CGIAR

Climate Action Program

Full design document

November 15, 2024

Table of contents

List of acronyms 4

1. Executive summary 6

2. High-level vision in response to challenges and megatrends 7

- 2.1. Challenges and megatrends 7
- 2.2. High-level vision 7
- 2.3. What is new in this Program? 7

3. Evidence-based and demand-led prioritization 8

4. Comparative advantage 10

5. Theory of change 11

- 5.1. Overarching research questions 11
- 5.2. Pathways to impact 12
- 5.3. Gender and social inclusion 12
- 5.4. Key actors and partnerships 12
- 5.5. Key assumptions 13
- 5.6. Programmatic innovation 13
- 5.7. Theory of change diagram 15

6. Areas of Work 16

- 6.1. AoW 1: Prioritization and coordination of climate action 16
- 6.2. AoW 2: Digital advisories and climate risk management 20
- 6.3. AoW 3: Locally led adaptation 25
- 6.4. AoW 4: Low-emission transitions 29
- 6.5. AoW 5: Finance and policy for scaling solutions 34

7. Country integration 38

- 7.1. Example of integration in India 38
- 7.2. Overview of selected work in top 15 countries 39

8. Boundaries and linkages with other components of the Portfolio 40

8.1. Boundaries 40

8.2. Linkages across the Portfolio 40

9. Monitoring, evaluation, learning, and impact assessment (MELIA) 42

9.1. Monitoring, evaluation, and learning (MEL) 42

9.2. Impact assessment (IA) 42

10. Capacity sharing 42

11. Gender equality, youth, and social inclusion 43

12. Climate change 43

13. Risk management 44

14. Funding sources 44

Annex: Pooled funding 47

References 56

Appendix 60

Appendix 1. Comparative advantage (Section 4 of the proposal) 61

Appendix 2. Climate Action Program's 2030 targets 64

List of acronyms

AGNES	African Group of Negotiators Expert Support
AICCRA	Accelerating Impacts of CGIAR Climate Research for Africa
AoW	Area of Work
ARI	advanced research institution
BC	biophysical capital
CA	comparative advantage
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CIS	climate information services
CLIC	Climate and Cryosphere part of World Climate Research Program
ClimBeR	CGIAR Initiative: Climate Resilience
CoP	United Nations Framework Convention on Climate Change Conference of Parties
CRP	Consortium Research Program
DCAS	digital climate advisory services
ESG	environmental, social, and governance (investors)
EWS	early warning system
FAO	Food and Agriculture Organization of the United Nations
FLW	food, land, and water (systems)
G/NFCS	Global and National Framework for Climate Services
GCF	Green Climate Fund
GESI	Gender Equality and Social Inclusion
GHG	greenhouse gas
GMP	Global Methane Pledge
IA	impact assessment
HC	human capital
HICs	high-income countries
HLO	high-level output
ICRM	integrated climate risk management
IFAD	International Fund for Agricultural Development
IFI	international financial institution
IIED	International Institute for Environment and Development
INGO	international nongovernmental organization
IPCC	Intergovernmental Panel on Climate Change
ISDC	Independent Science for Development Council
LED	low-emission development
LEFS	low-emission food systems

LLA	locally led adaptation
LMICs	low- and middle-income countries
LT-LEDs	long-term low-emission development strategies
MELIA	monitoring, evaluation, learning, and impact assessment
MFI	microfinance Institution
MRV	monitoring, reporting, and verification
NAP	national adaptation plan
NARES	national agricultural research and extension system
ND-GAIN	Notre Dame Global Adaptation Initiative
NCQG	New Collective Quantified Goal
NDC	nationally determined contribution
NGO	nongovernmental organization
NHMS	national hydrological and meteorological services
OC	outcome
OP	output
R&D	research and development
ROI	return on investment
SBSTA	Subsidiary Body for Scientific and Technological Advice (part of UNFCCC)
SC	social capital
SMEs	small and medium enterprises
SS	Strategic Shift
TOC	theory of change
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WEAI	Women's Empowerment in Agriculture Index
WMO	World Meteorological Organization
WRI	World Resources Institute
WUE	water-use efficiency

1. Executive summary

Climate change is accelerating. Global temperatures are expected to exceed 1.5°C above pre-industrial levels by the early 2030s. Extreme weather events are becoming more frequent and severe, with devastating impacts on food production, water availability, and livelihoods. Food systems are also a major driver of climate change, responsible for ~35% of global greenhouse gas (GHG) emissions. Systemic inequalities at multiple scales increase climate change challenges and impacts for vulnerable and marginalized people.

The Climate Action Program will deliver the science, innovation, and collaboration necessary to transform food, land, and water (FLW) systems for a climate-resilient, net-zero, and more equitable future. It contributes particularly to the CGIAR Impact Area on climate change adaptation and mitigation, while advancing all five Impact Areas. With an overall ambition of climate action across agri-food systems, the Program's research will support resilient, low-emission farms, landscapes, and aquatic resources of **38 million small-scale producers and value chain actors**. By 2030, the Program will contribute to **emissions reductions or removal of 1 gigaton of CO_2e by supporting equitable mitigation action at scale.** These targets will be enabled by the Program's support for the development of at least **100 climate policies and the unlocking of at least USD 15 billion in climate finance**.

The Climate Program strategically advances CGIAR's climate research Portfolio, building upon the CGIAR Research Initiatives on Climate Resilience (ClimBeR), Low-Emission Food Systems, Livestock and Climate, and NEXUS Gains as well as the Climate Impact Area Platform. This integration enhances our ability to engage in more comprehensive and impactful research and impact on a wide scale and to use systems thinking to guide a just climate transition toward resilient FLW systems.

The Program consists of five interdependent Areas of Work (AoWs):

AoW 1: Prioritization and Coordination of Climate Action

AoW 2: Digital Advisories and Climate Risk Management

AoW 3: Locally Led Adaptation

AoW 4: Low-Emission Transitions

AoW 5: Policy and Finance for Scaling Solutions

Acting as the climate hub for the CGIAR, the Program will foster system-wide climate-sensitive programming by aligning research agendas, facilitating collaboration, and amplifying innovations to scale impact (AoW 1). It will develop climate analytics and identify priorities and knowledge gaps to inform research on climate resilience, mitigation, and just transitions (AoW 1). Research on climate risk management and digital advisories, locally led adaptation, and low-emission transitions will support on-the-ground climate action by governments, the private sector, and civil society organizations (AoWs 2, 3, and 4), while research on policy and finance will drive large-scale impact and institutional change (AoW 5).

Strong national and partner ownership, stakeholder engagement, and coordinated collaboration across actors will ensure that research is demand driven and co-designed; leads to large-scale, desired outcomes; and develops and benefits from new models of capacity sharing. The Climate Action Program will leverage existing partnerships with national governments, national agricultural research and extension systems (NARES), community-based organizations, and academic institutions. The Program will expand partnerships with international financial institutions (IFIs) and intergovernmental organizations to influence policy and investment for system-wide change. The success of the Climate Action Program rests on Gender Equality and Social Inclusion (GESI) approaches promoting deep, equitable partnerships, active listening, and trust building with disenfranchised actors and communities across FLW systems.

The Climate Action Program will prioritize working in countries with high levels of climate vulnerability and those with high mitigation potential, high partner demand, and potential to build on or scale out past achievements. The Program will roll out its five AoWs across 30 countries in CGIAR's six regions, working closely with all relevant CGIAR Centers for holistic FLW system transformation. With rising demand for climate action, the Program also expects growing bilateral support for research in other strategically important countries. Building on CGIAR's legacy of high-quality science and partnerships, the Climate Program sets a new standard for innovation, collaboration, and scaling in addressing the global climate crisis.

2. High-level vision in response to challenges and megatrends

2.1. Challenges and megatrends

Climate change is accelerating, with significant impacts for agri-food systems, the environment, and local and national economies. Global temperatures are 1.2°C above pre-industrial levels and will likely exceed the 1.5°C threshold by the early 2030s (IPCC 2023). Extreme weather is more frequent and severe (Hassan, Nayak, and Azam 2024; Lesk et al. 2022; Cullmann et al. 2021), and economic losses, particularly from extreme events, are accelerating. As a result, the most vulnerable small-scale producers and consumers in the Global South face the dual threats of climate catastrophe and food insecurity.

Food systems already contribute one-third of global annual GHGs (Crippa et al. 2021). Population growth and shifts in consumption patterns toward increased intake of meat and dairy will further increase emissions, especially methane (Ivanovich et al. 2023). Environmental degradation is widespread, and land is degrading faster than it is restored (UNCCD 2024). Geopolitical instability is exacerbated by climate-induced resource competition and conflict (UNHCR 2024). These megatrends will exacerbate human and ecosystem vulnerability and increase the imperative for mitigation. The challenge is aligning FLW systems with Paris Agreement targets (global temperature rise of no more than 1.5 to 2°C) without compromising food and nutrition security for vulnerable small-scale producers and consumers.

2.2. High-level vision

The Climate Action Program will deliver the science, innovation, and collaboration necessary to transform FLW systems for a climate-resilient, net-zero, and equitable future. The Program particularly contributes to the CGIAR Impact Area on climate change. It will advance research across agri-food systems to benefit 38 million of the most vulnerable small-scale producers and value chain actors across 30 countries through more resilient, low-emission farms, landscapes, and aquatic systems, and it will help other CGIAR Programs reach an additional 100 million producers. The Program aims to reduce, avoid, and/or remove GHG emissions by 1 gigaton CO_2e by 2030 in 30 countries, while setting a trajectory of 5 gigaton CO_2e annual reductions by 2050. Moreover, at least 100 policies and USD billion in climate finance will be informed by the Climate Action Program.

The Program will provide guidance on climate analytics, priorities, and knowledge gaps to drive research on climate resilience, mitigation, and just transitions (AoW 1). Acting as the climate hub for the entire CGIAR, the Program will foster system-wide climate-sensitive programming by delivering user-ready data on climate risks and emission hotspots, aligning research agendas, facilitating cross-Program collaboration, mainstreaming climate justice, and amplifying contextualized innovations and insights to scale impact.

Research and development on climate risk management and digital advisories, locally led adaptation, and low-emission transitions will support on-the-ground innovation and implementation (AoWs 2, 3, and 4). Research on policy, finance, and institutional mechanisms will drive large-scale impact (AoW 5).

Demand-driven research and partnerships will ensure that outcomes from this Program are relevant and lasting. Diverse climate actors will use the research results to better implement multi-scalar climate solutions: bundled digital climate information services; early warning systems (EWS) and adaptive safety nets for vulnerable small-scale producers; climate-resilient landscape management; water management systems fit for future climates; national systems for integrated risk management; locally co-produced climate solutions and pathways; frameworks to avoid maladaptation; socio-technical bundles to implement large-scale carbon removal and methane reduction; food system innovations to reduce emissions; digital AI-aided monitoring, reporting, and verification (MRV) systems; loss and damage assessment to drive financial transfers; and evidence-based policy and finance for scaling.

2.3. What is new in this Program?

The Program's vision has a **broad systems focus** that targets ambitious climate action in FLW systems and **uses strategic prioritization** to identify actions with high returns on investment. The key emerging areas of work include the following:

- **Mainstreaming gender equality and social inclusion (GESI) for just climate transitions:** The Program ensures equitable benefits from climate adaptation and mitigation actions. Aligned with ISDC's Strategic Shifts **SS3 and SS4**, it addresses the root causes of vulnerability, inequality, and injustice in FLW systems (AoW 1). It also fosters inclusive, locally led adaptation and mitigation (AoWs 3, 4), water systems governance (**SS2**) (AoW 2), and inclusive finance (AoW 5).
- **Digital technologies and AI:** These technologies are crucial across the Program for empowering stakeholders, particularly youth (**SS4**), and driving equitable climate action. This is achieved through education, capacity development (**SS5**), innovation, and co-creation. Under AoW 2, digital technologies are vital for scaling and innovation of digital climate advisories and early warning systems. Digital technologies will also be foundational for advancing MRV in AoW 4, filling data gaps, and attracting new finance opportunities.
- **A novel approach to policy and finance:** The Program will focus on guiding and tracking policy implementation and reporting against global targets (**SS9**). The new approach centers on understanding country needs and leveraging climate science, data, foresight, and trade-off analyses (**SS8**) to improve the bankability of climate finance proposals (AoW 5).
- **CGIAR's Climate Hub for Prioritization and Coordination:** This hub creates a new operational model, fostering partnerships and climate learning across sectors (**SS6**). It hosts climate analytics, provides user-ready climate data for prioritization, and coordinates collaborations across the 2025–30 Portfolio on climate, enhancing research quality and amplifying impact through integration and engagement (AoW 1).

The unique value proposition of the Climate Action Program is its capacity to deliver equitable climate action at scale by strategically bridge gaps between user needs and usability, science-based information and decision-making, and local climate action and higher-level policy processes.

3. Evidence-based and demand-led prioritization

Given the immense scale and interconnected nature of the challenges posed by climate change across FLW systems (Siegel 2021), CGIAR must carefully prioritize its focus on climate action, both geographically and thematically. To accomplish this, we adopted a rigorous, data-driven methodology complemented by a qualitative assessment to identify priority regions and countries. In its prioritization exercise, the Climate Action Program considered the following criteria:

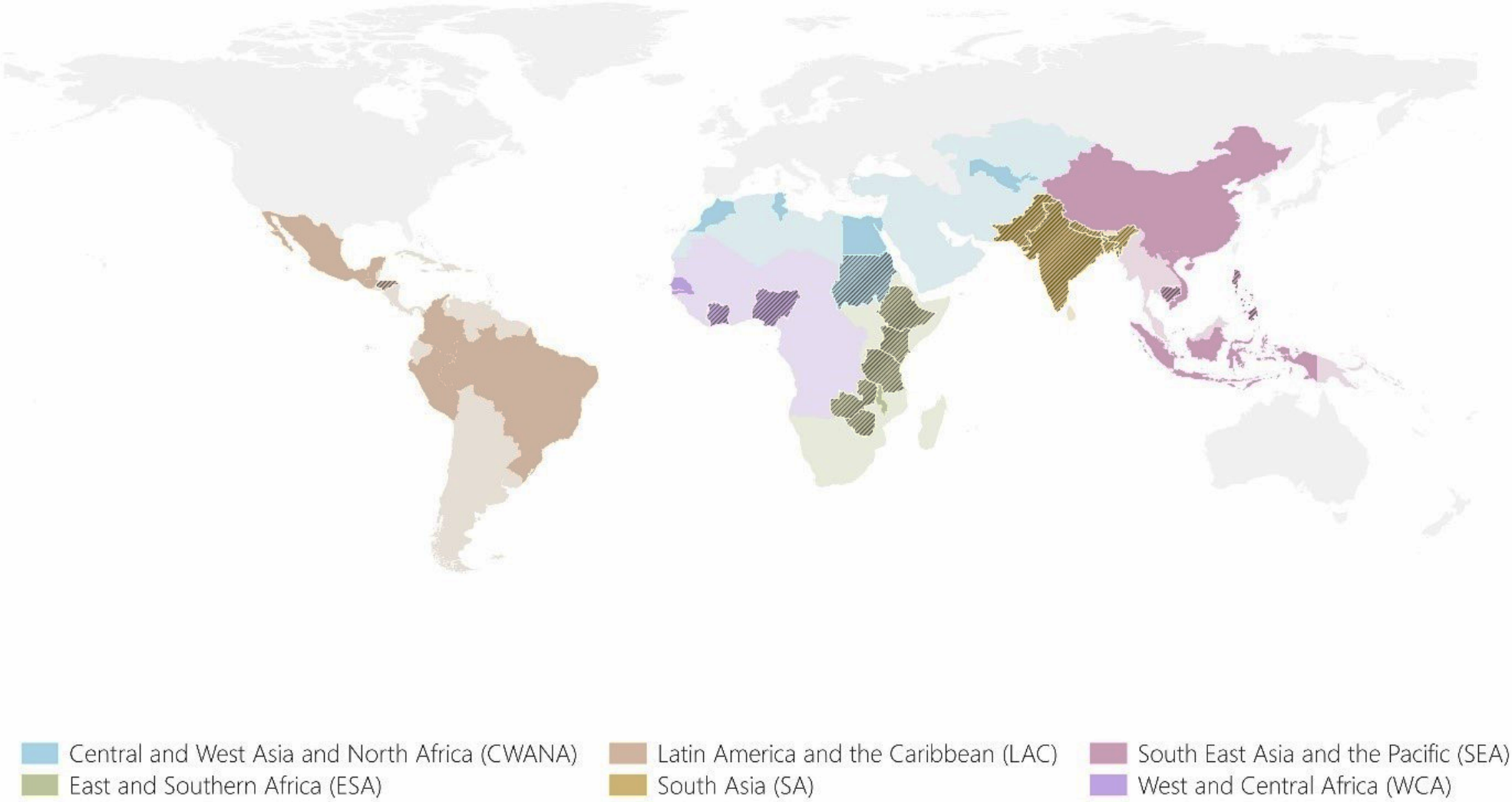
- **Climate hazards and emissions, vulnerability, and potential for Program impact:** To prioritize geographies for climate adaptation work, we considered climate variables such as rainfall, temperature, and drought indices; flood extremes; vulnerability to climate hazards; and lack of adaptive capacity of FLW systems. To prioritize countries for climate change mitigation work, we considered two criteria: (1) emissions hotspots, and (2) enabling environments for impact, which includes priorities of national governments and institutional capacity. Generally, countries that are food secure and have stable policy and institutional systems would have higher potential for significant GHG mitigation outcomes.
- **Strong expressed demand:** Our prioritization exercise considered feedback from more than 2,000 stakeholders consulted through webinars and face-to-face meetings by the Initiatives contributing to the Climate Action Program (ClimBeR, Low-Emission Food Systems, NEXUS Gains, and Livestock and Climate), our participation in and summaries of CGIAR listening sessions, and demand expressed through bilateral programs that contribute to this Program.
- **Trust and partnerships:** The contributing Initiatives have developed more than 400 new partnerships focused on driving climate action across Africa, Asia, and Latin America. Even more partnerships have been developed through climate-related bilateral research programs. As the Program's goals can be achieved only through strong local, national, regional, and global partnerships, countries with existing partnerships through Initiatives or bilateral programs were considered.
- **Country presence:** A CGIAR office in the country is an essential conduit for maintaining partnerships, receiving continuous feedback on research results, hearing new demands, and shaping the national discourse on climate action. CGIAR's physical presence in a country was therefore a key criterion for prioritizing geographies for climate action.
- **Building on achievements:** The contributing Initiatives have developed more than 30 innovations with proven impacts on climate action, specifically focusing on the poorest food producers and other food system actors. Geographies where these innovations have demonstrated early success and impact were given special consideration during the prioritization process. Other interventions with high potential for impacts in certain geographies were equally considered. Additionally, CGIAR Centers' advanced experimental facilities, synergies with bilateral programs, and regional balance across CGIAR geographies were also considered for prioritization.

We ranked 128 countries in the six CGIAR mega-regions based on their vulnerability to climate change (lower number indicating higher vulnerability) and lack of coping capacity (lower number indicating lower coping capacity) using the Notre Dame Global Adaptation Initiative (ND-GAIN) (Chen et al. 2018), the INFORM Climate Change Risk Index (Poljanšek et al. 2022), and the countries identified by (Bonilla-Cedrez et al. 2023; Costa, Thornton, and Wollenberg 2023) as global hotspot countries for adaptation and mitigation interventions in agriculture. This process ensured that our prioritization identified those countries that face the greatest challenges and have the largest potential for impact. This quantitative ranking of countries was further adjusted to include countries with CGIAR presence, strong expressed demand, ongoing work from primary initiatives and bilateral projects, and established partnerships.

Following this procedure, the top 30 ranked countries were identified as priority countries for Program implementation (Figure 3.1). These priority countries represent a diverse array of climate risks, FLW management systems, and socio-political contexts, each requiring tailored approaches for climate action. These countries are well distributed across the six mega-regions of CGIAR: **South East Asia and the Pacific (SEA)**—Cambodia, China, Indonesia, Philippines, Timor-Leste, Vietnam; **South Asia (SA)**—Bangladesh, India, Nepal, Pakistan; **Central and West Asia and North Africa (CWANA)**—Egypt, Morocco, Tunisia, Uzbekistan; **East and Southern Africa (ESA)**—Ethiopia, Kenya, Malawi, Sudan, Tanzania, Zambia, Zimbabwe; **West and Central Africa (WCA)**—Côte d'Ivoire, Nigeria, Senegal; and **Latin America and the Caribbean (LAC)**—Brazil, Colombia, Guatemala, Honduras, Mexico, Peru. Countries like Bangladesh, India, and Pakistan, with high population densities, face both drought- and flood-related challenges yet contribute significantly to food system emissions. Countries like Côte d'Ivoire, Ethiopia, Kenya, Nigeria, Senegal, Sudan, and Zambia contend with food system productivity challenges, land degradation, food insecurity, conflict, and rapidly changing climate conditions. In the **CWANA** region, countries such as Egypt, Morocco, and Uzbekistan face arid climates, water management issues, and the need for sustainable land practices. Finally, countries like Brazil, China, India, Indonesia, Mexico, and Vietnam are food production powerhouses with dynamic economies, struggling to balance development and climate actions, offering significant opportunities for low-emission development across FLW systems. From these 30 priority countries, the top 15 ranked countries were selected to provide an overview of specific geographies, major production systems, and Areas of Work (see section 7.2).

The team will conduct a further prioritization exercise during the Inception Phase to align the number of countries with the available budget. As the Portfolio-wide prioritization process continues, the list of priority countries may change based on further input from partners, donors, and CGIAR Centers. Deeper engagement and analysis will be required to refine the prioritized countries, considering partnerships established through the primary Initiatives, their three-year achievements, and the geographic focus of bilateral projects mapped to this Program. The intensity of AoWs and activities will also vary across selected countries to address strategic needs and maximize potential impact. Based on the available budget, we will implement a full set of AoWs in 15 top prioritized countries (cross-hatched countries in Figure 3.1), while limiting the scaling of successful interventions in the other 15 countries. While AoWs 1 and 5 will be essential in all countries of implementation, some countries will have a stronger focus on adaptation, while others may prioritize mitigation.

Figure 3.1. Priority countries for implementing the Climate Action Program. Cross-hatched countries are the top 15 prioritized countries for which an overview of the area of work is provided in section 7.2.



4. Comparative advantage

CGIAR's comparative advantage (CA) in implementing climate actions across FLW systems in the Global South lies in its interdisciplinary expertise, strong partnerships, and over 20 years of research on climate adaptation and low-emission development. As a global science-based solutions broker, CGIAR is uniquely positioned to provide actionable climate data, prioritize climate actions, and integrate cutting-edge innovations with local contexts. By co-developing and co-evaluating tailored climate-adaptation and low-emission strategies for smallholder producers and food system actors, CGIAR plays a key role in shifting FLW systems into more resilient and low-emission pathways. Its strong networks with national agencies and trust with policymakers makes CGIAR a key player in shaping climate change policies and integrating climate into sectoral policies across the countries in the Global South. The historically high return-on-investment (ROI) of CGIAR technologies (Fuglie and Echeverria 2024; Alston, Pardey, and Rao 2022) places CGIAR in a strong position to collaborate with financial institutions and convince them to boost climate investments, enabling the scaling of equitable, inclusive, and justice-oriented climate solutions. Additionally, CGIAR's deep-rooted partnerships with local and international research and development agencies, strong trust among policymakers, and collaboration with advanced research institutes (ARIs) and global think tanks have positioned the organization as a key partner in shaping international policies and processes on climate. Below we describe the details of our analysis of CGIAR's CA and identify strategic partners in delivering desired high-level outputs.

The Climate Program will generate six high-level outputs (HLOs) under the categories of Innovation, Capacity, and Policy:

- **Innovation**
  - Prioritized science for advancing adaptation and low-emission development action, based on demand and impacts.
  - Pipeline of adaptation and mitigation solutions tailored for different users and contexts.
  - Frameworks, tools, methods, and analytics for climate action.
- **Capacity**
  - Innovative models of capacity sharing and training.
- **Policy**
  - Data, evidence, and knowledge for climate-specific and climate-sensitive policymaking, implementation, and climate finance.
  - Science and climate policy and other multi-stakeholder processes.

Delivery of these diverse HLOs will be supported by the following:

- **Human capital:** Developing innovations for adaptation, mitigation, and low-emission development — and supporting those innovations with data, evidence, knowledge, and the necessary frameworks, tools, and methods — requires scientists with a range of transdisciplinary systems skills. Disciplinary experts in various biophysical, social, and data sciences, including climate and systems modelers, are needed with the maturity and skills to work in multi- and transdisciplinary manners in the varying contexts of LMICs.
- **Biophysical capital:** The Climate Action Program will use traditional field stations, on-farm experimental facilities, and other infrastructure to implement applied research and demonstrate and measure diverse aspects of FLW systems. Central to the Climate Action Program will be modeling and big data analytics requiring high-performance computing and data facilities and supporting hardware.
- **Social capital:** Collaboration is needed among academic, national, civil society, and private sector actors to implement and scale adaptation and mitigation innovations and policies, exchange science and ideas across diverse sources, and contextualize these to the systems and environments of LMICs.

To determine CGIAR's CA, we considered potential partners among our traditional partners who might deliver this set of requirements:

- *Demand partners*, including NARES, government water and disaster agencies, community-based and farmer organizations, and the private sector.
- *Innovation partners* who have technical expertise and come from ARIs in LMICs and high-income countries (HICs) and NARES.
- *Scaling partners*, including international nongovernmental organizations (INGOs), development actors, the private sector, climate finance investors, and accelerator funds.

Other possible partners include national governments (e.g., for support for nationally determined contributions [NDCs]), multilateral donors and other IFIs, and intergovernmental and regional organizations. There is also potential for expanded engagement with other ARIs and international research organizations, institutes, and universities.

An analysis of the potential partners and their CA (Appendix 1) showed that with regard to human capital, knowledge, and skills, CGIAR has a likely CA due to the world-class transdisciplinary systems science, including social sciences and data analytics, that it applies in the contexts of the LMICs. CGIAR clearly provides these skills in geographies where such skills are minimal. CGIAR has the global coverage and reach to interface between diverse partners and contextualize and apply innovations and science being created from this flow of information and collaboration. CGIAR may also have a likely CA on specific biophysical capital but with a more limited geographical coverage for field experimentation compared with NARES partners. CGIAR has global coverage for the collection and application of data, modeling, and analytics in the context of LMICs. For impact and scaling, CGIAR has the social capital, networks, and influence through long-term presence and formal country agreements to convene partners for co-designing and implementing innovations that can generate impact on the ground, such as MRV, policy influence, and adherence to the NDCs. CGIAR has highly regarded climate scientists conducting applied research in the climate-vulnerable target regions and countries, who have well-established partnerships with policymakers dealing with the NDCs, and wide networks of influence to play the role of climate knowledge brokers and conveners. Incentives for delivering these HLOs are high for CGIAR and nearly all partners.

Given the CA of INGOs and regional agricultural organizations in terms of their social capital and their specific human capital related to understanding the broader context and political landscapes, the Climate Action Program will explore more strategic partnerships with these organizations for cross-country delivery of climate-smart

innovations. For policy-related aims, CGIAR has particularly strong design and engagement processes and is able to convene partners to benefit from the skills and networks of the NARES, local universities, and policy think tanks. Partnerships with private sector actors will bring a CA in advocacy for positive policy environments, enhancing private sector participation. Partnerships with government, which is the lead policy implementer, are essential to align favorable policies with government incentives. Nonstate actors bring the CA of grassroots connections and working relationships with farmer groups and government, which positions them to conduct advocacy and facilitate community engagement in policy processes related to climate action.

To deliver the HLOs, the Climate Action Program will further prioritize partnerships that use the strengths of various institutions and bodies, such as the following:

- **Creating a pipeline of adaptation and mitigation solutions**: NARES have a CA in technical capacity, connection to and understanding of the context, and biophysical capital such as facilities and infrastructure in the target geographies.
- **Creating the frameworks, tools, methods, and analytics**: Selected ARIs have a CA in providing upstream science, blue-sky exploration, and modern infrastructure;.
- **Influencing science and climate policy and other multi-stakeholder processes**: Governments, local nongovernmental organizations (NGOs), and INGOs have a CA in using their presence on the ground and their ability to enable implementation and scaling.
- **Generating demand for science to advance adaptation and low-emission development**: Think tanks, civil society organizations, and farmer organizations have a CA in terms of their ability to network, advocate for change, and engage a broad spectrum of stakeholders and society.

5. Theory of change

The Climate Action Program aims to help meet the Paris Agreement's targets of limiting global temperature rise to well below 2°C (ideally 1.5°C) and advancing the Global Goal on Adaptation. Unaddressed climate impacts will exacerbate food and nutrition insecurity, environmental degradation, and socioeconomic inequalities (Barbier and Hochard 2018; Brown et al. 2015; IPCC 2023), as well as compound future climate risks (AghaKouchak et al. 2020). We focus on supporting countries in achieving adaptation and mitigation goals outlined in their national adaptation plans (NAPs) and other climate and sectoral policies. Our ambition of climate action for more resilient FLW systems through place-based solutions, and national and global climate policies grounded in science and co-created with stakeholders, addresses climate concerns in the context of global megatrends, such as growing inequalities, technological disruptions, demographic shifts, and increasing conflict (ISDC 2023).

5.1. Overarching research questions

1. What system approaches, including combinations of socio-technological innovation, policy change, and capacity sharing, can reshape FLW systems to achieve inclusive climate resilience and low-emission development across diverse geographies and contexts?
2. How effective will different adaptation and mitigation interventions be in reducing community and ecosystem vulnerabilities, lowering emissions, and advancing broader development goals in a rapidly warming world?
3. What strategies, including climate-related information and co-creation processes, enable the scaling of locally led adaptation and mitigation actions across heterogenous socio-ecological systems, effectively addressing the political economy dynamics and root causes of vulnerability while engaging local stakeholders to overcome constraints?
4. What role can emerging technologies play in accelerating and enabling effective, timely, and equitable climate action by informing decision-making across all levels, from farmers coping with climate variability to financial institutions managing investment risk?
5. How can integrating the latest climate science, place-based data, and local knowledge effectively unlock public and private investments that minimize maladaptation risks, support just transitions, and ensure that climate transitions deliver equitable, durable adaptation benefits and emission reductions?

These research questions guide the Program's outputs and intermediate outcomes, ensuring that research is demand driven, context and gender specific, and actionable.

Box 1. Climate Action Program's 2030 Outcomes

These outcomes align with the CGIAR Results Framework's indicators for the Climate Change Impact Area and represent the Program's results. Results from other Programs and Accelerators will be additional.

By 2030, we aim to

- Benefit 38 million people.
- Support 100 climate and sectoral policies.
- Inform investment of USD 15 billion.
- Avoid, reduce, or sequester 1 Gt of CO_2e.

5.2. Pathways to impact

The Climate Action Program is implemented through five interconnected AoWs: (1) Prioritization and Coordination of Climate Action, (2) Digital Advisories and Climate Risk Management, (3) Locally Led Adaptation, (4) Low-Emission Transitions, and (5) Finance and Policy for Scaling Solutions. These AoWs work in concert through three interlinked pathways to impact—Innovation, Capacity Sharing, and Policy Change—aligned with the CGIAR Research Strategy. Each pathway plays a critical role in accelerating the achievement of the 2030 targets and incorporates explicit scaling strategies to enhance impact. Scaling up and scaling out are integral to our impact pathways. The Program embeds these scaling strategies within each pathway, building on the experience gained from the Consortium Research Programs (CRPs), 2022–24 Portfolio (Initiatives), and bilateral projects.

The **Innovation Pathway** facilitates the customization and scaling of demand-driven, prioritized, and co-developed solutions that address key adaptation and mitigation challenges. This pathway not only generates new data and knowledge but also integrates solutions developed across the CGIAR Portfolio 2025–30 that contribute to climate resilience, risk reduction, mitigation, equity, and just transitions. Examples include frameworks for understanding the root causes of vulnerability (AoW 1.2), for avoiding maladaptation (AoW 3.3), identifying incentive structures for methane reductions (AoW 4.2), and tracking and reporting progress toward the Global Goal on Adaptation (AoW 5.1). Key strategies for scaling within this pathway include replicating and adapting successful climate solutions across locations. These scaling strategies address challenges such as translating climate forecasts into actionable advisories (AoW 2.1) and designing business models for methane reduction in rice and livestock production and aquaculture (AoW 4.2). As the Innovation Pathway drives these and other breakthroughs, it keeps CGIAR at the forefront of science and innovation, shaping the future of climate resilience and low-emission development.

The **Capacity Sharing Pathway** focuses on capacity strengthening of governments, producers and value chain actors, the private sector, and research institutions, including CGIAR scientists, to work on demand-driven climate issues. This pathway emphasizes capacity-sharing mechanisms to assess needs, set priorities (AoW 1), and co-develop training programs and collaboration models that enhance both technical and institutional capacities while ensuring inclusivity (AoWs 1–5). New methods, such as on-demand technical assistance (AoW 5.2), a centralized entry point for climate (Climate Hub) (AoW 1.1), and embedding of seconded staff within key organizations (AoWs 2 and 5), ensure that partners can readily access and use CGIAR innovations. To expand reach and inclusivity, digital platforms are used to connect with key audiences (e.g., AoWs 2.2 and 4.4). Strong partnerships with local institutions are also forged to embed capacity sharing within existing structures (AoWs 2, 3, 4), ensuring sustainability and long-term impact. This pathway fosters mutual learning, collaboration, and knowledge exchange, empowering local and global actors with the necessary skills to take effective climate action.

The **Policy Change Pathway** focuses on translating scientific evidence into actionable policies and investments that align with international targets and national development goals. Key activities include convening or strengthening existing multi-stakeholder platforms and supporting governments in developing and implementing NDCs, NAPs, and LT-LEDS while repurposing policy frameworks to drive more climate, environmentally, and socially sound agriculture and land use (AoWs 1.5 and 5.1). The pathway also builds the investment case for adaptation, mitigation, and loss and damage financing (AoW 5) and ensures that local concerns inform national policies and investments (AoWs 3.2 and 4.1–4.3). By linking science to policies and investments, this pathway supports development of frameworks for future inclusive FLW systems while helping to unlock the resources needed to accelerate adaptation and low-emission development today.

5.3. Gender and social inclusion

GESI is integral to the Climate Action Program's impact pathways, ensuring that women, youth, and marginalized groups benefit from climate adaptation and mitigation solutions. In the Innovation Pathway, solutions are co-developed through locally led adaptation and living labs for low-emission food systems to address the unique needs and constraints of various social groups, with a focus on creating innovations that are accessible for vulnerable populations. Gender- and social-disaggregated data will inform key interventions, such as digital advisory development and low-emission forage solutions, supporting inclusivity in all scaling pathways. In the Capacity Sharing Pathway, GESI is embedded in training and knowledge-sharing efforts, supporting access to programming and information. This includes empowering women and marginalized communities to engage in climate action at multiple scales, whether through co-design, formal and informal educational opportunities, or global processes such as UNFCCC negotiations. In the Policy Change Pathway, the Program advocates for gender-responsive and inclusive policies, such as calling for gender-smart financial mechanisms that promote equitable access to climate finance, integrating and amplifying the voices and needs of the most vulnerable in climate governance, and integrating GESI concerns into climate policy frameworks to drive more inclusive responses.

5.4. Key actors and partnerships

Achieving the Program's objectives will require the engagement of a diverse set of actors throughout FLW systems. Climate action demands a shift in discourse, attitudes, power dynamics, and deliberate actions that break from business-as-usual approaches. This Program will be rooted in strong national and partner ownership, functional institutional structures, and coordinated collaboration across actors and the CGIAR system. A systematic partnership prioritization process will be established in the initial phase of the Program implementation, coordinated with other relevant Programs. This will foster alignment across Programs and help to identify catalytic partnerships that amplify impact (AoW 1.1). Policymakers will play a crucial role in aligning sectoral policies with global climate goals, particularly the Paris Agreement (AoWs 1 and 5). The private sector, from corporations to small- and medium-sized agri-enterprises (agri-SMEs), will be key in scaling low-emission innovations, driving green investments, and pursuing adaptation actions (AoWs 3 and 4). Research institutions, including NARES and universities, will co-develop solutions, data tools, and scientific outputs (AoWs 2–4). Local actors, such as land, water, and ecosystem managers, along with marginalized and vulnerable groups, like Indigenous peoples, will be instrumental in driving locally led climate adaptation (AoWs 2–4). Furthermore, financial institutions, particularly climate funds, will mobilize resources to support large-scale implementation (AoW 5). These meaningful partnerships ensure the Program's relevance, legitimacy, and long-term sustainability, allowing CGIAR innovations to contribute to a transformative global climate agenda.

5.5. Key assumptions

- **Cooperation drives action**: Continued collaboration and cooperation at international and regional levels will ensure the flow of information, funding, and support for climate adaptation and mitigation efforts.
- **Policies drive climate investments and projects**: Climate policies at both national and international levels will serve as a crucial catalyst for development of adaptation and mitigation investments and projects.
- **Engagement drives ownership and uptake**: Scaling models will effectively and meaningfully engage local communities and marginalized and vulnerable groups, ensuring their ownership of adaptation and mitigation solutions, which will increase uptake and sustainability.
- **Evidence drives change**: Governments and the private sector will use evidence on the impacts of climate change to drive interest and capacity to create research-informed policies and investments.

5.6. Programmatic innovation

The Climate Action Program represents a strategic advancement in CGIAR's climate research Portfolio, synthesizing the experience from past initiatives such as CCAFS, Climate Resilience, Low-Emission Food Systems, the Climate Change Impact Area Platform, NEXUS Gains, and significant bilateral projects such as Accelerating Impact of CGIAR Climate Research in Africa (AICCRA), Programme for Climate-Smart Livestock (PCSDL) in East Africa, Climate-Smart Initiatives for Climate Change Adaptation and Sustainability in Prioritized Agricultural Production Systems in Colombia (CSICAP), Climate-Smart Technologies in Mali, Enhanced Coastal Fisheries (ECOFISH) in Bangladesh, and Thai Rice NAMA, among many others. By unifying efforts under a singular mission and toward critical topics central to the CGIAR Results Framework and Strategy, the Program takes a novel integrated approach toward supporting adaptation and mitigation action. Furthermore, integrating innovations, capacity sharing, and policy change into a cohesive framework enhances our ability to generate impact at scale. By embedding experts within key institutions and offering on-demand technical assistance, the Climate Action Program also creates new and consolidated direct channels for science to influence policy and practice, driving system-wide change. Building on CGIAR's legacy of high-quality science, this Program sets a new standard for innovation in addressing the global climate crisis.

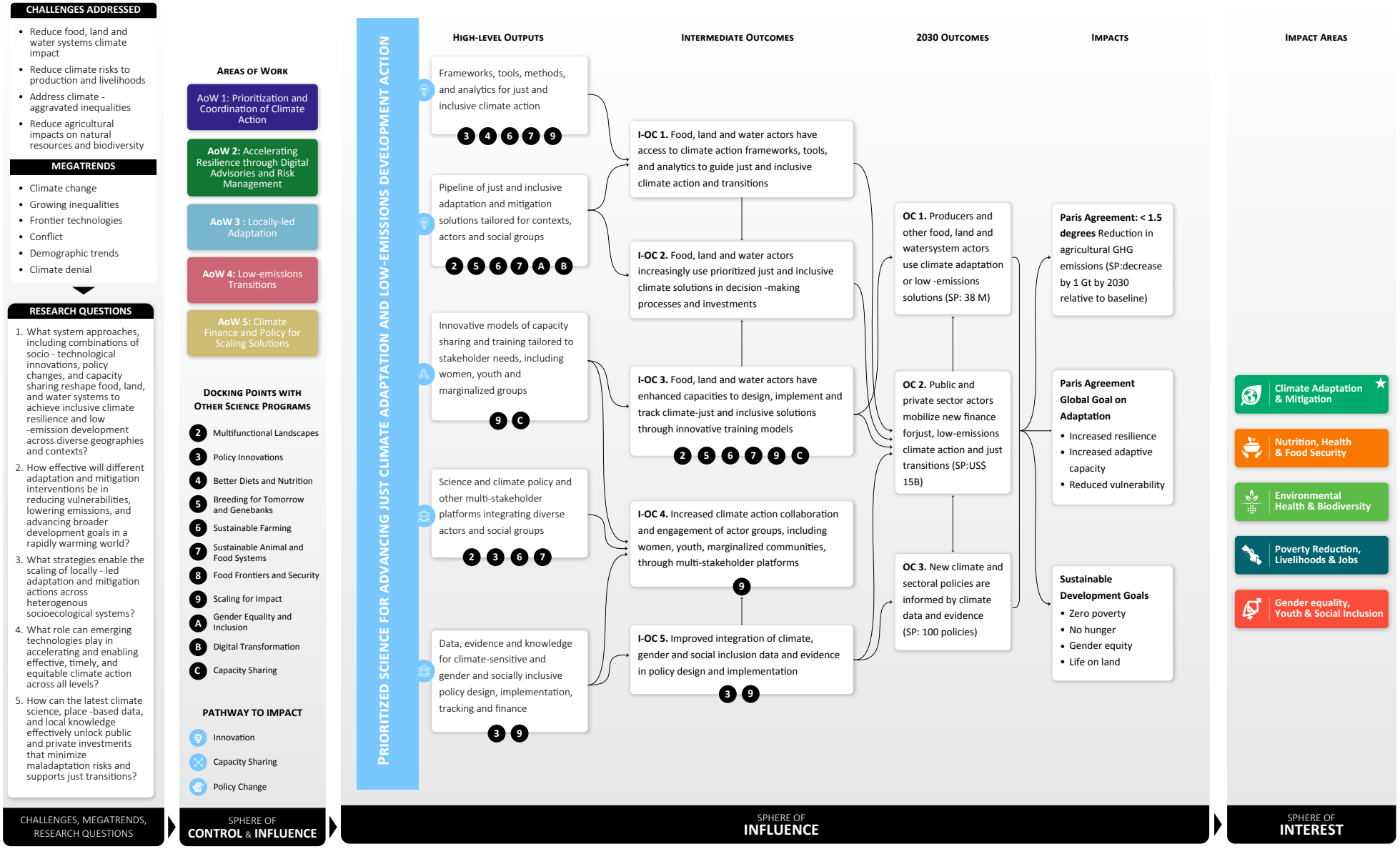
Table 5.1. Climate Action Program outputs and outcomes

ToC element	Statement	Contributing AoWs	Partners (including internal) and roles	Assumption	Indicator and target
OP 1	Prioritized science for advancing adaptation and low-emission development action	1	CGIAR, ARIs, NARES, UN agencies		
OP 2	Frameworks, tools, methods, and analytics for climate action	1–5	CGIAR, ARIs, NARES, UN agencies, governments, private sector actors		
OP 3	Pipeline of adaptation and mitigation solutions tailored for different users and contexts	2–4	CGIAR, ARIs, NARES, local governments, private sector actors, rural communities		
OP 4	Innovative models of capacity sharing and training	1–5	CGIAR, NARES, local governments, Capacity Sharing Accelerator		
OP 5	Science and climate policy and other multi-stakeholder platforms	1, 5	CGIAR, NARES, UN agencies, regional climate negotiation organizations, IPCC		
OP 6	Data, evidence, and knowledge for climate-specific and climate-sensitive policymaking, implementation, and climate finance	4, 5	CGIAR, ARIs, NARES, national ministries, IFIs, UNFCCC		

ToC element	Statement	Contributing AoWs	Partners (including internal) and roles	Assumption	Indicator and target
IOC 1	FLW actors use climate action frameworks, tools, and analytics to guide future climate actions	1–5	NARES; local governments; private sector; international organizations that build resilience, reduce climate risk, and increase mitigation	Tools and frameworks are user friendly and adaptable to different contexts	
IOC 2	FLW actors increasingly use prioritized climate solutions in decision-making processes and investment	4, 5	National governments, NARES, international organizations	Science outputs are accessible and relevant to decision-makers	
IOC 3	FLW actors and CGIAR staff have strengthened capacities to design, implement, and track climate solutions through innovative training models	2–5	NARES, local governments, producer organizations, CapDev Accelerator	Training models effectively address capacity gaps and are culturally appropriate	
IOC 4	Engagement and collaboration on climate action increase through multi-stakeholder platforms	1	NARES, UN agencies, civil society organizations, private sector	Platforms are inclusive and facilitate meaningful dialogue	
IOC 5	Policy formulation and implementation increasingly integrate climate-specific data and evidence	1, 5	National ministries, local governments, IFIs	Policymakers have the capacity to interpret and apply climate data	
2030-OC 1	Producers and other FLW system actors use climate adaptation or low-emissions solutions	2–4	National governments, NARES, local communities	Engagement drives ownership and adoption	38 million producers/users adopt climate adaptation or low-emission-solutions
2030-OC 2	Public and private sector actors mobilize new finance for climate action and just transitions by investing in new programs	5	National governments, IFIs	Policies drive programming; evidence drives change	USD 15 billion invested for climate action
2030-OC 3	New climate/sectoral policies are informed by climate data and evidence	5	Local, national, regional governments	Cooperation drives change; evidence drives change	100 climate-related policies implemented, including NAPs, NDCs, other sectoral policies
Impact	FLW systems reduce their GHG emissions	4	National governments, private sector, CGIAR Programs	Low-emission innovations are scalable and adopted	Net emissions from FLW systems decrease by 1 Gt by 2030 relative to baseline
Impact	Small-scale producers have increased resilience, increased adaptive capacity, and reduced vulnerability	2, 3	National governments, NARES, local communities	Solutions developed enable small-scale producers to adapt	150 million small-scale producers are resilient to climate shocks and using low-emission production options

5.7. Theory of change diagram

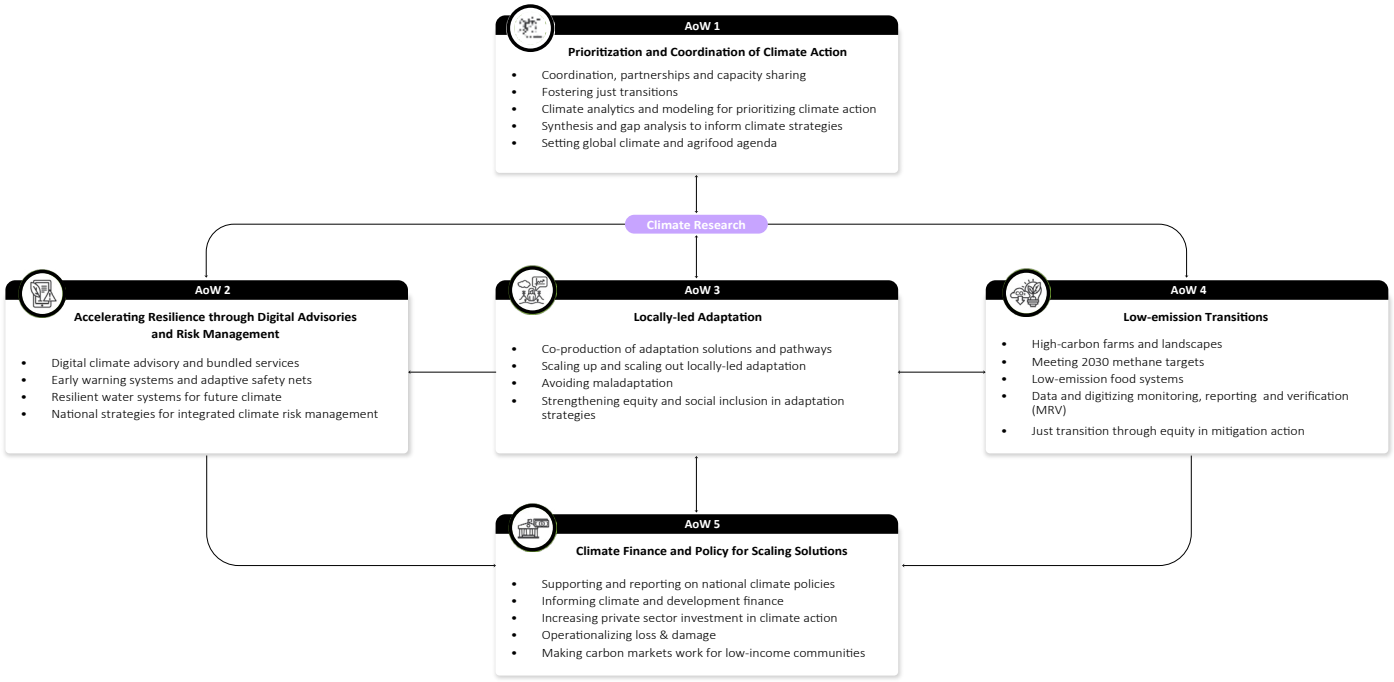
Figure 5.1. Program-level theory of change



6. Areas of Work

The overall ambition of the Climate Action Program is to deliver the science, innovation, and collaboration necessary to transform FLW systems for a climate-resilient, net-zero, and equitable future. The five AoWs described below (Figure 6.1) will contribute to CGIAR's three 2030 collective global targets on climate adaptation and mitigation, addressing the needs of local communities and contributing to development objectives and social justice (CGIAR 2022). This Program achieves these goals both by conducting its own activities and by facilitating climate action across the entire CGIAR Portfolio 2025–30. Integration among the AoWs is essential. AoW 1 helps set climate change priorities for CGIAR and global partners with a complementary synthesis role. AoWs 2, 3, and 4 drive on-the-ground adaptation and mitigation action, also linking to other Programs and Accelerators. AoW 5 provides the enabling environment for scaling through policy and finance.

Figure 6.1. Five Areas of Work of the Climate Action Program and their linkages



6.1. AoW 1: Prioritization and coordination of climate action

6.1.1. Ambition

The benefits of climate action outweigh by far the costs of inaction, especially in a 1.5ºC warmer world (IPCC 2019). However, with finite financial resources and often fragmented climate action efforts, coordination and prioritization are paramount. AoW 1 will lead an unprecedented global effort in prioritization and coordination of climate action for CGIAR and its partners. Serving as the climate hub for the entire CGIAR, AoW 1 will (1) strengthen coordination and collaboration on climate action across the entire CGIAR through a front-desk function; (2) mainstream a just transitions lens that informs strategies and theories of change; (3) produce, host, and disseminate climate analytics for prioritization; (4) synthesize and consolidate climate and FLW system research and action; and (5) engage in and influence international policy processes. By 2030, these pillars will provide clear evidence of a more integrated CGIAR climate agenda; nurture at least 125 global, regional, national, and local partnerships; incorporate tailored insights and mainstream a just transitions lens into 100% of CGIAR's actions; and co-lead at least 30 international multi-stakeholder initiatives that influence global agendas, including those of the UNFCCC. These outcomes will enable CGIAR and partners to contribute to ambitious global climate targets.

6.1.2. Research questions

1. What specific structural, institutional, and governance barriers perpetuate climate injustices in FLW systems and how can FLW systems be transformed to achieve the dual challenges of resilience and mitigation while ensuring that climate action is just?
2. In the context of a 1.5ºC warmer world, how can a harmonized analytical framework, new data, models, and supportive scientific infrastructure integrating economic, biophysical, and social inclusion dimensions be developed to accurately identify critical climate action hotspots in LMICs' FLW systems, and how does this improve the prioritization of interventions?
3. What are transformative climate futures, and how do scientific and practice knowledge syntheses help identify gaps in climate action research and project implementation to attain these futures?
4. How can we use the latest climate science and policy to inform and influence global, regional, and national climate processes, including the UNFCCC negotiation tracks?

6.1.3. Description of sub-Areas of Work

AoW 1.1. Coordination, partnerships, and capacity sharing

Climate change is highly cross-cutting, creating challenges of fragmentation of projects, initiatives, funding streams, and partnerships across CGIAR and partners. AoW 1.1 will become CGIAR's Climate Hub, coordinating efforts on climate action across all of CGIAR. It will develop innovative partnership and capacity-sharing models to promote learning, collaboration, and scaling. The hub will identify climate action entry points in all Programs of the 2025–30 CGIAR Portfolio. It will serve as an essential gateway and go-to resource for partners and academic institutions, helping these stakeholders understand how to engage with the Program, its outputs, and its networks. AoW 1.1 also aims to enhance critical thinking of climate scientists and partners globally to tackle cutting-edge questions in climate change research and design, including on climate justice (linked to AoW 1.2) and how to implement effective climate interventions in FLW systems. Key activities include establishing a CGIAR community of practice with regular consultations and workshops, facilitating exchange programs with ARIs, and supporting and mentoring young researchers from diverse backgrounds across LMICs. The goals are to disseminate CGIAR's findings more broadly, to promote two-way learning with the development community, and to integrate new knowledge into policy (AoW 5) and practice (AoWs 2–4).

AoW 1.2. Fostering just transitions

As a purveyor of FLW system research for some of the most climate-vulnerable and marginalized communities in the world, it is essential that CGIAR prioritize climate action that is fair and just. Under AoW 1.2, CGIAR and partners will implement research on the underlying structural, institutional, and governance challenges driving climate injustices and identify effective, inclusive, and transformative climate actions that address the underlying inequalities that are the root causes of climate vulnerability. This includes novel frameworks and analyses on connections between climate change, justice, and conflict (Whitfield et al. 2021; Raleigh et al. 2024; Sanz-Barbero et al. 2018) that can be used to develop just and equitable transitions toward a more sustainable and resilient future (Gupta et al. 2023). This research will inform CGIAR and its partners and support governments and other actors in designing effective interventions for empowering women, youth, and other vulnerable groups. Results will guide implementation of AoWs 2–4, feed into the Just Transitions Climate Finance Facility implemented in AoW 5, and support just transition efforts across the CGIAR 2025–30 Portfolio.

AoW 1.3 Climate analytics and modeling for prioritizing climate action

CGIAR partners have expressed a need for precise and actionable climate insights, underpinned by evidence and best-in-kind models and data. However, in many LMICs climate insights, food system models, decision-support tools, and datasets are scanty or difficult to integrate, making their rapid deployment and use challenging, especially by non-experts. AoW 1.3 will bring together new and existing data, analyses, and insights on climate drivers, impacts, and uncertainties in a harmonized manner that can be used by CGIAR Programs and partners to prioritize climate action. Use cases for analytical work are identified through AoWs 1.1, 1.2, and 2–5, creating a deep understanding of the demand. Close collaboration with the global climate change community and ARIs will support transdisciplinary approaches. Research includes biophysical and socioeconomic observations, surveys, remote-sensing analytics, climate impact modeling, and scenario-based modeling. Results will be used to identify hotspots of climate risks, GHG emissions, reduction in ecosystem services, and land use change. Scenario-based foresight and ex ante assessments (conducted with the Policy Innovations Program) will be used to assess changes in the effectiveness of adaptation and mitigation action, including potential for synergies and trade-offs (Antle et al. 2020). Outputs from AoW 1.3 will support prioritization of adaptation and mitigation activities in AoWs 2–4 and policy and finance interventions in AoW 5 and will help set climate priorities for the CGIAR Portfolio.

AoW 1.4. Synthesis and gap analysis

Each year CGIAR and its partners publish hundreds of papers and carry out hundreds of projects on climate impacts, adaptation, and mitigation for FLW systems. There is an enormous opportunity to synthesize insights from this body of scientific and practical knowledge to identify collective learnings and key research gaps. These syntheses could also provide estimates on the return on investment for climate-focused FLW research agendas, which thus far remains largely unknown. AoW 1.4 will perform targeted systematic reviews and meta-analyses on key topics, integrating novel AI and data science tools to develop living syntheses. Tailored products, including climate outlook reports, policy briefs, position papers, and communication strategies, will inform national to global climate strategies (AoWs 1.5 and 5.1) and investments (AoWs 5.2–5.5). Within CGIAR, outputs will bridge the gap between data and impact, empowering stakeholders with key insights to improve project design and set future research agendas.

AoW 1.5. Setting the global climate and FLW agenda

AoW 1.5 will strategically engage in global climate policy arenas, including key forums like the UNFCCC's CoP and Subsidiary Body for Scientific and Technological Advice (SBSTA), the World Economic Forum, and the G20 Climate and Sustainability Working Group. CGIAR will leverage science generated from across the Portfolio to provide data-driven inputs on critical topics such as the New Collective Quantified Goal (NCQG) on climate finance, the Global Goal on Adaptation, loss and damage, food systems approaches, just transitions, transformative adaptation, nonmarket approaches, and climate security. Through research publications, policy briefs, blogs, side events, webinars, advocacy materials, and position papers, CGIAR will engage in and influence global discussions. AoW 1.5 will also develop training programs for climate negotiators engaged in FLW system discussions. These will be done in partnership with regional agencies, focusing on improving technical and analytical skills to effectively utilize and interpret climate science. We will collaborate with regional partners, including regional economic communities and sectoral forums, as well as key negotiator blocks such as the African Group of Negotiators Expert Support (AGNES), least-developed countries, and more, to strengthen capacity for future decision-making.

6.1.4. High-level outputs

- Innovative partnerships and capacity sharing with key climate actors to drive scaled-up climate action across CGIAR (AoW 1.1).
- Frameworks, strategies, and tools to identify root causes of vulnerability and pathways and priority focus areas for just transitions (AoW 1.2).
- User-ready data, simulations, and decision-support tools for understanding climate risks, emission hotspots, and trade-offs across multiple dimensions (AoW 1.3).
- Synthesis products that identify key knowledge gaps and effective climate interventions and advocacy and communication materials to influence decision-makers (AoW 1.4).
- Communications strategies, advocacy materials, and curricula for negotiators to support strategic engagements with global climate bodies (e.g., UNFCCC) (AoW 1.5).

6.1.5. Theory of change

Figure 6.2. AoW 1: Prioritization and coordination of climate action

RESEARCH QUESTIONS

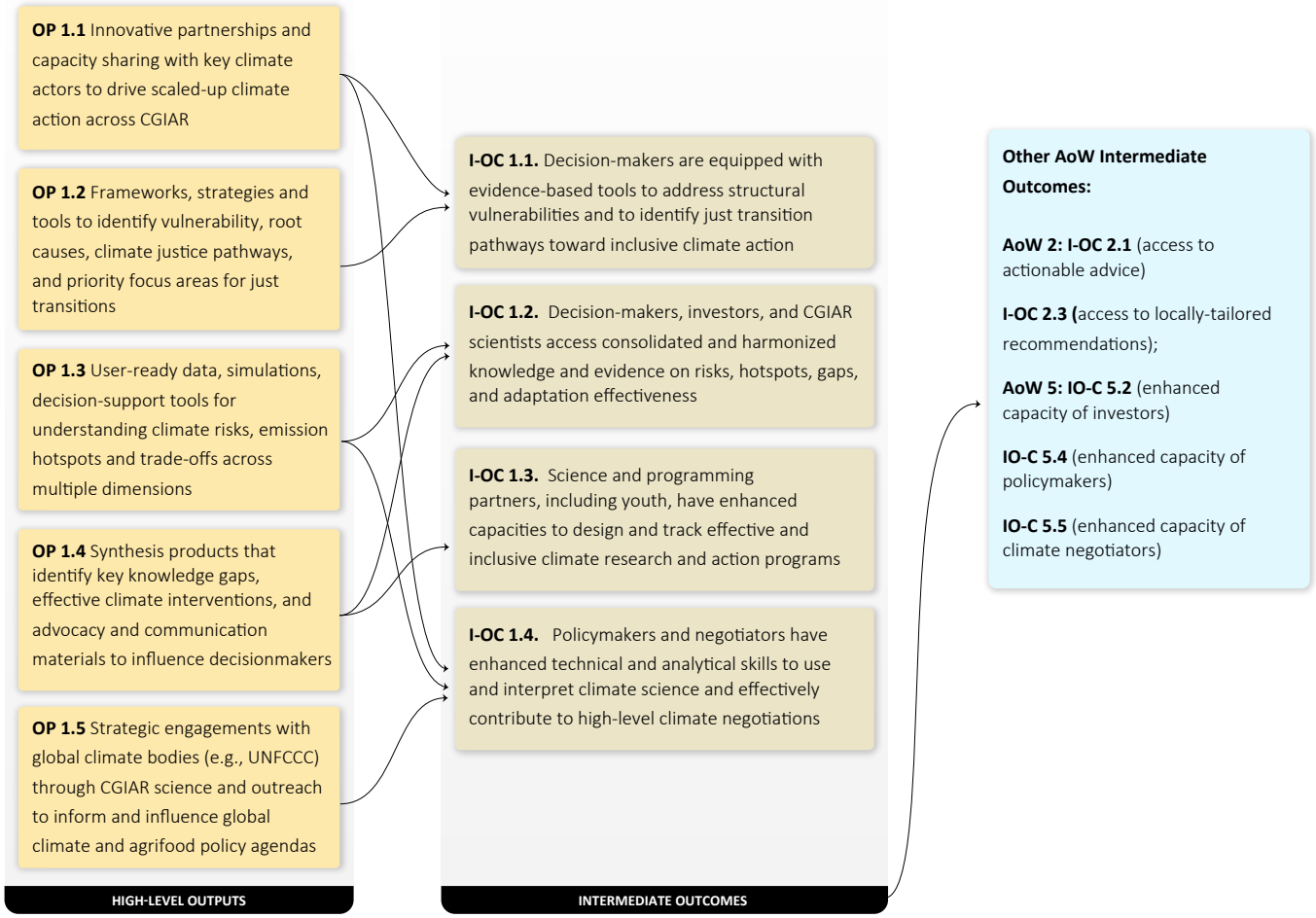
1. What specific structural, institutional, and governance barriers perpetuate climate injustices in food, land and water systems, and how can these systems be transformed to achieve the dual challenges of resilience and mitigation while ensuring that climate action is just?
2. In the context of a 1.5º C warmer world, how can a harmonized analytical framework, new data, models, and supportive scientific infrastructure integrating economic, biophysical, and social inclusion dimensions be developed to accurately identify critical climate action hotspots in LMICs' food, land and water systems, and how does this improve the prioritization of interventions?
3. What are transformative climate futures and how do scientific and knowledge syntheses help identify gaps in climate action research and project implementation to attain these futures?
4. How can we use the latest climate science and policy to inform and influence global, regional and national climate processes, including the UNFCCC negotiation tracks?

RESEARCH ACTIVITIES

- Climate Hub will coordinate CGIAR's climate action efforts and promote collaboration
- Prioritize research on climate injustices and identify effective, inclusive climate actions
- Provide harmonized climate insights and modeling analytics to support climate action prioritization
- Synthesize research on climate impacts and food, land and water systems to inform climate strategies
- Strategically engage in global climate policy arenas to influence discussions on climate action in agrifood systems

SUPPORT ACTIVITIES

- Serves as a hub for Climate Action where other CGIAR programs and global partners can interact
- Collaboration with agricultural research institution, international organizations and development partners
- Interaction with ministries and other stakeholders in focal countries
- Other CGIAR Science Programs and bilateral projects



6.1.6. Partnerships

This AoW will enhance its impact through strategic partnerships with ARIs, international organizations, NARES, and local NGOs dedicated to climate justice. It will work closely with academic and government institutions with expertise and data in climate, impact analysis, GHG modeling, and Earth observations. Collaborative efforts with other CGIAR Programs and Accelerators are crucial for delivering high-level outputs and outcomes. Plans for building new partnerships focus on equitable research collaborations that scale solutions and foster significant impact.

Table 6.1. AoW 1 outputs and outcomes

ToC element #	Statement	Partners (including internal) and roles	Assumptions (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 1.1	Innovative partnerships and capacity sharing	CGIAR, NARES, ARIs, UN agencies, regional climate negotiation organizations, private sector		
OP 1.2	Strategies and tools to identify and assess root causes of climate vulnerability and climate justice pathways	Ministries of environment and climate change, ministries of agriculture, ministries of social welfare and rural development, CBOs, NARES, international development partners, CGIAR, ARIs, private sector		
OP 1.3	Harmonized data infrastructure on climate, risks, current and future hotspots, and effects of overshooting 1.5°C. threshold	Ministries of environment and climate change, ministries of agriculture, UN agencies, hydrometeorological agencies, space agencies, CBOs, digital and AI companies, NARES, development partners, CGIAR, ARIs		
OP 1.4	Synthesis products on knowledge gaps, effective climate interventions, and metrics	UN agencies, IFIs, development partners, CGIAR, ARIs		
OP 1.5	Communications strategies, advocacy materials, and curricula for negotiators to support strategic engagements with global climate bodies (e.g., UNFCCC)	CGIAR, NARES, ARIs, UN agencies, regional climate negotiation organizations		
IOC 1.1	Decision-makers are equipped with evidence-based tools to address structural vulnerabilities and to identify just transition pathways toward inclusive climate action	Ministries of environment and climate change, ministries of agriculture, ministries of social welfare and rural development, UN agencies, development partners	Decision-makers are interested in addressing root causes of climate vulnerability	
IOC 1.2	Decision-makers, investors, and CGIAR scientists access consolidated and harmonized knowledge and evidence on risks, hotspots, and adaptation effectiveness	UN agencies, IFIs, development partners, CGIAR, ARIs	Decision-makers want more information and evidence to support their decisions, and evidence is in an accessible format	
IOC 1.3	Science and programming partners — including youth — have enhanced capacities to design and track effective and inclusive climate research and action programs	CGIAR, NARES, ARIs, UN agencies, regional climate negotiation organizations, private sector	Incentives exist for partners to want to track climate action	
IOC 1.4	Policymakers and negotiators have enhanced technical and analytical skills to use and interpret climate science and effectively contribute to high-level climate negotiations	CGIAR, NARES, ARIs, UN agencies, regional climate negotiation organizations	Policymakers want to access and use climate data in their decisions	

6.2. AoW 2: Digital advisories and climate risk management

6.2.1. Ambition

Average annual climate-related losses to the agricultural sectors of LMICs are estimated at USD 21.6 billion (FAO 2023a; Holleman et al. 2020). These losses will increase in the coming decades unless small-scale producers and vulnerable communities have timely access to information and technology bundles to anticipate and manage climatic stresses (Born et al. 2021). Through human-centered climate information services (CIS) and early warning systems (EWS), this AoW will harness global, regional, and national capabilities in weather and climate forecasts and real-time monitoring and address information asymmetries and gaps that currently hinder appropriate responses from farm to national levels (Funk et al. 2023). It will particularly engage rural youth and support women producers and other marginalized groups (Partey et al. 2018). The sub-AoWs use a broader framework of risk management that includes cascading impact pathways of proactive risk reduction while safeguarding critical FLW systems and mainstreaming climate actions, which will form a strong foundation for successful implementation of adaptation action and low-emission transitions. They will strengthen the capacity of institutional networks, national governments, and the private sector to co-design and scale inclusive service bundles that integrate climate-informed advisory, risk insurance, and anticipatory cash transfers and other climate-adapted assistance. Results will benefit other Programs/ Accelerators and AoWs 3–5drawing on insights from AoW 1.1 prioritization efforts to shape policies and catalyze investment.. Our goal is to transform CIS and EWS in 30 countries, helping 30 million vulnerable people, including small-scale women producers, adapt to climate variability and extremes. This, in turn, supports improved FLW systems, with tangible benefits for all five CGIAR Impact Areas.

6.2.2. Research questions

1. How effective are bundled digital CIS in meeting the specific needs of women and men small-scale producers and vulnerable communities within crop, livestock, and fisheries value chains?
2. How can improved design, deployment, use, and continuous evaluation of EWS and linked anticipatory action overcome information asymmetries, coordination gaps, and dissemination challenges for more equitable protection of the most at-risk rural populations and the ecosystem services that support their livelihoods?
3. How can enhanced governance approaches (institutions, policies, regulation, and infrastructure) improve equity in access to and management of water resources under future climate conditions?
4. How can existing national frameworks and strategies for climate services be strengthened, adapted, or expanded to address evolving and compound climate risks and deliver measurable resilience outcomes across sectors and scales?

6.2.3. Description of sub-Areas of Work

Collaborating with international, national, and local stakeholders, this AoW will identify impactful entry points and support institutional readiness for CIS and risk management (in collaboration with AoW 1.1). Human-centered design; inclusive, participatory approaches and modeling; and responsible digital innovation methods will be central to AoW 2. Through collaboration with national partners, AoW 3, and other Programs/Accelerators (Breeding for Tomorrow and Genebanks, Sustainable Farming, Sustainable Animal and Aquatic Foods, Multifunctional Landscapes, and Digital Transformation), we will design and test bundles for climate risk reduction with a special focus on water as a core resource for climate resilience (Cofie and Amede 2015). Partnerships with the private sector (SMEs, MFIs, digital start-ups) will spur digital and business model innovations and scaling (Agyekumhene et al. 2023). Continuous evaluation will build a strong evidence base for transforming CIS and EWS for enhanced and more inclusive impacts.

AoW 2.1. Digital climate advisory and bundled services (DCAS)
Significant opportunities exist to boost the impact of CIS through more consistent use of human-centered design principles and better translation of climate and weather forecasts and monitoring and surveillance systems into more actionable, more equitable, and more integrated advice. Empowering farmers and institutions providing national hydrological and meteorological services (NHMS) is crucial (Findlater et al. 2021). AoW 2.1 will, together with AoW 1, identify impactful entry points through a hotspot mapping approach to assess climate risks, institutional readiness, and infrastructural or technical bottlenecks. This approach will guide strategic investments and interventions where CIS and climate-resilient technologies are most impactful. CIS actions will incorporate human-centered design principles to scale the provision of tailored, climate-informed, actionable, bundled services for 30 million small-scale producers, based on local priorities. Enhanced capacities in NHMS and the private sector (including SMEs) and learning cycles (climate literacy) will be critical for harnessing state-of-the-art climate science. CIS will be delivered to at the grassroots level through well-established channels, including digital extension platforms, collaboration with the Digital Transformation Accelerator, participatory approaches (e.g., Loboguerrero et al. 2018), and stakeholder networks. They will offer bundled advisory services with credit, insurance, and climate-resilient farming technologies, linking with AoWs 3 and 4 as well as the Breeding for Tomorrow and Genebanks, Sustainable Farming, Sustainable Animal and Aquatic Foods, and Multifunctional Landscapes Programs.

AoW 2.2. Early warning systems and adaptive safety nets
The Sendai Framework and the Early Warning for All (EW4All) initiative aim to expand access to EWS (UNDRR and WMO 2023). AoW 2.2 will partner with the World Meteorological Organization (WMO) and national organizations to address gaps in EWS pillars—detection, communication, and preparedness—with a focus on rural livelihoods (G. Amarnath et al. 2024). We will strengthen early warning capacity in at least 30 vulnerable countries by improving cross-sectoral coordination, addressing data gaps and information asymmetries, and co-designing tailored, gender-sensitive adaptive safety nets (Hidrobo et al. 2024). NHMS and disaster risk management offices will improve real-time response protocols for disaster prevention and early responses. Improved EWS will incorporate innovations in cross-timescale climate forecasting (AoW 1.2), flood and drought forecasting, pest and disease surveillance, forecast systems (linked to the Food Frontiers and Security Program), Earth observation, impact-based forecasting, and data science (Digital Transformation Accelerator) (Lam et al. 2023). The EWS will enable the progression from early warnings to adaptive safety nets (e.g., forecast-based finance, anticipatory cash transfers, disaster risk insurance). Cross-sector coordination with humanitarian organizations will ensure timely aid. We will assess alignment with the Sendai Framework's targets, including EWS coverage and action plans, in a just transition framework.

AoW 2.3. Resilient water systems for future climates

Resilient water systems are the foundation of climate-resilient agricultural systems (Sikka, Alam, and Mandave 2022; Cofie and Amede 2015). AoW 2.3 will strengthen water systems' ability to withstand climate challenges at the watershed to basin scale. High-resolution climate change data (AoW 1.3), hydrological modeling, water accounting, and equitable engagement of stakeholders will underpin the co-creation of tailored recommendations, in collaboration with and informing the Sustainable Farming, Policy Innovations, and Sustainable Animal and Aquatic Foods Programs. For instance, integrated water accounting and productivity studies provide evidence for addressing the potential effects of future climate on the water, food, energy, and environment nexus (Johnson 2022). Our approach will empower public and private stakeholders (including government, small-scale producers, and development partners) to proactively develop and implement integrated nature-based long-term resilience measures and governance frameworks for enhancing water-related risk management, enabling system resilience (Rosenstock et al. 2024). Prioritization and planning of water-related investment enables sustainable surface and groundwater management in extreme climatic conditions. Evidence generation will guide the design and implementation of coherent policies (AoW 5.1) that promote sustainable water futures.

AoW 2.4. National strategies for integrated climate risk management

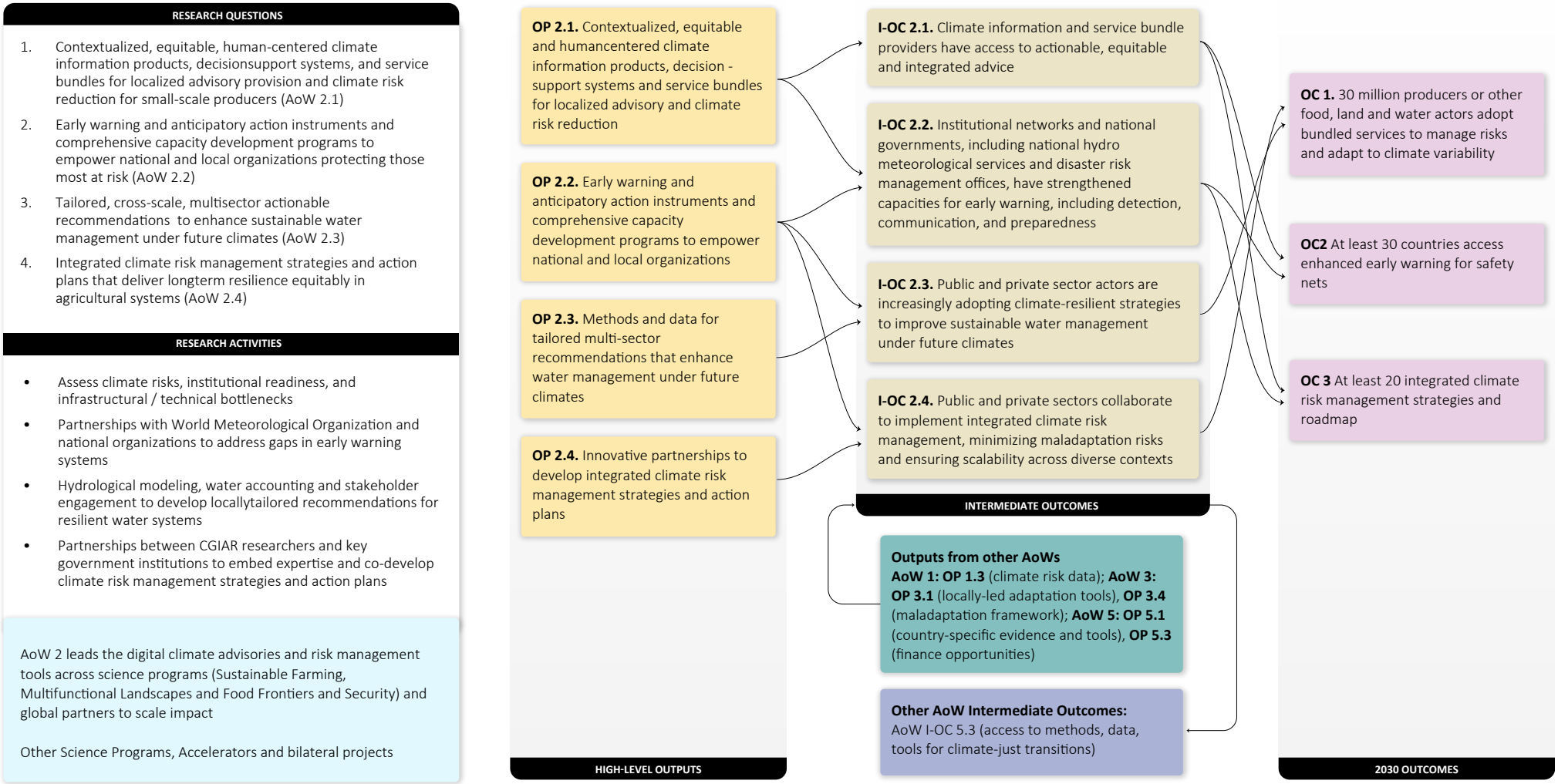
Pervasive hazards and interconnected risks evolve over time, often compounding one another (Challinor et al. 2018; Niggli et al. 2022), requiring nationally coordinated and multi-sectoral responses that demand strategies and investments for implementing integrated climate risk management. AoW 2.4 will leverage the Global and National Framework for Climate Services (G/NFCS) (Hewitt et al. 2020) as a key planning and coordination instrument, to co-develop integrated climate risk management strategies and action plans with partners in at least 20 countries. AoW 2.4, along with government partners, will assess whether and how the existing progress in NFCS implementation has delivered resilience outcomes in agriculture and other sectors and supported marginalized populations, including women farmers. The evidence of NFCS impact (or lack thereof), together with stakeholder consultations and participatory and scenario-based assessments, will help refine priorities and theories of change and create effective strategies and roadmaps for integrated climate risk management. These strategies will lay out clear institutional and coordination arrangements within and across sectors for delivery. The strategies and action plans will inform and be informed by national adaptation planning (AoW 5.1), will link to the Policy Innovations Program, and will help catalyze investment (AoWs 5.2 and 5.3).

6.2.4. High-level outputs

1. Contextualized, equitable, human-centered climate information products, decision-support systems, and service bundles for localized advisory provision and climate risk reduction for small-scale producers (AoW 2.1).
2. Early warning and anticipatory action instruments and comprehensive capacity development programs to empower national and local organizations protecting those most risk (AoW 2.2).
3. Tailored, cross-scale, multi-sector, actionable recommendations to enhance sustainable water management under future climates (AoW 2.3).
4. Integrated climate risk management strategies and action plans that deliver long-term resilience equitably in agricultural systems (AoW 2.4).

6.2.5. Theory of change

Figure 6.3. AoW 2: Digital advisories and risk management



6.2.6. Partnerships

This AoW engages with global organizations (including the WMO, the United Nations Office for Disaster Risk Reduction [UNDRR]), national agencies (NHMS, disaster risk reduction offices, national research organizations), global and regional climate prediction centers, international organizations (including from the humanitarian sector), local organizations (NGOs, farmer organizations, grassroots women's groups, youth organizations), and the private sector (SMEs, MFIs). Partnerships with the WMO, UNDRR, and humanitarian sector will contribute to coordination at various levels and strategic direction, especially under AoWs 2.2 and 2.4. Work with national and local organizations (including the private sector) will help establish a demand-driven agenda, build capacities, and co-design innovations in risk reduction based on human-centric design principles. Harnessing state-of-the-art climate prediction and observation will require collaborations with ARIs. Partnerships with MFIs, SMEs, and governments will facilitate scaling of promising solutions.

Table 6.2. AoW 2 outputs and outcomes

ToC element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 2.1	Contextualized, equitable, and human-centered climate information products, decision support systems, and service bundles for localized advisories and climate risk reduction	Ministries of agriculture, hydrometeorological agencies, space agencies, tech startups, NARES, development partners, CGIAR, community organizations, insurance companies, financial institutions, SMS and radio providers		
OP 2.2	Early warning and anticipatory action instruments and comprehensive capacity development programs to empower national and local organizations	Ministries of agriculture, disaster management organizations, agriculture service centers, NARES, INGOs, social protection agencies, development partners, CGIAR, humanitarian organizations, financial institutions		
OP 2.3	Methods and data for tailored multi-sector recommendations that enhance water management under future climates	Ministries of agriculture, land, forestry, water, livestock and fishers, local development agencies, NARES, development partners, INGOs, planning departments, basin development authorities		
OP 2.4	Innovative partnerships to develop integrated climate risk management strategies and roadmaps	Small-scale producers, grassroots organizations, Indigenous groups, CGIAR, civil society organizations, development partners, INGOs, CGIAR, SMEs, think tanks		
IOC 2.1	Climate information and service bundle providers have access to actionable, equitable and integrated advice	Ministries of agriculture, hydrometeorological agencies, tech startups, NARES, development partners, CGIAR, community organizations, insurance companies, financial institutions, SMS and radio providers	Partners will adopt DCAS innovation and solutions to enhance their interventions and programs targeting small-scale and marginalized producers and vulnerable communities.	# farmers, strengthened capacity to de-risk production
IOC 2.2	Institutional networks and national governments, including national hydrometeorological services and disaster risk management offices, have strengthened capacities for early warning, including detection, communication, and preparedness	National governments, NARES, INGOs, social protection agencies, development partners, humanitarian organizations, financial institutions, Food Frontiers and Security Program, Digital Transformation Accelerator	Solutions will support collaboration across partners to invest in capacity development and early warning systems	# institutions with strengthened capacity

ToC element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
IOC 2.3	Public and private sector actors are increasingly adopting climate-resilient strategies to improve sustainable water management under future climates	Ministries of agriculture, forestry, water resources, NARES, development partners, INGOs, planning departments, basin development authorities, AoWs 1 and 5, Landscape Program	Cross-scale multi-sector actionable recommendations guide partners' needs. National and international organizations are motivated to invest in water system resilience for future climate strategies	# national govts and international organizations using or investing in our tools and evidence and guiding coherent polices
IOC 2.4	Public and private sectors collaborate to implement integrated climate risk management, minimizing maladaptation risks and ensuring scalability across diverse contexts	National governments, departments of disaster management, environment, and climate change	National partners, NARES, and donors collaborate to empower vulnerable communities with accessible, scalable ICRM approaches, minimizing maladaptation risks and fostering long-term resilience.	# of partner organizations avoiding maladaptation and using ICRM strategies
2030-OC 1	30 million producers or other FLW actors adopt bundled services to manage risks and adapt to climate variability	Ministries of agriculture, development partners, NGOs	Data, tools, and methods are relevant to sector needs and local context. Relevant engagements with partners and stakeholders support change.	Initiatives, projects, Programs, measures in target countries reach 30 million farmers
2030-OC 2	At least 30 countries access enhanced early warning for safety nets	Ministries of disaster management, NGOs, humanitarian organizations, agricultural development partners, NGOs, development partners	Program has robust community engagement and ownership, effective data collection and analysis, strong coordination among stakeholders, and adequate funding and resources. Early warning systems are culturally relevant, accessible, and linked to actionable response plans. Capacity development programs focus on building local expertise, promoting adaptive management, and fostering sustainable partnership.	Initiatives, projects, Programs, measures in target countries take place in 30 countries
2030-OC 3	At least 20 integrated climate-risk management strategies and roadmaps are developed	Ministries of disaster management, NGOs, humanitarian organizations, agricultural development partners, NGOs, development partners	Agriculture and food systems are fortified against the unpredictable challenges of climate change. National governments and vulnerable communities, equipped with effective climate risk management tools, are empowered to adapt, thrive, and ensure equitable access and scalable solutions for a resilient future	Initiatives, projects, Programs, measures adopted by 20 countries

6.3. AoW 3: Locally led adaptation

6.3.1. Ambition

Vulnerable communities often lack resources and decision-making power to adapt to climate change. This AoW develops tools and approaches that support strengthening the capacities of these communities to adapt in ways that address gendered and other socioeconomic inequalities. As such, locally led adaptation (LLA) is a cornerstone of the just transition approach taken by the Climate Action Program. Using the principles of LLA (Coger et al. 2022), this AoW will support organizations' climate adaptation action in developing mechanisms for financing LLA, building local stakeholders' capacities to access funds, facilitating locally developed adaptation solutions and pathways, and integrating local priorities into national and global policy processes (GCA 2023). While AoW 3 is focused on adaptation, actions must take place within low-emission pathways to avoid maladaptation, with a particular emphasis on solutions that enhance synergies and co-benefits with mitigation (Bertana et al. 2022). AoW 3 will develop and apply frameworks and methodologies for development partners, implementers, and researchers for avoiding socioeconomic and ecological maladaptation, with attention to synergies and trade-offs with mitigation and social inclusion goals. Social inclusion — across categories and intersections of gender, age, economic resources, and other social identities — will be cross-cutting and embedded across all AoW 3 engagement and scaling processes (Rahman et al. 2023; Carr and Thompson 2014). The research ambitions in AoW 3 center on analyzing the interplays of socioeconomic, institutional, and technical factors in processes of climate change adaptation and scaling (Glover et al. 2019). Outputs of this research will support subsequent institutionalization of LLA in programmatic and policy contexts. **By 2030, AoW 3's LLA activities will benefit 8 million people through transdisciplinary and multi-scale participatory action research that integrates socioeconomic, technical, and institutional research and engagements with scaling partners.**

6.3.2. Research questions

- How can adaptation solutions and pathways be co-produced, locally adapted, and scaled in ways that build local institutional capacities, leverage local knowledge, and address gendered and other socioeconomic inequalities?
- How can household and institutional interventions combine to enhance local agency in pursuing climate change actions that are technically effective, socially inclusive, and institutionally sustainable?
- How can LLA solutions and principles be scaled through local governments, producer networks, finance ministries, NGO networks, agribusinesses, and private investment, in ways that foster accountability and transparency as well as cross-sector collaboration?
- How can climate adaptation solutions and pathways avoid maladaptation and adverse environmental outcomes and enhance synergies and co-benefits, especially with respect to mitigation and social equity domains?
- How can we strengthen equity and social inclusion of marginalized groups in adaptation strategies?

6.3.3. Description of sub-Areas of Work

AoW 3.1. Co-production of adaptation solutions and pathways
Local climate change adaptation requires new technologies, practices, and services to be used within household production systems operating within institutional and ecosystem contexts. AoW 3.1 supports practical processes that address the institutional, financial, technical, and GESI dimensions of LLA (Vincent 2023). Working with AoW 1 and the Scaling for Impact Program, AoW 3.1 will collaborate with local institutions, producer organizations, governments, value chain actors, and businesses to establish adaptation priorities that also enhance synergies and co-benefits with mitigation (Yet et al. 2020). Adaptation solutions, business models, and pathways will be developed locally but will leverage CGIAR and partner expertise along with citizen science. Local communities will be empowered through capacity building and decentralized decision-making to ensure that climate solutions fit small-scale producers' complex lives and address larger environmental and socioeconomic goals, including inequalities.

While some climate solutions in AoW 3.1 will draw on innovations from AoW 2, AoW 4, and other Programs, AoW 3.1 will also use transdisciplinary methods to collaborate directly with local innovators to develop solutions that leverage local knowledge and scientific insights (Naess, Thompson, and Allen-O'Neil 2023). By 2030, AoW 3.1 will have strengthened local institutional capacities for designing and implementing inclusive adaptation pathways. It will also empower producers to co-develop adaptation solutions and socio-technological bundles with partners.

AoW 3.2. Scaling LLA
Turning LLA into impact at scale requires innovative models, approaches, and partnerships with and between local actors. Building on collaborations with AoW 3.1, AoW 3.2 will strengthen local institutional, business, and producer capacities to develop and implement mechanisms for scaling adaptation solutions focusing on business model support, systemic capacity, enabling environments, and innovative mechanisms for financing LLA across scales (Amarnath et al. 2023). This involves bundling technologies, management practices, services, financing, delivery mechanisms, and institutional arrangements (Barrett et al. 2020). It also involves implementing mechanisms that address supply-side constraints and de-risking climate finance for agriculture. Working with the Scaling for Impact Program, AoW 3.2 will use LLA to co-design scaling pathways with local stakeholders, which will then be deployed and evaluated for effectiveness. Specifically, scaling out LLA involves a range of mutually reinforcing activities, including strengthening local governance, developing scalable models and best practices, fostering knowledge exchange, ensuring sustainable funding, building strategic partnerships, integrating local knowledge, advocating for supportive policies, and leveraging digital technologies, while ensuring scaling is responsible, inclusive, and equitable. While AoW 3.2 will focus on scaling out through reconfiguring local institutional relationships and processes, AoW 5 will complement this work by scaling up LLA approaches through national policy frameworks, funding mechanisms, and global development partners' program design.

AoW 3.3. Avoiding maladaptation
AoW 3.3 will test frameworks for ex ante analysis of potential maladaptation risks, as well as practical strategies for addressing them in collaboration with AoW 1.3. Designed for development partners, planners, and implementers, these frameworks and strategies will include analysis of adaptation actions across two broad categories. First, we will analyze distributional equity and social inclusion impacts, with a focus on gender, youth, and economic assets. Second, we will analyze ecological impacts, especially GHG emission and carbon sequestration, but also water, soil, and air quality. We will work with AoW 4 to apply mitigation

analyses to adaptation solutions, identifying potential synergies and trade-offs between adaptation and mitigation goals. In addition to informing programming design, the avoiding maladaptation framework will also be adapted to inform monitoring, evaluation, learning, and impact assessment (MELIA) activities, starting within the Climate Action Program and ultimately expanding to development partners and other CGIAR Programs.

AoW 3.4 Strengthening equity and social inclusion in adaptation strategies

The most vulnerable people are often also least able to adapt to the negative impacts of climate change given their lack of access to resources, services, and structural inequalities (FAO 2024). This sub-area develops research and works with partners to strengthen the resilience capacities of marginalized groups, including women producers and youth, through social and policy innovations and bundled solutions that support transformational adaptation and livelihood security (Carr et al. 2022). It will develop the evidence base on drivers of inequalities and power dynamics in climate change adaptation using a political economy approach. It will also design new and apply recent CGIAR innovations that support gender and climate justice, such as the Women's Empowerment in Climate Change Index (under development) and will collaborate with the Gender Equality and Inclusion Accelerator. In collaboration with AoWs 3.1, 3.2, 1, and 5, it will work with grassroots women's organizations, youth, Indigenous peoples, vulnerable smallholder producers, and other value chain actors to elevate their voices and agency in decision-making processes and leadership roles for climate-resilient agrifood systems at multiple scales.

6.3.4. High-level outputs

- Institutional innovations and technical practices that simultaneously address climate change adaptation, livelihood, GHG emissions reduction and social inclusivity goals (AoW 3.1).
- Detailed methodologies for implementing LLA so that it integrates adaptation planning, financing, and climate solution co-development in ways that enhance social inclusion, local agency, and economic sustainability (AoW 3.1).
- Guidelines on how to scale out climate solutions to producers, how to scale up LLA processes within governance systems, and how to implement LLA processes in new sites. These will be designed for local and national partners, as well as development planning and implementation partners, as appropriate (AoW 3.2).
- Framework and methods to support local and national planners, development partners, and implementers to anticipate and address potential negative outcomes associated with adaptation efforts (AoW 3.3).
- Policies, institutions, and interventions to address the root causes of inequality, including gender-transformative approaches, for equitable climate change adaptation (AoW 3.4).

6.3.5. Theory of change

Figure 6.4. AoW 3: Locally led adaptation

RESEARCH QUESTIONS

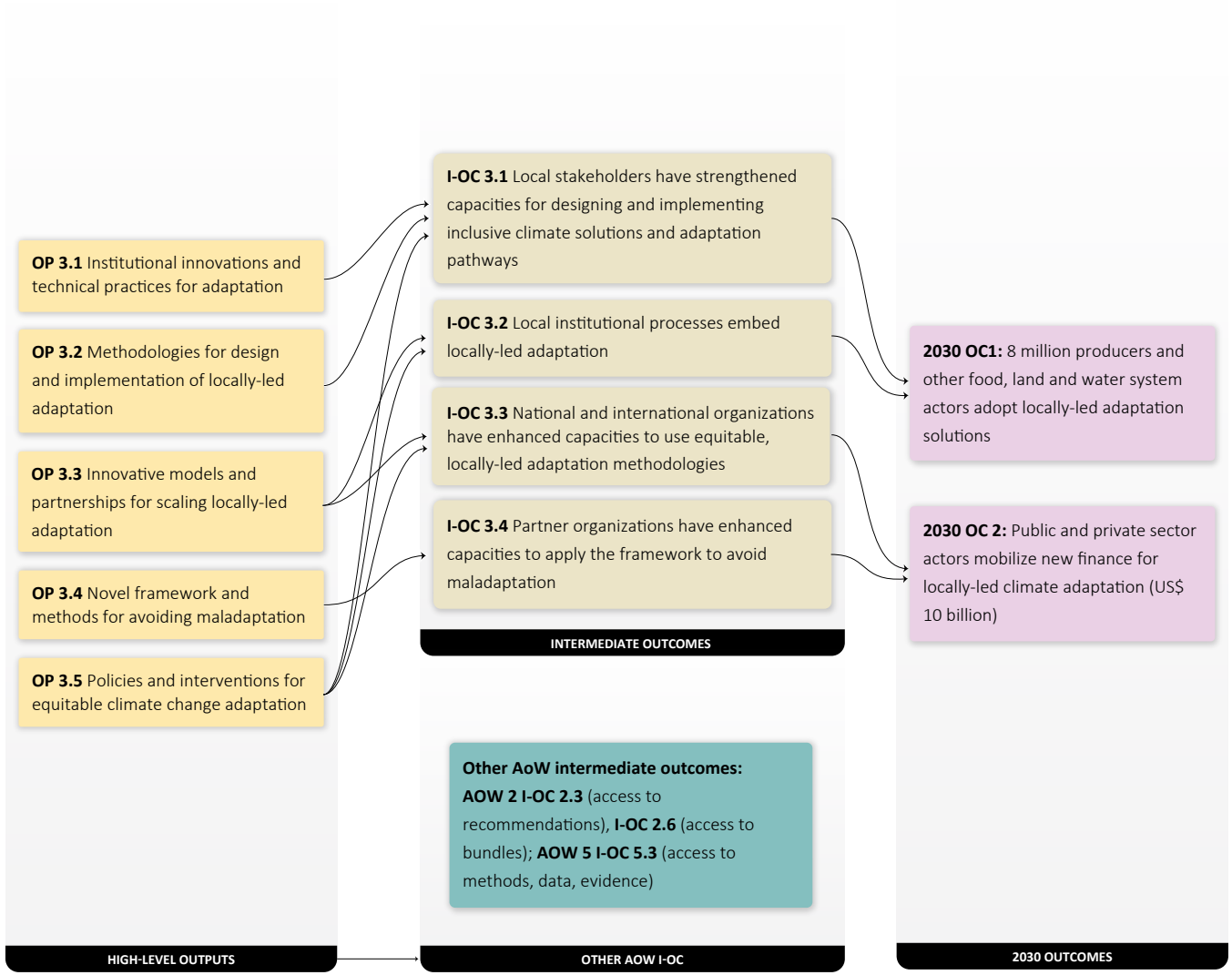
1. How can adaptation solutions and pathways be co-produced, locallyadapted and scaled?
2. How can household and institutional interventions combine to enhance local agency in pursuing climate change?
3. How can locally-led adaptation solutions and principles be scaled through local partners in ways that foster accountability, transparency and crosssector collaboration?
4. How can adaptation solutions avoid producing adverse outcomes in environmental, especially GHGs, and social equity domains?
5. How can we strengthen equity and social inclusion of marginalized groups in adaptation strategies?

RESEARCH ACTIVITIES

- Building local stakeholder capacities to access funds and facilitate adaptation solutions and pathways at scale
- Co-production of adaptation technologies and services, institutional innovations and scaling models
- Frameworks and methodologies for avoiding ecological and socioeconomic maladaptation
- Assessing mitigation co-benefits of climate solutions
- Research to strengthen the resilience capacities of marginalized groups

SUPPORT ACTIVITIES

- Scaling for Impact Program
- AOW 1: Prioritization
- AOW 2: Digital CIS for bundling in locally-led adaptation
- AOW 4: GHG analysis of practices
- AOW 5: Blended finance for scaling locally-led adaptation



6.3.6. Partnerships

AoW 3 will work through partnerships across scales. We will work with farmer organizations, NARES, local businesses, producer organizations, and local civil society to ensure a broad foundation for LLA planning. Scaling activities will then bring in financial institutions — which can include banks, national investment capital, and blended finance — as well as local organizations for outreach and implementation. In conjunction with AoW 5, we will link LLA processes with global financial inputs, connecting national partners with organizations that are keen to support LLA, such as the Green Climate Fund (GCF), the World Bank, and other thought leaders, such as the Global Centre for Adaptation, CARE, and the World Resources Institute (WRI).

Table 6.3. AoW 3 outputs and outcomes

ToC element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP3.1	Institutional innovations and technical practices that simultaneously address climate change adaptation, livelihood, and social inclusivity goals	Local governments, SMEs, NARES, research partners, AoW 1, AoW 4		
OP3.2	Methodologies for design and implementation of LLA development in ways that enhance social inclusion and local agency	Local governments, SMEs, NARES, research partners, AoW 1, AoW 4		
OP3.3	Innovative models and partnerships for scaling LLA	Local governments, SMEs, financial institutions, NARES, ministries of finance, ministries of agriculture, AoW 2, Scaling for Impact Program		
OP3.4	Novel framework and methods for avoiding maladaptation	Local governments, research partners, NARES, AoW 1, AoW 5		
OP3.5	Policies, institutions, and interventions for equitable climate change adaptation	Grassroots women's organizations, governments, Gender Equality and Inclusion Accelerator		
IOC3.1	Local stakeholders have strengthened capacities for designing and implementing inclusive climate solutions and adaptation pathways	Local governments, local civil society, NARES, SMEs, producer organizations, financial organizations, development partners, scaling partners	LLA interventions address priority needs; local partners are willing and able to pursue LLA processes and principles	
IOC3.2	Local institutional processes embed LLA	Local governments, civil society, SMEs, NARES, producer organizations, financial organizations	Local governments and other partners have enabling environment to integrate LLA	
IOC3.3	National and international organizations have enhanced capacities to use equitable, LLA methodologies	Ministries of finance, ministries of agriculture, financial institutions, NARES, development partners, AoW 5	LLA methodologies meet partners' needs; national and international organizations are motivated to support LLA	
IOC3.4	Partner organizations have enhanced capacities to apply the framework to avoid maladaptation	Local and national governments, research partners, development partners, AoW 5	Partner organizations are receptive to frameworks for avoiding maladaptation	
2030-OC1	8 million producers and other FLW system actors adopt LLA solutions	Local and national governments, development partners, AoW 5	LLA is widely picked up by the climate and development community	8 million producers or users adopt climate solutions
2030-OC2	Public and private sector actors mobilize new finance for locally led climate adaptation (USD 10 billion)	Local and national governments, development partners, scaling partners, AoW 5	LLA methodologies meet partners' needs; national and international organizations are motivated to support LLA.	Investors develop USD 5 billion climate projects

6.4. AoW 4: Low-emission transitions

6.4.1. Ambition

In LMICs, population growth and demographic changes are increasing the demand for nutritious food, including livestock products, driving GHG emissions up due to intensified agricultural production (Pretty et al. 2018), land use changes, and greater energy consumption (Frank et al. 2019). These activities will worsen climate change, raise adaptation costs, reduce the biological carbon sink, and threaten food, water, energy security, and social equity. To reduce the climate impact of FLW systems, it is essential to adopt a holistic approach ("from seed to fork") that sustainably integrates production systems within landscapes. This approach — addressing land use practices, policies, and finance (e.g., carbon markets) — aims to achieve food security, reduce emissions, and harness ecosystem services from sustainably managed landscapes. Together with partners, this AoW will support the creation and implementation of low-emission development (Nash et al. 2015) in at least 30 countries by enhancing carbon sequestration, decreasing current GHG emissions, and avoiding future emissions to achieve an overall GHG reduction of 1 gigaton CO_2e by 2030 in 30 countries. Additionally, this AoW will strengthen national and local implementation of at least 15 NDCs and mobilize up to USD 5 billion in mitigation-related climate investment, with over 50% directed toward small-scale producers and their communities.

6.4.2. Research questions

- What is the feasibility of sequestering carbon in farms and landscapes at large scales, especially by small-scale producers, where are these potentials most promising, and how can they be incentivized?
- How can methane mitigation strategies in rice, livestock, and aquatic systems be advanced, tailored, and scaled fast enough to meet the 2030 global methane targets?
- What kinds of food system innovations can drive significant emissions reductions within different development trajectories, and how can accountability for climate impacts be improved?
- How can data and MRV for low-emission FLW systems be improved while reducing the costs of their use via data platforms, data, remote sensing, and artificial intelligence?
- How can we increase equity in mitigation action and achieve a just climate transition in FLW systems?

6.4.3. Description of sub-Areas of Work

Mitigation is a critical topic that is both urgent and long overdue in relation to smallholder FLW systems in LMICs. Sequestering carbon in landscapes and avoiding further deforestation will be approached across all scales from field to landscape and from producer to policymaker in AoW 4.1. For LMICs to meet the 2030 methane targets, it is critical to reduce methane emissions in rice and livestock systems and understand methane emissions from emerging aquatic systems, and these are the focus of AoW 4.2. Developing low-emission food systems requires the full range of actors to be engaged in developing business and finance models, policies, and institutional agency that support integrated food system approaches, and this is the focus of AoW 4.3. Tracking and supporting low-emission transitions in LMICs needs MRV and data to empower small-scale producers and communities to manage low-emission practices and attract external incentives. AoW 4.4 will build context-appropriate systems and data to overcome barriers in this area. Finally, AoW 4.5 focuses on reducing inequalities and injustices in mitigation action for a more just climate transition.

AoW 4.1. High-carbon farms and landscapes

The land sector provides a highly cost-effective way to scale carbon storage, with nature-based solutions like reforestation potentially sequestering up to 30% of global emissions at lower costs than engineering approaches, for example (IPCC 2019). AoW 4.1 will work with a broad range of actors to test the potential for reducing CO_2 emissions and sequestering carbon in soil and biomass across farms, forests, grasslands, and coastal landscapes. These multi-stakeholder actors will co-develop higher-tier forest and emissions data and identify practices, policies (e.g., REDD+, EUDR), and finance mechanisms (e.g., green bonds, high-integrity payments for ecological services with AoW 5) to support carbon sequestration and emission reduction through sustainable management of FLW systems. Together with other Programs (Multifunctional Landscapes, Sustainable Farming, Sustainable Animal and Aquatic Foods), AoW 4.1 aims to help countries eliminate the need to further deforest or change land use for food production. The approaches build on previous work, especially the approaches of the Low-Emission Food Systems Initiative, that facilitates partnerships for locally driven and socially inclusive action research and capacity strengthening. Through observations, modeling, remote sensing, and impacts and trade-off analyses done with AoW 1.3, this sub-area will assess and promote the benefits of providing socially and economically viable mitigation strategies. AoW 4.1, together with AoWs 1.2, 1.3, and 5.5 (Making carbon markets work for low-income communities), will support government and NGO stakeholders in their efforts to prevent carbon losses, build carbon stocks, and restore landscapes, while enhancing biodiversity.

AoW 4.2. Meeting 2030 methane targets

Livestock and rice are major drivers of global methane, a GHG with a relatively short life in the atmosphere and therefore a priority for rapidly reducing atmospheric warming and the focus of international mitigation initiatives (Jackson et al. 2024). Together with local and country partners, we will co-develop new socio-technological bundles for rice, livestock, and aquaculture systems that decrease methane emissions. We will build on successful but isolated mitigation technologies by integrating them with innovations from other Programs and assess other SDG-related benefits (e.g., on human, animal, and soil health, profitability, gender equity, and biodiversity) (Elias et al. 2021). We will further identify the best incentive structures for these advanced bundles using behavioral economic research. With AoW 5, we will work with organizations supporting small-scale producers and development partners to create the evidence base, institutional awareness, and agency for policymakers to effectively act. We will build strong local partnerships for transdisciplinary action research, social inclusion, and capacity strengthening, including at sites established by the Low-Emission Food Systems Initiative and AoW 3. AoW 4.2 will work closely with AoWs 1.3 and 4.4 to support the local measurement and tracking of methane emissions that will also serve as a traceability function for low-carbon certified products and markets.

AoW 4.3. Low-emission food systems (LEFS)

Food systems account for about one-third of global GHG emissions, and food system actors can foster low-emission development (LED) across the value chain. AoW 4.3 will link with governments, private sector actors, and civil society organizations to develop knowledge and identify push and pull mechanisms (i.e., business and finance models, policies, and institutional agency) for emerging and integrated LEFS innovations and low-carbon-emitting, nature-based approaches. Research will focus on reducing food loss and waste, circular and closed loop systems, local food systems, trade and emissions accounting, emission

offsetting via the use and scaling of clean energy technologies (solar irrigation pumps, agrivoltaic systems), and precision nutrient management to reduce nitrous oxide emissions, with the goal of empowering food system actors to accelerate the transition to clean energy and low-emission food systems through market and nonmarket drivers. We will foster stronger climate commitments by the private sector (e.g., through voluntary agreements, strengthened global food commodity platforms, and voluntary carbon markets) and work on transparent approaches to reducing food system emissions. Ex ante impact assessments (e.g., on gender, equity, jobs, nutrition) will evaluate promising options in the context of future climate and market scenarios and scaling opportunities in close collaboration with AoW 1.3.

AoW 4.4. Data and digitizing monitoring, reporting, and verification (MRV)

The lack of data and accurate, transparent, and cost-effective MRV systems for emissions monitoring is a major barrier to the implementation and scaling of low-emission innovations in LMIC FLW systems (Rosenstock and Wilkes 2021; Luedeling et al. 2022). AoW 4.4 will develop publicly accessible, big-data platforms for MRV of low-emission farming at a range of scales: for countries to develop Tier 2 and 3 national GHG inventories; for private sector and value chain actors to quantify GHG emissions from the farm to the consumer for transparency and accountability; and for small-scale producers and communities to manage low-emission practices with user-friendly MRV tools while gaining access to carbon markets. The platform will use the expertise, tools, and data from CGIAR together with those available from national partners to establish big-data and remote-sensing analytics and capacities for their use. New methods will be developed to measure emissions using remote and proximal sensing bolstered with AI and field verification, including local capacity to cost-effectively verify emissions reductions according to Article 6 and voluntary carbon market standards. These methods will be applied to overcome the data gaps common in most LMICs, automate and update data in real time, support integration with larger digital information systems, advance models for estimating emissions, and ultimately attract new forms of finance to rural food systems transformation supporting AoW 5.5 (Vermeulen et al. 2018). The resulting low-cost MRV and data will contribute to the global stock take (2029) and improve access to finance, technical advisories, and benefits from carbon markets and higher-value markets.

AoW 4.5. Just transition through equity in mitigation action

Climate goals cannot be achieved without a just climate transition in FLW systems. Yet mitigation action often compounds and widens inequities in marginalized groups' access to resources, technical options, and benefits (Farnworth et al. 2017). Marginalized groups tend to be ignored or receive lower levels of mitigation benefits, while also being the most vulnerable to losing livelihood options due to mitigation policies (Huyer et al. 2024). To address this gap, AoW 4.5 complements AoW 1.2 by focusing on women and youth as vulnerable populations whose participation is critical to the transformation toward a low-emission economy. AoW 4.5 will develop science-based policies, institutions, and interventions to increase women's and youth's agency, influence, and access to mitigation-related climate finance, technical options, and benefits. Analysis of intersectionality and related barriers and opportunities for social inclusion will inform scaling in AoWs 4.1, 4.2, and 4.3 (Huyer et al. 2024).

6.4.4. High-level outputs

- Evidence and partnerships to inform low-emission development strategies, supported by incentives, policy, and private sector engagement across farms, forests, grasslands, and coastal landscapes (AoW 4.1).
- Integrated socio-technological bundles co-developed and piloted with national partners to reduce methane emissions in livestock, aquaculture, and rice systems, contributing to 2030 NDC and Global Methane Pledge (GMP) targets (AoW 4.2).
- Evidence and partnerships to inform low-emission food systems strategies including closed-loop production systems, improved nitrogen-use efficiency (NUE), minimized food loss and waste, clean energy, and dietary shifts co-developed and tested with private, public, and civil society sector stakeholders (AoW 4.3).
- A public good, state-of-the-art digital platform for the MRV of low-emission farming to support mitigation efforts from farm to national scales (AoW 4.4).
- Policies, institutions, and interventions to increase women's and youth's agency, influence, and benefits from mitigation action (AoW 4.5).

6.4.5. Theory of change

Figure 6.5. AoW 4: Low-emission transitions

RESEARCH QUESTIONS

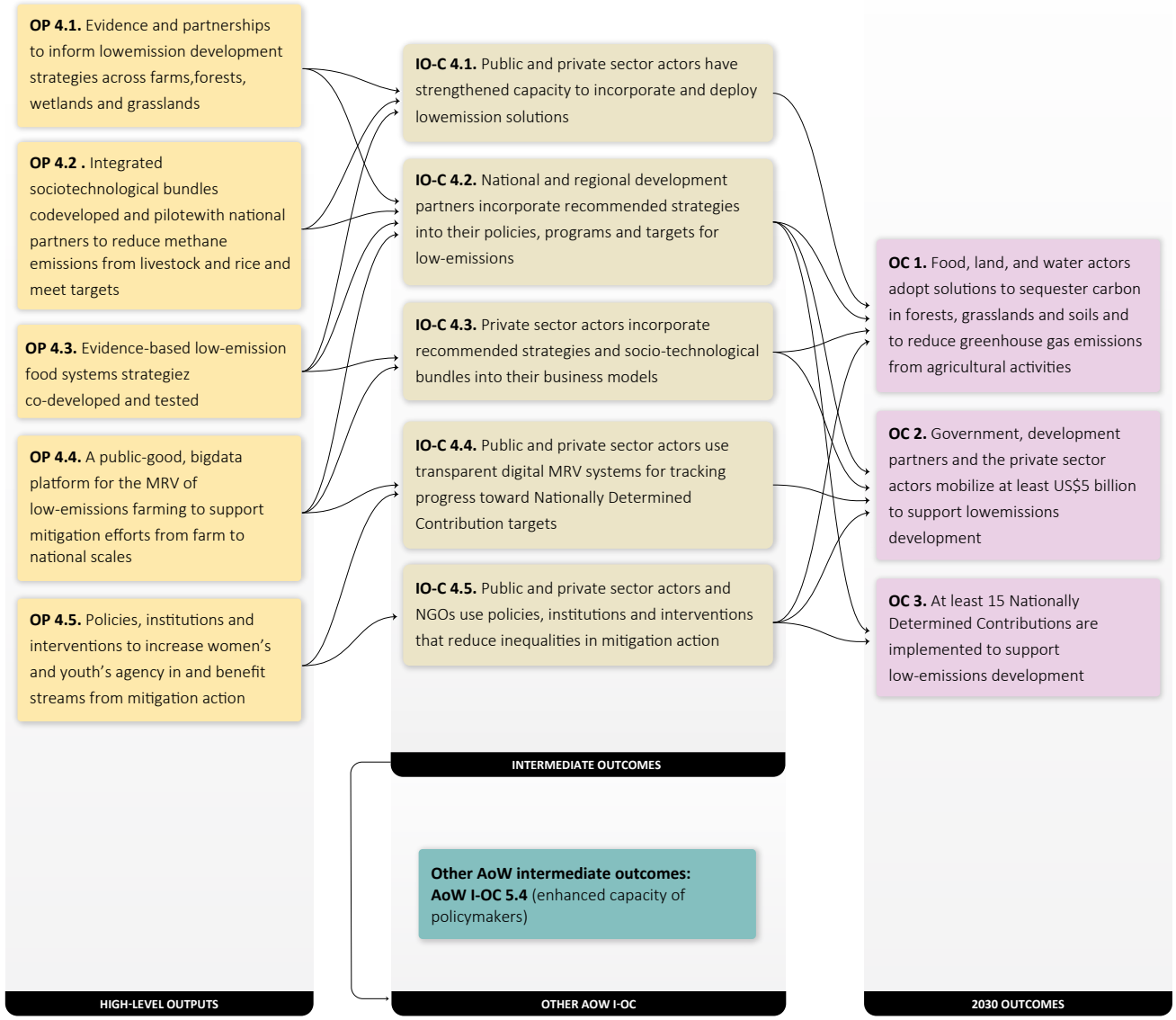
1. What is the feasibility of sequestering carbon in farms and landscapes at large scales, especially by smallscale producers? Where are these potentials most promising, and how can they be incentivized?
2. How can methane mitigation strategies in rice, livestock and aquatic systems be advanced, tailored, and scaled fast enough to meet the 2030 global methane targets?
3. What kinds of food system innovations can drive significant emission reductions within different development trajectories and how can accountability for climate impacts be improved?
4. How can data and monitoring, reporting and verification (MRV)for lowemission food, land, and water systems be improved while reducing the costs of its use via data platforms, digital information systems, artificial intelligence and machine learning?
5. How can we increase equity in mitigation action and achieve a just climate transition in food, land, and water systems?

RESEARCH ACTIVITIES

- Policy co-development with stakeholders for higher relevance and to identify data gaps and capacity needs
- Analysis of policies and finance mechanisms, to support their efficient, effective, equitable design Frameworks and methodologies for avoiding ecological and socioeconomic maladaptation
- Field, farm, and landscape experiments with National Agriculture Research and Extension Systems (NARES) to test mitigation packages
- Behavioral research, games to assess incentive structures
- Comprehensive assessments of food systems 'from seed to fork' to identify fast-track win-win emission reduction opportunities
- Big data and MRV: Combining GIS and Remote Sensing data with modeling approaches. Exploring AI and machine learning to automatize functions
- Socioeconomic studies to develop business cases
- User-centered design, programming for tool development
- Policies and tools to increase equity in mitigation action

SUPPORT ACTIVITIES

- Partnership building with NARES, knowledge networks, private sector
- Capacity-sharing activities
- CGIAR Science Days in target countries
- Policy dialogues, knowledge brokering
- Targeted communication activities



6.4.6. Partnerships

AoW 4 will build strong partnerships with NARES for the co-development, refinement, and adjustment of innovation bundles and equip champions who integrate findings into policy with the necessary capacity. New strategies and approaches will be closely aligned with national and subnational governments as the main users who will facilitate lasting impact at scale. Various partnerships with big food and energy companies and their umbrella organizations have been established under the Initiatives and will be crucial to drive down food system emissions according to findings and innovations from AoW 4.3. New private sector partnerships will be sought in view of carbon investment stimulated by innovations in AoWs 4.1, 4.2, and 4.4. Collaboration with ARIs will be particularly important for the advancement of digitized MRV.

Table 6.4. AoW 4 outputs and outcomes

ToC element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 4.1	Low-emission development strategies across farms, forests, grasslands, and coastal landscapes	ARIs, rural communities, private sector actors, ministries of agriculture, environment, and climate, Multifunctional Landscapes Program		
OP 4.2	Integrated socio-technological bundles co-developed and piloted with national partners to reduce methane emissions in livestock, aquaculture, and rice systems	NARES, rural communities, private sector actors, relevant ministries of agriculture, environment, and climate, Sustainable Animals and Aquatic Foods Program, Sustainable Farming Program		
OP 4.3	Evidence-based low-emission food systems strategies co-developed and tested	NARES, ARIs, rural communities, private sector actors, relevant ministries of agriculture, environment, and climate		
OP 4.4	In three key LMIC target regions, the creation of a public good, big-data platform for the MRV of low-emissions farming	NARES, ARIs, private sector actors, relevant ministries of agriculture, environment, and climate, Digital Transformation Accelerator		
OP 4.5	Policies, institutions, and interventions to increase women's and youth's agency in and benefit streams from mitigation action	Grassroots women's organizations, governments, Gender Equity and Inclusion Accelerator, private sector		
IOC 4.1	Public and private sector actors have strengthened capacity to incorporate and deploy low-emissions solutions	NARES, Capacity Sharing Accelerator	Methods, technologies address NARES and private sector needs and context. Complementary capacity development activities and resources from other development actors are consistently provided to public and private partners.	
IOC 4.2	National and regional development partners incorporate recommended strategies into their policies, programs, and targets for low emissions.	Ministries of agriculture, environment, and climate, NARES as national champions, NGOs, development partners, donors	Relevance of data, tools, and methods to sector needs and local context. Relevant engagements with partners and stakeholders that support change.	

ToC element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
IOC 4.3	Private sector incorporates recommended strategies and socio-technological bundles in their business models	Private sector value chain actors	Private sector partners have enough resources to support incorporation of new strategies and/or explore new services and products. Private sector partners are convinced of the viability of AoW 4-promoted strategies.	
IOC 4.4	Public and private sector actors use transparent digital MRV systems for tracking progress toward NDC targets	NARES to bridge research to private sector actors, relevant ministries of agriculture, environment, and climate	Relevance of data, tools, and methods to sector needs and local context. Relevant engagements with partners and stakeholders that support change.	
IOC 4.5	Public and private sector actors and NGOs use policies, institutions, and interventions that reduce inequalities in mitigation action. approaches	Governments, Gender Equality and Inclusion Accelerator, private sector actors, NGOs	Approaches are easy to adopt and seen as overall beneficial by marginalized populations.	
2030-OC 1	FLW actors adopt solutions to sequester carbon in forests, grasslands, and soils and to reduce GHG emissions from agricultural activities	National governments, ministries of environment and climate	Solutions developed for action are supported by incentives, available finance, and policies.	15 countries meeting their NDC targets; NDC stock-taking and GHG inventories show reduced emissions as pledged by countries
2030-OC 2	Government, development partners and private sector actors mobilize at least USD 10 billion to support low-emission development	Ministries of agriculture, development partners, NGOs	Relevance of data, tools, and methods to sector needs and local context. Relevant engagements with partners and stakeholders that support change.	Initiatives, projects, Programs, measures in target countries achieve combined 1 gigaton CO_2e reduction by 2030
2030-OC 3	At least 30 NDCs are implemented to support low-emission development	IFIs, development partners, national ministries, AoW 5, Scaling for Impact Program	Socio-technological bundles receive positive feedback from producers and other stakeholders (are aligned with development priorities, have effective business models attached, bring along other benefits). Investors and program developers are convinced of overall benefits and effectiveness of socio-technological bundles.	Mobilization of about USD 5 billion in new climate investments

6.5. AoW 5: Finance and policy for scaling solutions

6.5.1. Ambition

Despite commitments to climate action, the scaling of solutions for FLW systems remains constrained by fragmented policy and limited investment (Chiriac, Vishnumolakala, and Rosane 2023). Addressing these concerns is critical to achieving food systems transitions that align with national development goals and international climate targets. AoW 5 supports the development and reporting of national climate policies and the integration of climate considerations into sectoral policies. Additionally, AoW 5 will provide insights to improve access to both public and private finance, including new financial instruments like the Loss and Damage Fund. Using translational science, the AoW will translate complex data into decision-ready insights and tailored analytics for both policy and finance decisions while addressing data gaps. Special focus will be placed on just transitions, ensuring marginalized populations and fragile states benefit from these efforts equitably (Paglialunga et al 2022; Bryan et al. 2024). AoW 5 builds on outputs from other AoWs, including adaptation and mitigation priorities (AoW 1.3), national CIS roadmaps (AoW 2.4), and low-emission business models (AoW 4), and will be operationalized through strategic collaboration with governments, financial institutions, and private sector entities. By 2030, AoW 5 aims to support 85 policies and mobilize USD 10 billion in adaptation and mitigation investments.

6.5.2. Research questions

1. What methods and information can strengthen national climate policies and sectoral policies for scaling inclusive climate-resilient and low-emission development while limiting the potential for maladaptive programming?
2. How can analytical tools meet the investment criteria of multilateral funds and development finance institutions to improve the bankability of projects?
3. Which financial instruments and models can reduce investment risks and attract private sector capital into climate-resilient and low-emission projects that benefit small-scale producers and marginalized communities?
4. What methodologies can build the evidence base for loss and damage finance and inform equitable allocation of resources?
5. What elements and frameworks are needed to create scalable carbon markets that ensure equitable benefit sharing?

6.5.3. Description of sub-areas of work

AoW 5 focuses on policy and finance. Policy efforts support the development and reporting on national climate policies and integration of climate consideration in sectoral policies (AoW 5.1). Finance efforts target large-scale climate and development finance (AoW 5.2), private sector investment in climate action (AoW 5.3), loss and damage (AoW 5.4), and carbon markets (AoW 5.5). Research will be conducted for and within engagements with users. Each engagement refines our theory of change by delivering cutting-edge, stakeholder-driven, and context-specific solutions.

AoW 5.1. Supporting and reporting on national climate policies
National climate policies like NDCs, NAPs, and LT-LEDS form the backbone of most countries' climate action plans. However, gaps in capacity, data limitations, and technical complexity hinder policy design and implementation (Nowak et al. 2024). AoW 5.1, with AoW 1.5, will support planning and delivering on climate goals by secondments of CGIAR experts to key institutions, coordinated through a CGIAR Climate Policy Working Group. These experts will collaborate with country teams to deliver science-driven analytics leveraging insights from AoW 1.3 (risks and emission data) and AoW 1.4 (synthesis), and innovations from across AoWs 2–4 and CGIAR Programs. Tailored analyses, such as marginal abatement cost curves, policy coherence and cost-effectiveness assessments, and development of science-based targets will ensure CGIAR inputs are actionable at national and sectoral levels. Specific attention will be directed toward impacts and benefits for underrepresented groups, including women, youth, and small-scale producers, such as consideration of social cohesion, peace, and migration. Collaborating with other CGIAR Programs, AoW 5 and AoW 1 approaches will provide essential inputs for sectoral policies in agriculture, water, energy, and more, where climate change is likely to reduce their effectiveness and/or they may exacerbate emissions. To improve reporting, AoW 5.1 will develop approaches and capacity building to support national GHG inventories and tracking and reporting on the Global Goal on Adaptation, complementing AoW 4.4 subnational efforts, and link these with less-explored dimensions such as peace and migration. Additionally, capacity-building initiatives will enhance skills for implementation of reporting systems. Emerging policy topics, such as nonmarket mechanisms from Article 6, will also be explored to advance new political pathways for climate action.

AoW 5.2. Informing climate and development finance
Climate and development finance mechanisms, such as the GCF and IFIs, are critical for achieving climate goals. AoW 5.2 will build on the foundational analytics in AoW 1.3 to deliver science-driven analytical support to ensure national project proposals leverage the latest climate risk, emissions, and equity data. AoW 5.2 will conduct cost-benefit analyses of mitigation and adaptation interventions, and advanced financial models that identify potential high-impact projects and maladaptation risks. We will specifically support social equity and inclusion and target fragile states such that climate finance can address adaptation in conflict-afflicted and vulnerable areas (Queiroz et al. 2021). Working directly with financial institutions and the Scaling for Impact Program, AoW 5.2 will ensure that our tools and analytics meet investment criteria such as the GCF's climate rationales and multilateral development bank guidelines. This approach will ensure that AoW 5.2 scientific evidence fits seamlessly into institutional workflows, improving the bankability of climate finance proposals. Through capacity-building initiatives, we will empower countries and direct-access entities to better access climate and development finance.

AoW 5.3. Increasing private sector investment in climate action
The global climate finance gap is vast, with trillions needed to achieve climate goals by 2030 in LMICs (UNFCCC 2024). Public funding alone is insufficient, so private sector investment is crucial for scaling climate solutions. However, challenges such as perceived risks, uncertain returns, and the lack of scalable business models persist. AoW 5.3 will leverage CGIAR's local knowledge, FLW expertise, and advanced climate analytics to identify and build bankable projects that directly benefit small-scale producers, marginalized communities, and local economies. This research will focus on developing financial models that quantify the economic value of adaptation, ROI, payback periods, and scalability to assess the viability of interventions such as nature-based solutions and solar-powered irrigation. We will also consider the socioeconomic impact on different groups to ensure equity and opportunity, as well as the investment risks posed by lack of social cohesion, conflict, and migration. Collaborating with the Scaling for Impact Program and working with financial institutions such as impact investors, commercial banks, corporations, and environmental, social, and

governance (ESG) investors, AoW 5.3 will provide scientific input into the design of blended finance models, finance facilities, financial instruments for climate risk management, and risk quantification tools to de-risk investments. This will create favorable conditions for private sector participation, while linkages with AoW 5.2 will ensure alignment with public sector resources to further unlock capital for climate adaptation and mitigation efforts.

AoW 5.4. Operationalizing loss and damage

Marginalized and vulnerable communities, particularly in fragile and conflict-affected regions, disproportionately suffer from climate impacts, yet existing climate finance mechanisms often fail to address their needs ("Financing a Greener Future" 2023). This gap is especially critical in the context of a just transition, where the Loss and Damage mechanism is intended to play a pivotal role. AoW 5.4 will develop and test methodologies like event attribution, remote sensing, participatory methods, and vulnerability mapping to provide evidence of losses and create a scientific foundation for loss and damage finance in LMICs (Engdaw et al. 2024). Tools will be co-designed with governments and communities, ensuring that outputs inform policy instruments and align with AoW 5.1. These methodologies will also aid the design of financial instruments like sovereign insurance and disaster risk finance tools, to optimize resource allocation by international bodies, including the Loss and Damage Fund and the Africa Risk Capacity Group.

AoW 5.5. Making carbon markets work for low-income communities

Carbon offsets from agriculture and food systems account for only 1% of voluntary and 2.3% of compliance markets (Ecosystem Marketplace 2022), with funds largely inaccessible to smallholder farmers and marginalized communities. AoW 5.5 will design mechanisms to enhance equity in carbon markets by reducing transaction costs, simplifying MRV protocols, and integrating local stakeholders in monitoring. Leveraging advanced MRV systems (AoW 4.4) and financing strategies (AoWs 5.2 and 5.3), AoW 5.5 will create scalable frameworks for carbon offset projects that align with smallholder socioeconomic realities. We will explore nested aggregation models to bundle smaller projects, reduce costs, and develop financial tools to manage market volatility. Governance protocols will ensure benefits reach marginalized groups, including women and youth, with third-party auditing to guarantee transparency. Continuous capacity sharing will build local technical literacy and facilitate long-term participation in carbon markets, focusing on successful GHG sources like avoided deforestation and grassland management while exploring new areas like enteric emissions with high smallholder potential.

6.5.4. High-level outputs

- Country-specific evidence and tools that support the design, tracking, and reporting of national climate policies (AoW 5.1).
- Analytical tools and frameworks that enhance access to climate finance (AoW 5.2).
- Innovative finance models that increase private sector engagement in climate resilience and low-emission development projects (AoW 5.3).
- Methodologies and evidence to operationalize the Loss and Damage Fund (AoW 5.4).
- Proven and scalable frameworks for carbon markets that enhance participation and benefit-sharing for smallholders (AoW 5.5).

6.5.5. Theory of change

Figure 6.6. AoW 5: Finance and policy for scaling solutions

RESEARCH QUESTIONS

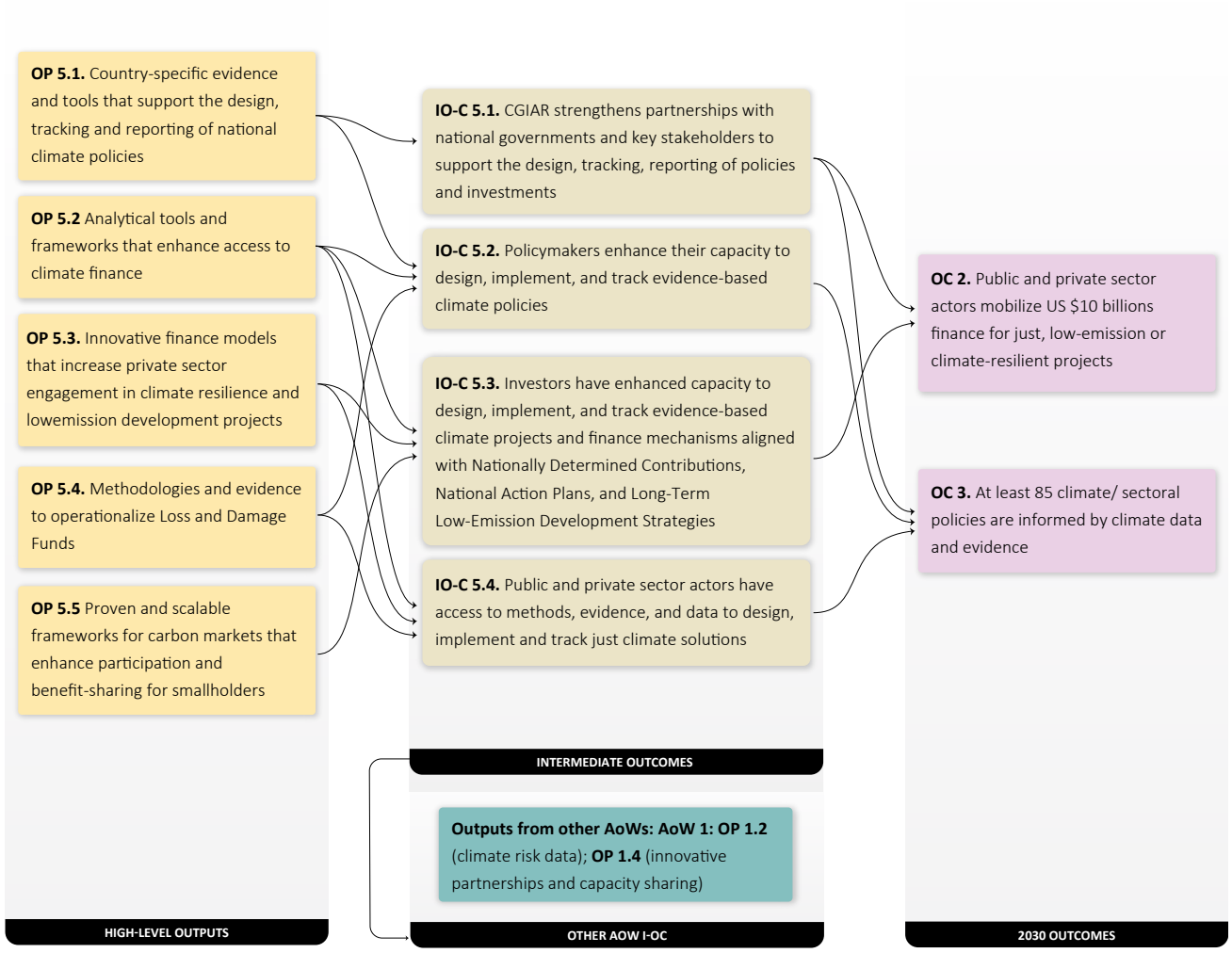
1. What methods and information can strengthen national climate policies and sectoral policies for scaling inclusive climate-resilient and low-emission development while limiting the potential for maladaptive programming?
2. How can analytical tools meet the investment criteria of multilateral funds and development finance institutions to improve the bankability of projects?
3. What financial instruments and models can reduce investment risks and attract private sector capital into climate-resilient and lowemission projects that benefit smallscale producers and marginalized communities?
4. What methodologies can build the evidence base for loss and damage finance and inform equitable allocation mechanisms or resources?
5. What elements and frameworks are needed to create scalable carbon markets that ensure equitable benefit-sharing for marginalized communities?

RESEARCH ACTIVITIES

- Surveys, interviews, and focus groups with policymakers, advisers, and investors to gather data on evidence needs, challenges, and capacities
- Analysis of existing Nationally Determined Contributions, National Action Plans, and sectoral policies to identify information gaps and align with scientific best practices
- Use of integrated aassessment models, probabilistic models, and climate risk assessments to support policy prioritization and planning
- Development of policy briefs, decisionsupport tools, and guidelines for sector-specific climate integration
- Risk analysis, financial modeling, and impact measurement to support climate finance design and evaluation

SUPPORT ACTIVITIES

- Cross-CGIAR Climate Policy Working Group
- Just-in-Time Technical Assistance Facility
- Just Transition Finance Facility
- Capacity-sharing programs, workshops, and continuous feedback mechanisms to align CGIAR's outputs with sectoralneeds and priorities



6.5.6. Partnerships

AoW 5 will establish strategic partnerships with key stakeholders in the public and private sectors. These include government ministries in LMICs responsible for designing and implementing national policies and influential NGOs and think tanks such as the Global Center on Adaptation that support policymakers and amplify science-based messages on global platforms. Collaborations with IFIs such as the World Bank, African Development Bank, and GCF are key sources of large-scale finance. Private sector partnerships will focus on philanthropies, commercial banks, corporations, and impact investors in agribusiness, particularly those developing financial instruments. CGIAR will also collaborate with research organizations like World Weather Attribution and universities to leverage technical expertise.

Table 6.5. AoW 5 outputs and outcomes

ToC element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 5.1	Country-specific evidence and tools that support the design, tracking, and reporting of national climate policies	National ministries coordinating climate policy formulation, local governments formulating subnational climate policies, CGIAR Programs		
OP 5.2	Analytical tools and frameworks that enhance access to climate finance	IFIs, multilateral development banks, GCF, and national partners (governments)		
OP 5.3	Innovative finance models that increase private sector engagement in climate resilience and low-emission development projects	Scaling for Impact Program, impact investors, commercial banks, corporations, ESG investors, advisory groups, investor coalitions, organizations supporting private investment in climate action, IFIs, philanthropies, GCF, CGIAR Programs		
OP 5.4	Methodologies and evidence to operationalize the Loss and Damage Fund	UNFCCC parties, Loss and Damage Fund, civil society, research partners (e.g., World Weather Attribution)		
OP 5.5	Proven and scalable frameworks for carbon markets that enhance participation and benefit sharing for smallholders	Local communities and farmers, philanthropies, audit and certification bodies		
IOC 5.1	CGIAR strengthens partnerships with national governments and key stakeholders to support the design, tracking, and reporting of policies and investments	Regional, national, and subnational multistakeholder forums and platforms	Governments and stakeholders prioritize climate action and are willing to collaborate with CGIAR for policy and investment improvements	
IOC 5.2	Investors have enhanced capacity to design, implement, and track climate policies and finance mechanisms aligned with NDCs, NAPs, and LT-LEDS	IFIs, international organizations, direct access entities, impact investors, corporations, regional bodies such as the African Union, Scaling for Impact Program	Adequate resources, training, and institutional support is provided to align investments with national and global climate goals	
IOC 5.3	Public and private sector actors have access to methods, evidence, and data to design, implement, and track climate-just solutions	Ministries responsible for matters related to climate change, finance, and agriculture, Scaling for Impact Program, think tanks, IFIs, philanthropies, impact investors, corporations	Reliable evidence is accessible, and there is a commitment to integrating it into policy and investment decisions	
IOC 5.4	Policymakers enhance their capacity to design, implement, and track evidence-based climate policies.	Ministries responsible for matters related to climate change, finance, and agriculture, Scaling for Impact Program, think tanks	Access to reliable data and expertise, adequate resources, training, and institutional support are provided	

ToC element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
2030-OC 2	Public and private sector actors mobilize USD 25 billion in new finance for just, low-emissions climate action and transitions	IFIs, impact investors, corporations, accredited entities helping countries access funds under UNFCCC financing mechanisms (e.g., United Nations Development Programme [UNDP], Food and Agriculture Organization of the United Nations [FAO]), Scaling for Impact Program, NGOs	Data and evidence are sufficient foundation to inform and unlock investments	USD 10 billion
2030-OC 3	At least 85 new climate/ sectoral policies are informed by climate data and evidence	Ministries of environment, finance, agriculture, and other sectors, national statistics agencies/bureaus, regional political bodies, Policy Innovations Program, national governments, think tanks, advisors	Climate policies such as NDCs, NAPs, and LT-LEDs are politically important and drive on-the-ground activities, availability of adequate financial resources required to support policy formulation	85 policies

7. Country integration

7.1. Example of integration in India

How is the Climate Action Program co-designed with key stakeholders and the Scaling for Impact Program to respond to local demand? In early 2024 ICRISAT organized a set of stakeholder processes (listening sessions) to gather national perspectives on how the CGIAR Climate Program's investments can contribute to the country's agricultural and food system goals. The perspectives from these engagements have influenced AoW focus (building on the strong climate agenda underway in India) and likely partnerships (especially for scaling and policy influence) in target geographies. We propose to continue this co-design and engagement process by establishing a national steering and expert technical committee to guide the work plan and respond to evolving needs using demand signaling and activity (re)prioritization in collaboration with the Scaling for Impact Program.

How will the Climate Action Program work be embedded in national and/or regional policies, strategies, programs, priorities, and processes? CGIAR's Climate Action Program builds on CGIAR's long-standing partnerships, particularly with the Indian Council of Agricultural Research (ICAR), national and state ministries, the academic system, and NGOs. This helps ensure Program alignment with agricultural policies focused on poverty alleviation, environmental sustainability, and productivity growth under climate change. These strong partnerships support program efficiency through bundling, piloting, testing, and scaling innovations in climate adaptation and mitigation through various AoWs. Leveraging CGIAR's physical presence, the Program promotes co-planning and resource sharing, while encouraging South-South exchanges to amplify its impact. Several contributing CGIAR Initiatives (e.g., NEXUS Gains, Low-Emission Food Systems), past CGIAR Research Programs (Climate Change, Agriculture, and Food Security; Water, Land, and Ecosystems), and bilaterally supported activities (with ICAR, ministries, and state-funded missions) have led to significant impact on the climate resilience of the country's FLW systems.

How are country lessons from the 2022–24 Portfolio (including regional/country partnership and engagement structures) integrated? We have integrated lessons on infrastructure sharing, enhanced South-South learning events, enhanced collaboration with private sector entities and better integrated stakeholders such as farmer producer organizations or water user associations into CGIAR Initiatives. Further, the Initiatives advanced climate data analytics and climate modeling and put a greater focus on the role of mitigation. Due to India's ample human capacity in most areas of climate science, the role of CGIAR in India is to support accelerated delivery of science, focus on areas of science that may be lagging (e.g., GESI, mitigation action), and play the role of a regional knowledge broker facilitating multi-country collaborations (e.g., regional policy, maladaptation, governance of water resources).

How will CGIAR work alongside specific local and other partners? Listening sessions highlighted key development demands at the state and district level and expectations of collaboration between CGIAR and partners. CGIAR anticipates fostering research innovations with scalable models for various technologies and practices that national partners can adopt and implement. Active participation in research by a vast network of local research and development centers that provide resources and local expertise will accelerate the achievement of the Program's goals. CGIAR's role as a facilitator and catalyst for partnerships, convening collaborations across sectors and geographies, was underscored as an essential role for innovation and knowledge exchange. Collaboration with stakeholders in understanding demand, refining research, influencing policies, prioritizing areas of study, leveraging NARES technologies, and using national expertise highlights the importance of shared ownership and co-creation.

How will the Program link with other Programs/Accelerators for more effective scaling and impact in this geography? The Program will link with other Programs/Accelerators by leveraging synergies across AoWs. Integration of CGIAR's climate-focused strategies with the Multifunctional Landscapes and the Sustainable Farming Programs enhances the resilience of agro-ecosystems. The tools of the Digital Transformation Accelerator facilitate precision farming and climate monitoring. The Sustainable Animal and Aquatic Foods Program enhances diversification and provides climate-adapted species, contributing to nutrition security. Linkages with the Gender Equality and Inclusion Accelerator help ensure that vulnerable groups actively participate in scaling solutions. Further, collaboration with the Better Diets and Nutrition Program supports stronger linkages between nutrition and climate action.

7.2. Overview of selected work in top 15 countries

Figure 7.1. Caption Needed

CGIAR region	Country	Specific geographies	Major production systems	Areas of work	Program and Accelerator collaboration
CWANA	Sudan	Nile River Basin	Wheat, groundnut, pearl millet, sorghum	AoWs 1–3, AoW 5	• Food Frontiers and Security • Breeding for Tomorrow and Genebanks
WCA	Nigeria	Guinea savanna, humid forest agro-ecological zones	Sorghum, pearl millet, groundnut, livestock, cowpea maize, fisheries/ aquaculture	All AoWs	• Sustainable Farming • Sustainable Animal and Aquatic Foods • Breeding for Tomorrow and Genebanks • Multifunctional Landscapes
ESA	Ethiopia	Ethiopian Highlands	Coffee, enset, maize, bean, teff, livestock, chickpea	AoW 1–3, AoW 5	• Sustainable Farming • Multifunctional Landscapes, • Breeding for Tomorrow and Genebanks
SA	Pakistan	Indus River Basin	Irrigated cropping, wheat-rice, fisheries	All AoWs	• Sustainable Farming • Multifunctional Landscapes
ESA	Kenya	Rift Valley, semi-arid regions	Mixed farming, horticulture, pigeonpea, sorghum, millet	All AoWs	• Sustainable Farming • Multifunctional Landscapes • Breeding for Tomorrow and Genebanks
ESA	Zimbabwe	Highveld, Middleveld	Maize-based livestock, millet, pigeonpea	All AoWs	• Sustainable Farming • Multifunctional Landscapes • Breeding for Tomorrow and Genebanks
SA	Bangladesh	Ganges-Brahmaputra Delta	Rice-wheat-vegetable, aquaculture, fisheries	All AoWs	• Sustainable Farming • Sustainable Animal and Aquatic Foods • Scaling for Impact
WCA	Côte d'Ivoire	Mountainous forest, humid forest, forest-savannah transition, and Sudano-Sahelian savannah agro-ecological zones	Rice, cassava, cocoa, coffee, livestock, fisheries	All AoWs	• Sustainable Farming • Breeding for Tomorrow and Genebanks • Multifunctional Landscapes • Sustainable Animal and Aquatic Foods
ESA	Tanzania	Central plateau	Maize-sorghum-bean, pigeonpea, crop-livestock and pastoral systems	AoW 1–3, AoW 5	• Sustainable Farming • Multifunctional Landscapes • Sustainable Animal and Aquatic Foods • Breeding for Tomorrow and Genebanks
ESA	Zambia	Zambezi River Basin	Maize-based, mixed cropping, aquaculture	AoW 1–3, AoW 5	• Food Frontiers and Security • Sustainable Animal and Aquatic Foods
SA	India	Ganges Basin, Deccan Plateau	Cereals, dryland crops, inland fisheries and aquaculture	All AoWs	• Multifunctional Landscapes • Sustainable Farming • Breeding for Tomorrow and Genebanks • Sustainable Animal and Aquatic Foods
SEA	Cambodia	Mekong Basin	Rice, rice-fish, mixed annual cropping, inland fisheries	All AoWs	• Sustainable Animal and Aquatic Foods • Scaling for Impact
SA	Nepal	Himalayan foothills	Terrace farming, mixed farming	AoW 1–3, AoW 5	• Multifunctional Landscapes
LAC	Honduras	Highlands, Pacific Coast	Millet, groundnut-based	AoW 1–3, AoW 5	• Better Diets and Nutrition
SEA	Philippines	Luzon, Mindanao	Rice-based, marine fisheries	All AoWs	• Sustainable Farming
WCA	Senegal	Old and new groundnut basin	Pearl millet, sorghum, groundnut, livestock	AoWs 1–3, AoW 5	• Food Frontiers and Security • Sustainable Animal and Aquatic Foods • Breeding for Tomorrow and Genebanks

Note: We plan to collaborate with the Scaling for Impact Program and Accelerators for all AoWs in all countries. Key partners in each country include relevant ministries (agriculture, environment and climate change, finance), local governments, SMEs, NARES, ARIs, the private sector, negotiators (e.g., AGNES), ISF Advisors, UN bodies (e.g., UNDP, FAO, UNFCCC), and various stakeholder forums. Detailed information will be collated during the project Inception Phase.

8. Boundaries and linkages with other components of the Portfolio

8.1. Boundaries

As all Programs and Accelerators are expected to make progress on the Climate Change Impact Area, the Climate Action Program will have linkages with all of them. As the central hub for CGIAR's climate expertise, the Climate Action Program coordinates climate-related activities across the Programs and Accelerators. This Program will be the primary source of critical data and analytics for prioritizing and implementing climate-related activities across all Programs. It will also develop, test, and scale system-wide climate innovations such as climate advisories, place-based research approaches, carbon in landscapes, and policy and finance mechanisms. While other Programs focus on specific components of food systems—such as Breeding for Tomorrow and Genebanks, Sustainable Farming, Sustainable Animal and Aquatic Foods, Multifunctional Landscapes, and Better Diets and Nutrition—and will thus develop context-specific socio-technical solutions, this Program adapts these solutions and contextualizes them within FLW systems to enhance climate resilience and low-emission development. Additionally, the Climate Action Program provides data infrastructure, tools, and impact measurement frameworks to quantify the resilience and mitigation potential of activities from other Programs. The Policy Innovations Program, for example, broadly addresses all policies related to food system transformation, whereas this Program focuses on climate policies and incorporating climate actions into sectoral policies. We pinpoint areas where the risk of climate insecurity is likely to increase, while the Food Frontiers and Security Program takes a more comprehensive approach by addressing broader issues of fragility and conflict within FLW systems.

8.2. Linkages across the Portfolio

An overview of linkages between the Climate Action Program and other Programs and Accelerators is shown in Table 8.1 and summarized in the following sections.

8.2.1. Breeding for Tomorrow and Genebanks

Climate data and analytics from AoW 1 will contribute to the Breeding for Tomorrow and Genebanks Program's prioritization of traits (biotic and abiotic), product profile development, and identification of target geographies for climate-resilient, resource-efficient varieties tailored to specific production systems. This will strengthen the capacity to develop breeding pipelines using prioritized traits to secure climate-resilient and nutritious crops and trees. Breeding for Tomorrow and Genebanks will leverage climate data and analytics in its conservation strategies, focusing on developing and preserving genetic materials that are well suited to current and future climate by preserving FLW resources that can respond to climatic shocks and stresses. By providing climate-resilient and resource-efficient genetic resources, the Program plays a crucial role in climate action, enabling the design and implementation of effective adaptation and mitigation strategies across food systems.

8.2.2. Multifunctional Landscapes

The Climate Action Program will collaborate to deliver landscape solutions that provide co-benefits for climate, environmental health, and biodiversity. AoW 1 will help inform the design of climate-responsive landscape solutions, while the Multifunctional Landscapes Program, as a place-based Program, will share methods for participatory action, governance research, and multi-stakeholder platforms.

8.2.3. Policy Innovations

The Programs will collaborate to integrate climate priorities within broader policy objectives by sharing data and information to deepen understanding of how climate impacts intersect with policy outcomes. While the Climate Action Program provides scenarios, data, voice amplification, and support for developing climate-aligned policies, Policy Innovations provides foresight modeling focused on food systems and integrates climate scenarios into food systems policies and institutions.

8.2.4. Better Diets and Nutrition

The Climate Program will collaborate closely with the Better Diets and Nutrition Program to promote healthy and sustainable dietary choices as strategies for climate mitigation and improving human health. By leveraging knowledge of climate-vulnerable zones, probable transformations of agricultural productivity, and vulnerable populations from this Program, the Better Diets and Nutrition Program can prioritize better diets and nutrition in these areas.

8.2.5. Sustainable Farming

Insights from climate data and analytics will inform the Sustainable Farming Program's targeted recommendations, helping prioritize target geographies and farming systems for solutions. The Climate Action Program addresses climate security from a global perspective while localizing modeling and prediction tools for specific farming systems; this approach will provide input to Sustainable Farming's adaptation and mitigation recommendations and help evaluate the co-benefits and trade-offs of adaptation and mitigation interventions at scale.

8.2.6. Sustainable Animal and Aquatic Foods

The two Programs will support each other by tracking progress toward 2030 methane targets, supporting scaling, and providing tailored information on climate impacts and hotspots to inform the development of improved breeds, climate-adaptive farming practices, and low-emission systems. The Sustainable Animal and Aquatic Foods Program will collaborate closely with AoWs 2 to 4 to develop context-specific adaptation and mitigation solutions and business models, and with AoW 5 to scale effective financial mechanisms and share system-specific narratives.

8.2.7. Food Frontiers and Security

The Climate Action Program will support the Food Frontiers and Security Program by providing climate data and offering platforms for assessing vulnerability to climate-related challenges; these data and platforms can be used to help formulate humanitarian and peace policies. The Program will also develop tools and provide capacity building to ensure that investments address climate issues. It will promote empowerment, equity, and justice, with a focus on migration and supporting frontier food systems (fragile, urban, and island).

8.2.8. Scaling for Impact

The Climate Action Program will collaborate with the Scaling for Impact Program to accelerate the adoption of climate solutions. The Scaling Program will support the Climate Action Program in designing resilient and low-emissions scaling

strategies in shared countries. AoW 5 will specifically work with Scaling to secure and manage large-scale investment for climate-resilient and low-emission FLW systems to achieve UNDP Climate Action's 2030 Program targets.

8.2.9. Digital Transformation Accelerator

The Programs will work together to integrate advanced digital technologies to understand climate risks, support improved MRV, and disseminate climate solutions. The Digital Transformation Accelerator supports the Climate Action Program by providing tools and platforms for accessing climate and weather analytics, enabling the creation of climate-informed advisory services. It also provides computing hardware and software expertise for collection of data, modeling, and weather downscaling. Together, the two Programs will co-design and co-invest with partners to develop accessible digital platforms for sharing climate information and solutions.

8.2.10. Capacity Sharing Accelerator

Both Programs will prioritize capacity building in interpreting climate-related data, empowering stakeholders to make decisions and amplify impacts. By working with country partners, both Programs will develop training programs and capacity-building systems. Key actions include building a CGIAR community of practice, fostering international collaborations, supporting research, promoting South-South cooperation on climate actions, and training climate negotiators.

8.2.11. Gender Equality and Inclusion Accelerator

The Climate Action Program will work closely with the Gender Equality and Inclusion Accelerator to ensure that the mitigation and adaptation solutions needed for gender-transformative solutions are co-developed and scaled in multiple locations and that they incorporate probable impacts from climate trends and extremes. Compatible methodologies and approaches for identifying hotspots of climate vulnerability will be co-developed, and solutions that address structural inequities and enhance women's and other marginalized communities' agency for action will be co-implemented.

Table 8.1. Overview of linkages of the Climate Action Program with other Programs and Accelerators

Program/ Accelerator	What the Climate Action Program provides	What the Climate Action Program receives	Mechanism of linkage
Breeding for Tomorrow and Genebanks	Climate analytics and insights, impact modeling, foresight, conservation strategies	Climate-targeted product concept designs and target product profiles, climate-resilient varieties and genetic resources	Data exchange, tailored information, co-design and co-investment in adaptation and mitigation strategies for climate-resilient FLW system
Sustainable Farming	Climate hazard analysis, GHG mitigation frameworks	Adaptation and mitigation solutions	Shared outcomes, co-investment, shared data platforms, joint research and monitoring systems
Sustainable Animal and Aquatic Foods	Climate impacts, hotspot analysis	Climate-smart innovations in sustainable animal and aquatic food production	Exchange of data and information, co-investment, shared outcomes
Multifunctional Landscapes	Climate emissions data, joint development tools	Bundled climate solutions, advocacy support	Exchange of methods, tools, and data; co-investment; joint activities
Better Diets and Nutrition	Low-emission food systems data, trade-off analysis	Healthy diets supporting climate goals	Exchange of data and information, joint activities in a subset of to-be-identified geographies
Scaling for Impact	Adaptation and low-emission solutions	Tools and approaches for scaling solutions	Joint investment, shared outputs/outcomes
Policy Innovations	Climate policy guidance	Foresight modeling, food systems policy insights	Exchange of data and information, co-investment in a subset of to-be-determined geographies
Food Frontiers and Security	Climate data, tools for climate challenges	Empowerment, support for food systems in fragile contexts	Exchange of data, insights, and tools; capacity-building co-investments
Gender Equality and Inclusion Accelerator	Methodologies to identify climate vulnerabilities	Gender-responsive approaches	Co-development and implementation of solutions
Capacity Sharing Accelerator	Climate data, resilient agriculture technologies	Capacity building, access to innovations	Joint efforts to empower stakeholders through capacity building, training programs, skill development, and knowledge dissemination
Digital Transformation Accelerator	Climate/weather analytics, crop modeling	Digital tools and platforms for advisory services	Data exchange through agreed protocols as well application programming interfaces (APIs); joint development of products/use cases

9. Monitoring, evaluation, learning, and impact assessment (MELIA)

9.1. Monitoring, evaluation, and learning (MEL)

To support MEL, the Climate Action Program will develop detailed plans for each AoW during the Inception Phase, and these will be integrated into the performance management plan. These plans will include in-depth details on pooled funding and light information on bilateral activities, ensuring synergy and avoiding overlap. Progress will be tracked against AoW ToCs, with six-monthly reviews to assess achievements and learnings and adjust ToCs, indicators, and outputs through adaptive management. Annual risk monitoring will review and reduce risks. The monitoring and evaluation (M&E) process will focus on user engagement with climate-resilient innovations, capacity development, and accountability to ensure efficiency.

Performance will be monitored through data on (1) research output quality and quantity, (2) partnerships and capacity sharing, (3) communication activities, and (4) resource mobilization. Established indicators will track progress against global targets (e.g., AoW 2 will use WMO's EWS indicators, while AoW 5 will use metrics from the Global Stocktake). Indicators will be updated to reflect ongoing discussions on the New Quantified Finance Goal and the Global Goal on Adaptation. The Program Management Committee will adjust pooled budget allocations based on MELIA results and will be supported by one full-time program manager.

9.2. Impact assessment (IA)

This Program will assess contributions across all CGIAR Impact Areas, focusing on adaptation and mitigation by continuing IA studies from Initiatives, deriving learnings from bilateral funding IA, and initiating new studies. Ongoing evaluations include an endline for a low-emission agroforestry training in Colombia (Low-Emission Food Systems) and mid- and end lines for clean energy interventions in South and Central Asia (NEXUS Gains). Bilateral evaluations include the assessment of climate information services (CIS) and climate-smart agriculture (CSA) in Ethiopia, Ghana, Kenya, Mali, Senegal, and Zambia by Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA), and the Climate-smart initiatives for climate change adaptation and sustainability in prioritized agricultural production systems in Colombia (CSICAP) project, funded by the Green Climate Fund and covering CIS, climate-resilient technologies, and capacity development.

New evaluations will systematically cover all AoWs, focusing on the effectiveness, scalability, and impact of interventions. For example, AoW 2 will examine how digital climate advisory and bundled services and early warning systems can enhance smallholders' capacity to anticipate and mitigate climate risks. AoW 3 will use impact assessment to identify maladaptation risks, such as increased emissions or intimate partner violence linked to adaptation action. AoW 4 will assess the benefit streams from mitigation action for vulnerable populations. Finally, for AoW 5, IA will test hypotheses linking climate policy to finance and ultimately to resilience and mitigation outcomes, evaluating how effective policies drive finance flows and how this finance fosters climate action. We will employ choice experiments, randomized controlled trials (RCTs), quasi-experimental designs comparing adopters and non-adopters, and high-frequency satellite information. Evidence on policy and finance mechanisms in delivering real-world climate impacts will be assessed through causal analysis and qualitative methods, such as outcome harvesting across regions, to assess real-world climate impacts.

10. Capacity sharing

One of the pathways for impact in this Program is through capacity-sharing activities to contribute to necessary changes in knowledge, attitudes, skills, and practices. Skill-based training, such as hands-on sessions on new technologies, will play a key role in this process. Additionally, exposure to a variety of capacity-building tools, including those focused on knowledge sharing and behavioral change, will help shift attitudes. Since all capacity-sharing activities will be co-designed, jointly implemented, and locally led, they will be well targeted to address the most pressing gaps in knowledge and skills, driving meaningful and sustained improvements in climate resilience and the transformation of FLW systems. Priorities for capacity-sharing activities in this Program include advanced analytics to pinpoint climate change priorities for adaptation and mitigation (AoW 1); bundling of digital advisory systems with diverse services for farmers (AoW 2); local adaptation planning for local governments (AoW 3); AI in the delivery of MRV for emissions reductions and carbon sequestration (AoW 4); emerging issues related to the new Loss and Damage Fund, as requested by farmer organizations (AoW 5); and the role of national banks in mainstreaming climate adaptation in their lending Portfolios to smallholder farmers (AoW 5).

Capacity sharing targets three different actor groups to ensure the effective dissemination and adoption of climate solutions. The first target group includes farmers, pastoralists, fisherfolk, SMEs, and all other direct users of our innovations and technologies. For these stakeholders, capacity-sharing activities will be centered on the uptake of the latest climate-resilient technologies and approaches emerging from both this Program and other CGIAR Programs. These activities will focus on ensuring that the climate solutions developed by CGIAR are well understood by relevant stakeholders, facilitating their adoption when supported by further scaling efforts, for example, in the Scaling for Impact Program. The impact expected from capacity sharing of this target group is adoption of these climate-resilient solutions, especially by communities and individuals most vulnerable to climate risks. The capacity-sharing activity for this target group will prioritize those stakeholders with higher exposure to climate-related challenges, ensuring that CGIAR science reaches those most impacted by climate change. AoW 3 on locally led adaptation will be particularly prominent in capacity-sharing activities, but capacity sharing for this target group is also mainstreamed in AoW 2 and AoW 4. CGIAR will also bring in the necessary expertise and external scientific knowledge to support the adoption and scaling of climate-ready solutions, many of which will be co-designed with local stakeholders to ensure contextual relevance and effectiveness.

The second target group consists of policymakers from local to global levels. This work will focus on sharing the knowledge necessary to drive policy change and improve the enabling environment for climate action, including through increasing financial flows to climate action. This target group includes climate negotiators from various countries in the Global South, and capacity sharing will help ensure that the latest scientific evidence informs their positions within UNFCCC negotiations. CGIAR's capacity-sharing activities for policymakers will be demand led, responding

directly to needs and requests. Capacity sharing for policy influence is a core function of the 2022–24 Climate Impact Platform, and that work will continue. AoW 5 will provide much of the content on options and solutions related to policy and finance to be fed into national to global processes but will work closely with AoW 1, which has a mandate for capacity sharing across CGIAR and for drawing out priorities and synthesis lessons across CGIAR.

The third target group is made up of CGIAR and NARES scientists. Capacity-sharing activities and mutual learning will keep them up to date on the latest developments in climate science and policy as they relate to CGIAR's work. For example, workshops with scientists from the IPCC and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) will provide updates on the latest assessment findings and contribute to filling gaps. In addition, activities will seek to enhance the skills of CGIAR scientists to use the latest climate science to influence and inform climate policies across different scales. By continuously engaging in these capacity-sharing exercises, CGIAR will ensure that its scientists and their partners remain at the cutting edge of climate science and provide them with the tools to influence policy decisions that are crucial for climate adaptation and mitigation. These activities are designed to equip CGIAR scientists and partners with the skills needed to translate scientific insights into impactful policy recommendations, facilitating broader systemic change across FLW systems. This activity will be coordinated by AoW 1.

11. Gender equality, youth, and social inclusion

Global climate goals cannot be achieved without addressing climate justice in FLW systems, to ensure both gender and social inclusion and just livelihood transitions. Systemic inequality increases climate change challenges for vulnerable and marginalized people. Gender- and equity-blind climate action widens inequalities further. Climate shocks affect women's livelihoods in agrifood systems more than men's, and their coping and adaptation options remain limited (Schipper et al. 2022). Women's work burden in agriculture increases relative to men's because of climate extreme events, such as heat stress (Nico and Azzarri 2024; Lee et al. 2021), and women are more likely to suffer production and income losses (FAO 2024). Rural women and girls fare worse on every human development indicator with data and face inequalities in access to resources that are essential for climate resilience, including climate information, digital tools, finance, and mitigation benefits (Bryan et al. 2023; FAO 2023b; Bryan et al. 2024; Sultana 2022). These trends demonstrate the need for attention to social inclusion in climate change research and point to where interventions are needed.

Formative research under the contributing CGIAR Initiatives also informs the Program. ClimBeR has an overall focus on social equity, including entry points to strengthening Indigenous peoples' participation in climate policy processes (Hellin et al. 2024). Low-Emission Food Systems has addressed power inequities in access to mitigation benefits through the Living Labs for People Innovation and is implementing diagnostic research on linkages between the Women's Empowerment in Agriculture Index (WEAI) and climate mitigation. NEXUS Gains is similarly advancing the science on interlinkages between climate action and women's empowerment and has also developed tools to monitor equitable mitigation action, such as the Women's Empowerment in Energy Index (Alvi et al. 2023) and the Energy Inclusivity and Equity Score.

The Climate Action Program will build on CGIAR research and other latest global science to tackle these injustices head on by co-developing participatory research around the following research questions:

1. What are the root causes of climate injustice and gendered inequalities in climate action in agri-food systems, and how can these be addressed?
2. What enabling factors and interventions empower marginalized and vulnerable people, including women and youth, to access options for climate change resilience, low-emission development, and just livelihood transitions?
3. What equitable adaptation and mitigation actions can reduce gender-related and other inequalities in agrifood systems?
4. How can we co-design CIS, low-emission development incentives, innovative finance products, and alternative livelihood options that are accessible and benefit youth, women, and other marginalized producers?
5. How can we ensure that mitigation benefits poor producers and other value chain actors?
6. How can we promote a change in the global climate change discourse toward climate justice and just livelihood transitions?

AoW 1, on Prioritization and Coordination, uses a climate justice lens to support future scenarios and research prioritization to promote social inclusion and just transitions. AoW 2, on Digital Advisories, co-designs CIS, EWS, and safety nets that de-risk production and livelihoods to service the needs of vulnerable small-scale producers and communities. AoW 3, on LLA, co-produces with local communities socially inclusive adaptation technologies and pathways. AoW 4, on Low-Emission Transitions, supports the active engagement of women and small-scale producers in co-producing new technical practices. AoW 5, on Policy and Finance, seeks to shift the climate discourse toward climate justice by directing policy and finance to marginalized populations and supporting loss and damage assessment methods. Research outcomes in these five areas will contribute to increased climate resilience for millions of women who work in FLW systems and new employment, education, or training opportunities for millions of youth.

The success of the Program's capacity to deliver research outcomes rests on identifying demand-driven research, working with deep, equitable partnerships — building on decades of CGIAR partnerships — and using active listening and trust with disenfranchised agri-food system actors, including grassroots women's organizations, Indigenous peoples, youth, smallholder producers, and other vulnerable groups. It also includes engaging gender, youth, and inclusion departments in ministries tasked with climate action and participation in global processes that drive increased equality in FLW systems. Furthermore, success requires making sufficient resources available to drive gender, equality, and youth research, action, and outreach. For this we estimate needing a team of at least five specialists who directly support this work and collaborate with other Programs and partners that want to turn around deep climate change inequities and injustices.

12. Climate change

This section does not apply to this Program as this proposal is all about climate change.

13. Risk management

Table 13.1. High-level risks, events, sources, and consequences

Risk	Risk statement (event, sources, consequences)
1: Underestimated catastrophic buildup of climate hazards	Accelerated post-2030 climate change due to sudden events (e.g., Amazon tipping point) risks making CGIAR climate science irrelevant, driving away users and donors.
2: Populism jeopardizes climate change responses	The rise of populist governments neglecting climate change could reduce climate funding, partner action, and overall impact.
3: UNFCCC climate policy decisions delayed	Slow progress in UNFCCC processes (Sharm-el-Sheikh Work Programme on Agriculture, Enhanced Transparency Framework, NDCs) due to stalled negotiations hinder global climate action, worsening effects on the global poor and the Global South and limiting CGIAR's impact.
4: Short-term economic interests clash with climate interests	Conventional practices prove too profitable to incentivize sector actors to transition to low-emission pathways.
5: Climate-induced displacement	Mass migrations from extreme climate events increase pressure on resources in recipient regions, altering emergency relief and capacity-sharing needs.

Note: Risks will be finalized and mitigation actions will be developed as part of the risk management plan during the Inception Phase.

14. Funding sources

The Climate Action Program will leverage pooled and bilateral funding to advance CGIAR's climate goals. In 2025, pooled funding will prioritize sustaining high-impact research and partnerships started under the 2022-24 Initiatives, including Climate Resilience, Low-Emission Food Systems, NEXUS Gains, and Livestock and Climate, as well as the Climate Impact Platform. This funding will be aligned to the results-based management approaches currently under discussion. In the following years, pooled funding will increasingly target innovative research on emerging climate issues, high-potential and/or underfunded topics, and essential support activities such as data infrastructure and MELIA. Foundational investments are critical for tracking progress and elevating CCGIAR's climate work as a whole. Bilateral funding, the Program's largest funding source, will support specific, in-depth, long-term research projects in priority regions and spillover countries. Some pooled funding will be allocated to build coherence in the climate portfolio and enhance contributions from bilateral projects. The Initiatives on which this Program builds operate in 18 countries, while bilateral projects extend the Program's reach to 116 countries, ensuring a broad and impactful global presence.

Pooled funding

The baseline allocation of **$18.12 million** is distributed across the Program's five AoWs as described in Table 14.1. Approximately 25% of the budget is dedicated to **Prioritization and Coordination of Climate Action**, focusing on advancing climate data modeling, risk assessments, and greenhouse gas inventories through a Just Transition lens to support the prioritization of effective climate actions. About 24% of the budget goes to **Digital Advisories and Climate Risk Management**, aimed at strengthening resilience to climate risks across sectors and scales by leveraging digital tools, early warning systems and safety nets, and climate information services to aid farmers and communities in managing risks. Roughly 13% is allocated to **Locally Led Adaptation**, emphasizing community-driven strategies that empower communities to co-develop and implement adaptation solutions tailored to local vulnerabilities and capacities. **Low-Emission Transitions** receives around 24%, supporting scalable, inclusive solutions that balance climate mitigation with food security, resilient livelihoods, and environmental sustainability. 14% is assigned to **Climate Finance and Policy for Scaling Solutions**, focusing on translating scientific evidence into policies and investments that drive large-scale climate action.

Table 14.1: 2025 pooled budget allocation by Area of Work (baseline scenario)

Area of Work	Budget (M USD)	Percentage
Prioritization and Coordination of Climate Action	4.53	25
Digital Advisories and Climate Risk Management	4.35	24
Locally Led Adaptation	2.36	13
Low-Emission Transitions	4.35	24
Climate Finance and Policy for Scaling Solutions	2.44	14
Total	**18.12**	**100**

The budget allocation across the five AoWs reflects the initial scope and intensity, based on the principle of continuity for Initiative research and partnerships. During the Inception Phase, the relative allocations among AoWs may be adjusted as more detailed activity plans are formulated to implement the Program's vision. If additional funding becomes available, it will go into a "challenge fund" to catalyze new research areas, foster cross-Program collaboration, and support scientific empowerment through awards for postdocs and associate scientists. During the Inception Phase, detailed estimates for implementing the AoWs across 30 priority countries will be developed.

Bilateral funding

A total of 145 bilateral projects, amounting to $167 million, have been mapped to the Climate Action Program (see Tables 14.2 and 14.3). Along with initial pooled funding for 2025, this brings the CGIAR climate portfolio's value to approximately $185 million. The 9:1 ratio of bilateral to pooled funding reflects a strong foundation of bilateral investments, providing substantial resources to extend and amplify Climate Action efforts beyond the capacity of pooled funding. This dynamic underscores the importance of clear integration between funding streams to maximize impact.

Table 14.2. Overview of the bilaterally funded projects mapped to the Climate Action Program

Number of Projects/Programs	CGIAR Center	Mapped Budget (kUSD)
31	Alliance	74,448
13	CIMMYT	35,547
18	IWMI	14,466
23	IRRI	9,399
8	IFPRI	8,297
11	WorldFish	6,476
17	IITA	6,063
7	ILRI	4,572
7	CIP	4,514
4	AfricaRice	2,282
6	ICRISAT	1,328
Total		167,391

Table 14.3. Bilateral projects with budget higher than USD 1 million mapped to the Climate Action Program

Project name	Funder Name	Lead Center	Budget (kUSD)
Climate-smart initiatives —Colombia	Colombia-MADR-Ministerio de Agricultura y Desarrollo Rural	Alliance	48,861
Crops to End Hunger	GIZ	CIMMYT	29,179
Water Resource Accountability in Pakistan (WRAP)	United Kingdom-Foreign, Commonwealth and Development Office (FCDO)	IWMI	8,711
Accelerating Impact of CGIAR Climate Research in Africa	International Development Association (IDA)	Alliance	8,529
Anti-methanogenic feedstock for livestock systems in global south	Bill & Melinda Gates Foundation (BMGF)	Alliance	8,113
The Gender, Climate Change and Nutrition Integration Initiative (GCAN)	BMGF	IFPRI	5,748
Asia Africa Bluetech Superhighway project	United Kingdom-FCDO	WorldFish	4,327
Mining useful alleles for CC adaptation	BMGF	CIMMYT	3,498
Advancing Climate-Smart Technologies to Strengthening Rice Farming in Thailand	Green Climate Fund (GCF)	IRRI	1,708
Climate Smart Village+ Program for MILF Camps Transformation.	OPAPRU - Government of the Philippines	Alliance	1,707
Mining useful alleles for CC adaptation	BMGF	IITA	1,600
Groundwater for aDvancing Resilience in Africa (G4DR)	Global Environment Facility (GEF)	IWMI	1,500
Accelerating adoption of Reg Ag practices	Foundation for Food and Agriculture Research (FFAR)	CIMMYT	1,464
Multiple Harvest Rice for Africa	BMGF	AfricaRice	1,413
Revival of Water Resources in Balochistan (Pakistan)	EU-European Union	IWMI	1,227
Production of vitroplants and 2 greenhouses	The International Fertilizer Development Center (IFDC)	IITA	1,208
The Adaptation and Valorization of Entrepreneurship in Irrigated Agriculture (AVENIR)	Mennonite Economic Development Associates of Canada (MEDA)	Alliance	1,197
The Gender, Climate Change and Nutrition Integration Initiative (GCAN)	USAID	IFPRI	1,188
MILLETS in upland regions of Odisha for crop diversification, climate resilience and enhanced Food and Nutritional Security	India-Department of Agriculture and Farmers' Empowerment, Government of Odisha	ICRISAT	1,070

Annex: Pooled funding

It is important to note that, due to the limited guidance provided for managing pooled funding budgets from 2025 onward and ongoing adjustments to the Program structure following the two review and revision rounds, the details in this Annex should be considered a starting point for further analysis and discussion. Significant engagement and effort will be required during the transition phase to finalize the lists of continuing activities (Table A.2) and prioritize new activities (Table A.3). This is anticipated for several reasons. First, it is unclear whether and how the pooled funding for the Program may grow as a result of engagement with and decisions made by CGIAR Funders in their allocations (including designated funding). Second, the resolution of the proposal's Section 6 write-up (i.e., at sub-AoW) is insufficient to determine specific activities across target geographies. Notably, the new activity lists associated with this Annex are at a greater level of detail, making it challenging to determine whether all novel areas of the Climate Action Program proposal are adequately addressed. Third, existing Initiatives, which served as the primary organizing units for developing this Annex, could leave a potential gap in the Program's scope. Fourth, further reflection is needed on the three-year achievements of the Initiatives, the partnerships established, and the specific geographies and activities in the Program. Finally, there is limited visibility into the activities of the large bilateral projects mapped to Climate Action, making it challenging to fully identify synergies and suggest where pooled funding will be most impactful. Therefore, further engagement and in-depth analysis will be necessary to fully estimate the Program's funding requirements and recalibrate the relative pooled budgets across the Areas of Works presented below.

Introduction

This annex outlines the role of pooled funding in supporting the Climate Action Program from 2025 to 2030. Focused on a conservative baseline (Scenario 1), pooled funding will ensure the continuity of critical research, partnerships, and Initiatives established during the 2022–24 cycle, including key successes from ClimBeR, Low-Emission Food Systems, NEXUS Gains, Livestock and Climate, and the Climate Change Impact Platform. Approximately 80% of the pooled funding will be allocated to maintaining and scaling these foundational efforts, ensuring that proven Initiatives *continue* to deliver impact and drive CGIAR's climate goals forward (Figure A.1). In addition, 20% of the pooled funding will be directed toward new activities, topics, or geographies with strong potential to generate significant outcomes, attract further investments, and enable clear shifts in focus of CGIAR climate research. These new activities will support enhanced scientific collaboration and operational efficiency, addressing emerging challenges and opportunities within the global climate agenda. Should surge funding become available (Scenario 2), this would allow for accelerated growth into new research areas and an expansion of geographical and thematic coverage, building on demonstrated results and ensuring value for money. Together, these investments position the Climate Action Program to adapt to evolving climate challenges while maximizing its global impact, fostering both climate mitigation and adaptation.

Key aspects that will be funded by pooled funding

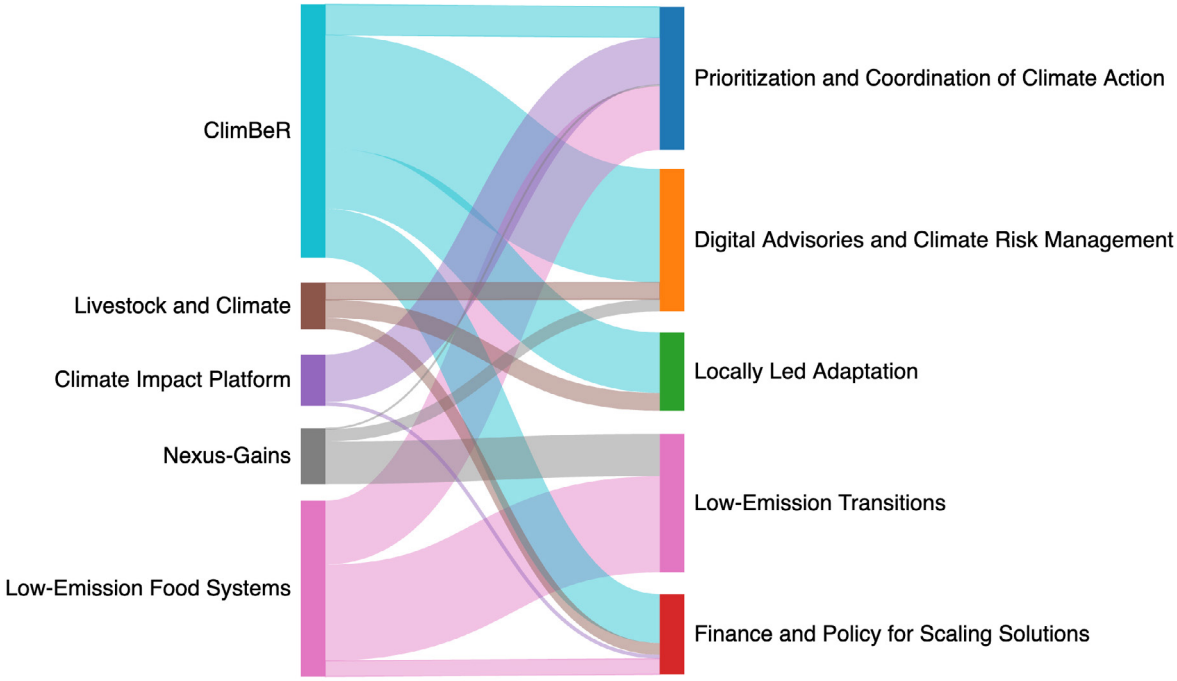
In 2025, approximately 73% of the baseline scenario budget is allocated to three critical Areas of Work (AoWs): Prioritization and Coordination, Digital Climate Risk, and Low-Emission Transitions. This distribution reflects the Program's prioritization of continuing core activities from Initiatives and the Climate Change Impact Platform. They have proven essential in providing data, tools, and capacity sharing that are foundational to CGIAR's future climate action (Table A.2).

- Prioritizing and Coordinating Climate Action (receiving 25% of the budget) will continue to drive forward climate data modeling, foresight, GHG inventories, marginal abatement cost curves, and risk assessments, vital for anticipating climate risk and emissions "hotspots" and regions for priority action. This AoW also becomes the hub for training and capacity sharing on climate topics, though these functions also cut across AoWs. This AoW leverages outputs from the Low-Emission Food Systems and ClimBeR Initiatives, which contribute critical insights on emissions and climate risks and adaptation pathways. For example, efforts to understand the drivers of land use emissions or iFEED models of trade-offs will continue to provide information and knowledge that provide the key inputs for governments and other decision-makers to prioritize action. Efforts started under the Impact Platform to synthesize evidence as a key input into prioritization and decision-making as well as the Platform's connections for training of various stakeholder for climate literacy will be essential.
- Low-Emission Transitions (24% of the budget) builds on the substantial progress made under Low-Emission Food Systems and NEXUS Gains, focusing on reducing emissions across key production and land use systems (including rice, livestock, and deforestation) and enhancing sinks, by supporting national programs to be more effective and efficient. Continued work in locations such as China, Colombia, Kenya, and Vietnam will refine emission measurement techniques and mitigation strategies to support prioritization of actions, benchmarking, monitoring, and reporting for nationally determined contributions, the Bonn Challenge, value chain initiatives, etc. To support climate action planning and prioritization, new work will integrate emission reduction options with economic data to develop marginal abatement cost curves for national- and jurisdiction-level activities. Work will also be expanded to support national compliance on clean supply chain initiatives (e.g., the EU Deforestation Directive, EUDR) and protect small-scale producers. Living Labs for People operate in four countries and serve as collaborative, on-the-ground platforms for co-designing and implementing low-emission development approaches at scale with producers, land managers, governments, local civil society organizations, and the private sector. They receive considerable in-kind and material support from partners. Continued support is essential to achieving the objectives of this AoW. Key priorities for new work are to expand the focus on equitable sharing of costs and benefits of climate actions and on opportunities for locally appropriate, healthy diets with low emission profiles. Recent research has looked at the role of international trade in emissions, with promising results. New activities in this area will be developed over the next six years. Following tool development and case study analyses, NEXUS Gains will focus on scaling gender-responsive solar irrigation and other sustainable energy solutions for agri-food systems to enhance resource efficiency while reducing emissions and negative impacts on other key natural resources such as land and water. The Women's Energy Empowerment Index (WEEI) and the Energy Inclusivity and Equity Score (EIES) will be applied to locations with high energy insecurity to drive equitable investments. Research results on solar irrigation case studies from South Asia and Sub-Saharan Africa will be published and results will be integrated into national investment plans. Additional research will support

governments, the private sector, and civil society organizations in accelerating a rural green energy transition based on expressed stakeholder demand, such as by the governments of Ethiopia, India, Nepal, and Pakistan. By integrating mitigation strategies with food security, nutrition, and development goals such as peace building, these activities ensure that climate actions will support development. National engagement has been growing, and there is demand for more support from all our partner countries. Capacity building, both internally and externally through the CLIFF-GRADS partnership with the Global Research Alliance, will continue, as will many national and international partnerships.

- Digital Advisories and Climate Risk Management (24% of the budget) focuses on scaling advisory services and early warning systems, which have become indispensable for climate-vulnerable farming communities. This AoW leverages the success of co-developed digital tools under initiatives like ClimBeR and Livestock and Climate, which have already shown promising results in countries such as Guatemala, Kenya, Senegal, and Zambia. These tools offer essential decision-making support for farmers, helping them manage climate risks, optimize water usage, and improve productivity in changing environments. The allocation to this AoW ensures that these existing digital solutions are continuously improved, enhanced with new technologies like AI-based recommendations, and adapted to meet the needs of more regions. As a scalable, demand-driven solution, digital climate advisory services (DCAS) represent one of the best opportunities to expand climate-smart practices quickly and efficiently, reducing risks for farmers and building resilience in agricultural systems. By focusing on approaches that target widespread access to and use of critical information to support adaptive capacity and resilience, this AoW matches its methods with this Program's goal of reaching 100 million producers.

Figure A.1. Illustrative mapping of activities and budgets from the 2022-24 Portfolio to Climate Action's AoWs



Note: This figure is based on about 80% of the 2024 budgets and highlights the continuity of aligned Initiatives' work. It shows that activities prioritized for continuity by the Initiatives have found a home in the Program's structure. Furthermore, it illustrates the consolidation of streams of work, creating greater coherence in the Climate Action Portfolio and offering new opportunities for operational efficiency and impact. All budget values are provisional estimates intended to provide an idea of relative distributions based on continuity (see Table A.1). Full accounting will be completed during the Inception Phase.

The remaining 27% of the 2025 budget supports newer and complementary AoWs:

- Locally Led Adaptation (13% of the budget) will develop and scale community-driven adaptation strategies, drawing on the successful models developed under ClimBeR and NEXUS Gains. This AoW focuses on bundling services with capacity sharing, ensuring that local communities have the tools and knowledge to continuously adapt effectively to climate change. In regions such as Bangladesh, Guatemala, and Zambia, tailored adaptation approaches will address specific vulnerabilities, prioritizing resilience building through risk reduction strategies such as diversification. These initiatives will leverage participatory action research and locally co-created solutions to empower local voices to guide decision-making processes. Formulation of this body of work into an AoW represents a new emphasis for CGIAR, as it firmly works to place decision-making power in the hands of local communities, ensuring that adaptation strategies are co-developed and implemented from the ground up, making CGIAR's work more responsive, inclusive, and impactful than before.
- Climate Finance and Policy for Scaling Solutions (14%) will unify CGIAR's various strands of work on climate policy and finance into a coordinated effort, focusing on leveraging financial mechanisms and creating evidence-based policy solutions that drive climate action at scale. Building on Initiatives such as Low-Emission Food Systems, ClimBeR, and NEXUS Gains and the Climate Change Impact Platform, this AoW will continue the work of generating critical country-specific evidence to set and deliver on goals and supporting the climate negotiations. Furthermore, this AoW will engage key financial partners—like the Green Climate Fund, World Bank, and regional development banks—unlocking funding pathways for large-scale climate initiatives. A shift toward secondments, direct access facilities, and other innovations to get science into decision-making processes, if funding is available, represents a new way of working for CGIAR, where scientific evidence is translated to directly influence policy and finance, enabling a larger reach and greater impact through coordinated actions across regions.

The amounts shown include the categories of indicated, confirmed, received, and Portfolio funding. They do not include carryovers, commitments, and advance from 2023. Data is sourced from the CGIAR Financing Plan Dashboard. Numbers are rounded and thus may not add up exactly. Because some institutions mapped less than the continuity principle (e.g., Low-Emission Food Systems) and others more (e.g., Impact Platform), the table clearly shows that the Climate Action Program and the Initiatives/Platform need to engage more intensively in the planning process for continuity and alignment for both continuing and new activities.

Table A.1. 2024 Financial outlook for the aligned Initiatives/Platform

Initiative	2024 funding (USD millions)	Mapped	Percentage mapped	Budgets for new activities	Total (USD millions)	% of 2024 funding
Climate Change Impact Platform	X	x	x	x	x	x
ClimBeR	X	x	x	x	x	x
Livestock and Climate	X	x	x	x	x	x
Low-Emission Food Systems	X	x	x	x	x	x
NEXUS Gains	X	x	x	x	x	x

Note: NEXUS Gains maps all of its work under the Just Energy Transitions workstream and a small share of its work under the water productivity workstream to the Climate Program.

Pooled funding is critical for the success of the Climate Action Program. It enables sustained effort beyond project-specific timelines, allowing the Program to:

- **Be agile and responsive to emerging opportunities**: Pooled funding helps maintain financial flexibility, so that the Program can pivot quickly to capture new opportunities that arise due to shifts in the partnership landscape, technological advancements, or changing political contexts. Pooled funding allows the Program to adapt dynamically, ensuring that it remains relevant and effective. Equally important is the ability to sunset activities when efforts fail to progress. This flexibility is particularly important for work where conventional funding might be too rigid to respond effectively.
- **Maintain and scale assets**: CGIAR has a strong track record of developing cutting-edge tools and technologies, but there are often incentives to focus on creating new tools rather than maintaining and growing existing ones. Pooled funding can address this gap by ensuring that assets are sustained and improved. Maintaining these assets as they are applied in new regions or contexts can be just as important as innovation, and more cost-effective. In some cases, this means previous bilateral funding may move toward pooled funding.

What is being stopped

Several activities were discontinued owing to the completion of Initiative outputs (with little to no follow-on activities required), changes in demand, and decisions to pursue more strategic priorities based on potential for impact, added value to the Climate Action Program, and CGIAR's comparative advantage.

- **ClimBeR** completed several time-bound outputs through its Social Equity crosscutting theme. These included a social equity framework; gender case studies of climate security in five countries in collaboration with the Climate Security Work Package; and a special issue of *Current Research in Environmental Sustainability [CRSUST]* on advancing transformative adaptation in food, land, and water (FLW) systems using a social equity lens. ClimBeR also began to develop a framework to track progress on the "Leave No One Behind" principle of the 2030 Agenda for Sustainable Development through Work Package 4. However, due to the lack of data to develop indicators, this activity will also be discontinued. Due to changes in partner demand and changes in the involvement of specific partners, ClimBeR will no longer develop climate security investment plans or an index to assess and compare climate security risks across geographies, while continuing the rest of the Climate Security agenda on Evidence, Policy, Programming and Finance (80% of the WP2 budget). However, we will continue to monitor changes in demand for these activities in case future 2041 opportunities arise. While most activities under ClimBeR will continue, the scope of these existing activities has been reduced to allow for exploration of new activities more aligned with this Program. These new areas include researching loss and damage attribution, scaling climate information services and climate security research in current and other regions, and studying locally led adaptation and conflict-sensitive climate adaptation approaches, among others.
- **Low-Emission Food Systems** completed several preliminary assessment activities for national food systems, quantifying emissions and assessing the feasibility of reducing emissions from several sources. Prioritization activities are complete, and teams are moving on to developing tools for monitoring progress on each national priority. The team has also completed the co-development of conceptual frameworks, situational analyses, and stakeholder mapping with local partners for applied research in each of the Living Labs for People jurisdictions. Initially our planning focus was designed to support countries to develop Long-Term, Low-Emission Development Strategies. However, more than 75 countries have already submitted these plans to the UNFCCC, and others are near completion. We will stop this activity and focus on supporting the operationalization of these plans at jurisdictional and national scales. Our teams have co-developed several sustainability strategies for value chains with significant GHG emissions. The teams will transition to supporting stakeholders to implement these and monitor their success in terms of both GHG emissions and human well-being. We will, however, monitor the evolution of the European Union Deforestation Regulation and other initiatives and assess the need for additional strategy development.
- **Climate Change Impact Platform.** All the functions and activities under the Platform will continue based on availability of funding.
- **NEXUS Gains.** The following elements of WP3 under the NEXUS Gains Program will not be continued next year, as the specific activities have been completed:
    - Baseline intrahousehold surveys on water, food, and energy security in India, Nepal, Pakistan, and Uzbekistan.
    - Case studies on energy and gender dynamics in Ethiopia, India, and Pakistan, as well as on inclusive energy policy in Nepal.
    - Development of the Women's Energy Empowerment Index (WEEI) and the Energy Inclusivity and Equity Score (EIES), both of which provide insights into women's and marginalized groups' access to clean energy.
    - Assessment of two solar irrigation technologies in Nepal (solar-lift irrigation and solarization of deep tubewells).
    - Development of tools for solar irrigation in South Asia, specifically the expansion of the tool from India to Nepal, and the Sub-Saharan African solar irrigation explorer.
    - Development of the Solar Irrigation Pump (SIP) sizing tool, an identified innovation of NEXUS Gains.

Potential new activities

In the absence of specific guidance on how to approach pooled funding budgets for 2025 and beyond, we sought suggestions from Initiatives for new activities under the assumption that they, along with their constituent Centers, would be heavily involved in decision-making on new activities because of the need for operational consistency within at least the first year of the Science Program and the broad base of the Centers involved. Each Initiative followed a different process to determine which activities should continue and what new activities to propose. As a result, they compiled a list of new activities, representing approximately 20% of the 2024 budget and aligning with the designated Areas of Work (AoWs). However, as of 12 September, the Writing Team has not yet vetted or made recommendations regarding these activities. The list presented here remains unembellished, without any prioritization or critique, as we await further guidance on who will ultimately make these decisions (e.g., Initiatives, WT, Centers) and any formal guidelines or processes that may be established. In short, more work is needed and transparency and criteria for decisions are critical.

Table A.2. Continuing activity suggested by the Initiatives/Platform based on 80% activity/budget continuity

Climate Action Program AoW	Activity name	Initiative
Prioritization and Coordination	Governance and Policy 4 Climate Security	ClimBeR
Prioritization and Coordination	integrated Future Estimator for Emissions and Diets (iFEED)	ClimBeR
Prioritization and Coordination	Inclusive Assessment Framework	ClimBeR
Prioritization and Coordination	Enhancing Climate Risk Profiles for Agriculture in Africa	ClimBeR
Prioritization and Coordination	Improved fine-scale crop type mapping using spatial production allocation model	ClimBeR
Prioritization and Coordination	Synchronous multi-breadbasket failure (Correlated climate risk)	ClimBeR
Prioritization and Coordination	Country profiles	Low-Emission Food Systems
Prioritization and Coordination	National-level policy engagement	Low-Emission Food Systems
Prioritization and Coordination	Marginal abatement cost curves	Low-Emission Food Systems
Prioritization and Coordination	PhD student at German Research Centre for Geosciences (GFZ)	Low-Emission Food Systems
Prioritization and Coordination	Impacts and policies (sustainable and healthy diet to manage climate change)	Low-Emission Food Systems
Prioritization and Coordination	Changing production practices, reducing FLW, and changing diets	Low-Emission Food Systems
Prioritization and Coordination	National-level policy engagement	Low-Emission Food Systems
Prioritization and Coordination	Data from emissions from perennial systems (cacao and coffee)	Low-Emission Food Systems
Prioritization and Coordination	GHG emission factors for different cropping systems, especially in livestock	Low-Emission Food Systems
Prioritization and Coordination	GHG quantification methodologies in different crops in Colombia	Low-Emission Food Systems
Prioritization and Coordination	TIER 2 approaches for GHG emissions from crop and livestock production systems	Low-Emission Food Systems
Prioritization and Coordination	Reducing methane emissions in rice and livestock	Low-Emission Food Systems
Prioritization and Coordination	Framework for Cost-effectiveness Analysis of GHG Mitigation Measures in Dairy Industry	Low-Emission Food Systems
Prioritization and Coordination	TIER 3 modeling N_2O emissions from cropping systems	Low-Emission Food Systems
Prioritization and Coordination	Data and evidence generation around livestock emission	Low-Emission Food Systems
Prioritization and Coordination	Emissions in the rice-shrimp systems	Low-Emission Food Systems
Prioritization and Coordination	GHG MRV	Low-Emission Food Systems
Prioritization and Coordination	Enhanced resilience through improved land and water management based on insights provided through eddy covariance experiments	NEXUS Gains
Prioritization and Coordination	Mapping of existing and emerging methods and metrics, includes repository curation, data co-hosting, and dashboard for monitoring climate action in agrifood sector	Impact Platform
Prioritization and Coordination	Internal and external facing learning and capacity sharing/ strengthening on the methods and metrics	Impact Platform
Prioritization and Coordination	Evidence synthesis: annual breakthrough report, synthesis of emerging issues with gaps, synthesis of CGIAR and partner evidence	Impact Platform

Climate Action Program AoW	Activity name	Initiative
Prioritization and Coordination	Packaging and dissemination of evidence briefs/ explainers, etc.	Impact Platform
Prioritization and Coordination	Engagement in key global climate processes: IPCC, UNFCCC, etc.	Impact Platform
Digital Climate Risk	Consolidation of digital and financial tools	ClimBeR
Digital Climate Risk	Bundled climate information services (CIS)	ClimBeR
Digital Climate Risk	Climate Security Observatory (CSO)	ClimBeR
Digital Climate Risk	Climate Security Sensitivity Tool	ClimBeR
Digital Climate Risk	Climate Security Programming Dashboard 4 Climate Finance	ClimBeR
Digital Climate Risk	Climate Security Training Modules	ClimBeR
Digital Climate Risk	Bundled climate information services (CIS)	ClimBeR
Digital Climate Risk	Consolidation of digital and financial tools	ClimBeR
Digital Climate Risk	Fostering the scaling of conservation agriculture in Morocco	ClimBeR
Digital Climate Risk	Co-creation of policy action related to agricultural water management in Morocco	ClimBeR
Digital Climate Risk	Fostering crop diversification as a climate adaptation into Senegal's climate action in the agricultural sector	ClimBeR
Digital Climate Risk	Fostering water management policy and vision in Senegal	ClimBeR
Digital Climate Risk	Promoting resilience and food security through risk-contingent credit in Africa	ClimBeR
Digital Climate Risk	Bundled climate information services (CIS) [RCMAS Climate+]	ClimBeR
Digital Climate Risk	Consolidation of digital and financial tools [ARBY]	ClimBeR
Digital Climate Risk	Bundled climate information services (CIS) [RCMAS Climate+]	ClimBeR
Digital Climate Risk	Consolidation of digital and financial tools [ARBY]	ClimBeR
Digital Climate Risk	Early warning, early action, and early finance	ClimBeR
Locally Led Adaptation	Bundled climate information services (CIS)	ClimBeR
Locally Led Adaptation	Disruptive Seeds	ClimBeR
Locally Led Adaptation	Social equity toolkit	ClimBeR
Locally Led Adaptation	Locally led adaptation (ACTION program)	ClimBeR
Locally Led Adaptation	Multiscale polycentric governance in transformative adaptation to climate change: a tool guide	ClimBeR
Locally Led Adaptation	Positive deviance approaches to co-designed technologies	Livestock and Climate
Low-Emission Transitions	The Living Lab from WP3	Low-Emission Food Systems
Low-Emission Transitions	Capacity sharing: junior scientist tandem	Low-Emission Food Systems
Low-Emission Transitions	Net mapping and fuzzy cognitive modelling	Low-Emission Food Systems
Low-Emission Transitions	Co-production of knowledge case study	Low-Emission Food Systems
Low-Emission Transitions	MSP research and capacity at the global level including the community of practices (CoP) on MSP	Low-Emission Food Systems
Low-Emission Transitions	LL4P in practice- identifying, co-developing and scaling innovations	Low-Emission Food Systems
Low-Emission Transitions	The Living Lab from WP3	Low-Emission Food Systems
Low-Emission Transitions	Capacity strengthening (e.g., decision analysis, proposal writing for partners, training of facilitators)	Low-Emission Food Systems

Climate Action Program AoW	Activity name	Initiative
Low-Emission Transitions	Workshop to support land use planning	Low-Emission Food Systems
Low-Emission Transitions	Productivity analysis	Low-Emission Food Systems
Low-Emission Transitions	Economic valuation in terms of WPT or WPA	Low-Emission Food Systems
Low-Emission Transitions	Streamline near real-time land use monitoring and delineate crop patterns	Low-Emission Food Systems
Low-Emission Transitions	Trade-off analysis among ecosystem services	Low-Emission Food Systems
Low-Emission Transitions	Citizen juries in Colombia	Low-Emission Food Systems
Low-Emission Transitions	Dairy sector baseline survey on mitigation options	Low-Emission Food Systems
Low-Emission Transitions	Drivers of food and land systems emission	Low-Emission Food Systems
Low-Emission Transitions	Adoption of low-emission technologies	Low-Emission Food Systems
Low-Emission Transitions	Financial and policy instruments for scaling low-emission food systems	Low-Emission Food Systems
Low-Emission Transitions	Six-step approach for scaling low-emission food systems	Low-Emission Food Systems
Low-Emission Transitions	Business model around low-emission food systems	Low-Emission Food Systems
Low-Emission Transitions	Research on financial and policy mechanism for scaling low-emission food systems	Low-Emission Food Systems
Low-Emission Transitions	The impacts of Sino-Brazil beef trade on deforestation	Low-Emission Food Systems
Low-Emission Transitions	Promote zero-carbon smart-village work	Low-Emission Food Systems
Low-Emission Transitions	Scaling strategies for low-emission food systems	Low-Emission Food Systems
Low-Emission Transitions	Scaling solutions to rice emissions	Low-Emission Food Systems
Low-Emission Transitions	Rangelands, mitigation, and peace	Low-Emission Food Systems
Low-Emission Transitions	Carbon markets in rice	Low-Emission Food Systems
Low-Emission Transitions	Assessing the impact of training on farmers' adoption of practices with low-emission potential	Low-Emission Food Systems
Low-Emission Transitions	Assessment of impacts of clean energy transition on CGIAR area impact indicators (gender, jobs, nutrition, equity, etc.)	Nexus-Gains
Low-Emission Transitions	Scaling of business and finance models and tools developed under NEXUS Gains to accelerate the rural clean energy transition	Nexus-Gains
Low-Emission Transitions	Determinants of scaling of solar solutions	Nexus-Gains
Low-Emission Transitions	Gender transformative approach to low-emission food systems	Low-Emission Food Systems
Climate Finance and Policy for Scaling Solutions	Technical support for Green Climate Fund proposals	ClimBeR
Climate Finance and Policy for Scaling Solutions	integrated Future Estimator for Emissions and Diets (iFEED)	ClimBeR
Climate Finance and Policy for Scaling Solutions	Inclusive assessment framework	ClimBeR
Climate Finance and Policy for Scaling Solutions	Climate-smart governance dashboard for adaptation planning	ClimBeR
Climate Finance and Policy for Scaling Solutions	Assessment of the impact of the Program's communication strategy on discourse (and actions) of stakeholders	Low-Emission Food Systems
Climate Finance and Policy for Scaling Solutions	Capacity sharing for early-career researchers	Low-Emission Food Systems
Climate Finance and Policy for Scaling Solutions	International policy engagement (webinars, conference, organizing event, negotiation)	Low-Emission Food Systems
Climate Finance and Policy for Scaling Solutions	Climate communications: internal and external (content production, packaging, dissemination and reporting)	Impact Platform

Table A.3. New activities suggested by the Initiatives/Platform based on 20% activity/budget continuity principle. The activities have not been prioritized or confirmed as we await guidance on the decision-making process. Additional activities may be suggested based on guidance provided.

Climate Action Program AoW	Activity name	Initiative
Prioritization and Coordination	Climate resilience toolkit co-designed/co-created with national and regional partners	ClimBeR
Prioritization and Coordination	Readiness and preparatory support framework for peace and positive climate action	ClimBeR
Prioritization and Coordination	Climate outlook reports	Impact Platform
Prioritization and Coordination	Exchange programs for CGIAR scientists and PhD support for ECR from Global South on climate issues	Impact Platform
Prioritization and Coordination	Customize CGIAR's PRMS for climate reporting and synthesize insights from CGIAR's climate Portfolio for annual reporting leading to 2030	Impact Platform
Prioritization and Coordination	Partnerships for livestock and climate	Livestock and Climate
Prioritization and Coordination	Economic analysis to develop marginal abatement cost curves for the national and jurisdiction level	Low-Emission Food Systems
Prioritization and Coordination	EU Deforestation Directive (EUDR)	Low-Emission Food Systems
Prioritization and Coordination	New primary data collection for emissions factors	Low-Emission Food Systems
Prioritization and Coordination	National engagement	Low-Emission Food Systems
Digital Climate Risk	Climate Smart Villages+	ClimBeR
Digital Climate Risk	Scaling up of bundled climate finance product (e.g., risk-contingent credit) tested in ClimBeR	ClimBeR
Digital Climate Risk	Compounded climate risk management	ClimBeR
Digital Climate Risk	DCAS training toolkit	ClimBeR
Digital Climate Risk	Tailored cross-scale multi-sector recommendations to enhance sustainable water management under future climates	ClimBeR
Digital Climate Risk	Climate information systems and DCAS to support e-extension systems in Morocco	ClimBeR
Digital Climate Risk	Adapt and integrate existing climate service frameworks by conducting comprehensive reviews, updating frameworks, and facilitating multi-stakeholder collaboration to ensure cross-sectoral coordination	ClimBeR
Digital Climate Risk	Integrate climate-informed financial mechanisms such as microinsurance and forecast-based financing into climate service frameworks	ClimBeR
Digital Climate Risk	Develop AI-based approaches to facilitate impact-based forecasting	ClimBeR
Digital Climate Risk	Compound risk framework	ClimBeR
Digital Climate Risk	Co-design and scaling of livestock insurance products and inclusive service bundles for de-risking livestock systems	Livestock and Climate
Digital Climate Risk	Co-design and scaling of livestock insurance products and inclusive service bundles for de-risking livestock systems	Livestock and Climate
Digital Climate Risk	Scaling credit risk scoring to unlock finance in pastoral areas	Livestock and Climate
Locally Led Adaptation	Targeted climate technical assistance, capacity building, and financing for locally led climate action and SMEs	ClimBeR
Low-Emission Transitions	Unintended effects on adaptation, peace, biodiversity, gender, and nutrition from adoption of low-emission technologies	Low-Emission Food Systems

Climate Action Program AoW	Activity name	Initiative
Low-Emission Transitions	Integrating climate mitigation and adaptation, biodiversity, gender, nutrition, and peace	Low-Emission Food Systems
Low-Emission Transitions	Landscape restoration for adaptation, biodiversity, gender, nutrition, and peace	Low-Emission Food Systems
Low-Emission Transitions	Reduce negative impacts from clean energy transition on key natural resources, such as water and the environment	NEXUS Gains
Low-Emission Transitions	Link clean energy solutions to new climate finance streams for rural areas, such as Green Climate Fund	NEXUS Gains
Low-Emission Transitions	National compliance on clean supply chain initiatives	Low-Emission Food Systems
Low-Emission Transitions	Implementing low-emission development approaches at scale with producers, land managers, governments, local civil society organizations, and the private sector.	Low-Emission Food Systems
Low-Emission Transitions	The role of international trade on emissions	Low-Emission Food Systems
Low-Emission Transitions	National engagement	Low-Emission Food Systems
Low-Emission Transitions	Sustainability strategies for value chains with significant GHG emissions.	Low-Emission Food Systems
Low-Emission Transitions	Scaling of Living Labs for People approach in China, Colombia, Kenya, and Vietnam	Low-Emission Food Systems
Climate Finance and Policy for Scaling Solutions	Localizing loss and damage: Event attribution to support loss and damage	ClimBeR
Climate Finance and Policy for Scaling Solutions	Climate resilience toolkit co-designed/co-created with national and regional partners	ClimBeR
Climate Finance and Policy for Scaling Solutions	Strengthening institutional capacity to offer macro-financing tools through the Sustainable Agriculture Finance Facility	ClimBeR
Climate Finance and Policy for Scaling Solutions	Training for climate negotiators	Impact Platform

References

AghaKouchak, Amir, Felicia Chiang, Laurie S. Huning, Charlotte A. Love, Iman Mallakpour, Omid Mazdiyasni, Hamed Moftakhari, Simon Michael Papalexiou, Elisa Ragno, and Mojtaba Sadegh. 2020. "Climate Extremes and Compound Hazards in a Warming World." *Annual Review of Earth and Planetary Sciences* 48 (1): 519–48.

Agyekumhene, C., P. Chilambe, S. Vyas, S. Brower, A. Ghosh, J. Ramirez Villegas, and E. Girvetz. 2023. *Boosting Prosperity: Enhancing Access to Agricultural Finance for Africa's Smallholder Dairy Farmers*. Climate Resilience Innovation Brief. CGIAR Initiative on Climate Resilience.

Alston, Julian M., Philip Pardey, and Xudong Rao. 2022. "Payoffs to a Half Century of CGIAR Research." *American Journal of Agricultural Economics* 104 (2): 502–29.

Alvi, M., F. Sufian, C. Ringler, T. Singh, E. Beniwal, and S. Raja. 2023. *Women's Empowerment and Energy Access: Insights from India, Nepal, and Pakistan*. NEXUS Gains Policy Note. CGIAR. https://hdl.handle.net/10568/137410

Amarnath, G., N. Alahacoon, Emmanuel Attoh, Mahesh Jampani, S. Panjwani, Surajit Ghosh, U. Amarasinghe, et al. 2024. "The Early Warning, Early Action, Early Finance (AWARE) Platform: Promoting Early Warning of and Effective Response to Climate Hazards." CGIAR. https://cgspace.cgiar.org/items/bedc396a-07de-4360-afb8-fc73dbc51654

Amarnath, Giriraj, C. Mweemba, E. Manishimwe, and Barbara van Koppen. 2023. "Locally Led Climate Action for Sustainable Community Resilience." CGIAR Initiative on Climate Resilience. Colombo, Sri Lanka: International Water Management Institute (IWMI).

Antle, J. M., and S. Ray. 2020. "Pathways to Sustainable Agricultural Development." In *Sustainable Agricultural Development*. Palgrave Studies in Agricultural Economics and Food Policy. Cham, Switzerland: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-34599-0_6

Barbier, Edward B., and Jacob P. Hochard. 2018. "The Impacts of Climate Change on the Poor in Disadvantaged Regions." *Review of Environmental Economics and Policy* 12 (1): 26–47.

Barrett, Christopher B., Tim G. Benton, Karen A. Cooper, Jessica Fanzo, Rikin Gandhi, Mario Herrero, Steven James, et al. 2020. "Bundling Innovations to Transform Agri-Food Systems." *Nature Sustainability* 3 (12): 974–76.

Bertana, Amanda, Brett Clark, Tabitha M. Benney, and Cameron Quackenbush. 2022. "Beyond Maladaptation: Structural Barriers to Successful Adaptation." *Environmental Sociology* 8 (4): 448–58.

Bonilla-Cedrez, Camila, Peter Steward, Todd S. Rosenstock, Philip Thornton, Jacobo Arango, Martin Kropff, and Julian Ramirez-Villegas. 2023. "Priority Areas for Investment in More Sustainable and Climate-Resilient Livestock Systems." *Nature Sustainability* 6 (10): 1279–86.

Born, Lorna, Steven Prager, Julian Ramirez-Villegas, and Pablo Imbach. 2021. "A Global Meta-Analysis of Climate Services and Decision-Making in Agriculture." *Climate Services* 22 (April): 100231.

Brown, Molly, John Antle, Peter Backlund, Edward Carr, Bill Easterling, Margaret Walsh, Caspar Ammann, et al. 2015. "Climate Change, Global Food *Security, and the U.S. Food System*. U.S. Department of Agriculture, the University Corporation for Atmospheric Research, and the National Center for Atmospheric Research. http://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf

Bryan, Elizabeth, Muzna Alvi, Sophia Huyer, and Claudia Ringler. 2024. "Addressing Gender Inequalities and Strengthening Women's Agency to Create More Climate-Resilient and Sustainable Food Systems." *Global Food Security* 40 (100731): 100731.

Bryan, E., R. Meinzen-Dick, and C. Ringler. 2023. "Gender, Resilience, and Food Security." In *Resilience and Food Security in a Food Systems Context,* edited by C. Béné and S. Devereux. Vol. 8. Cham, Switzerland: Palgrave-MacMillan.

Carr, Edward R., and Mary C. Thompson. 2014. "Gender and Climate Change Adaptation in Agrarian Settings: Current Thinking, New Directions, and Research Frontiers." *Geography Compass* 8 (3): 182–97.

Carr, Tony W., Siyabusa Mkuhlani, Alcade C. Segnon, Zakari Ali, Robert Zougmoré, Alan D. Dangour, Rosemary Green, and Pauline Scheelbeek. 2022. "Climate Change Impacts and Adaptation Strategies for Crops in West Africa: A Systematic Review." *Environmental Research Letters: ERL [Web Site]* 17 (5): 053001.

CGIAR. 2022. "2030 CGIAR Research and Innovation Strategy." https://cgspace.cgiar.org/server/api/core/bitstreams/6125b92c-01b6-480c-9d69-881cea4579b1/content

Challinor, Andy J., W. Neil Adger, Tim G. Benton, Declan Conway, Manoj Joshi, and Dave Frame. 2018. "Transmission of Climate Risks across Sectors and Borders." *Philosophical Transactions. Series A, Mathematical, Physical, and Engineering Sciences* 376 (2121). https://doi.org/10.1098/rsta.2017.0301.

Chen, Chen, Jessica Hellmann, Lea Berrang-Ford, Ian Noble, and Patrick Regan. 2018. "A Global Assessment of Adaptation Investment from the Perspectives of Equity and Efficiency." *Mitigation and Adaptation Strategies for Global Change* 23 (1): 101–22.

Chiriac, Daniela, Harsha Vishnumolakala, and Paul Rosane. 2023. “The Climate Finance Gap for Small-Scale Agrifood Systems: A Growing Challenge.” Climate Policy Initiative.

Cofie, Olufunke, and Tilahun Amede. 2015. “Water Management for Sustainable Agricultural Intensification and Smallholder Resilience in Sub-Saharan Africa.” *Water Resources and Rural Development* 6 (November): 3–11.

Coger, T., A. Dinshaw, S. Tye, B. Kratzer, M. T. Aung, E. Cunningham, C. Ramkissoon, et al. 2022. *Locally Led Adaptation: From Principles to Practice*. Washington, DC: World Resources Institute. https://www.wri.org/research/locally-led-adaptation-principles-practice

Costa, Ciniro, Jr, Philip Thornton, and Eva Wollenberg. 2023. “Global Hotspots of Climate Change Adaptation and Mitigation in Agriculture.” *Frontiers in Sustainable Food Systems* 7 (November). https://doi.org/10.3389/fsufs.2023.1216205

Crippa, M., E. Solazzo, D. Guizzardi, F. Monforti-Ferrario, F. N. Tubiello, and A. Leip. 2021. “Food Systems Are Responsible for a Third of Global Anthropogenic GHG Emissions.” *Nature Food* 2 (3): 198–209.

Cullmann, J., M. Dilley, P. Egerton, V. F. Grasso, C. Honoré, F. Lúcio, J. Luterbacher, et al. 2021. *2021 State of Climate Services: Water*. Geneva: World Meteorological Organization.

Ecosystem Marketplace. 2022. *The Art of Integrity: State of Voluntary Carbon markets, Q3 Insights Briefing*. Washington, DC: Forest Trends Association.

Elias, M., M. Ihalainen, I. Monterroso, and B. Gallant. 2021. “Enhancing Synergies between Gender Equality and Biodiversity, Climate, and Land Degradation Neutrality Goals: Lessons from Gender-Responsive Nature-Based Approaches.” Rome: Bioversity International. https://cgspace.cgiar.org/bitstream/10568/114844/1/Enhancing_Elias2021.pdf

Engdaw, Mastawesha Misganaw, Brian Mayanja, Sabrina Rose, Ana Maria Loboguerrero, and Aniruddha Ghosh. 2024. “Bridging Evidence Gaps in Attributing Loss and Damage, and Measures to Minimize Impacts.” *PLOS Climate* 3 (8): e0000477.

FAO (Food and Agriculture Organization of the United Nations). 2023a. “Loss and Damage and Agrifood Systems: Addressing Gaps and Challenges.” Rome. https://doi.org/10.4060/cc8810en.

———. 2023b. “The Status of Women in Agrifood Systems.” Rome.

———. 2024. “The Unjust Climate.” Rome. https://doi.org/10.4060/cc9680en.

Farnworth, Cathy Rozel, Trần Thu Hà, Björn Ole Sander, Eva Wollenberg, Nicoline C. de Haan, and Shawn McGuire. 2017. “Incorporating Gender into Low-Emission Development: A Case Study from Vietnam.” *Gender, Technology and Development* 21 (1–2): 5–30.

“Financing a Greener Future.” 2023. *Nature Communications* 14 (1): 533.

Findlater, Kieran, Sophie Webber, Milind Kandlikar, and Simon Donner. 2021. “Climate Services Promise Better Decisions but Mainly Focus on Better Data.” *Nature Climate Change* 11 (9): 731–37.

Frank, S., P. Havlík, E. Stehfest, H. van Meijl, P. Witzke, I. Pérez-Domínguez, M. van Dijk, J. C. Doelman, T. Fellmann, J. F. Koopman, and A. Tabeau. 2019. “Agricultural Non-CO_2 Emission Reduction Potential in the Context of the 1.5°C Target. *Nature Climate Change* 9 (1): 66–72.

Fuglie, Keith O., and Ruben G. Echeverria. 2024. “The Economic Impact of CGIAR-Related Crop Technologies on Agricultural Productivity in Developing Countries, 1961–2020.” *World Development* 176 (106523): 106523.

Funk, Chris, Laura Harrison, Zewdu Segele, Todd Rosenstock, Peter Steward, C. Leigh Anderson, Erin Coughlan de Perez, et al. 2023. “Tailored Forecasts Can Predict Extreme Climate Informing Proactive Interventions in East Africa.” *Earth’s Future* 11 (7): e2023EF003524. https://doi.org/10.1029/2023ef003524

GCA (Global Center on Adaptation). 2023. “Stories of Resilience: Lessons from Local Adaptation Practice.” Rotterdam and Cape Town: Global Center on Adaptation and Climate and Development Knowledge Network.

Glover, Dominic, James Sumberg, Giel Ton, Jens Andersson, and Lone Badstue. 2019. “Rethinking Technological Change in Smallholder Agriculture.” *Outlook on Agriculture* 48 (3): 169–80.

Gupta, Tanaya Dutta, Bia Carneiro, Frans Schapendonk, Grazia Pacillo, Ma Suza, and Peter Läderach. 2023. “Through the Lens of Inequality: What Can We Learn from CGIAR as a Case Study of Research on the Climate–security Nexus?” *International Development Planning Review* (April): 1–26.

Hassan, Waqar Ul, Munir Ahmad Nayak, and Mohd Farooq Azam. 2024. “Intensifying Spatially Compound Heatwaves: Global Implications to Crop Production and Human Population.” *Science of the Total Environment* 932 (172914): 172914.

Hellin, Jon, Eleanor Fisher, Mary Ng’endo, Ana María Loboguerrero, Nyang ’ori Ohenjo, and Sabrina Rose. 2024. “Enhancing Indigenous Peoples’ Participation in Climate Policy Processes.” *PLOS Climate* 3 (4): e0000392.

Hewitt, C. D., E. Allis, S. J. Mason, M. Muth, R. Pulwarty, J. Shumake-Guillemot, A. Bucher, et al. 2020. “Making Society Climate Resilient: International Progress under the Global Framework for Climate Services.” *Bulletin of the American Meteorological Society* 101 (2): E237–52.

Hidrobo, Melissa, Amber Peterman, Neha Kumar, Monica Lambon-Quayefio, Shalini Roy, Daniel O. Gilligan, and Flor Paz. 2024. *Social Protection and Gender: Policy, Practice, and Research*. IFPRI Discussion Paper 2257. Washington, DC: International Food Policy Research Institute. https://hdl.handle.net/10568/144240

Holleman, C., Conti, and V. 2020. *Role of Income Inequality in Shaping Outcomes on Individual Food Insecurity: Background Paper for The State of Food Security and Nutrition in the World 2019.* FAO Agricultural Development Economics Working Paper 19-06. Rome: FAO.

Huyer, Sophia, Ana Maria Loboguerrero, Nitya Chanana, and Olga Spellman. 2024. "From Gender Gaps to Gender-Transformative Climate-Smart Agriculture." *Current Opinion in Environmental Sustainability* 67 (101415): 101415.

IPCC (Intergovernmental Panel on Climate Change). 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: Summary for Policymakers*. Geneva: IPCC.

IPCC. 2023. *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, H. Lee and J. Romero (eds.)]. Geneva: IPCC. doi: 10.59327/IPCC/AR6-9789291691647.

ISDC (CGIAR Independent Science for Development Council). 2023. "Megatrends and CGIAR's Research Portfolio." ISDC Standing Panel on Impact Assessment. https://iaes.cgiar.org/isdc/megatrends/

Ivanovich, Catherine C., Tianyi Sun, Doria R. Gordon, and Ilissa B. Ocko. 2023. "Future Warming from Global Food Consumption." *Nature Climate Change* 13 (3): 297–302.

Jackson, R. B., M. Saunois, A. Martinez, J. G. Canadell, X. Yu, M. Li, B. Poulter, et al. 2024. "Human Activities Now Fuel Two-Thirds of Global Methane Emissions." *Environmental Research Letters: ERL [Web Site]* 19 (10): 101002.

Johnson, N. 2022. "Measuring the Impact of Integrated Systems Research: Promising Approaches and Why CGIAR Needs to Care." International Water Management Institute (IWMI) and CGIAR Research Program on Water, Land and Ecosystems (WLE). https://play.google.com/store/books/details?id=CjI4EAAAQBAJ

Lam, Remi, Alvaro Sanchez-Gonzalez, Matthew Willson, Peter Wirnsberger, Meire Fortunato, Ferran Alet, Suman Ravuri, et al. 2023. "Learning Skillful Medium-Range Global Weather Forecasting." *Science* 382 (6677): 1416–21.

Lee, Yeyoung, Beliyou Haile, Greg Seymour, and Carlo Azzarri. 2021. "The Heat Never Bothered Me Anyway: Gender-Specific Response of Agricultural Labor to Climatic Shocks in Tanzania." *Applied Economic Perspectives and Policy* 43 (2): 732–49.

Lesk, Corey, Weston Anderson, Angela Rigden, Onoriode Coast, Jonas Jägermeyr, Sonali McDermid, Kyle F. Davis, and Megan Konar. 2022. "Compound Heat and Moisture Extreme Impacts on Global Crop Yields under Climate Change." *Nature Reviews. Earth and Environment* 3 (12): 872–89.

Loboguerrero, Ana Maria, Francisco Boshell, Gloria León, Deissy Martinez-Baron, Diana Giraldo, Liliana Recaman Mejía, Eliecer Díaz, and James Cock. 2018. "Bridging the Gap between Climate Science and Farmers in Colombia." *Climate Risk Management* 22 (January):67–81.

Luedeling, E., C. Whitney, A. Wilkes, E. Aynekulu, and T. Rosenstock. 2022. "Limitations of Using Simple Indicators for Evaluating Agricultural Emission Reductions at Farm Level: Evidence from Kenyan Smallholder Dairy Production." *Carbon Footprints* 2 (3). https://doi.org/10.20517/cf.2022.11

Naess, Lars Otto, John Thompson, and Bridget Allen-O'Neil. 2023. "Agricultural Innovation and Climate Change Adaptation: A Framework for Analysis." In *Handbook on Climate Change and Technology*, 324–37. Cheltenham, UK: Edward Elgar.

Nash, Julie, N. Gurwick, E. Wollenberg, C. Costa, and G. Galford. 2015. "Methods for Identifying Low Emissions Development Options for Agriculture." CCAFS Working Paper no. 147. Copenhagen: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). https://cgspace.cgiar.org/handle/10568/69449

Nico, Gianluigi, and Carlo Azzarri. 2024. "Climate Change and Sex-Specific Labor Intensity: An Empirical Analysis in Africa." *Global Food Security* 42 (100799): 100799.

Niggli, Laura, Christian Huggel, Veruska Muccione, Raphael Neukom, and Nadine Salzmann. 2022. "Towards Improved Understanding of Cascading and Interconnected Risks from Concurrent Weather Extremes: Analysis of Historical Heat and Drought Extreme Events." *PLOS Climate* 1 (8): e0000057.

Nowak, Andreea C., Lucy Njuguna, Julian Ramirez-Villegas, Pytrik Reidsma, Krystal Crumpler, and Todd S. Rosenstock. 2024. "Enhanced Policy Adequacy Facilitates National Climate Adaptation Tracking across Africa." *Nature Climate Change* 14 (8): 787–88.

Paglialunga, Elena, Andrea Coveri, and Antonello Zanfei. 2022. "Climate Change and within-Country Inequality: New Evidence from a Global Perspective." *World Development* 159 (106030): 106030.

Partey, S. T., R. B. Zougmoré, M. Ouédraogo, and B. M. Campbell. 2018. "Developing Climate-Smart Agriculture to Face Climate Variability in West Africa: Challenges and Lessons Learnt." *Journal of Cleaner Production* 187: 285–295.

Poljanšek, K., S. Marzi, L. Galimberti, D. Dalla Valle, J. S. Pal, A. H. Essenfelder, J. Mysiak, and C. Corbane. 2022. “INFORM Climate Change Risk Index: Concept and Methodology.” Luxembourg: Publications Office of the European Union.

Pretty, Jules, Tim G. Benton, Zareen Pervez Bharucha, Lynn V. Dicks, Cornelia Butler Flora, H. Charles J. Godfray, Dave Goulson, et al. 2018. “Global Assessment of Agricultural System Redesign for Sustainable Intensification.” *Nature Sustainability* 1 (8): 441–46.

Queiroz, Cibele, Albert V. Norström, Andrea Downing, Zuzana V. Harmáčková, Cedric De Coning, Vanessa Adams, Mohamed Bakarr, et al. 2021. “Investment in Resilient Food Systems in the Most Vulnerable and Fragile Regions Is Critical.” *Nature Food* 2 (8): 546–51.

Rahman, M. Feisal, Danielle Falzon, Stacy-Ann Robinson, Laura Kuhl, Ross Westoby, Jessica Omukuti, E. Lisa F. Schipper, et al. 2023. “Locally Led Adaptation: Promise, Pitfalls, and Possibilities.” *Ambio* 52 (10): 1543–57.

Raleigh, Clionadh, Andrew Linke, Sam Barrett, and Elham Kazemi. 2024. “Climate Finance and Conflict: Adaptation amid Instability.” *Lancet Planetary Health* 8 (1): e51–60.

Rosenstock, Todd S., Namita Joshi, Alcade C. Segnon, Laura Cramer, Caroline Mwongera, Andreea C. Nowak, Lucy Njuguna, Elliot R. Dossou-Yovo, Peter Steward, and Julian Ramirez-Villegas. 2024. “Decision Support Tools for Agricultural Adaptation in Africa.” *Nature Food* 5 (3): 186–88.

Rosenstock, Todd S., and Andreas Wilkes. 2021. “Reorienting Emissions Research to Catalyse African Agricultural Development.” *Nature Climate Change* 11 (6): 463–65.

Sanz-Barbero, Belén, Patricia López Pereira, Gregorio Barrio, and Carmen Vives-Cases. 2018. “Intimate Partner Violence against Young Women: Prevalence and Associated Factors in Europe.” *Journal of Epidemiology and Community Health* 72 (7): 611–16.

Schipper, L. F., A. Revi, B. L. Preston, E. R. Carr, S. H. Eriksen, L. R. Fernández-Carri, and B. Glavovic. 2022. “Climate Resilient Development Pathways.” In *IPCC WGII Sixth Assessment Report. Climate Change 2022*. Geneva: IPCC.

Siegel, Frederic R. 2021. “Food 2050: More Mouths to Feed—Food Availability and Access.” In *The Earth’s Human Carrying Capacity: Limitations Assessed, Solutions Proposed*, edited by Frederic R. Siegel, 87–107. Cham, Switzerland: Springer International.

Sikka, Alok K., Mohammad Faiz Alam, and Vidya Mandave. 2022. “Agricultural Water Management Practices to Improve the Climate Resilience of Irrigated Agriculture in India.” *Irrigation and Drainage Systems* 71 (S1): 7–26.

Sultana, Farhana. 2022. “Critical Climate Justice.” *Geographical Journal* 188 (1): 118–24.

UNCCD (United Nations Convention to Combat Desertification). 2024. “UNCCD Data Dashboard.” https://data.unccd.int

UNDRR (United Nations Office for Disaster Risk Reduction) and WMO (World Meteorological Organization). 2023. *Global Status of Multi-Hazard Early Warning Systems*. Geneva.

UNFCCC (United Nations Framework Convention on Climate Change). 2024. *Second Report on the Determination of the Needs of Developing Country Parties Related to Implementing the Convention and the Paris Agreement*. SCF/2024/35/4, Annex I.

UNHCR (UN Refugee Agency). 2024. “Global Trends in Forced Displacement in 2023.” Geneva. https://www.unhcr.org/global-trends-report-2023

Vaughan, Catherine, James Hansen, Philippe Roudier, Paul Watkiss, and Edward Carr. 2019. “Evaluating Agricultural Weather and Climate Services in Africa: Evidence, Methods, and a Learning Agenda.” *Wiley Interdisciplinary Reviews. Climate Change* 10 (4): e586.

Vermeulen, Sonja J., Dhanush Dinesh, S. Mark Howden, Laura Cramer, and Philip K. Thornton. 2018. “Transformation in Practice: A Review of Empirical Cases of Transformational Adaptation in Agriculture under Climate Change.” *Frontiers in Sustainable Food Systems* 2 (October). https://doi.org/10.3389/fsufs.2018.00065

Vincent, Katharine. 2023. “Development Geography II: Community-Based Adaptation and Locally-Led Adaptation.” *Progress in Human Geography* 47 (4): 604–12.

Whitfield, Stephen, Marina Apgar, Chikondi Chabvuta, Andrew Challinor, Karl Deering, Andrew Dougill, Abid Gulzar, et al. 2021. “A Framework for Examining Justice in Food System Transformations Research.” *Nature Food* 2 (6): 383–85.

Yet, Barbaros, Christine Lamanna, Keith D. Shepherd, and Todd S. Rosenstock. 2020. “Evidence-Based Investment Selection: Prioritizing Agricultural Development Investments under Climatic and Socio-Political Risk Using Bayesian Networks.” *PLOS One* 15 (6): e0234213.

CGIAR

Climate Action Program

Appendix

November 15, 2024

Appendix 1. Comparative advantage (Section 4 of the proposal)

Table A1.1. Comparative advantage analysis for the Climate Action Program's six high-level outputs

High-level output	Needed sources of CA required to deliver the high-level output	CGIAR's sources of CA in delivering the high-level output	Potential partner types	Partners' sources of CA in delivering the high-level output	Analysis and indication of where CA lies
Pipeline of adaptation and mitigation solutions tailored for different users and contexts **Prioritized science** for advancing adaptation and low-emission development action, based on demand and impacts **Data, evidence, and knowledge** for climate-specific and climate-sensitive policymaking, implementation, and climate finance **Frameworks, tools, methods**, and analytics for climate action	**Human capital (HC)** 1. Transdisciplinary scientists bringing systems solutions 2. Social scientists to focus on adoption and scaling process, inclusiveness: economic drivers, gender 3. Data analysts: Biometrician, climate and systems modelers 4. Skills and knowledge **Biophysical capital (BC)** 1. Field station and on-farm experimental facilities for adaptive research and demonstration 2. Infrastructure, instruments to measure food, land and water systems. 3. Secure data storage and computing facilities 4. Access to global data and modeling outputs 5. Presence on the ground **Social capital (SC)** 1. Relevant partnerships and networks to co-design and implement 2. Long-term relationships and commitment with national R4D organizations to achieve impact 3. Long-term scientific links to newest discoveries and adaptive research **Incentives (I)** 1. Incentives for NARES: Increased capacity, international scientific links, enhanced delivery of mandates. 2. CGIAR: creation and publication of IPGs, stakeholder impact, delivery of mandate. 3. National universities, ARIs: Increased capacity, access to data, collaborations, links for student projects 4. CBOs and INGOs: access to innovations and technical assistance, new business models, delivery of mission.	Considering all CGIAR centers collaborating in Climate Action: **Human capital** • 1–3: cover all required disciplines • 4: Knowledge hubs for innovations, science, data, methods *STRONG* **Biophysical capital** • 1: Access to modern laboratories, experimental facilities in SE Asia, South Asia, Africa, and Latin America • 2–5: All CGIAR centers • cover target regions and have varying country presence. *MODERATELY STRONG* **SC** • 1: Strong partnerships and networks with NARES and community-based (CBOs), farmer organizations (FOs) • 2: Long-term relationships and commitment with national R4D organizations through physical presence • 3: Long-term scientific links with partner universities through capacity development and joint projects and publications. *MODERATELY STRONG* **Incentives:** • Publication of IPGs • Proof of impact for developed and scaled innovations • Opportunity to address very diverse challenges (e.g. approaches such as living labs/locally led adaptation) • Developing partner capacity and strong collaborations *STRONG*	**Current** • Demand partners (DPs): NARES, governments, CBOs, FOs, funders, private sector • Innovation partners (IPs): internal CGIAR, NARES, universities, ARIs, CBOs, MSP/IPs • Scaling partners (SPs): internal CGIAR, governments, (I)NGOs, development actors and projects, private sector **New/expanded** Demand partners: • Country governments (e.g., NDC support); funders: AfDB, ADB, WB, IFAD • Regional agricultural research organizations (FARA, ASARECA, CCARDESA, CORAF) • Intergovernmental organizations (IGAD, COMESA (Common Market for Eastern and Southern Africa) **IPs:** • ARIs • International research institutes and universities **SPs:** • INGOs	**Current** **NARES/national universities:** **Human capital** • 1–3: partly covering, usually weaker in transdisciplinary systems sciences, social sciences and data analytics • 4: not always to the required level *MODERATE* **Biophysical capital** • In most cases access to 1–3 but often not adequate. • 4: Limited • 5: Variable across target countries *MODERATE* **Social capital** • 1+2: good • 3: Generally less developed *MODERATE* **Incentives** • Increased technical capacity and international scientific links • High impact publication and evidence of scaling • Opportunities for collaborations, funding and higher-level education (within country and abroad) *STRONG* **Government:** **Human capital** • 1–3: partly cover knowledge required for articulating demand and scaling depending on geography • 4: not always aware *WEAK to MODERATE* **Biophysical capital** • In most cases access to 1–3 but not always fully functional • 4: rare • 5: very varied across target countries *MODERATE* **Social capital** • 1+2: very good • 3: weak or moderate **Incentives:** • Impact on the ground • Increased technical capacity • Access to innovations and technical assistance, international scientific links • New business models *MODERATE* **CBOs/FOs** **Human capital:** • Usually limited technical capacity and skills for innovation implementation • Have the traditional organizational setup for implementation, traditional knowledge and skills *MODERATE* **Biophysical capital**: • Not applicable but access to farmer, pastoralist, fisher groups for applied demonstrations, engagement. *WEAK* **Social capital**: • Excellent because of strong social networks (bonds and trust) and building on traditional institutions *STRONG* **Incentives**: • Access to innovations and new practices, inputs, technical backstopping, expectation to increase incomes and improve livelihoods *STRONG*	CA largely sits with CGIAR with regard to scientific human capital, knowledge, and skills because of its coverage and global reach; CGIAR also has a CA to some extent on specific biophysical capital, especially infrastructure, but with limited geographical coverage for field experimentation. CGIARhas global coverage for data and computing-related aspects. Via long-term presence and formal country agreements, CGIAR has the social capital, networks, and influence to convene partners for co-designing and implementing innovations, policy influence, etc., that can generate impact on the ground. Incentives for delivering this HLO are high for CGIAR and nearly all partners. To overcome some limitations in CGIAR's CA, the strategy will be to utilize: • the CA of NARES with regard to their human capital in some areas (technical related to the context) and SC, • the CA of selected ARIs in providing in-depth and blue-sky expertise and modern infrastructure, • the CA of government using their presence on the ground and their ability to change policy, enable implementation and scaling. Given the CA of INGOs and Regional agricultural organizations in terms of their specific human capital related to understanding broader context and political landscapes and their social capital, we shall explore more strategic partnerships with these organizations for country delivery of innovations.

High-level output	Needed sources of CA required to deliver the high-level output	CGIAR's sources of CA in delivering the high-level output	Potential partner types	Partners' sources of CA in delivering the high-level output	Analysis and indication of where CA lies
				Private sector (value chain linkages) **Human capital:** • Specialized expertise and capacity • Business orientation which helps to ensure sustainability *POTENTIALLY STRONG for delivery and scaling.* **Biophysical capital:** • Infrastructure on the ground linked to business opportunities *POTENTIALLY STRONG* **Social capital:** • Business networks, linkages to government and donor communities *POTENTIALLY STRONG* **Incentives:** • Access to innovation that can lead to new business opportunities • Technical backstopping • Financial support *MODERATE TO STRONG*	
				Advanced research institutes (ARIs) **Human capital**: • 1–3: across different institutes covering all required disciplines • 4: Knowledge hub for Innovations *STRONG* **Biophysical capital:** • 1+2: Access to good quality laboratories and experimental facilities, measurement capabilities. • 3+4: Usually limited but improving • 5: only very limited presence on the ground *MODERATE* **Social capital:** • Long-term scientific links with partner universities through capacity development and joint publications *WEAK TO MODERATE* **Incentives:** • Publication of IPGs • Proof for developed and used innovations. • Opportunity to address very diverse challenges (living labs) • Impact on the ground, • Developing partner capacity and strong human ties *STRONG*	
				New partners **INGOs & Regional agricultural organizations** **Human capital:** • 1–3: cover knowledge required for articulating demand; understanding regional broader issues and context and political landscapes • 4: some skills and knowledge *MODERATE* **Biophysical capital**: • 1-4: Dependent on country infrastructure and partnership. Some regional organizations (e.g. AGRYMET, IGAD) developing high level capabilities for data and modeling of climate for example. • 5: varied across orgs, most depend on national partners *WEAK TO MODERATE* **Social capital:** • Good linkages and networks with NARES, local NGOs and governments with grassroot organizations and civil society *MODERATE TO STRONG* **Incentives:** • Impact on the ground • Increased technical capacity • Access to innovations and new business models *WEAK TO MODERATE*	

High-level output	Needed sources of CA required to deliver the high-level output	CGIAR's sources of CA in delivering the high-level output	Potential partner types	Partners' sources of CA in delivering the high-level output	Analysis and indication of where CA lies
Science and climate **policy** and other **multi-stakeholder platforms** Innovative **models** of capacity sharing and training	**Human capital (HC):** 1. Development economists, policy specialists, climate knowledge brokers 2. GSI scientists to ensure gender integration in policy design 3. Social scientists specialized in policy analysis and governance 4. Subject matter experts (FLW systems) for technical guidance 5. Engagement facilitator to facilitate policy dialogue and engagement **Physical capital (PC)**: 1. Presence in countries, local context **Social capital (SC)** 1. Relationships with regional, national, local government 2. Links to private sector actors 3. Relationship with nonstate actors (NGOs, CBOs, CSOs, etc.) 4. Long-term relationships with local universities, NARES, think tanks 5. Established relationships with influential academics and experts 6. Established relationships with reputable personalities with substantial institutional connections. **Incentives (I)** 1. Incentives for CGIAR: public good through greater influence on policy for impact, influence and capacity development to support the mission 2. Incentives for funder: value for money, increased impact 3. Incentive for government: political influence and visibility. Implementation of good policy. 4. Incentives for local universities, NARES, and think tanks: visibility and influence. Delivery of mission 5. Incentives for private sectors: positive business environment 6. Incentives for non-state actors: visibility and influence. Delivery of mandate.	**Human capital:** • Across the CGIAR all areas are strongly covered *STRONG* **Physical capital:** • Present in most countries, but not all human capital areas present *MODERATELY STRONG* **Social capital:** • 1, 3, 4 available through host country arrangements • 2, 5, 6 dependent on CG individuals and their networks *STRONG* **Incentives:** Incentives for CGIAR - greater influence on policy for impact *STRONG*	**Demand partners (DPs):** • **Governments** (regional, national, local, parastatals) • **Funders** (World Bank, AfDB, ADB, IDB, philanthropic foundations, aid agencies) • **Private sector** (associations, FPs, value chain actors) • N**onstate actors** (CSOs, CBOs, NGOs) **Innovation Partners (IPs):** **Internal CGIAR** • **Governments** (regional, national, local, service delivery parastatals) • **Universities, NARES, think tanks** • **Nonstate actors** (CSOs) • **Private sector** **Scaling partners (SPs):** • **Governments** (regional, national, local, service delivery parastatals) • **Funders** (World Bank, AfDB, ADB, IDB, Philanthropic Foundation, AID Agencies) • **Nonstate actors** (CSOs) • Private sector	**Current:** **Private sector:** **Human capital:** Limited, some applied technical expertise available. *WEAK* **Physical capital:** Presence in country and context *STRONG* **Social capital:** All available to partially available *MODERATELY STRONG* **Incentives:** Incentives for private sectors: greater stake in policy as key actor affected by policy environment *STRONG* **Governments:** **Human capital**: 1, 2, 3, available but with lower capacity; 4 can be available, 5 rarely available. *MODERATELY STRONG* **Physical capital:** 1 is available *STRONG* **Social capital:** 1–6 are available but goodwill sometimes compromised by misaligned political interests *MODERATELY STRONG* **Incentives:** Incentive for government: political influence and visibility *STRONG* **Universities, NARES, think tanks** **Human capital:** 1–5 available, 6 partially available *STRONG* **Physical capital:** 1 is available *STRONG* **Social capital:** 1, 4, 5 available, 2, 3, 6 partially available *MODERATELY STRONG* **Incentives:** Incentives for local universities, NARES, and think tanks: visibility and influence *STRONG* **Funders** **Human capital:** 1–4 are available but sometimes not specialized, 5 partially available *WEAK* **Physical capital:** 1 is available but remotely engaged *MODERATELY STRONG* **Social capital:** 1, 3, 4, 5, 6 available, 2 partially available *STRONG* **Incentives:** Incentives for donors: value for money, increased impact *STRONG* **Nonstate actors** **Human capital:** 1–5 could be available but usually at low level of expertise *WEAK* **Physical capital:** 1 is available *STRONG* **Social capital:** 1, 2, 3 and 6 available; 4 and 6 partially available, 5 hardly available *MODERATELY STRONG* **Incentives:** Incentives for nonstate actors: visibility and influence. *STRONG*	CGIAR CA: Policy design and engagement processes generally strong and benefit from partnerships with NARES, local universities and think tanks. Partnership with private sector actors will also bring the CA of advocacy for positive policy environments, enhancing private sector participation. As the lead policy implementer, partnership with government is paramount, as favorable policies are aligned with government incentives for political influence and visibility. Nonstate actors bring the CA of grassroot connections and working relationships with government, which positions them for advocacy and community engagement facilitation role needed in policy process

Note: HC = human capital, BC = biophysical capital, SC = social capital, I = incentives.

Appendix 2. Climate Action Program's 2030 targets

Nested climate targets

The Climate Action Program plays a pivotal role in supporting the CGIAR system to achieve its system-wide climate targets while also directly contributing through its own work, supported by both pooled and bilateral funding mechanisms. As such, for each indicator, Climate Action will need to set four nested targets:

1. System-wide: The overarching target for CGIAR under the Program/Accelerators.
2. Climate Action-specific: The direct contributions of Climate Action to these targets.
3. Pooled funding: The portion of the Climate Action target supported by "pooled" (W1W2) funding.
4. Bilateral funding: The portion of the Climate Action target achieved through bilateral projects mapped to Climate Action.

Currently, the processes for reporting, attribution, and outcome contributions are still being refined. Therefore, all target values at this stage should be considered indicative. Collaborative work across Programs and Accelerators will be essential to finalize and implement these targets effectively. We recommend that all targets be revised during the Inception Phase to ensure alignment with both CGIAR system-wide goals and evolving funding mechanisms.

CGIAR 2030 climate outcomes and indicators

Climate Action's 2030 outcome targets directly match the CGIAR Research 2030 Research Strategy and Results Frameworks Indicators for the Climate Change Impact Area. This includes three primary goals, with indicators in parentheses (CGIAR Results Framework v3, March 2024):

1. Equip 500 million small-scale producers to be resilient to climate shocks, with climate adaptation solutions available through national innovation systems (# people benefiting from climate-adapted innovations).
2. Implement all national adaptation plans (NAPs) and nationally determined contributions (NDCs) to the Paris Agreement (# plans with evidence of implementation, #$ invested in climate adaptation investments).
3. Turn agriculture and forest systems into a net sink for carbon by 2050, with emissions from agriculture decreasing by 1 Gt per year by 2030 and reaching a floor of 5 Gt per year by 2050 (# tons CO_2e).

Climate Action modifies the indicators for goals 1 and 2 above to be inclusive of mitigation and reflect the scope of the program. Additionally, while goal 3 is primarily an indicator of impacts (not outcomes), it is crucial to highlight its long-term importance in achieving climate goals and reducing future climate hazards. Climate Action has set ambitious programmatic targets for each goal. The system-wide contribution and relative proportion to pooled versus bilateral will be needed**.**

People benefiting (38 million)

Indicator: # of people benefiting from climate innovations, adaptation, or mitigation

Climate Action itself aims to reach more than 38 million people (equivalent to 10 million households, assuming an average household size of five people). This target is broken down across several key Areas of Work (AoWs): 30 million individuals will be engaged through AoW 2: Digital Climate Risk Management, 8 million through AoW 3: Locally Led Adaptation, and an unknown number through Low Emissions Innovations. To provide context, a recent study suggests 260–305 million smallholder farms in Asia and Africa (1.3–1.5 billion people, assuming the same average household size) may benefit from weather forecasts, making our target equal to less than 3% of potential people.

AoW 2: Digital Climate Risk Management (30 million producers)

The largest proportion of the 38 million target — 30 million people — will be reached through innovations in Digital Climate Risk Management. These innovations include advanced climate information services, early warning systems (EWS), and decision-support tools designed to empower small-scale producers to make informed decisions in response to climate variability and extremes. Leveraging mobile platforms, satellite data, and radio-based advisory services has already demonstrated the ability to scale rapidly, reaching vast numbers of people with localized, actionable climate information. For example, the bilateral project AICCRA (Accelerating Impacts of CGIAR Climate Research for Africa) reports reaching more than 3 million people in its first three years by collaborating with digital providers in six African countries. Similarly, the CCAFS (Climate Change, Agriculture, and Food Security) program has successfully reached nearly 6 million farmers in Senegal and 1 million in India in just one year through similar initiatives. These examples highlight the rapid scalability of digital climate risk management tools when embedded into national and regional innovation systems.

Early warning systems have proven to be particularly impactful. For instance, the CREWS Initiative (Climate Risk and Early Warning Systems) has provided access to forecasts and early warning services to over 396 million people across 45 countries since 2017, with significant advancements in 2023, when more than 125 million people benefited from improved services across Africa, Asia Pacific, and the Caribbean. Integrating these systems ensures that farmers are informed about climate risks and equipped with strategies to safeguard their livelihoods. Given the demonstrated scale and cost-effectiveness of innovations in this Area of Work, the goal of reaching 30 million people may, in fact, be a conservative estimate. However, a key consideration is how effectively this information leads to behavior change among producers. Research indicates promising results, with some studies showing income increases of 19% to over 60% due to improved access to climate information (Vaughan et al. 2019). Building on these insights, this AoW will focus on further refining the mechanisms that drive behavior change and innovating to enhance the usability and impact of digital services.

AoW 3: Locally Led Adaptation (8 million small-scale producers)

AoW 3 aims to engage 8 million producers by leveraging community-driven approaches to foster resilience at the grassroots level. This AoW prioritizes empowering communities, including marginalized groups such as women and youth, to lead in designing and implementing adaptation strategies. While locally led approaches have a track record of success, they have often been difficult to scale. To address this challenge, AoW 3.2 will work with meso-scale partners—organizations that can connect local to higher-level efforts. A prime example is a potential collaboration with the Rainforest Alliance, which works with 4 million producers in coffee and cocoa production systems. Rainforest Alliance needs practical indicators that are meaningful for producers for tracking adaptation and resilience, and working together offers an opportunity to scale locally led adaptation (LLA) through the Alliance's certification schemes, which reach 4 million farmers. As of late 2024, ongoing LLA and scaling work in Kenya implemented as part of the Livestock and Climate Initiative is reaching 60,000 mixed crop-dairy farmers with improved feeding practices as well as a strengthened local knowledge exchange network involving producers, cooperatives, dairy companies, the local private sector, agricultural extension agents, and county officials. Such partnerships help improve inclusive decision-making in these programs that help reach scale.

Low-Emission Innovations (unknown)

The benefits of the Low-Emission Innovations work package are estimated based on the potential for emission reductions in key targeted countries (see "Climate Change Mitigation" below). Achieving these emission reductions will require changes in food, land, and water systems management. However, estimating the number of people who will benefit from this Area of Work is not currently feasible. Future assessments can downscale these assessments and disaggregate them to key emission sources in the targeted countries.

Policies informed (100 policies)

# of policies informed

The Climate Action Program will be a key source of climate information and knowledge, influencing both climate-specific and general sectoral policies. Key opportunities include the NDC revisions, which countries submit every five years, including in 2025 and 2030; NAPs, which the UNFCCC decided in 2024 that every country must have by 2030 and for which the Green Climate Fund has set aside funding to support their development; and Long-Term Low Emission Development Strategies (LT-LEDS), which are increasingly being developed to support long-term visions for low-carbon growth. Additionally, countries must submit documents to the UNFCCC, such as Biennial Transparency Reports (BTRs), due every two years, which require reporting on GHG emissions, and Adaptation Communications (Ad Comms), which provide updates on adaptation progress. Together these represent significant opportunities for the Program to shape national and international climate action strategies.

Localizing and implementing these national policies at the subnational level also provides avenues for impact. For instance, through programs like FLOCCA in Kenya, where all 54 countries are involved, the Climate Action Program can help ensure frameworks are adapted to local contexts. Beyond climate-specific policies, the Program, working with other Programs, can inform sectoral strategies in agriculture, water, and energy by providing critical climate data, ensuring these policies are climate-sensitive (e.g., through AoW 1 analytics). In addition to national and subnational policies, the program can influence regional policies through partnerships with organizations such as NEPAD and Regional Economic Communities (RECs), which coordinate climate action across multiple countries. These bodies provide platforms for the Program to engage with large-scale, regional frameworks, expanding the potential for policy impact across entire regions. By working with key partner organizations and addressing major challenges in the climate space, the program has the potential to influence multiple policies with singular pieces of work, amplifying its reach across global, regional, national, and subnational levels. Thus, we are moderately confident that our target is obtainable assuming adequate funding and appropriate organization of our efforts.

Climate finance (USD 15 billion)

The USD 15 billion climate finance target is relatively small compared with the estimated needs, which the UNFCCC projected to reach trillions by 2030 (UNFCCC 2024). However, USD 15 billion may seem large in comparison to some 2022–24 Initiatives, which secured investments in the tens of millions. The opportunity is clear. Major development finance institutions, such as the Green Climate Fund (GCF), IFAD's Adaptation for Smallholder Agriculture Program (ASAP), and the World Bank, often approve investments ranging from USD 200 to 500 million per project. For example, assuming an average project size of USD 250 million in each of the 30 target countries, half the target—USD 7.5 billion—could be met. The GCF has already invested more than USD 5 billion in agricultural projects. Additionally, the emerging carbon market for agriculture is estimated to be in the billions. Even the new Loss and Damage Fund, still in its early stages, stands at approximately USD 600 million. Achieving our USD 15 billion target will require new ways of working, including integrating science more closely into institutional decision-making processes. This means actively positioning ourselves as key advisors throughout these processes, ensuring that scientific insights shape how climate finance decisions are made.

Climate change mitigation (1 Gt CO_2e by 2030)

avoided losses of CO_2e

This represents roughly 17% of the system-wide target (1 Gt CO_2e/year). We calculated potential sequestration and avoided losses based on agroecological zones and average rates of soil carbon accumulation in our priority countries. During the inception phase, we will refine this target in line with updated implementation plans.