, J.W., Roudier, P., Watkiss, P., Carr, E.R., 2019. Evaluating agricultural weather and climate services in Africa: Evidence, methods, and a learning agenda. *WIREs Clim. Change 10*. https://doi.org/10.1002/wcc.586.

[236]Coughlan de Perez, E., Harrison, L., Berse, K., Easton-Calabria, E., Marunye, J., Marake, M., Murshed, S., Shampa, and Erlich-Honest Zauisomue. (2022). Adapting to Climate Change through Anticipatory Action: The Potential Use of Weather-Based Early Warnings. *Weather and Climate Extremes, September 2022*. 100508. https://doi.org/10.1016/j.wace.2022.100508.

[237]Thalheimer, L., Simperingham, E., & Wasswa Jjemba, E. (2022). The Role of Anticipatory Humanitarian Action to Reduce Disaster Displacement. *Environmental Research Letters 17*(1): 014043. https://doi.org/10.1088/1748-9326/ac4292.

[238]Tozier de la Poterie, A., Clatworthy, Y., Easton-Calabria, E., Coughlan de Perez, E., Lux, S., & van Aalst, M. (2022). Managing Multiple Hazards: Lessons from Anticipatory Humanitarian Action for Climate Disasters during COVID-19. *Climate and Development 14*(4): 374–88. https://doi.org/10.1080/17565529.2021.1927659.

[239] Zermoglio, F., Zodrow, G., and Salinas, J. (2021). *Evaluation of USAID’s Climate Services Investments Since 2012.* (Contract No. AID-OAA-M-13-00017). E3 Analytics and Evaluation Project, U.S. Agency for International Development. https://pdf.usaid.gov/pdf_docs/PA00XC9V.pdf#:~:text=This%20report%20provides%20results%20from%20a%20performance%20evaluation,identify%20lessons%20learned%20across%20various%20climate%20services%20interventions

Illustrative Intervention: Strengthen Agricultural Advisory and Early Warning Services Linked to Forecast-Based Action Planning

Rationale: The impacts of climate change, particularly the increase in climate variability, create uncertainty for farmers seeking to invest in or implement innovative agricultural technologies and techniques.[240] Providing early warnings and strengthening agricultural advisories tailored to a changing climate are crucial to facilitate the adoption of climate-smart technologies and encourage investment.[241,242] Policy makers, private sector actors and communities should also become better equipped to know how to utilize and respond to information provided. Thus, effective early warning systems accompanied by customized advisory services are vital tools for facilitating agricultural transformation.

Intervention: Highly customized and gender-responsive advisories that inform crucial decisions like crop selection and optimal planting schedules can empower farmers and drive the adoption of sustainable agricultural practices.[243] Early warning systems provide critical, timely climate- and weather-related information. In addition to addressing producers' immediate needs, tailored advisories must address long-term climate projections that allow farmers to make appropriate investment decisions for a climate-changed future. Note: it is important that the intervention not only support strengthening the advisories and service, but also the community, subnational and national-level stakeholders' ability to prepare in advance, take action, and manage events to reduce impact and promote great resilience. For example, if the advisory recommends a certain seed variety for an upcoming weather event (e.g., drought, heavy rains), stakeholders could coordinate to ensure that sufficient and appropriate seed is available on the market for people to purchase at an affordable price, and/or in combination with government funded programs/subsidies. Local ownership and leadership increase the acceptance and effectiveness of early warning systems and ability to utilize the information. Locally led early warning systems, rooted in the knowledge and experience of their end-users, have the potential to resonate within farming communities.[244] To maximize this potential, advisories and early warnings should transcend the traditional one-way flow of information. Rather than treating farmers as recipients, the approach should emphasize two-way communication that leverages farmers' experiences, data, and knowledge. Cultivating a dynamic feedback loop between farmers and advisory providers will make the information exchanged a trusted and reliable resource, driving positive change in agricultural practices.

[240]Hansen, J., Hellin, J., Rosenstock, T. et al. (2019). Climate-risk management and rural poverty reduction. *Agricultural Systems, 172*, 28–46. doi: 10.1016/j. agsy.2018.01.019.
[241]Hansen, J. W., Vaughan, C., Kagabo, D. M. et al. (2019). Climate services can support African farmers' context-specific adaptation needs at scale. *Frontiers in Sustainable Food Systems, 3*, 21.
[242]Carr, E. R. (2023). Climate Services and Transformational Adaptation. *Sustainability, 15*(1), 289.
[243]Born, L., Hansen, J., Zebiak, S., Rose, A., Ouédraogo, I., Whitbread, A., Amarnath, G., Ndiaye, O., Kagabo, D., Alemayehu, S. & Gumucio, T. (2023). Helping Farmers Make Better Decisions Using Climate Services. In B. Campbell, P. Thornton, A. Loboguerrero, D. Dinesh, & A. Nowak (Eds.), *Transforming Food Systems Under Climate Change through Innovation* (pp. 75-88). https://doi.org/10.1017/9781009227216.008
[244]Walker, S. (2021). Development of Tailored Early Warning Agromet Advisories for Farmers in Zambia, Indonesia, and South Africa. *Frontiers in Climate, 3*, 710625.

Opportunity for USAID: To drive systemic change toward a climate-resilient future in agrifood systems worldwide, USAID should partner with organizations and stakeholders to equip farmers with reliable information that guides decision-making and reduces vulnerability to climate variability.[245] USAID has already demonstrated its commitment by making significant investments in climate information and early warning systems such as the Famine Early Warning Systems Network (FEWS NET), SERVIR, the Climate Information Services Research Initiative (CISRI), and the Planning for Resilience in East Africa through Policy, Adaptation, Research and Economic Development (PREPARED) project. USAID can leverage these flagship programs to offer more localized advisory services. For example, FEWSNET has well-developed models and infrastructure to facilitate the deliberate integration of advisory services. SERVIR has an opportunity to enhance its impact by focusing on supporting widespread agro-meteorological advisory services at scale. These services can empower farmers with valuable guidance to optimize their agricultural practices. The PREPARED project is enhancing the expansion, development, delivery, and usability of innovative early warning systems and climate information services. In addition, USAID should consider integrating agricultural advisory and early warning services across all of its FTF agricultural productivity improvement and value chain projects.
Illustrative Example of Impact: A recent review of the contribution of climate services to SDG 2[246] found moderately strong evidence that climate services contribute to improvements in food security or intermediate conditions necessary for food security (across varied services and geographies). For example, 18 evaluations of farmers' use of climate services to manage risk showed moderately strong evidence that farmers who used weather and climate information experienced productivity and income benefits. Evidence from 23 studies of agricultural early warning systems suggests that such systems have benefits that exceed their costs, and supports the understanding that these systems help avoid losses in productivity, wealth, and food security at the household level.
High-Potential Geographic Focus Areas: This intervention is most needed in sub-Saharan Africa, where a significant population relies on agriculture and 60 percent of the population doesn't have access to early warning services.

VI. Call to Action

Climate change is an urgent and existential global challenge. Its adverse impacts on agrifood systems are felt in every corner of the planet–from severe drought and dramatically declining yields in the Sahel to flood-induced crop and livestock losses in South Asia—with the most vulnerable people and ecosystems disproportionately affected.

USAID has taken up the call to action. It has increased leadership, expertise, and investments to address the climate crisis. In its Climate Strategy, the Agency lays out its most ambitious goals yet, reducing GHG emissions while helping partner countries and communities adapt to climate impacts. Addressing both the causes and consequences of the climate crisis requires bold, transformational changes in both our interconnected agrifood systems and how the Agency itself operates.

This report provides recommendations to help USAID align its approach and investments to operationalize its ambitious and essential Climate Strategy. The Agency should seize this opportunity to help safeguard both agrifood systems and the future of the planet. USAID cannot meet the moment, however, without sufficient resources. Where current levels and criteria for

[245]Carr, E. R. (2020). Resilient livelihoods in an era of global transformation. *Global Environmental Change, 64*(August), 102155. https://doi.org/10.1016/j.gloenvcha.2020.102155

[246] Hanson, J., List, G., Downs, S., Carr, E., Diro, R., Baethgen, W., Kruczkiewicz, A., Braun, M., Furlow, J., Walsh, K., Magima, N. (2022). Impact pathways from climate services to SDG2 ("zero hunger"): A synthesis of evidence. *Climate Risk Management*. https://www.sciencedirect.com/science/article/pii/S2212096322000067

funding do not align with its climate ambitions, the U.S. government must allocate additional funds. It is time to take action, and USAID has never been better positioned to do so.

Appendices

Appendix A: Definition of Terms

Agriculture, Forestry and Other Land Use (AFOLU): An economic sector or livelihood strategy that includes "anthropogenic land-use activities (e.g., management of croplands, forests, grasslands, wetlands), and changes in land use/cover (e.g., conversion of forest lands and grasslands to cropland and pasture; afforestation)."[247]

Agroforestry: Land-use systems and technologies deliberately using trees and other woody perennials on the same land-management units as animals and/or crops.[248] This may include techniques such as alley cropping (intercropping rows of trees with other crops), planting trees along field margins as windbreaks, silvopasture (incorporating trees with livestock pasture), and multi-strata home gardens (planting crops of different canopy heights with high density).

Carbon Credits: Tradable assets representing verified reductions in emissions or carbon sequestration. Carbon credits can be traded on compliance markets where they do confer the right to emit an offset amount of carbon, or on voluntary markets where they do not, or packages as part of a larger contract. Carbon credits are often traded as part of a cap-and-trade regime, in which greenhouse gas emissions by sector are capped by firm limits, and companies can buy and sell allowances to emit limited amounts with prices set by supply and demand.

Carbon markets: "Trading systems in which carbon credits are sold and bought. Companies or individuals can use carbon markets to compensate for their greenhouse gas emissions by purchasing carbon credits from entities that remove or reduce greenhouse gas emissions".[249]

Certification programs: Programs certifying commodities and products for their contribution to goals such as avoiding deforestation, responsible land use, and ethical labor practices. Certified products often have higher market value than non certified products. Certification programs may be challenged by monitoring and verification, and different certifications for the same product may have different standards and effectiveness.

Climate-resilient development pathways: "Development trajectories that successfully integrate mitigation, adaptation and sustainable development," with the aim of supporting "sustainable development for ensuring planetary health and human wellbeing".[250]

Country Development Cooperation Strategy (CDCS): "USAID's Country Development Cooperation Strategies (CDCSs) are grounded in development theory, practice, literature, and experience from implementation, and support USAID's mission to promote and demonstrate democratic values abroad, and advance a free, peaceful, and prosperous world. They set forth a high-level Goal supported by Development Objectives (DOs) or, in the case of a regional

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[247]Smith P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E.A. Elsiddig, H. Haberl, R. Harper, J. House, M. Jafari, O. Masera, C. Mbow, N.H. Ravindranath, C.W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, & F. Tubiello. (2014). Agriculture, Forestry and Other Land Use (AFOLU). In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

[248]IPCC. (2022). Annex II: Glossary. In Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger, (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. pp. 2897–2930. https://doi.org/10.1017/9781009325844.029

[249]"What Are Carbon Markets and Why Are They Important?" *Climate Promise*, UNDP, 18 May 2022, https://climatepromise.undp.org/news-and-stories/what-are-carbon-markets-and-why-are-they-important. Accessed 18 July 2023.

[250]Schipper, E.L.F., Revi, A., Preston, B.L., Carr, E.R., Eriksen, S.H., Fernandez-Carril, L.R., Glavovic, B.C., Hilmi, N.J.M., Ley, D., Mukerji, R., Muylaert de Araujo, M.S., Perez, R., Rose, S.K., & Singh, P.K. (2022). Climate Resilient Development Pathways. In: H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Eds.). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 2655–2807). Cambridge University Press. https://doi.org/10.1017/9781009325844.027.

strategy (RDCS), Regional Development Objectives (RDOs), that each Mission, in collaboration with its development partners, will work to address during the strategy period".[251]

Food security and nutrition: "Access to—and availability, utilization, and stability of—sufficient food to meet caloric and nutritional needs for an active and healthy life".[252]

Food Loss and Waste (FLW): Food losses occurring at the retail and final consumption points of the food chain, related to retailer and consumer behavior.[253]

Healthy diets: Diets which are safe, balanced, based on nutritious foods, and of adequate quantity for optimal growth and development at all life stages.[254]

Inclusive Transformative Change: To achieve inclusive, sustainable development, all sectors and all levels of society—from local to national, rural to urban—require new ways of living and working to manage the drivers and impacts of climate change.[255] This is more than technical and material change. Each of the systems considered in this report engage issues of identity, institutions, and power through the ways in which people make sense of the world. Transformations toward climate-resilient development will have unequal impacts and benefits across communities and countries. Many of these unequal outcomes will be rooted in individual and group identities. Gender and other identities define individual roles and responsibilities, serving as the foundation for the power relationships that shape vulnerability to climate change impacts. As a result, climate impacts usually mobilize and reinforce preexisting patterns of marginalization with dire implications for the human security of the most vulnerable[256,257]).

Incremental change: Modifications which preserve the overall integrity of a system or process, which may be extensions of existing behaviors. In some cases, incremental changes may accrue to transformational change.[258]

Intersectional: Intersectionality refers to the interaction of various dynamics of social differentiation, such as gender, age, socioeconomic status, racial and ethnic identity, education levels, or class, that influence power and agency in a system or community. For example, an intersectional lens on gender considers "complexities and diversity among women, men, and other gender groups—moving beyond the binary focus on the difference between women and men."[259] [260]

Intervention: An activity or a set of activities organized in a project or program designed to influence positive economic, social, and behavioral change.

Just transition: "Transitioning the global economy to a low-carbon, resilient one in a way that seeks positive environmental, social, and economic outcomes together, delivers equitable

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[251]"Country Development Cooperation Strategies (CDCS)" *U.S. Agency for International Development*, 4 Apr. 2023, www.usaid.gov/results-and-data/planning/country-strategies-cdcs.
[252]U.S. Government. (2022). *U.S. Government Global Food Security Strategy: Fiscal Year 2022-2026.* pp.85. United States Government. https://www.usaid.gov/sites/default/files/2022-05/Global-Food-Security-Strategy-FY22-26_508C.pdf
[253]FAO. (2011). *Global food losses and food waste – Extent, causes and prevention*. FAO. https://www.fao.org/3/i2697e/i2697e.pdf
[254]U.S. Government. (2022). *U.S. Government Global Food Security Strategy: Fiscal Year 2022-2026.* United States Government. https://www.usaid.gov/sites/default/files/2022-05/Global-Food-Security-Strategy-FY22-26_508C.pdf
[255]IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: *Climate Change 2022: Impacts, Adaptation, and Vulnerability.* Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press.
[256]United Nations Environment Programme. (2021). *Emissions Gap Report 2021: The Heat Is On – A World of Climate Promises Not Yet Delivered.* United Nations. https://www.unep.org/emissions-gap-report-2021
[257]Carr, E. R., & Thompson, M. C. (2014). Gender and Climate Change Adaptation in Agrarian Settings: Current Thinking, New Directions, and Research Frontiers. *Geography Compass, 8*(3), 182. https://doi.org/10.1111/GEC3.12121
[258] IPCC. (2022). Annex II: Glossary. In Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger, (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* pp. 2897–2930. https://doi.org/10.1017/9781009325844.029
[259] Ravera, F., Martín-López, B., Pascual, U., & Drucker, A. (2016). The diversity of gendered adaptation strategies to climate change of Indian farmers: A feminist intersectional approach. Ambio, 45(Suppl 3), 335–351. https://doi.org/10.1007/s13280-016-0833-2
[260] Tavenner, K., Crane, T. A., Bullock, R., & Galiè, A. (2022). Intersectionality in gender and agriculture: toward an applied research design. Gender, Technology and Development, 26(3), 385–403.

benefits, and does no harm," and should use "inclusive, gender-equitable, and participatory decision-making and development processes that ensure justice".[261]

Leverage points: Processes, interactions, or elements of a system or systems where targeted actions could lead to transformational change.

Livelihood transitions: Shifts in the resources and activities which allow people to live in response to changing conditions. This may include livelihood diversification or rural-to-urban migration in response to climate hazards.[262]

Low-emissions livestock development: Production system that reduces GHG emissions while achieving greater production of outputs.[263]

Maladaptation: "Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas emissions, increased or shifted vulnerability to climate change, greater inequality, or diminished welfare, now or in the future",[264] For example, addressing water shortages through irrigation practices that will be unsustainable over the medium term is a maladaptation, as demonstrated by the Peru irrigation project highlighted in WRI's Food Systems at Risk report (2021).[265] The irrigation project was launched in the mid-1980s and resolved short-term water needs leading to thriving agricultural zones. Decades later, the project is facing a constrained water supply as glacially-fed water reserves are diminishing. The introduction of insurance products offers another example in some contexts as these products can reduce signals to change the status quo, thus preserving inefficient or harmful decisions, processes, and actions while disproportionately benefitting wealthier and more powerful members of the community.[266]

Malnutrition: "Poor nutritional status caused by nutritional deficiency or excess. Malnutrition is a condition resulting when a person's diet does not provide adequate nutrients for growth and maintenance or if a person is unable to fully utilize the food eaten due to illness; this consists of both undernutrition and overweight or obesity."[267]

Midcourse Stocktaking: USAID "Missions use portfolio reviews and midcourse stocktakings to adapt strategies [CDCS] to changes in country context, development needs, new priorities, and evidence from implementation and development literature."[268]

Nature-based solutions: "Actions to protect, manage, and restore ecosystems (including managed systems such as agricultural lands) that address societal challenges effectively and adaptively."[269]

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[261]USAID (2022). *USAID Climate Strategy 2022-2030*. p.48. U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy
[262]Birkmann, J., E. Liwenga, R. Pandey, E. Boyd, R. Djalante, F. Gemenne, W. Leal Filho, P.F. Pinho, L. Stringer, & D. Wrathall. (2022). Poverty, Livelihoods and Sustainable Development. In: H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Eds.). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* (pp. 1171–1274). https://doi.org/10.1017/9781009325844.010.
[263]FAO. 2019. *Five practical actions towards low-carbon livestock*. FAO. https://www.fao.org/3/ca7089en/ca7089en.pdf
[264]IPCC. (2022). Annex II: Glossary. p.2915. In Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger, (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* pp. 2897–2930. https://doi.org/10.1017/9781009325844.029
[265] Carter, R., Choularton, R., Ferdinand, T., Ding, H., Ginoya, N., & Preethan, P. (2021). Food Systems at Risk: Transformative Adaptation for Long-Term Food Security. World Resources Institute. https://doi.org/doi.org/10.46830/wrirpt.19.00042
[266] Reckien, D., Magnan, A. K., Singh, C., Lukas-Sithole, M., Orlove, B., Schipper, E. L. F., & Coughlan De Perez, E. (2023). Navigating the continuum between adaptation and maladaptation. *Nature Climate Change*. https://doi.org/10.1038/s41558-023-01774-6
[267]U.S. Government. (2022). *U.S. Government Global Food Security Strategy: Fiscal Year 2022-2026.* P.88. United States Government. https://www.usaid.gov/sites/default/files/2022-05/Global-Food-Security-Strategy-FY22-26_508C.pdf
[268]USAID. (n.d.). *Country Development Cooperation Strategies (CDCS)*. U.S. Agency for International Development. https://www.usaid.gov/results-and-data/planning/country-strategies-cdcs
[269]USAID (2022). *USAID Climate Strategy 2022-2030*. P.48. U.S. Agency for International Development. https://www.usaid.gov/policy/climate-strategy

Net-zero targets: Targets or commitments to balance anthropogenic GHG emissions with anthropogenic GHG removals, at global or sub-global scales.[270]

Nutrition: The access and utilization of food and nutrients for life, health, growth, development, and well-being.[271]

Payment for ecosystems services (PES): The principle in which a group of actors are paid to adopt new practices or act in ways that promote ecosystem services (including conservation, or climate change adaptation and mitigation), often falling outside of an immediate market mechanism. PES programs may be privately or publicly funded.

Post-harvest loss (PHL): Losses in the handling, processing, transportation, and/or storage of food between farm and distribution.[272] A lack of access to proper storage is a common driver of PHL.

Public-private partnerships (PPPs): Collaborations between governmental bodies and private sector for-profit corporations, business associations, or cooperatives. PPPs foster collaboration between actors and can help improve value chain efficiency, land use governance, and responsible production.

Regenerative agriculture: A farming system that rebuilds soil organic matter through soil biology, diversified crop systems, and improves water retention and nutrient uptake. Regenerative agriculture is "crop neutral"; that is, it is applicable to almost all crops and farming systems.[273]

Soil health: "The continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans."[274]

System: A group of interacting and interconnected sets of actors and elements that jointly produce a particular outcome.[275] Agriculture and food systems involve activities, individuals, and resources engaged in the production, processing, transporting, and consumption of food, fiber, and other outputs from farming, fisheries, forestry, and pastoralism.[276] Like all systems, the elements of agriculture and food systems can evolve independently or through deliberate action.

Target Country: A nation selected to receive USAID investment, programming, and/or research outputs. "FTF target countries are the flagship bilateral investments of FTF and are where we think we can move the needle forward in achieving FTF's topline goals of reducing poverty, hunger and stunting."[277]

Transformative systemic change: This includes changes to the fundamental attributes of systems in response to actual or expected climate and its effects on people, often at a scale and ambition greater than incremental activities. It includes systems changes toward a climate-resilient development pathway (CRDP) that addresses climate change over timescales.

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[270]IPCC. (2022). Annex II: Glossary. In Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger, (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* pp. 2897–2930. https://doi.org/10.1017/9781009325844.029

[271]WHO. (2000). Nutrition for health and development: A global agenda for combatting malnutrition. World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/66509/WHO_NHD_00.6.pdf;sequence=1

[272]FAO. (2011). *Global food losses and food waste – Extent, causes and prevention*. FAO. https://www.fao.org/3/i2697e/i2697e.pdf

[273]Dahm, M., & Listman, M. (May 9, 2022). *Q&A: Regenerative agriculture for soil health*. CIMMYT. https://www.cimmyt.org/news/qa-regenerative-agriculture-for-soil-health/

[274]USDA. (2022, October). *Soil health.* U.S. Department of Agriculture, Natural Resources Conservation Service. https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health

[275]USAID. (2014). *A Framework for Inclusive Market System Development.* U.S. Agency for International Development. https://www.marketlinks.org/resources/framework-inclusive-market-system-development

[276]U.S. Government. (2022). *U.S. Government Global Food Security Strategy: Fiscal Year 2022-2026.* United States Government. https://www.usaid.gov/sites/default/files/2022-05/Global-Food-Security-Strategy-FY22-26_508C.pdf

[277]U.S. Government. (2022). *Feed the Future Target Country Selection.* pp.2. U.S. Feed the Future. https://www.feedthefuture.gov/resource/feed-the-future-target-country-selection/

Transformational adaptation: “Adaptation that changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts.”[278]

Transformative change: “A system-wide change that requires more than technological change through consideration of social and economic factors that, with technology, can bring about rapid change at scale.”[279]

Village Saving and Lending Association (VSLA): Small-scale savings groups that are self-managed by the community members. “The core objectives of these groups are to provide a safe environment for members to save money through purchase of shares, and access small loans.”[280]

Zone of Influence: A defined geography within a Feed the Future target country, where USAID focuses efforts and measures population-level impact.[281]

[278] IPCC. (2022). Annex II: Glossary. In Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger, (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* (p.2899), pp. 2897–2930. https://doi.org/10.1017/9781009325844.029
[279] IPCC. (2022). Annex II: Glossary. In Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger, (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* (p.2925), pp. 2897–2930. https://doi.org/10.1017/9781009325844.029
[280] UNCDF. (2021). *Digitalization of Village Savings and Loans Associations (VSLAs) in Uganda.* UN Capital Development Fund. pp.2. https://www.uncdf.org/article/6620/digitalization-of-village-savings-and-loans-associations-vslas-in-uganda
[281] U.S. Government. (2022). *Feed the Future Target Country Selection.* U.S. Feed the Future. https://www.feedthefuture.gov/resource/feed-the-future-target-country-selection/

Appendix B: Relevant USAID Policies

USAID Climate Strategy 2022–2030: The strategy outlines USAID's "whole-of-agency" approach to climate change and includes two strategic objectives: direct targeted action (Objective 1) and transformative systems change (Objective 2). The Climate Strategy also outlines four areas USAID has identified as its strengths with regard to climate change, including (1) its global presence; (2) longevity (specifically, being a trusted and influential partner); (3) breadth of expertise (both technical and contextual); and (4) convening power.

US Government Global Food Security Strategy 2022–2026: The strategy has the overall goal of sustainably reducing global hunger, malnutrition, and poverty. It has three main objectives: (1) inclusive and sustainable agriculture-led economic growth; (2) strengthened resilience among people, communities, countries, and systems; and (3) a well-nourished population, especially among women and children. Climate change is incorporated as a priority and is outlined as "one of the greatest risks to achieving agriculture-led economic growth." The Global Food Security Strategy (GFSS) is supported by the **U.S. Government's Global Food Security Research Strategy, 2022–2026.**

U.S. Government's Global Food Security Research Strategy, 2022–2026:[282] The research strategy focuses on three areas where science and innovation are essential to progress: climate-smart agricultural innovations; improved nutrition through high-quality, affordable diets; and genetic improvement of resilient crops and livestock.

US Government Global Water Strategy 2022–2027:[283] The strategy's goal is to build health, prosperity, stability, and resilience through sustainable and equitable water resources management and access to safe drinking water, sanitation services, and hygiene practices. Its third strategic objective, to "improve climate-resilient conservation and management of freshwater resources and associated ecosystems," is particularly relevant to agricultural sector programming.

President's Emergency Plan for Adaptation and Resilience (PREPARE): Announced at the Conference of the Parties (COP) 26, PREPARE is the USG initiative elevating the United States' approach to international adaptation.[284]

2022 Resilience Policy Revision (Draft): Updates the 2012 Resilience Policy, which outlined a framework for building resilience in the face of shocks and stresses, including through "(1) reducing exposure to risk through, for instance, climate change adaptation and mitigation, improved infrastructure, or peacebuilding; and (2) strengthening the sources of resilience that matter most at each level and in each context." This policy is a complement to the Climate Strategy because it includes adaptation and mitigation approaches and addresses other types of risks (e.g., economic, conflict, disease).

USAID Biodiversity Policy: The Biodiversity Policy has two stated goals: 1) to conserve biodiversity in priority places; and 2) to integrate biodiversity as an essential component of human development. The Strategy incorporates the concepts of co-benefits with regard to climate change adaptation and mitigation efforts, including those around livelihood incentives, as well as consideration of negative impacts on biodiversity, such as agricultural expansion leading to deforestation.

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[282]U.S. Government. (2022). *U.S. Government Global Food Security Strategy: Fiscal Year 2022-2026*. United States Government. https://www.usaid.gov/sites/default/files/2022-05/Global-Food-Security-Strategy-FY22-26_508C.pdf
[283]U.S. Government. (2022). *U.S. Government Global Water Strategy: 2022-2027*. United States Government. https://www.usaid.gov/sites/default/files/2022-11/US-Global-Water-Strategy-2022.pdf
[284]The White House. (2022). *PREPARE Action Plan.* https://www.whitehouse.gov/wp-content/uploads/2022/09/PREPARE-Action-Plan.pdf

USAID Policy on Promoting the Rights of Indigenous Peoples (PRO-IP): The goal of PRO-IP is to "improve the impact and sustainability of development programs by ensuring that they respect Indigenous Peoples' rights and engage Indigenous Peoples as partners in development processes." PRO-IP relates directly to the Climate Strategy's Intermediate Result 1.4: *Partner with Indigenous Peoples and local communities to lead climate action,* and could be used for activities that include nature-based solutions, forest management, land use, and other interventions.

USAID's Gender Policies and Guidance: USAID has several policies to incorporate gender considerations intro programming, including the Gender Equality and Women's Empowerment (GEWE) policy; the USG National Strategy on Gender Equity and Equality; and USAID ADS 205 (Integrating Gender Equality and Female Empowerment in USAID's Program Cycle). USAID is also developing a Gender and Climate Framework.

Local Capacity Strengthening Policy: While the Local Capacity Strengthening Policy does not specifically incorporate climate change, it presents an overarching framework for approaching implementation, which puts local actors and systems at the center of designing locally owned and led solutions, which is a key element of the climate strategy. It includes three principles for effective programming of local capacity strengthening, which are "(1) start with the local system; (2) strengthen diverse capacities through diverse approaches; and (3) plan for and measure performance improvement in collaboration with local partners" (USAID, 2022, 3).[285]

Private Sector Engagement Policy (PSE): The PSE Policy outlines an approach to working in partnership with private sector stakeholders to develop and implement sustainable, market-based solutions.

[285]USAID. (2022). *Local Capacity Strengthening Policy*. p.3 USAID. https://www.usaid.gov/sites/default/files/2022-10/LCS-Policy-2022-10-17.pdf

Appendix C: Comparison of FTF and EEI Adaptation-, Mitigation-, and Climate Finance-Related Indicators

Indicator Focus	FTF Indicators[286]	GCC indicators[287]
	Hectares under improved management	
Adaptation-related	EG.3.2-28 Number of hectares under improved management practices or technologies that promote improved climate risk reduction and/or natural resources management with USG assistance [IM-level]) EG.3.2-25 Number of hectares under improved management practices or technologies with USG assistance [IM-level]	EG.13-8 Number of hectares under improved management expected to reduce GHG emissions
	Individual practices	
	EG.3.2-24 Number of individuals in the agriculture system who have applied improved management practices or technologies with USG assistance [IM-level] EG.3.2-a Percent of producers who have applied targeted improved management practices or technologies [ZOI-level]	EG.11-1 Number of People Trained in Climate Change Adaptation by USG Assistance EG.11-5 Number of people supported by the USG to adapt to the effects of climate change
	Yield	
	EG.3-10,-11,-12 Yield of targeted agricultural commodities among program participants with USG assistance [IM-level] EG.3-h Yield of targeted agricultural commodities within target areas [ZOI-level]	*There are no GCC indicators which address yield.*
	Policy or institutional action	
	RESIL-1 Number of host government or community-derived risk management plans formally proposed, adopted, implemented or institutionalized with USG assistance [IM-level]	EG.11-3 Number of laws, policies, regulations, or standards addressing climate change adaptation formally proposed, adopted, or implemented as supported by USG assistance EG.11-2 Number of Institutions with Improved Capacity to Assess or Address Climate Change Risks Supported by USG Assistance

[286]U.S. Government. (2019). Feed the Future Indicator Handbook. https://agrilinks.org/post/feed-future-indicator-handbook
[287]USAID. (2022). Climate Change Standard Indicator Handbook. https://www.climatelinks.org/resources/gcc-standard-indicator-handbook

	Resilience	
	RESIL-a Ability to recover from shocks and stresses index [ZOI-level] - FTF CONTEXT-11 Yield of targeted agricultural commodities [National-level] - FTF CONTEXT-12 Average Standard Precipitation Index score during the main growing season [ZOI-level] - FTF CONTEXT-13 Average deviation from 10-year average NDVI during the main growing season [ZOI-level] - FTF CONTEXT-14 Total number of heat stress days above 30 °C during the main growing season [ZOI-level] - FTF CONTEXT-15 Proportion of agricultural area under productive and sustainable agriculture (SDG indicator #2.4.1) [National-level] New FTF resilience indicators (though these are only required for activities in FTF target or Resilience Focus country and for activities with an intentional resilience focus.	EG.11-6 Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance
Mitigation-related	**Emissions**	
	There are no FTF indicators which address emissions.	EG.13-6 Greenhouse Gas (GHG) emissions, estimated in metric tons of CO_2-equivalent, reduced, sequestered, or avoided through sustainable landscapes activities supported by USG assistance EG.13-7 Projected Greenhouse Gas emissions reduced or avoided from adopted laws, policies, regulations, or technologies related to sustainable landscapes as supported by USG assistance EG.13-8 Number of hectares under improved management expected to reduce GHG emissions
Climate finance-related	*There are no FTF indicators which specifically address climate finance, though there are several indicators related to access to finance more broadly.*	EG.11-4 Amount of investment mobilized (in USD) for climate change adaptation as supported by USG assistance EG. 13-4 Amount of investment mobilized (in USD) for sustainable landscapes as supported by USG assistance

Appendix D: Technical Approach to High-Potential Leverage Point Prioritization t

The prioritization of high-potential leverage points for system transformation draws upon a review of recent assessments (the IPCC Sixth Assessment Report) and peer-reviewed articles. This review was complemented by extensive discussions with the Subcommittee, inputs collected from public meetings, and other expert inputs obtained through key informant interviews.

Drawing upon this body of knowledge, leverage points were prioritized using two main criteria:

1. The anticipated global contributions of the leverage point to adaptation, mitigation, and food security goals, as outlined in the IPCC Sixth Assessment Report[288]
2. Whether USAID has any specific policies, priorities, or investments pertaining to the leverage point

Under the first criterion, the report assessed contributions to mitigation by drawing on IPCC technical estimates for the mitigation potentials of various response options, with the largest individual impacts estimated at around 3 $GtCO_2$-equivalent per year. For adaptation, contributions were assessed relative to the projected 100 million lives expected to be affected by climate change and a carbon-based economy between 2010 and 2030. This report adopts the IPCC threshold for categorizing adaptation contributions as "large," which is a contribution of at least 25 percent of this total. Finally, this report followed the IPCC methodology for food security, categorizing any food security effort as having a large potential contribution if it addressed the needs of at least 12.5 percent of the approximately 800 million individuals currently experiencing undernourishment. It is important to note that while this report relies on quantifications based on IPCC methodologies to prioritize leverage points, large impacts may be achieved by identifying and targeting a key leverage point that can bring about significant change for a priority population. This consideration informed this report's prioritization of leverage points in a qualitative manner.

The prioritization process mapped the leverage points identified in the working paper to the response options described in the IPCC report. This process highlighted four leverage points with the potential for systematic impact. The transformations they might produce are expected to have medium-to-large benefits for adaptation, mitigation, and food security. These leverage points include ***integrated soil and water management***, ***integrated forest and agricultural land management***, ***reduced food waste and post-harvest loss***, and ***low-emissions livestock development***. In addition, ***weather and climate services*** have been identified as having a large positive impact on food security along with substantial potential to facilitate transformations in agrifood systems.

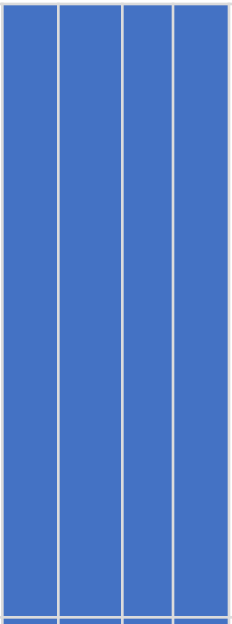
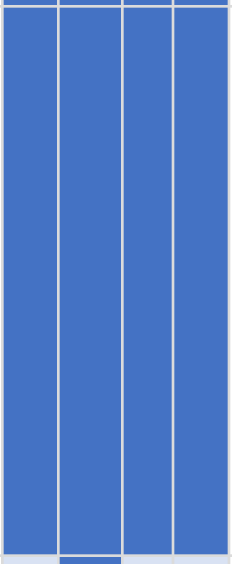
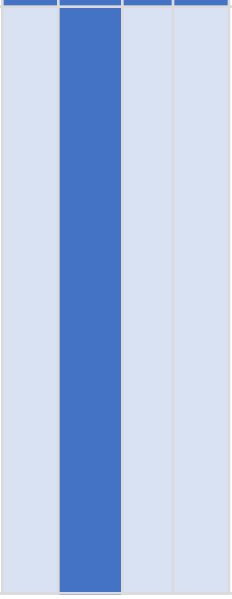
Based on desk review, KIIs, and Subcommittee guidance, the study also identified social, institutional, and policy leverage points with high transformative potential: empowering women and underrepresented groups; research and development (R&D) for climate adaptation and mitigation; and carbon markets linked to regenerative agriculture.These leverage points target key systems and populations that can become drivers of system transformation that makes them valuable. Their potential impact depends on the project context. Therefore, project theories of change should identify key systems and groups and how these leverage points can catalyze needed systemic transformation.

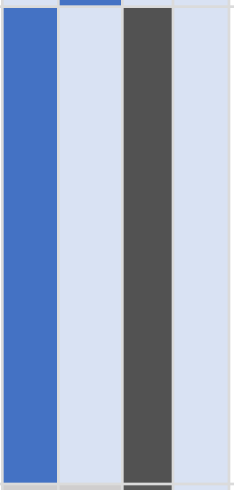
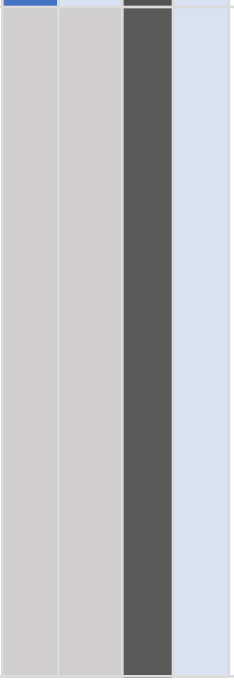
[288]Shukla, P. R., Skea, J., Calvo Buendia, E., Masson-Delmotte, V., Pörtner, H. O., Roberts, D. C., ... & Malley, J. (2019). IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.

It is important to acknowledge the complexity and specificity of agriculture and food systems, which are influenced by factors such as geography, socioeconomic conditions, culture, and behavior. Therefore, the potential transformative changes associated with these leverage points will vary by place, and interventions targeted at these leverage points must be tailored to suit the unique circumstances of each context, including these specific transformative potentials. Appendix H contains process guidance for transformation that provides the critical considerations for identifying and prioritizing leverage points and designing interventions appropriate to the systems in question to facilitate this targeting.

Table 2:
Key: A = Adaptation, FS = Food Security, M = Mitigation, PA = Policy Alignment

Response Options	A	FS	M	PA	Context and Evidence Base
High-potential technical priorities					
Integrated soil and water management					Enhancing ***soil carbon content*** has been projected to have substantial potential mitigation benefits, estimated to range from 0.4 to 8.6 $GtCO_2e$ per year with high confidence. This is achieved by increasing soils' capacity to act as carbon sinks. Additionally, increasing soil carbon content provides significant adaptation benefits by enhancing the resilience of food crop production systems to the impacts of climate change. These adaptation benefits are estimated to impact up to 3.2 billion people positively, though confidence in these estimates is low. Soil carbon sequestration has the potential to reduce calorie loss by improving agricultural productivity, potentially preventing undernourishment for an estimated 60−225 million people. On the other hand, ***integrated water management*** has an estimated mitigation potential of 0.1–0.72 $GtCO_2$ yr–1. The potential GHG emission reduction is mainly estimated from cropland and rice cultivation, for example, through using the alternate wetting and drying technique. Integrated water management offers significant adaptation benefits, as it enhances water availability and the reliability of agricultural output. Some adaptation strategies include minimizing water evaporation and losses, implementing precision water management techniques, and embracing water harvesting and storage solutions. Adaptation through integrated water management is estimated to affect 250 million people and improve food security for a billion people. Several policies implemented by USAID support integrated water management and soil health to combat hunger and establish sustainable systems. These policies include the climate strategy, the global food security strategy, the global food security research strategy, and the global water strategy. These initiatives aim to address global fertilizer challenges and contribute to the fight against hunger while promoting the development of sustainable agricultural systems.

Integrated forest and agricultural land management		The ***integration of forests within agricultural landscapes*** is projected to have significant mitigation benefits, with an estimated potential ranging from 0.1 to 5.7 $GtCO_2e$ per year (medium confidence). By incorporating forests into agricultural areas, agroforestry practices offer substantial benefits, enhancing the resilience of agricultural lands to climate change through improved soil microbial activity, lower rates of erosion, and diversified farming systems. These benefits are estimated to positively impact around 30 percent of the world's population using trees across agricultural landscapes (medium confidence). Furthermore, agroforestry has the potential to improve productivity, leading to food security benefits for up to 1.3 billion people who farm on degraded agricultural land. USAID has implemented various policies that align with agroforestry. These policies include the climate strategy, the global food security strategy, the global food security research strategy, and the biodiversity policy. These initiatives aim to combat hunger, build sustainable systems, and promote the integration of agroforestry practices to achieve these goals.
Reduced food waste and post-harvest loss (PHL)		The reduction of ***food waste and post-harvest loss*** offers significant mitigation benefits, with estimates ranging from 0.8 to 4.5 $GtCO_2$ per year with high confidence. Simultaneously, these efforts substantially impact global food security, benefiting at least 1 billion people, by improving food availability. While global estimates for the adaptation benefits of reduced food waste are currently lacking, it is estimated that reducing post-harvest loss could positively affect adaptation for 320 to 400 million people by alleviating pressure on land resources. It is evident that addressing food waste and post-harvest loss holds a significant priority for USAID. This commitment is exemplified through the Agency's involvement in initiatives like Friends of the Champions 12.3, where food waste and post-harvest loss are key priorities. In addition, USAID's Feed the Future program is making substantial investments to foster critical solutions that will reduce food loss and waste, further emphasizing the agency's dedication to tackling this global challenge.
Low-emissions livestock development		Low-emissions livestock development, particularly through ***improved grazing land****,* has large potential mitigation benefits, estimated at 1.4–1.8 $GtCO_2e$ yr^{-1}, while the potential benefit from ***livestock management*** is estimated at 0.2–2.4 $GtCO_2e$ yr^{-1} (medium confidence). At the same time, these practices, including animal diversification, regulation of stocking rates, the establishment of exclosures, etc. improve the resilience of livestock production systems, potentially benefiting up to 25 million people. Improved livestock management, including the use of various animal types and feeds, has the potential to positively impact the lives of approximately one million people. The potential impact of improved grassland management could extend to over one billion people, a significant portion currently relying on subsistence agricultural systems. Several USAID policies align with low-emission livestock production, including the global food security strategy. Through FTF and humanitarian programming, USAID often implements interventions to

		support livestock-dependent livelihoods. Furthermore, USAID has pledged its support to the Global Dairy Net Zero Initiative.
Weather and Climate Services		Existing ***early warning systems*** reach over 100 million people globally, potentially enabling farmers to make informed agricultural decisions to prepare for adverse conditions. These proactive measures are likely to positively impact food security through various pathways, including improving availability by informing farmer decision-making and de-risking agricultural value chain investment, as they enhance the resilience of agricultural systems and help mitigate potential losses caused by adverse weather events. Further research is needed to estimate the mitigation potential of climate services. USAID continuously invests in enhancing and strengthening the climate services capabilities of partner countries. USAID's Climate Strategy emphasizes the co-production of demand-driven climate services, taking them to scale as a key action area for achieving its adaptation target.
De-risking agriculture and food systems		While investments targeting the ***de-risking*** of agriculture have a logical impact pathway, through improved and more reliable food production to greater food security and adaptive capacity, there is limited evidence for specific adaptation impacts of these investments. However, supportive evidence indicates that risk transfer instruments, such as insurance, yield positive benefits for food security, potentially benefiting over 1 million people. Further studies are needed to determine specific mitigation benefits related to this leverage point. Recognizing the importance of managing risks associated with natural hazards, USAID has made significant investments in researching strategies to address these challenges. The agency is actively working to develop approaches that enhance resilience and reduce vulnerability to climate disasters. While further evidence and specific estimates are needed, USAID's focus on researching risk management strategies and supporting private sector investments highlights its commitment to addressing the challenges of agricultural risk, promoting adaptation, and building resilient market systems.

 Large positive: ***Mitigation*** More than 3 $GtCO_2$-eq yr^{-1}; Adaptation Positively impacts more than around 25 million people; ***Food Security*** Positively impacts more than around 100 million people

 Moderate positive: ***Mitigation*** 0.3–3 $GtCO_2$-eq ***Adaptation*** 1 million to 25 million ***Food Security*** 1 million to 100 million

 Small positive ***Mitigation*** >0 ***Adaptation*** Under 1 million ***Food Security*** Under 1 million

 Limited/No evidence

To address the context-dependence of intervention impact and value, this report offers a rubric for ranking interventions that can guide project design across contexts. This rubric considers two broad factors in ranking interventions:

1. Transformative potential: This report prioritizes interventions with the greatest transformative potential. Interventions might yield transformations directly, or they might serve to move people and places toward transformational pathways.
2. Evidence for efficacy: Once the relative transformative potential of different interventions is identified, prioritization moves to the consideration of the evidence for their efficacy. This included assessing the amount of evidence for intervention efficacy and the robustness and reliability of that evidence.

Intervention Prioritization Matrix

	High Transformative Potential	Low Transformative Potential
High/Reliable Evidence	Highest priority	Third-highest priority: these might have more evidence in terms of implementation and what they accomplish, but if they cannot move people and places toward transformational pathways they are not helpful.
Low/Unreliable Evidence	Second-highest priority, if the potential transformation is important and if the evidence is largely lacking, as opposed to suggesting the intervention does not work.	Avoid these interventions unless there is a unique argument to be made for them

This general rubric is complemented by two further considerations:

1. Policy alignment: A final means of ranking the interventions is to consider their relationship to how they affect (biodiversity, gender roles, seed varieties, transportation networks, etc.) or how the transformations they bring about align with USAID's priorities. Where all things are equal, interventions that further Agency priorities should be prioritized.
2. Multiple benefits: In line with the climate-resilient development framing, this report ranked interventions with both an adaptation and mitigation benefit above those that only work on one or the other, or that might create negative trade-offs between adaptation and mitigation.

Appendix E: Illustrative Interventions of High-Potential Leverage Points

Leverage Point: Soil Health

Illustrative Intervention: Payment for Ecosystem Services (PES)
Rationale: PES "leverages external private sector, government, or public institution buyer interest in maintaining or enhancing ecosystem services to pay land users to modify practices that threaten an ecosystem."[289] The costs of protecting or augmenting those benefits, or the loss of such benefits, often fall outside of effective market mechanisms, at least in the short to medium term. Soil health-related PES can facilitate and expedite the adoption of improved soil management practices which, under traditional market mechanisms, do not account for the value of the associated ecosystem services.[290,291] PES can be an effective tool because, to transition to regenerative agriculture, farmers must generally take on additional costs for new technologies and practices. However, revenue and productivity may fall the first few years before a project becomes profitable.[292] PES can encourage early adopters to take up and maintain new practices, yielding demonstration effects (showing other farmers that these methods work over time), and reducing stigma. PES may also seek to catalyze new services to support these practices (i.e., tree nurseries, private sector input suppliers are aware and incentivized to promote adoption). In addition, designers should be aware that differences in the quality of resources available to women and men may affect adaptive capacity and coping strategies. The specific tasks and roles of men and women affect their share of income from ecosystem services.[293] Local knowledge systems and differing access to resources and institutions also affect who benefits.[294]
Intervention: The exact structure of a PES in a given activity must be determined by the local social, economic, and agroecological context. However, PES for forest conservation, regenerative agriculture, water management, and soil health would ideally be structured in a way that involves both public and private sector engagement and responsibilities, with a clear exit plan for USAID's convening role and/or initial funding. In regenerative agriculture-oriented PES, schemes should be designed so that farmers receive a fair, predetermined payment for adopting regenerative agriculture practices. Ideally, this payment would incorporate the societal value of soil carbon, which reflects the monetary value of the ecosystem services of healthy soils.[295] Schemes should be designed to incentivize practices which would not occur under business-as-usual scenarios (additionality) while avoiding degradation of ecosystem services outside the program domain (leakage) and ensuring that practices are not reversed (permanence).[296] Practices would need to be both taught and monitored over time for the system to be effective. Importantly, PES is not intended to be indefinite but to support farmers through the transition to regenerative agricultural practices and, in particular, through the first few years where production and profitability will potentially decrease. PES systems should be structured at a minimum to cover four years, and ideally six.[297] However, it is possible that a USAID activity may begin to exit sooner if the PES has been structured with a clear lead, such as the government or a private sector player, in an organizing role (by far the preferred model).
Opportunity for USAID: USAID can play the key role of facilitator or convener in setting up an initial agreement for PES by bringing together the public sector, private sector, farmers, and other

[289]ProLand. (2021). *Sustainable Landscapes Resource on Select Strategies to Reduce Land-Based Greenhouse Gas Emissions*. Report of the ProLand Project, implemented by Tetra Tech and funded by the U.S. Agency for International Development. https://www.climatelinks.org/resources/sustainable-landscapes-resource-select-strategies-reduce-land-based-greenhouse-gas
[290]Lal, R., Monger, C., Nave, L., Smith, P. (2021). The role of soil in regulation of climate. *Phil. Trans. R. Soc. B* 376: 20210084. https://doi.org/10.1098/rstb.2021.0084
[291]Lal, R. (2022). Reducing carbon footprints of agriculture and food systems. *Carbon Footprints 2022*(1):3. https://doi.org/10.20517/cf.2022.05
[292]Martins, F., Atleo, T., Mbazima, G., and Israelit, S. (2021, December 2). *Helping Farmers Shift to Regenerative Agriculture*. Bain & Company. https://www.bain.com/insights/helping-farmers-shift-to-regenerative-agriculture/.
[293]Yang, Y. C. E., Passarelli, S., Lovell, R. J., & Ringler, C. (2018). Gendered perspectives of ecosystem services: A systematic review. *Ecosystem Services, 31*, 58–67. https://doi.org/10.1016/j.ecoser.2018.03.015
[294]Fortnam, M., Brown, K., Chaigneau, T., Crona, B., Daw, T. M., Gonçalves, D., Hicks, C., Revmatas, M., Sandbrook, C., & Schulte-Herbruggen, B. (2019). The Gendered Nature of Ecosystem Services. *Ecological Economics, 159*, 312–325. https://doi.org/10.1016/j.ecolecon.2018.12.018
[295]Lal, R. (2014). Societal value of soil carbon. *J.Soil Water Conservation 69*(6):186A-192A. https://doi.org/10.2489/jswc.69.6.186A
[296]Fripp, E. (2014). *Payments for Ecosystem Services (PES): A practical guide to assessing the feasibility of PES projects*. CIFOR.
[297]Martins, F., Atleo, T., Mbazima, G., and Israelit, S. (2021, December 2). *Helping Farmers Shift to Regenerative Agriculture*. Bain & Company. https://www.bain.com/insights/helping-farmers-shift-to-regenerative-agriculture/.

stakeholders to define the terms and activities required at all levels. USAID could also leverage funding to catalyze the initial PES, potentially attracting other funders such as multinational buyers trying to reduce value chain emissions requirements, the public sector through agricultural subsidies, foundations, and impact investors. In some cases, USAID may also join existing PES structures that need to be scaled or expanded. USAID has utilized PES, including on sustainable landscapes work, and the Agency can capture lessons learned, resources, and tools. However, challenges remain. PES schemes may take time to become established unless there is already in-country momentum. PES also requires the standardization of reporting and measurement methods to enable markets to effectively and accurately characterize the potential costs, risks, and returns available in the space. For regenerative agriculture, PES is still being tested. The evidence of the sustainability and ability of the funding to be withdrawn is under review. Activity designers should carefully monitor and adapt programs and pilots for changing dynamics during implementation. PES is meant to complement but not replace other agricultural sector development efforts to support government programs to incorporate climate adaptation and mitigation efforts.

High-Potential Geographic Focus Areas: PES could work in most geographic areas with diverse ecosystems. However, ideally there would be a large enough community of farmers to make economies of scale work more quickly. With more proof of concept, these can also be rolled out to thinner markets.

Illustrative Intervention: Soil Water Management

Rationale: Accelerated climate change is associated with more frequent and intense extreme events, namely droughts and floods, across regions. These climate impacts are associated with wide fluctuations in soil water content (green water), surface and groundwater resources (blue water), and soil degradation, which undermine both the quality and quantity of yields and increase costs (e.g., for irrigation). Improving soil organic carbon and soil organic matter is also instrumental in increasing green water supply, and improved soil water management practices can increase crop yields.[298,299,300]

Intervention: If farmers adopt improved soil water management technologies and practices, their production will be more resilient in the face of climate variability and extreme events. This is particularly relevant in horticulture, a subsector greatly reliant on irrigation and a source of nutritious foods. Adopting efficient use of water resources can also reduce the water footprint of production, soil erosion, and land degradation.[301] Low-cost technologies for on-farm water management, such as solar pumps and soil moisture sensors, can facilitate improvements in water management that improve the sustainability of land and water while maintaining or increasing yields. Access to these technologies may be increased by improving import logistics and creating tariff exemptions. Effective use of irrigation technology depends on the availability of extension services and irrigation education. Improving national capacities for developing water resource strategies can help manage agricultural water use.[302] In some cases, private sector actors may bundle irrigation technologies and provide agronomic support and capacity building to farmers.

[298]Lal, R. (2020). Regenerative agriculture for food and climate. *J.Soil Water Conservation.* https://doi.org/10.2489/jswc.2020.0620A
[299]Stewart, B.A., & Lal, R. (2018). Increasing World Average Yields of Cereal Crops: It's All About Water. In D. L. Sparks (Ed.), *Advances in Agronomy* (pp. 1-44). Academic Press, Vol. 151. https://doi.org/10.1016/bs.agron.2018.05.001.
[300]Lal,R. (2020). Soil organic matter and water retention. *Agronomy J.112*(5):3265-3277. https://doi.org/10.1002/agj2.20282
[301]World Bank Group. (2018). *Realigning Agricultural Support to Promote Climate-Smart Agriculture.* (Agriculture Global Practice Note). World Bank. http://hdl.handle.net/10986/30934
[302]Malabo Montpellier Panel (2018). *Water-Wise: Smart Irrigation Strategies for Africa: Benin. Dakar*. December 2018. https://www.mamopanel.org/media/uploads/files/Water-wise_case_study_Benin.pdf

Opportunity for USAID: USAID activities could provide grants to small farmers to develop infrastructure, purchase equipment, and conduct public awareness campaigns. However, these programs should also consider and strengthen ongoing operations needs and locally based maintenance services. In countries facing barriers in importing low-cost irrigation technologies, USAID can play an important role in easing tariffs and improving import logistics. USAID may also consider a more balanced look at priorities in favor of green water storage and use. Green water also aligns well with improved soil health as a determining factor for soil water holding capacity. The distinction between green water and blue water is important for at least two reasons: (i) green water held in the soil is by far the greater source of productive water; and (ii) investing therein is likely to be more cost effective than investing in blue water for irrigation.[303] Investing in green water should therefore be prioritized when allocating scarce resources, but that is often not the case. USAID can build capacity in extension services and training in irrigation technology deployment, improve water resource mapping and modeling, and work with the private sector to enhance understanding of women as a market segment.[304] As women's participation in agriculture depends on access to resources,[305] public–private partnerships that train private sector staff on marketing to women can improve equitable technology access. Because irrigation and water-use efficiency improvements can intensify water demand,[306] proper management enabling aquifer recharge and capacity building for efficient irrigation application is critical to prevent water resource depletion.

High-Potential Geographic Focus Areas: The feasibility of these practices is context dependent, especially regarding labor availability, vegetative cover, and the frequency and timing of extreme events. It is applicable for all agricultural regions and zones and especially important/urgent in arid and semi-arid regions. Most immediate impact is possible where there is high rainfall variability and in places with inefficient irrigation practices that deplete soil.

Leverage Point: Synergies between Agriculture and Forest Cover

Illustrative Intervention: Increase Tree Cover in Smallholder Systems

Rationale: By embracing agroforestry interventions and incorporating intercropping of high-value tree products, smallholders can enhance their food security, improve their diets and nutrition, and ensure long-term productivity by increasing resilience to weather and climate challenges. As a result, their incomes will stabilize or increase, leading to improved resilience and adaptive capacity in their livelihoods. Additionally, this approach will contribute to the mitigation of carbon emissions.

Intervention: Increasing tree cover in homesteads and smallholder systems can improve food security, reduce risks, and increase carbon sequestration. Alley cropping, multi-strata homegardens, windbreaks, and silvopasture are agroforestry systems with significant potential for improving mitigation outcomes, reducing vulnerability, and increasing adaptive capacity among smallholders. Incorporating fruit trees or other high-value trees in alley cropping, windbreak, and silvopastoral systems can enhance these opportunities by diversifying income sources, increasing dietary diversity, promoting women's decision-making in the household, and contributing additional ecosystem services.[307,308] For example, multi-strata homegardens improve food security and dietary quality and hold twice the soil

[303]The TOPS Program, CARE. (2017). *Water-Smart Agriculture in Uganda: The TOPS Agriculture and Natural Resource Management Case Study Series.* The Technical and Operational Performance Support (TOPS) Program and Food Security and Nutrition (FSN) Network. https://www.fsnnetwork.org/resource/water-smart-agriculture-uganda
[304]Lefore, N. (2023, January 18) Personal Communication [Virtual Interview].
[305]Theis, S., Lefore, N., Meinzen-Dick, R., & Bryan, E. (2018). What happens after technology adoption? Gendered aspects of small-scale irrigation technologies in Ethiopia, Ghana, and Tanzania. *Agriculture and Human Values 35*, 671–684. https://doi.org/10.1007/s10460-018-9862-8
[306]Barrett, T., Feola, G., Khusnitdinova, M., & Krylova, V. (2017). Adapting Agricultural Water Use to Climate Change in a Post-Soviet Context: Challenges and Opportunities in Southeast Kazakhstan. *Human Ecology, 45*(6), 747–762. https://doi.org/10.1007/s10745-017-9947-9
[307]ProLand. (2021). *Agriculture's Footprint: Designing Investment in Agricultural Landscapes to Mitigate Tropical Forest Impacts*. Report of the ProLand Project, implemented by Tetra Tech and funded by the US Agency for International Development. https://www.climatelinks.org/resources/agricultures-footprint-designing-investment-agricultural-landscapes-mitigate-tropical
[308]Barrios, E., Gemmill-Herren, B., Bicksler, A., Siliprandi, E., Brathwaite, R., Moller, S., Batello, C., & Tittonell, P. (2020). The 10 Elements of Agroecology: Enabling transitions towards sustainable agriculture and food systems through visual narratives. *Ecosystems and People*, *16*(1), 230–247. https://doi.org/10.1080/26395916.2020.1808705

carbon stocks of other agroforestry systems.[309,310,311,312,313]

PESs and support for smallholders engaged in product certification programs can increase uptake of agroforestry practices among smallholders by defraying startup costs. Programs should be flexible and responsive to local context and may increase participation by allowing participants to select practices best suited for their land.[314] Certification programs can be implemented in partnership with governments to improve coverage and provide additional resources to participants.[315] Programs should be co-designed with local communities, recognizing and employing traditional knowledge and ensuring gender and social inclusion.

Opportunity for USAID: USAID could work to expand PES and certification and build national extension services and capacity. USAID could also support PPPs that benefit smallholders and household-level producers in supply chains for larger producers and/or export markets.

High-Potential Geographic Focus Areas: Particularly relevant to tropical and subtropical forest regions across the globe

Leverage Point: Food Waste and Loss Reduction

Illustrative Intervention: Increased R&D Investments in Food Loss and Waste Reduction

Rationale: Despite the adaptation and mitigation benefits associated with reducing food waste and post-harvest loss, there is a shortage of research on measurement approaches to losses and waste for crucial commodities such as fish, vegetables, root crops, cereals, and pulses throughout stages in the value chain and across regions. Effective action requires greater understanding of the impacts of climate change (e.g., increased temperature) on FLW for specific regions and products.

Intervention: Increased R&D investments are needed to establish a baseline understanding of the degrees and stages of food waste and loss. This information can project climate change impacts and inform policy goals. R&D is also needed to develop and pilot technologies to mitigate FLW in specific contexts and to evaluate their economic viability, social acceptance, and adoption potential. A better understanding of the socioeconomic, behavioral, and policy dimensions of FLW will incentivize the development of economically viable FLW mitigation technologies viable for uptake throughout the value chain. This will improve food availability and producer incomes and reduce agricultural emissions associated with FLW. Women are a significant part of the post-harvest handling and processing/packaging stages; for example, serving as 83 percent and 72 percent of actors respectively in West Africa.[316] To ensure gender equality and empower women and underrepresented groups, it is

[309]Nair, P. R. (2007). The coming of age of agroforestry. *Journal of the Science of Food and Agriculture*, *87*(9), 1613–1619. https://doi.org/10.1002/jsfa.2897
[310]Barrios, E., Gemmill-Herren, B., Bicksler, A., Siliprandi, E., Brathwaite, R., Moller, S., Batello, C., & Tittonell, P. (2020). The 10 Elements of Agroecology: Enabling transitions towards sustainable agriculture and food systems through visual narratives. *Ecosystems and People*, *16*(1), 230–247. https://doi.org/10.1080/26395916.2020.1808705
[311]Jansen, M., Guariguata, M. R., Raneri, J. E., Ickowitz, A., Chiriboga-Arroyo, F., Quaedvlieg, J., & Kettle, C. J. (2020). Food for thought: The underutilized potential of tropical tree-sourced foods for 21st century sustainable food systems. *People and Nature*, *2*(4), 1006–1020. https://doi.org/10.1002/pan3.10159
[312]Shi, L., Feng, W., Xu, J., & Kuzyakov, Y. (2018). Agroforestry systems: Meta-analysis of soil carbon stocks, sequestration processes, and future potentials. *Land Degradation & Development*, *29*(11), 3886–3897. https://doi.org/10.1002/ldr.3136
[313]Gumucio, T., Twyman, J., & Clavijo, M. (2017). *Gendered Perspectives of Trees on Farms in Nicaragua: Considerations for Agroforestry, Coffee Cultivation, and Climate Change* (Issue Koczberski 2007). International Center for Tropical Agriculture (CIAT); CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS); CGIAR Research Program on Forests, Trees and Agroforestry (FTA) https://cgspace.cgiar.org/handle/10568/78670
[314]ProLand (2020). *What Do Experience and Research Tell Us About Using PES To Limit Deforestation? A Synthesis of the Evidence and Case Studies From Uganda and Colombia*. Report of the ProLand Project, implemented by Tetra Tech and funded by the US Agency for International Development. https://www.climatelinks.org/projects/proland/productive-landscapes-what-do-experience-and-research-tell-us-about-using-pes-limit
[315]ProLand (2020). *The Role of Governments in Making Certification Effective: A Synthesis of the Evidence and a Case Study of Cocoa in Cote d'Ivoire*. Report of the ProLand Project, implemented by Tetra Tech and funded by the US Agency for International Development. https://www.climatelinks.org/projects/proland/productive-landscapes-role-governments-making-certification-effective-synthesis-evidence
[316] Nordhagen, S. (2021) *Gender equity and reduction of post-harvest losses in agricultural value chains.* Global Alliance for Improved Nutrition Working Paper #20. https://doi.org/10.36072/wp.20

essential to conduct research on the effects of post-harvest loss (PHL) reduction technologies with a gender-sensitive approach. Introducing technology in post-harvest handling can have positive impacts, such as reducing labor, energy, and time burdens on women. However, it's also important to consider that this may lead to potential challenges, such as lost income or employment opportunities for women who are heavily involved in the grading and sorting processes of post-harvest handling.

Opportunity for USAID: Feed the Future Innovation Labs need to proactively integrate future climate impacts into their FLW research efforts. Innovation Labs could conduct research to understand the impact of climate change on FLW across different temperature scenarios and contexts. USAID could also extend its Innovation Lab model by directly funding national research institutions in countries to enhance localized FLW mitigation research. Through its policy work, USAID could advocate for larger resource allocations for FLW reduction research in national budgets. It could also foster collaboration with the private sector to support its engagement in FLW mitigation through research and development, investments in supply chain management, quality control, and technological innovations including those related to prolonged product shelf life.

High-Potential Geographic Focus Areas: Considering the direct impact of food loss on farmers, regions with high levels of food loss should be prioritized (sub-Saharan Africa estimated at 21.4 percent, SIDS at 17.3 percent, Eastern and South-Eastern Asia at 15.1 percent of a food loss index of 98.7 in 2016 and 101.2 in 2020[317]) as well as countries where Agricultural Investment is less than 0.5 percent of GDP, including many in sub-Saharan Africa.[318]

Leverage Point: Low-Emission Animal Production

Illustrative Intervention: Diversify feed sources for livestock

Rationale: Feed quantity and quality are the main constraints on increasing livestock productivity. Without investments in this area, the livestock sector will not intensify and achieve sustainability targets. Even local ruminant livestock breeds can increase productivity twofold when fed adequate amounts of high-quality feeds. Feed production, as rangelands or grown feeds (including grains), is a major source of CO_2 emissions from the livestock sector. It also requires trade-offs with human food security as farmers in mixed crop/livestock systems determine which crops to grow.

Intervention: Options for improving feed production within environmental bounds require limited additional land use. They must stabilize dry season production and increase productivity in high-potential areas. Three promising options include:

1. **Investing in greater feed production circularity.** Mixed crop-livestock systems already use crop stover, and dual-purpose improved varieties of sorghum and millet have been shown to increase livestock productivity in these systems. This approach has been critical for parts of SSA and Asia, as crop residues already represent 40 to 50 percent of the biomass consumed in these systems. However, considering that other biomass streams can come from food waste, prioritizing ways to process food waste as feed is an important research area. Recent studies have shown that up to 40 percent of global livestock product consumption could be satisfied by incorporating food waste for poultry, pork, and ruminants.
2. **Investing in alternative feed sources.** A range of insects can be produced from food waste, and these are often high in protein and very digestible. Success in producing insects at scale for smallholders is an area that requires investment to ensure that feed value chains are created and reach all producers. Microbial fermentation from sewage is another option that could produce significant quantities of feed to replace grains for different livestock species. This

[317]FAO. (n.d.) Indicator 12.3.1 - Global Food Loss and Waste. SDG Indicators Data Portal, FAO. https://www.fao.org/sustainable-development-goals-data-portal/data/indicators/1231-global-food-losses/en
[318]ASTI. (n.d.) Agricultural Science and Technology Indicators. ASTI/IFPRI/CGIAR. https://www.asti.cgiar.org/data

strategy could lead to alternative development pathways of peri-urban areas and will provide solutions for the waste management and health sectors in LMIC metropolises, where waste management is an issue.

3. **Investing in novel genetics programs for feed production.** Low-emissions trajectories for livestock mandate that feed options are constantly reevaluated, and new, innovative solutions are tested at speed. Algaes of different types, incorporating methanogenic genes into forages, and breeding grasses with higher oil content are options currently being tested. Bringing these options to LMICs will require open-source research.

Opportunity for USAID: Though scarce in the public or philanthropic sectors, R&D focused on feed remains the foremost priority for increasing livestock productivity. Amid the current focus on enhancing sustainability in livestock enterprises (such as the Methane Pledge and Koronivia initiative), USAID should assume a leadership role in exploring innovative approaches to animal rearing across varied systems. USAID should invest in public and private partners and open-source research, and tap the strengths of its Innovation Labs to advance work in this area.

High-Potential Geographic Focus Areas: This intervention could be most effective in mixed crop−livestock production systems and peri-urban environments. Greater investment in advanced techniques may be needed to achieve effectiveness in commercial production.

Leverage Point: Climate Services

Illustrative Intervention: Train and Equip National Meteorological Services to Provide Reliable, Tailored, and Usable Climate Information and Advisory Services

Rationale: Despite notable progress in climate modeling, prediction, and the use of information communications technology (ICT) for dissemination, many developing countries and regions face challenges in generating high-quality and actionable climate information and advisories.[319] Bringing climate services and early warning systems up to the standards observed in developed countries could result in savings of up to $2 billion annually through loss mitigation.[320] Investment in upgraded climate services minimizes the economic and social impacts of climate events and ensures effective and efficient utilization of other available resources.

Intervention: National Meteorological Services (NMS) are the authoritative providers of weather and climate information for local and national decision-making and climate adaptation planning. However, NMSs struggle with limited funds, inadequate equipment, and understaffing.[321] Modernization of NMS operations should move them to the forefront of technological advancements in observing, forecasting, and understanding weather and climate trends. Significant investments enhance the quality and quantity of available data for forecasters and improve their numerical weather and climate prediction capabilities. NMS support may include provisions to ensure an adequate and educated workforce through both recruitment and training efforts that keep pace with technological and meteorological advancements. Such investments can empower governments to enhance overall resilience to climate impacts.

[319]Dinku, T. (2019). Challenges with availability and quality of climate data in Africa. In *Extreme hydrology and climate variability* (pp. 71-80). Elsevier. https://doi.org/10.1016/B978-0-12-815998-9.00007-5

[320]Hallegatte, S. (2012). *A cost effective solution to reduce disaster losses in developing countries: Hydro-meteorological services, early warning, and evacuation.* [Policy Research Working Paper Series 6058]. The World Bank.

[321]Ashley, L., Carter, R., Ferdinand, T., Choularton, R., Appadurai, N., Ginoya, N., & Preethan, P. (2020). Applying Climate Services to Transformative Adaptation in Agriculture. World Resources Institute

Opportunity for USAID: In addition to supporting technology and data upgrades, USAID should concentrate efforts on modernizing NMSs by supporting organizational reforms and enhanced workforce capabilities. It should facilitate improved partnerships with leading meteorological institutions and allocate resources towards R&D of cutting-edge climate data and products. USAID should also support NMS to better integrate with government agricultural sector development and disaster risk management programs so that information can be utilized as part of a wider program of preparedness, response, and resilience.

High-Potential Geographic Focus Areas: Sub-Saharan Africa has the lowest level of observational stations and early warning system capacity in the world.[322] Increased investments in NMSs are necessary to address this gap. In addition, SIDS also require increased investment in their NMSs.

[322]World Meteorological Organization. (2020). 2020 State of Climate Services: Risk Information and Early Warning Systems. WMO

Appendix F: Target Calculation Methodology

Mitigation

The methodology for reaching the mitigation target focused on three components: non-CO_2 emissions, which are localizable to the farm level; wider food system emissions, including CO_2, for which attribution cannot be tied to the site of production; and the need to avoid further land conversion to ensure that reductions in GHGs are not offset by emissions associated with changes to existing land uses.

To calculate the share of non-CO_2 emissions, which predominate at the farm level, we took country-by-country data on projected 2030 emissions from a refereed study[323] and narrowed the emissions to those from countries in which USAID works. That study estimated an emissions reduction need of 1 GT CO_2e/yr by 2030. USAID partner countries make up 58 percent of total projected 2030 emissions, suggesting USAID should aim to reduce non-CO_2 emissions across its portfolio by 0.58 GT CO_2e/yr by 2030. This does not mean that every USAID country should contribute the same amount, either absolute or percentage, to this reduction. Some countries have much greater emissions, and much greater potential emissions reductions, than others.

To calculate the share of food system-wide emissions that USAID should seek to reduce, this report drew from a refereed study[324] which found that in non-Annex 1 countries,[325] energy-related pre- and post-production CO_2 emissions (off farm) are 2.38 GtCO_2e/yr. The same study found on-farm energy use in these countries resulted in emissions of 0.658 GtCO_2e/year. Taken together, these two figures show that there are 3.038 Gt CO_2e/yr worth of emissions beyond the farm gate in the food system associated with non-Annex 1 countries. Using expert judgment from the BIFAD subcommittee, the study author team set a target of reducing these emissions by 20 percent by 2030, or 0.6 Gt CO_2e/year.

This report estimated the cumulative emissions reductions achieved in the course of achieving the annual target by assuming an extended ramp-up period as USAID designed, procured, and implemented new programming. The assumption was that USAID would achieve approximately 10 percent of the annual goal in each of the first four years of the strategy, followed by a rapid climb to the target over the second half of the strategy and programs came online and began delivering mitigation benefits.

Adaptation

Enable the improved climate resilience of at least 180 million people who depend on agriculture.

To determine the proportion of the USAID Climate Strategy adaptation target of 500 million people with improved resilience that should be allocated to the agrifood sector, we examined the percentage of individuals employed in agriculture within the countries where USAID operates.

The initial analysis encompassed 167 countries where USAID had completed disbursements between 2014 and 2022 across all sectors (based on data from https://results.usaid.gov/). After

[323]Richards, M. B., Wollenberg, E., & van Vuuren, D. (2018). National contributions to climate change mitigation from agriculture: Allocating a global target. *Climate Policy*, *18*(10), 1271–1285. https://doi.org/10.1080/14693062.2018.1430018

[324]Tubiello, F. N., Rosenzweig, C., Conchedda, G., Karl, K., Gütschow, J., Xueyao, P., Obli-Laryea, G., Wanner, N., Qiu, S. Y., Barros, J. D., Flammini, A., Mencos-Contreras, E., Souza, L., Quadrelli, R., Heiðarsdóttir, H. H., Benoit, P., Hayek, M., & Sandalow, D. (2021). Greenhouse gas emissions from food systems: Building the evidence base. Environmental Research Letters, 16(6), 065007. https://doi.org/10.1088/1748-9326/ac018e

[325]The data in this study does not allow for more precisely targeting the subset of non-Annex 1 countries in which USAID works (within the UNFCCC, non-Annex 1 countries are those that, in 1992, were not members of the Organisation for Economic Co-operation and Development or an economy in transition). However, such targeting would not greatly change the calculations included here.

excluding high-income countries, the focus narrowed to 144 countries. Within this subset, the share of the population employed in agriculture was assessed using World Bank Open Data. Ten of the 144 countries lacked agricultural employment data. One hundred and thirty-four countries were thus included in the final analysis. For each country, the share of individuals employed in agriculture was then weighted by the total population according to World Bank Open Data. The population-weighted average proportion of people engaged in agriculture across 134 countries where USAID operates was 36 percent. The study team then applied this proportion to USAID's 500 million person adaptation target, resulting in a figure of 180 million people whose climate resilience could be improved through agrifood sector interventions.

> *Illustrative Impact Target: Reduce the number of additional people pushed into extreme poverty because of climate impacts on agrifood systems by 50 million, at least half of whom are women.*

Because the causal pathway from climate change to food insecurity and dietary quality is complex, quantification of impact is challenging. Rozenberg & Hallegatte (2015)[326] addressed the complexity behind quantifying the human impacts of climate change by building a broad scenario-based approach. Their approach was updated by Jafino et al. (2020).[327] Broadly speaking, both studies divided the future into two economic development scenarios. The first is an optimistic scenario where the world in 2030 is characterized by high or universal access to basic services, steeply declining inequality, and less than three percent of the world population experiencing extreme poverty. The second is a pessimistic scenario where improvements in access to basic services and inequality are limited, inequality remains high, and the rate of extreme poverty is near 15 percent. Recognizing that different Representative Concentration Pathways (RCPs) did not necessarily result in different temperatures by 2030, both studies characterized climate impacts in terms of two broad scenarios: one where the impacts of climate change are severe, and another where the impacts are more attenuated. Jafino et al. (2020)[328] then constructed a two-by-two matrix and estimated the levels of additional extreme poverty under each scenario.

Table 3: Estimated number of people pushed into extreme poverty by climate change (Jafino et al., 2020)[329]

	Low-impact scenario	High-impact scenario
Optimistic Scenario	+32.2 million	+67.7 million
Pessimistic Scenario	+42.0 million	+131.5 million

The critical point in these studies is that high impacts from climate change produce significant increases in the number of people living in extreme poverty relative to low impacts. Given the effects of the COVID-19 pandemic on health and economic outcomes and current trends in inequality and poverty, it is unlikely the prosperity scenario will be realized in 2030. Further, the impacts of climate change have long manifested at the high end of expected ranges as defined

[326]Rozenberg, J., & Hallegatte, S. (2015). *The Impacts of Climate Change on Poverty in 2030 and the Potential from Rapid, Inclusive, and Climate-Informed Development.* Policy Research Working Paper; No. 7483. World Bank. https://openknowledge.worldbank.org/handle/10986/23447
[327]Jafino, B.M., Walsh, B., Rozenberg, J., Hallegatte, S. (2020). *Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030.* Policy Research Working Paper; No. 9417. World Bank. https://openknowledge.worldbank.org/handle/10986/34555
[328]Jafino, B.M., Walsh, B., Rozenberg, J., Hallegatte, S. (2020). *Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030.* Policy Research Working Paper; No. 9417. World Bank. https://openknowledge.worldbank.org/handle/10986/34555
[329] Jafino, B.M., Walsh, B., Rozenberg, J., Hallegatte, S. (2020). *Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030.* Policy Research Working Paper; No. 9417. World Bank. https://openknowledge.worldbank.org/handle/10986/34555

by the IPCC, suggesting that we are likely living in a high-impact scenario. Therefore, any target should be focused on a somewhat pessimistic scenario closer to the high-impact climate scenario.

Under scenarios that lean toward pessimistic/high impact, more than half of those pushed into extreme poverty are driven there by increased food prices and factors related to agricultural production, health, or dietary issues directly associated with malnutrition in all forms.

Taken together, the evidence suggests that, with effective development and adaptation efforts through 2030, USAID could realize something close to the optimistic/low-impact scenario, as opposed to the pessimistic/high-impact (current) scenario. Roughly speaking, achieving this broad shift would result in 100 million fewer people being pushed into extreme poverty by 2030, with agricultural and food system efforts responsible for approximately 50 million fewer people in extreme poverty. The scenarios strongly suggest that rapid and inclusive development can produce very significant reductions in the number of people experiencing extreme poverty due to climate change impacts—as many as 63.8 million fewer.

Finance

The proposed target of $36 billion in climate finance by 2030 takes the $150 billion Climate Strategy goal as a starting point. It then assumes that the proportion of this target focused on food and agriculture should match the share of that sector's global need for finance relative to other sectors.

Drawing from FOLU (2019), UNEP (2022), and Thornton et al (2023), CPI, in *The Landscape of Climate Finance for Agrifood Systems*, estimated an annual investment requirement of between USD 212 billion and USD 1.27 trillion to transform agrifood systems by 2030.[330] In total, there is a projected need for at least 5.2 trillion in annual climate finance across all sectors to get climate action on track for achieving the 1.5-degree warming target.[331] Thus, taking the higher end requirement (USD 1.27 trillion), the agrifood sector would account for approximately 24 percent of total climate financing needs. Applying that same proportion to the USAID total finance goal (150 billion) results in the $36 billion target.

It is important to note that data and knowledge on climate finance needs are constantly evolving. Assessment of these needs should be viewed as a high-level snapshot of a dynamic situation—this 2030 target is meant to provide a helpful direction, not a rigid goal.

[330]Chiriac, D., Vishnumolakala, H., & Rosane, P. (2023). *Landscape of Climate Finance for Agrifood Systems*. Climate Policy Initiative. https://www.climatepolicyinitiative.org/wp-content/uploads/2023/07/Landscape-of-Climate-Finance-for-Agrifood-Systems.pdf

[331] Boehm, S., L. Jeffery, K. Levin, J. Hecke, C. Schumer, C. Fyson, A. Majid, J. Jaeger, A. Nilsson, S. Naimoli, J. Thwaites, E. Cassidy, K. Lebling, M. Sims, R. Waite, R. Wilson, S. Castellanos, N. Singh, A. Lee, and A. Geiges. (2022). *State of Climate Action 2022*. Bezos Earth Fund, Climate Action Tracker, Climate Analytics, ClimateWorks Foundation, NewClimate Institute, the United Nations Climate Change High-Level Champions, and World Resources Institute. https://doi.org/10.46830/wrirpt.22.00028.

Appendix G: Transformative Change Conceptual Framework and Process Guidance

There are few, if any, incremental pathways to a food- and nutrition-secure future for many countries in which USAID works.[332] Meeting USAID's agricultural development, food security, and climate goals will, in most settings, require the transformation of existing systems. The following guidance is intended to help project and program designers think through the identification of needed transformations, a prerequisite for designing effective interventions that might move people and places onto climate-resilient development pathways. It is structured around four broad areas of design decision-making:

1. Identifying the need for transformational change
2. Aligning needed transformations with local, national, and USAID development goals (e.g. CDCS, NDCs, and NAPs)
3. Ensuring transformations have the scale and/or importance necessary to achieve country and USAID food security, agriculture, and climate goals
4. Using CRD thinking to ensure that transformations shift the system toward a desirable, climate-resilient pathway

Identify the need for transformational change

While building climate-resilient food and agricultural systems often requires transformational change, that need should be established at the outset of the design process. For example, project designers might identify key systems that shape food security outcomes (such as smallholder agriculture, transportation networks, or agricultural finance) and build plausible scenarios of their future functions under climate and other forms of change (i.e. ,economic transition, demographic growth, political stability).

Once the challenges faced by these key systems are established, designers should ask if it is possible to address them through incremental changes. In some parts of the world, climate change may not present deep challenges to existing systems for decades. As transformational change can create many costs and uncertainties, they should be weighed against incremental changes that might address the challenges effectively and with less uncertainty. Designers should consider the question of the need for transformation both in the present and over the next 20 to 30 years to ensure that any incremental solutions yield durable outcomes.

Policy Alignment

Realizing that the transformations necessary to achieve adaptation, mitigation, and food security goals will require grounding in local, national, and USAID goals. Documents like the CDCS, which represent a collaborative understanding of national and USAID priorities, are valuable references for ensuring that the intended transformation is intended to help achieve goals shared by both the Agency and the country. Failure to align with either USAID or country goals can result in projects that will have limited buy-in and potentially very limited funding, making them unlikely to be effective. If the proposed transformational change does not align with both country and USAID goals, designers should reconsider the transformative need they have identified and restart the design process around another transformational opportunity.

[332]IPCC. (2022). Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: *Climate Change 2022: Impacts, Adaptation, and Vulnerability.* Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K.

Scale/Importance

Development and climate resources are limited and their judicious use is critical to achieving USAID's climate and food security goals. It is therefore important to establish that the scale and/or importance of a proposed transformation will contribute substantially to achieving the shared goals of the country and USAID, while also being socially inclusive. Project theories of change should establish that a specific transformation will produce a change toward one or more adaptation, mitigation, or food security goals, either through impacts across large populations or areas or by targeting a key population or process that might leverage wider impact. If a proposed transformation does not do so, designers should reconsider the transformative need they have identified and restart the design process around another transformational opportunity.

Applying Climate Resilient Development (CRD) Thinking to Systems Transformation

Transformations rarely come without costs or trade-offs. Designers should identify any trade-offs between the intended benefits of a transformation and other dimensions of CRD. For example, if a proposed transformation to an agricultural system is likely to yield a large mitigation benefit, designers should assess if that transformation results in lost adaptive capacity or creates path dependencies that might limit future development opportunities.

> Climate-resilient development pathways are "development trajectories that successfully integrate mitigation, adaptation and sustainable development," with the aim of supporting "sustainable development for ensuring planetary health and human wellbeing"[333]

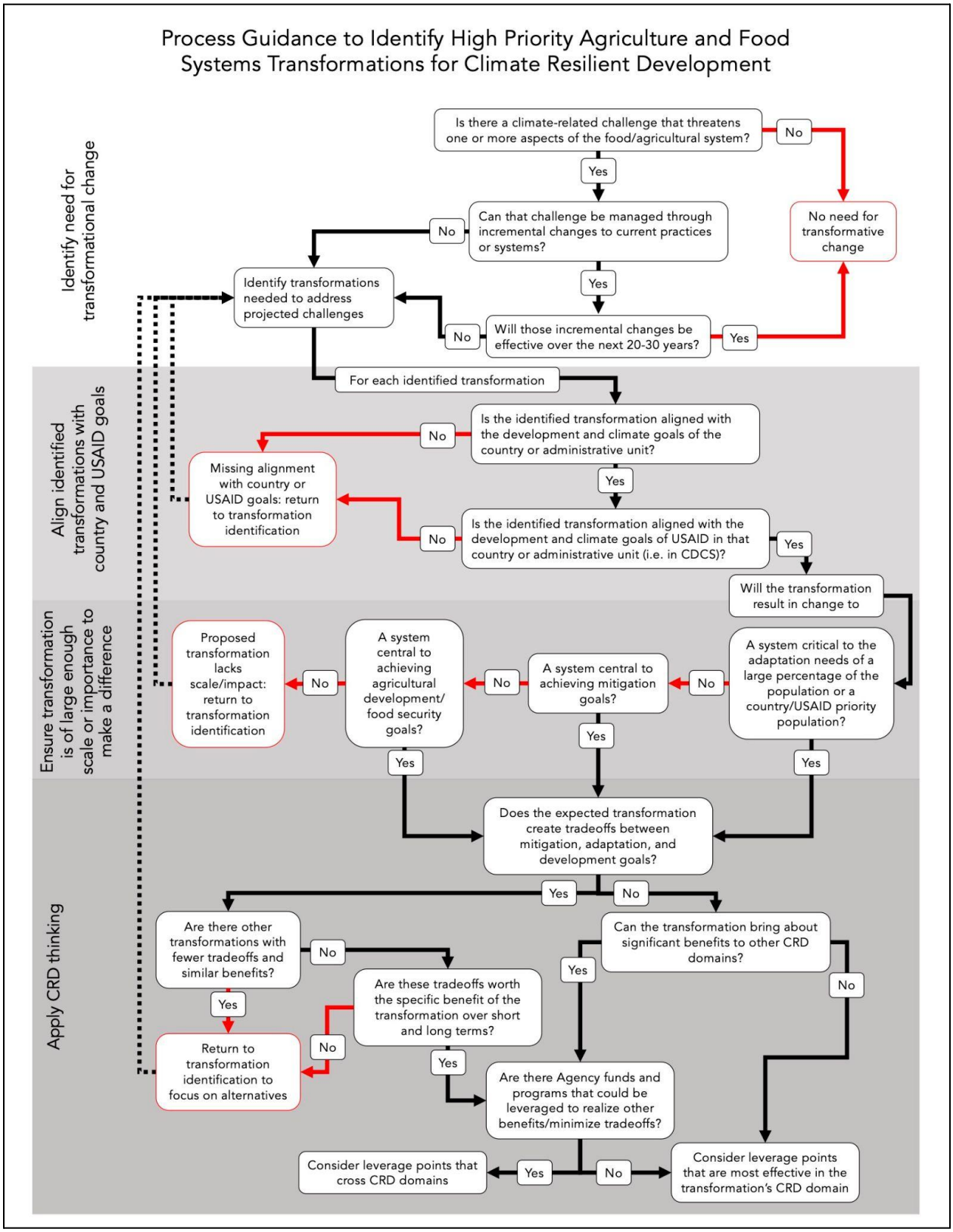
In situations where trade-offs exist, project designers must weigh the benefits of the transformation against the costs to CRD overall. In some cases, trade-offs might be warranted, such as where the benefit is very large and the costs to other aspects of CRD are small or transitory. In such cases, this rationale should be a transparent part of project design and theory of change. Project designers should consider if there are Agency resources that might help to minimize these trade-offs. For example, in the case of the agricultural transformation above, project designers might decide that the mitigation trade-off is very small relative to the adaptation benefit and therefore it is worth proceeding. However, they could look for adaptation resources, in terms of expertise and funding, to shape transformation such that trade-offs are minimized. Where trade-offs exist, they can be seen as opportunities to design integrated CRD projects. This is not to suggest that all transformations have to achieve adaptation, mitigation, and food security benefits. However, project design should minimize trade-offs and be ready to realize benefits across multiple dimensions of CRD should they arise.

In other cases, substantial trade-offs may weigh against implementation. These costs could appear immediately, or they might emerge over time, rendering the proposed transformation undesirable. In such cases, designers should consider seeking other transformational opportunities with fewer trade-offs.

There may be rare cases where there are no CRD trade-offs associated with a proposed transformation. In those situations, project designers should look for opportunities to generate co-benefits in other dimensions of CRD. If the agricultural transformation example had no trade-offs, designers might consider consulting with mitigation and food security expertise to look for resources to deliver one or more CRD co-benefits through implementation. This is

[333] Schipper, E.L.F., Revi, A., Preston, B.L., Carr, E.R., Eriksen, S.H., Fernandez-Carril, L.R., Glavovic, B.C., Hilmi, N.J.M., Ley, D., Mukerji, R., Muylaert de Araujo, M.S., Perez, R., Rose, S.K., & Singh, P.K. (2022). Climate Resilient Development Pathways. In: H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Eds.). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 2655–2807). Cambridge University Press. doi:10.1017/9781009325844.027.

another opportunity to build a project with integrated CRD goals. In situations where there are no opportunities for co-benefits, project designers should focus on leverage points that deliver the most effective transformations in the project domain.



Appendix H: Detailed Study Objectives and Methodology

Study Objectives

The study has three primary objectives:

1. Identify priority leverage points for transformative systemic change and scaling climate finance to achieve the targets and intermediate results for the sector.
2. Suggest realistic 2030 targets to guide USAID program design for the agriculture, food, and nutrition sectors.
3. Prioritize areas for USAID action in the sector and recommend interventions.

The study also sought to understand USAID internal systems, processes, and practices in its global agriculture and food security programs to identify opportunities, gaps, and recommendations for mainstreaming ambitious climate change adaptation and mitigation goals. The specific sub-objectives are:

1. Describe how historical and current climate risk and climate change information is incorporated into program and activity design across USAID's Feed the Future, BHA food security programming, and DDI/EEI's agriculture and food security-related programs and identify opportunities where they can be more effective.

2. Describe how climate risk and climate change analysis, models, and assessments are used to inform priority country and ZOI selection, Country Development Cooperation Strategy (CDCS) development, and Activity design and implementation by Missions and operating units and identify opportunities where they can be more effective.

3. Describe how USAID's agriculture research investments support either improved understanding of climate challenges or climate solutions across the climate change timescales and thematic areas, particularly the extent to which those solutions engage social, behavioral, and governance aspects of climate change adaptation and mitigation. The assessment will identify opportunities for improving the effectiveness of research investment for climate action.

4. Describe how USAID's processes and practices for reporting across USAID's Feed the Future, BHA food security programming, and DDI/EEI's agriculture and food security-related programs incorporate climate risks, direct and indirect climate impact, and other climate change-related outcomes. The assessment will include comparison of Feed the Future climate-related indicators to standard climate change indicators.

5. Identify the ways USAID funding instruments (e.g., grants, investments, TA, contracts, etc.) support private sector engagement, contribute to achieving adaptation and mitigation goals in agriculture and food systems, and identify additional instruments that could be deployed, if any, including strengthened procurement language that prioritizes climate action.

6. Identify opportunities to maximize the climate change adaptation *and* mitigation co-benefits in USAID's agriculture and food security and nutrition investments, particularly within the Feed the Future authorizations/resource allocations and with an emphasis on better prioritization of underrepresented populations, more appropriate

interventions for the local context, and evidence-based investments.

7. Identify incentives that could motivate USAID agriculture and food security-related staff and leadership to prioritize climate-related considerations into strategy, program design, investment decisions and day-to-day operations.

8. Identify the opportunities for USAID to leverage its partnerships, convening and demonstration power to influence global policies, donor policies, cooperating country policies, and the private sector to address climate change adaptation and mitigation in agriculture and food systems.

Study Methodology

The study relies on the analysis of data and information collected from:

- A **desktop review** on the transformation of agriculture, food, and nutrition systems to achieve climate adaptation and mitigation outcomes, including existing systematic reviews of the state of climate change knowledge, including recent assessments (i.e., IPCC AR6), scientific articles, and relevant work in the gray literature
- A **document review** of USAID policies, protocols, guidance, and programmatic documents (such as CDCSs and Climate Annexes)
- **Expert inputs** from the subcommittee members
- **Key informant interviews** (KIIs) with subcommittee members, other experts from the climate and agriculture community, and USAID staff across the Agency working in agriculture and food security, who provided institutional expertise that was used to shape specific report recommendations. See Table 3, below, for a full list of KIIs.

The recommendations in the report were developed based on careful analysis of USAID's current operations and potential, aggregation of the inputs of experts–both internal and external to the Agency–and extensive deliberation by the subcommittee.

List of Key Informants

Table 3: Key Informant Interviews

Name	Affiliation	Title
Rahma Adam	WorldFish	Scientist
Alex Apotsos	USAID	Climate Change Advisor
Mauricio Benitez	BIFAD Subcommittee; responsAbility Investments AG	Member; Nature-Based Solutions and Food Systems Lead
Rob Bertram	USAID, Bureau for Resilience and Food Security	Chief Scientist
Margie Brand	Vikāra Institute	Director

Name	Affiliation	Title
Allison Brown	USAID, Bureau for Conflict Prevention and Stabilization	Bureau Environmental Officer
Elizabeth Bryan	IFPRI, Environment and Production Technology Division	Senior Scientist
Gillian Caldwell	USAID	Chief Climate Officer and Deputy Assistant Administrator
Rebecca Chacko	USAID	Senior Climate Change Integration Specialist
Daniela Chiriac	BIFAD Subcommittee; Climate Policy Initiative	Member; Senior Consultant
Jonathan Cook	USAID, Bureau for Resilience and Food Security	Senior Resilience and Climate Adaptation Advisor
Abdoulaye Dia	USAID, Senegal Mission	Agricultural Team Lead
Sara Diamond	USAID, Natural Climate Solutions	AAAS Science and Technology Policy Fellow
Papa Dieye	USAID, Senegal Mission	Deputy Director, Economic Growth Office
Alex Eaton	Sistema.bio	Co-founder and CEO
John Fay	SVA Services International	Director
Mike Field	Vikāra Institute	Senior Systems Thinking Specialist
Keith Fuglie	USDA, Economic Research Service	Senior Economist
Christina Garcia	Ya'axché Conservation Trust	Executive Director
James Gaffney	USAID, Center for Agriculture Led Growth; Bureau for Resilience and Food Security	General Development Officer
Jerry Glover	USAID, Center for Agriculture	Deputy Director
Noel Gurwick	USAID, Center for Environment, Energy, and Infrastructure	Senior Climate and Land Advisor
Malick Haidara	USAID, Bureau for Development, Democracy, and Innovation	Senior Energy and Climate Change Advisor
Georgia Hartman	USAID, Bureau for Development, Democracy, and Innovation	Senior Gender Advisor for Environment and Climate

Name	Affiliation	Title
Mario Herrero	BIFAD Subcommittee; Cornell University	Member; Professor, Atkinson Scholar
Tanja Havemann	Clarmondial AG	Director / Founder
Sashi Jayatileke	USAID, Center for Energy, Environment, and Infrastructure	Senior Climate Finance Advisor
Linda Jones	International Consultant	Inclusive Growth / Market Systems Gender Equality and Social Inclusion
Rayan Kassem	Youth4Nature	Regional Director for West Africa
Ahmed Kablan	USAID, Bureau for Resilience and Food Security	Senior Science Advisor, Food Safety Division
Rattan Lal	BIFAD The Ohio State University	Member; Distinguished University Professor,
Songbae Lee	USAID, Bureau for Resilience and Food Security	Agricultural Finance Team Lead
Nicole Lefore	Texas A&M University, Borlaug Institute for International Agriculture	Director, Feed the Future Innovation Lab for Small Scale Agriculture
Oumou Ly	USAID, Senegal Mission	Climate Integration Lead and Environmental Specialist, Economic Growth Office
Brian Midler	Aceli Africa	Founder and CEO
Jami Montgomery	USAID, Bureau for Resilience and Food Security	Division Chief, Resilient Communities and Systems
Gerson Morales	USAID, Guatemala Mission	Project Management Specialist
Stephen Morin	USAID, Bureau for Resilience and Food Security	Division Chief, Market Systems and Finance Center for Agriculture-Led Growth
Hans Muzoora	USAID, Bureau for Resilience and Food Security	Agricultural Finance Advisor, Market Systems and Finance Division
Mark Napier	FSD Africa	CEO
Moffatt Ngugi	USAID, Mozambique Mission	Environment and Natural Resource Officer
Carlijn Nouwen	BIFAD Subcommittee; Climate Action Platform for Africa	Member: Co-founder

Name	Affiliation	Title
Tom Ole-Sikar	Maasai Women Development Organisation MWEDO	Food Systems and Business Development Consultant
Christy Owen	USAID Green Invest Asia, Pact	Chief of Party
Catherine Pomposi	USAID, Bureau for Resilience and Food Security	Climate Monitoring and Evaluation Advisor
Rajiv Pradhan	Swisscontact (Cambodia)	Country Director
Mike Reilly	USAID, Program Office, Strategic Planning	Program Officer
Deborah Rubin	Cultural Practice	Director
Nathaniel Scott	USAID, Colombia Mission	Deputy Director, Sustainable Ecosystems and Economic Development Office
Kirsten Spainhower	USAID, Bureau for Resilience and Food Security	Country Support Officer and Climate Integration Lead
Regan Smurthwaite	EnCompass LLC	Climate Monitoring, Evaluation, and Learning Specialist
Yasser Toor	US International Development Finance Corporation	Head of Food Security Investments; Managing Director
Ann Vaughan	USAID, Bureau for Resilience and Food Security	Senior Advisor for Climate Change
Fernando De Villena	USAID, Peru Mission	Technical Advisor, Office of Alternative Development
Larissa Warhol	USAID, Bureau for Environment, Energy, and Infrastructure; Bureau for Development, Democracy , and Innovation, Natural Climate Solutions	Senior Climate Change and Land Advisor
Katie West	USAID, Bureau for Resilience and Food Security	Senior Program Analyst, Analytics and Learning Division
Simon Winter	Syngenta Foundation for Sustainable Agriculture	Executive Director
Peter Wright	BIFAD Subcommittee: CARE USA	Member; Senior Technical Advisor
Fernanda Zermoglio	USAID, Bureau for Resilience and Food Security	Senior Climate Change Adaptation and Resilience Advisor

Name	Affiliation	Title
Linda Zuze	IDinsight	Incoming Director

Table 4: BIFAD Climate Change Subcommittee Presentations

Name	Affiliation	Title
Rob Bertram	USAID, Bureau for Resilience and Food Security	Chief Scientist
Kevin Coffey	USAID, Bureau for Humanitarian Assistance, Office of Technical and Program Quality, Risk Analysis	Senior Humanitarian Assistance Officer and FEWSNET Program Manager
Noel Gurwick	USAID, Center for Environment, Energy, and Infrastructure	Senior Climate and Land Advisor
Songbae Lee	USAID, Bureau for Resilience and Food Security	Agricultural Finance Team Lead
Aurelia Micko	USAID, Kenya & East Africa Environment Office	Director
Zach Stewart	USAID, Center for Agriculture-Led Growth	Production Systems Specialist / US Diplomat
Ann Vaughan	USAID, Bureau for Resilience and Food Security	Senior Advisor for Climate Change