TECHNICAL NOTE

Low Emissions Agriculture and Food Systems Development: Opportunities in Support of Food Security and Climate Action

What is LEAFS?1

Low Emissions Agriculture and Food Systems (LEAFS) substantially reduce greenhouse gas (GHG) emissions compared to business as usual scenarios and/or emissions per unit of agricultural output.2

Globally, agriculture and food systems contribute roughly 30 percent of all GHG emissions, yet where these emissions come from and how they are produced varies dramatically. In some countries or regions, and in some markets, the potential to reduce GHG emissions is low. In these cases, USAID staff and development partners might choose to prioritize adaptation and reducing future emissions intensity. In other geographies and value chains, targeted mitigation actions are critical. Within a country, activity design and implementation often present opportunities to address broad climate-smart agriculture and food systems goals that include both mitigation and adaptation, whether via in-field practices or systemic policy or market interventions. Although this note focuses on terrestrial systems, fisheries/aquatic systems also provide low-carbon food sources.

How does this Technical Note relate to USAID strategies and existing guidance?

Climate mitigation in agriculture and food systems is a critical contribution to the Global Food Security Strategy and to USAID’s Climate Strategy, particularly the following strategy elements:

- Global Food Security Strategy Cross-cutting Intermediate Result 4 directly addresses “enhanced climate change adaptation and mitigation”. As a group, cross-cutting intermediate results 4 (improved natural resources management), 5 (improved water resources management), and 6

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1 Note: The US is also one of the leads of the Lowering Emissions by Accelerating Forest Finance (LEAF) Coalition, which is a distinct initiative that is not the topic of this technical note.
2 Emissions intensities.
(more effective governance, policies, and institutions) point to protecting resources to support mitigation efforts (as well as adaptation).

- **Climate Strategy Intermediate Result 1.1** (Catalyze urgent emission reductions and sequestration) and **Strategic Objective 2** (Catalyze transformative shifts to net-zero and resilient pathways); and the GHG emissions reduction target (6 billion tons CO2e by 2030, the majority of which we expect to come from **natural climate solutions**). Intermediate Result 1.1 includes a commitment by USAID to support countries to dramatically reduce emissions of short-lived climate pollutants like methane.

- Achieving LEAFS also integrates with priorities in the Biodiversity Policy, the Global Water Strategy, and the Resilience Policy, among others.

This technical note complements existing guidance relevant for advancing LEAFS. Examples include:

- The **Global Food Security Strategy activity design guidance** on Climate Smart Agriculture and Food Systems (CSAFS), which describes an approach to maintain or improve productivity, while acting to mitigate and adapt to climate change. Interventions under the CSAFS approach range from farm management practices to landscape action to systems change (e.g. markets, policy). The Strategy design guidance on Natural Resource Management explains links with agriculture at farm and landscape scales.

- Additional resources that support programming for LEAFS include: Agriculture’s Footprint, which describes biophysical, market, and governance approaches to avoid agriculture-driven deforestation that can result from extensifying production; generalized strategic approaches, including for sustainable supply chains generally and sustainable cattle production; and a feasibility analysis of interventions for low-emissions livestock in East Africa. In addition, analysis and capacity-building efforts through support to the CGIAR’s Low-Emissions Flagship within the Climate Change, Agriculture, and Food Security Program provide many useful examples of high-impact approaches to LEAFS programming.

- The United States launched the **Global Methane Pledge**, a global commitment to reduce global methane emissions at least 30 percent from 2020 levels by 2030. Agriculture is the source of roughly 45 percent of human-caused methane emissions, and methane traps roughly 80 times as much heat as carbon dioxide over twenty years, and it persists in the atmosphere for 9 to 15 years. Therefore, when methane emissions decline, the heat-trapping power of the atmosphere also quickly declines.

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4 By comparison, GHGs like carbon dioxide and nitrous oxide persist in the atmosphere for decades, resulting in long lag times between reduced emissions and reduced concentrations in the atmosphere.
Why Low Emissions Agriculture and Food Systems?

Need: If we are to meet the Paris Agreement goal to limit global temperature increase to 1.5-2.0 degrees above pre-industrial levels, the **agriculture and food system needs to be part of the solution**. The imperative to reduce emissions from the agriculture and food system in priority places rests on the observation that, across the planet, agriculture and food systems contribute **one-third of total anthropogenic GHG emissions**. Action is critical in countries with existing or projected large livestock populations or high rates of deforestation, peatland degradation, or mangrove loss driven by agriculture. In other countries, work to promote food security and low emission development pathways may reduce emissions per unit of output (emissions intensity) and avoid trajectories that lead to high emissions. See figure 1 below for a breakdown of emissions within agrifood systems.

Figure 1. Global emissions for land use and land use change related to agrifood systems

Opportunity: Not only is it necessary to achieve lower emissions through agriculture and food systems, it is possible to do it. Moreover, reductions in emissions intensity are generally aligned with economic gains from more efficient use of inputs, conservation of soil carbon and improved soil health, reduced erosion and sedimentation and other environmentally friendly outcomes. Agriculture and Food systems **hold enormous potential for climate mitigation actions** and low emissions development pathways.

Commitments: Finally, nations of the world are stepping up to this challenge. By 2015, 103 nations had committed to reduce greenhouse gas emissions from agriculture. By 2021, sixteen Low- and lower

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6 Agriculture’s large contribution arises because it produces substantial amounts of methane and nitrous oxide, both of which trap tremendous amounts of heat per molecule, and because it drives tropical deforestation.
middle-income countries had included specific agriculture mitigation measures in their NDCs⁹ and 50-70 percent of the countries with the highest potential for reducing GHG emissions in livestock and rice value chains or through soil carbon included mitigation measures in these subsectors in their NDCs.¹⁰

Figure 2. Global food systems emissions in 2020 by value chain, including land conversion¹¹

“Implementation of major mitigation actions for intensifying [Agriculture and] Food Systems based on existing low emission and carbon sequestration practices have the potential to reduce Food Systems emissions beyond net-zero by 2050 while increasing food production.” ¹²

A Global Challenge Requiring Context-Specific Solutions

As with many facets of international development, responding to the climate crisis is a global challenge that requires local, context-specific solutions. USAID’s development portfolio covers diverse partner countries from major GHG emitters to ones with historically low emissions.

In numerous countries where USAID works, agriculture and land use emissions dominate GHG emissions, and these sources are expected to increase as population and incomes grow, agricultural

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⁹ Bangladesh, Belize, Bhutan, Côte d’Ivoire, Indonesia, Liberia, Malawi, Mali, Nigeria, Pakistan, Rwanda, Senegal, Sierra Leone, Sri Lanka, Uganda, Viet Nam; see CCAFS database https://ccafs.cgiar.org/resources/tools/agriculture-in-the-ndcs-data-maps-2021


¹¹ Costa, C., E. Wollenberg., M.Benitez et al. 2022. Roadmap for achieving net-zero emissions in global food systems by 2050. Scientific Reports.12: 15064

¹² Ibid.
production intensifies, and dietary shifts increase demand for meat and dairy. Achieving LEAFS gains requires prioritizing low-emission development in areas with potential for globally or regionally significant impacts, such as emissions hotspots, areas projected to have very rapid emissions growth, and areas with high potential for carbon sequestration. The climate crisis and development inequalities should be considered together.

One major source of agricultural programming at USAID, the Feed the Future program, supports agricultural development through target and aligned efforts in approximately 40 countries, 35 of which are among the 50 poorest countries. In these places, where USAID invests heavily in food security and nutrition, agricultural productivity, resource use efficiency and GHG emissions are often among the lowest in the world. However, emissions are projected to rise throughout the agriculture and food system as these economies develop. In these countries, it is worth considering trajectories of agriculture-driven emissions into the future, decreasing emissions per output compared to business-as-usual scenarios, and supporting low emission development pathways.

The Agency tackles agriculture challenges across a wide range of USAID partner countries including major GHG emitters. Programs that advance LEAFS are often supported by funding targeted to reduce GHG emissions from land use change and land management and stem biodiversity loss. These investments typically also support economic development, strengthen governance and land rights, combat corruption, and/or empower marginalized peoples.

What parts of agriculture and food systems offer the highest impact opportunities to reduce GHGs?

Certain agricultural practices and components of agriculture and food systems stand out in their potential to reduce GHG emissions.

Produce and Protect
When paired with effective land governance and market interventions, increasing agricultural productivity could be an effective pathway to achieve climate, environmental, economic, and social objectives in low- and lower middle-income countries. Land governance means both formal and customary rules and incentives coupled with equitable enforcement, regulation to conserve valued resources including forests (Figure 3). Effective land governance across diverse land systems and large areas – often manifested as a mosaic of informal and formal governance mechanisms – is essential to prevent increased profitability from driving agricultural expansion and deforestation, and these program

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14 [https://unfccc.int/process/the-paris-agreement/long-term-strategies](https://unfccc.int/process/the-paris-agreement/long-term-strategies)

15 Outcomes of this approach can include: Reduced greenhouse gas emission intensities; greater resilience to climate change; improved incomes, food security, and household nutrition; and reduced pressure to expand cropland area, which currently accounts for three-fourths of food production gains in sub-Saharan Africa.
aspects require resources and focus. The ‘produce and protect’ approach is compelling because agriculture is both the major driver of land use change and deforestation and a dominant sector in many USAID countries.

Figure 3. Governance approaches that can reduce agriculturally driven deforestation.

Critical Crops and Value Chains
Several value chains merit strong consideration for climate change mitigation. It is well established that pasture expansion for cattle (beef and dairy) is by far the most important driver of tropical deforestation, and cattle are the largest source of agricultural methane emissions, producing more than the gas and oil sectors combined. Rice cultivation is a major source of emissions (also largely methane, owing to the use of flooded soils to grow rice). Oil palm and soy cultivation account for approximately 20 percent of deforestation. Substantial risks to forests also stem from rubber, coffee, cocoa, maize, and cassava. Addressing deforestation driven by commodity crops involves multiple facets such as finance, land use planning, trade, and supply chain transparency, traceability, and disclosure. USAID has a growing community of practice versed specifically in this approach to climate change mitigation in the agriculture sector.

17 From Miler et al. 2021. Agriculture’s Footprint
18 Pendrill et al. 2022. Disentangling the numbers behind agriculture-driven tropical deforestation Science, Vol 377, Issue 6611 DOI: 10.1126/science.abm9267
Figure 4. Research shows that certain agricultural practices can deliver meaningful reductions in emissions while also supporting economic development and food security.

Agricultural practices that have potential to significantly reduce GHG emissions include (left to right) (top row) agroforestry expansion, expansion of perennial crops to replace annual crops, grassland improvements and pasture management, improved soil management; (middle row) alternate wet-dry irrigation of rice, more efficient and climate-friendly management of fertilizers, reforestation of abandoned agricultural lands, avoided deforestation from agricultural expansion; (bottom row) improved feed quality, improved cattle herd management, silvopastoral systems and breeding, and improved water management. Images from InfoNotes developed by CCAFS and deforestation front photo by Edward Burtynsky.
Low-Emission Agricultural Practices

Table 1 summarizes a number of agricultural practices with high mitigation potential and includes co-benefits each practice often delivers for other common development objectives, which include food security, livelihoods, adaptation, biodiversity, health, pollution, energy, and water. Interventions to reduce emissions from livestock appear at the top because of the outsized GHG emissions resulting from ruminant livestock and the associated potential for climate change mitigation. In addition to the livestock management practices listed in table 1, cattle herd management and fodder production merit consideration. Land use change appears second in this table because deforestation (often driven by cattle expansion) is a second dominant LEAFS pathway.

Of the many crop management practices available to growers, a relatively small number meaningfully influence GHG emissions, and the third section of Table 1 summarizes many of them. They include choices about fertilizer type and application, rice field management, agroforestry, and tillage, which are often pursued for food security and livelihood benefits. Additional practices not listed individually in Table 1, such as biomass burning (an aspect of residue management), can also offer substantial mitigation potential.

The fourth and fifth sections of Table 1 outline improved supply chains and demand-side drivers, extend the traditional definition of ‘agricultural practices’ and reflect a growing recognition of the need to consider food systems in their entirety. Going beyond the farm field, approaches that have high potential to reduce emissions include reducing post-harvest loss and food waste, and shifting existing diets or dietary trajectories away from foods with high carbon footprints. The section below on ‘systems perspective’ elaborates on these demand-side measures.

An assessment of how several USAID agriculture (primarily Feed the Future) programs influence GHG emissions produced nine InfoNotes that illustrate how several high-impact practices contribute to low-emissions agricultural development. Often, one or two practices vastly dominated the GHG benefits achieved. For example, in Honduras’ ACCESO (Spanish for access) activity, perennial crop expansion dwarfed the combined contributions of improved soil management, improved water management, improved feed quality, improved fertilizer management, and improved grassland management (Figure 5).

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20 Figure 4 in: Nash et al. 2016. CCAFS InfoNote. ACCESO in Honduras: Mitigation co-benefits of perennial crop expansion, soil management, and livestock improvements
<table>
<thead>
<tr>
<th>Food System Responses</th>
<th>Mitigation Potential</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improved Livestock Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silvopastoral systems&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Very High</td>
<td>Food Security, Livelihoods, Adaptation, Biodiversity</td>
</tr>
<tr>
<td>Methane inhibitors&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Very High</td>
<td>NA/Unknown</td>
</tr>
<tr>
<td>Feed and fodder banks&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation, Biodiversity</td>
</tr>
<tr>
<td>Seasonal feed supplementation&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation, Biodiversity</td>
</tr>
<tr>
<td>Improved animal health and parasite control&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation</td>
</tr>
<tr>
<td>Improved manure management&lt;sup&gt;2&lt;/sup&gt;</td>
<td>High</td>
<td>Pollution, Water</td>
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<tr>
<td><strong>Land use change</strong></td>
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<td></td>
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<tr>
<td>Reduced deforestation / forest degradation&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Very High</td>
<td>Adaptation, Biodiversity</td>
</tr>
<tr>
<td>Reduced grassland conversion to cropland&lt;sup&gt;2&lt;/sup&gt;</td>
<td>High</td>
<td>Adaptation, Biodiversity</td>
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<tr>
<td><strong>Improved Crop Management</strong></td>
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<tr>
<td>Increased soil organic matter content&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Very High</td>
<td>Food Security, Livelihoods, Adaptation, Biodiversity, Water</td>
</tr>
<tr>
<td>Residue management and cover crops&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Very High</td>
<td>Food Security, Adaptation, Biodiversity, Pollution</td>
</tr>
<tr>
<td>Precision fertilizer management&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation, Pollutio</td>
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<tr>
<td>Biochar application to soil&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Adaptation, Livelihoods</td>
</tr>
<tr>
<td>Agroforestry&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation, Biodiversity</td>
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<tr>
<td>Changes in crop area, land rehabilitation (enclosures, afforestation), replacing annual with perennial farming&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Adaptation, Livelihoods, Biodiversity, Water</td>
</tr>
<tr>
<td>Tillage and crop establishment&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation, Biodiversity, Water</td>
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<tr>
<td>Reduced flooding in rice fields&lt;sup&gt;3&lt;/sup&gt;</td>
<td>High</td>
<td>Adaptation, Water</td>
</tr>
<tr>
<td>Crop–livestock systems&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation, Biodiversity</td>
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<tr>
<td><strong>Improved Supply Chains</strong></td>
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<tr>
<td>Reduce food loss&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Very High</td>
<td>Food Security, Livelihoods, Adaptation</td>
</tr>
<tr>
<td>Improved food transport and distribution&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Adaptation, Food Security</td>
</tr>
<tr>
<td>Improved efficiency and sustainability of food processing, retail and agrifood industries&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Food Security, Livelihoods, Adaptation</td>
</tr>
<tr>
<td>Improved energy efficiencies of agriculture&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Adaptation, Energy</td>
</tr>
<tr>
<td><strong>Demand Management</strong></td>
<td></td>
<td></td>
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<tr>
<td>Dietary changes&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Very High</td>
<td>Food Security, Adaptation, Health, Water</td>
</tr>
<tr>
<td>Reduce food waste&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Very High</td>
<td>Food Security, Adaptation, Water, Energy</td>
</tr>
<tr>
<td>Transparency and traceability of food chains and external costs&lt;sup&gt;1&lt;/sup&gt;</td>
<td>High</td>
<td>Adaptation, Health, Energy, Water</td>
</tr>
</tbody>
</table>

<sup>1</sup> Adapted from Rosenzweig et al, 2020 Nature Food, Figure 1 [source 1], IPCC 2019 Special Report on Climate Change and Land, Figure SPM.3 [source 2], and Poore and Nemecek, 2018 Science [source 3].
Figure 5. Impact of agricultural practices on net GHG emissions (tons CO2e / year) for USAID’s ACCESO activity in Honduras.22

Systems Perspectives

Opportunities for climate mitigation extend beyond the farm to include the broader food system. Systems approaches strengthen the linkages to food security outcomes and incorporate high impact mitigation opportunities along value chains, through demand-side actions, and through policy reform.

Reducing food loss and waste in a value chain increases the food available for consumption, increasing food security. It also decreases GHG emissions, notably methane, that result from decomposition of food waste and avoids emissions that would result from additional production required to compensate for lost or wasted food.

In areas with heavy consumption of cattle products (beef and dairy), dietary shifts to nutritious, more sustainable diets can dramatically reduce the carbon footprint of the food system. These dietary shifts can reduce demand and hence drive down production of carbon intensive food while increasing demand for high-value agricultural commodities such as less carbon-intensive livestock (e.g., poultry and pork), tree nuts, and legumes that help maintain farmer incomes.23

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22 CCAFS InfoNote. Nash et al. 2016. ACCESO in Honduras: Mitigation co-benefits of perennial crop expansion, soil management, and livestock improvements

23 In the case of ruminant livestock (e.g. cattle, sheep, and goats), this means both less methane production by animals and less deforestation to create pasture or cropland to feed animals.
Systems approaches that achieve impacts at scale include building **policy and finance instruments and capacity that promote low emissions pathways**. These approaches entail partnerships with diverse institutions including local, regional, and national governments; domestic and multinational buyers and processors of agricultural products; civil society organizations; and agricultural and rural development banks.

- Countries frequently include agriculture in their Nationally Determined Contributions, but methods and capacity for monitoring, reporting, and verifying GHG emissions from agriculture and food systems need to be strengthened. With better MRV systems, countries are more likely to receive credit for mitigation gains and, therefore, to invest in low-emission agriculture systems.

- Improving land tenure and tree tenure provides landowners with incentive to make longer-term investments such as agroforestry and perennial crops, which can reduce pressure on conservation areas. In Zambia, USAID has seen that tree survival rates are higher in areas with village-level community governance, where villagers also receive inputs to boost sapling survival, and where farm level land tenure is secure.

- In many countries, the overarching vision for agriculture and food systems advanced by finance and policy institutions strongly influence farmer adoption of specific practices (e.g., conservation agriculture, agroforestry), choices about which crops to grow (e.g., increased use of tree crops, annual vs perennial crops), and tendency to expand cropland into forests or grasslands. Finance can come as public subsidies controlled often by the Ministry of Agriculture or from banks or credit unions. Climate finance will also play a more significant role in the future, with carbon markets, results based payments, other public policies and private sector investments shifting incentives for the uptake of these practices. Khatri-Chhetri et al. (2021) observed that “Innovative financing mechanisms and instruments that integrate climate finance, agriculture development budgets, and private sector investment can improve and increase farmers' and other value chain actors' access to finance while delivering environmental, economic, and social benefits.” Bringing Ministries of Agriculture onboard with sustainable production practices and engaging Ministries of Finance on public budgets for climate and agriculture finance is a powerful approach to achieve long-lasting outcomes.

  - The approaches taken by USAID/RDMA’s Green Invest Asia program included working with banks to build the evidence base and institutional confidence that making loans to producers using more sustainable practices carried acceptable risks and would be a profitable investment. Also see the new Catalyzing Finance for Climate Action invest resource guide.

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- **MexicoREDD+** (Reducing Emissions from Deforestation and Forest Degradation) worked with the Government of Mexico to develop detailed maps of farms and their proximity to high value forests. These maps were intended to enable targeted distribution of agricultural subsidies for conservation practices to farms most likely to expand into forests.

- Increasingly, corporations that source agricultural products from across the world have public-facing commitments to reduce GHG emissions or halt deforestation in their supply chains. Support for these organizations to develop, strengthen, and implement [Science Based Targets](https://www.sciencebasedtargets.org), and to learn from their peer organizations, merits consideration.

- Building alliances between conservation organizations and ranchers/farmers can provide the foundation for large-scale adoption of low-emissions agriculture and land management. [USAID/Paraguay's Forest Conservation and Agriculture Alliance](https://www.usaid.gov/paraguay) activity provides a useful illustration.

- Although energy use has historically contributed relatively little to GHG emissions from the agriculture and food system, with most emissions originating directly from land, pre- and post-production processing have become very significant contributors of GHG emissions in many cases surpassing emissions directly from land. Increasing the renewable energy and energy efficiency of energy-intensive value chains can contribute to mitigation in the food system, as can reducing hydrofluorocarbon leakage from refrigerant systems.25

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### Table 2: USAID Entry Points into LEAFS

<table>
<thead>
<tr>
<th>Stage of the Program Cycle</th>
<th>Questions to Consider and Select Resources</th>
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</table>
| Strategy                  | ● Which agriculture sectors and geographies within the Strategy scope are prominent sources of GHG emissions?  
● If focusing on high-emissions sectors and geographies, what are the opportunities for incorporating low-emissions practices and approaches? |
| Program Design and        | ● If focusing on high-emission sectors, geographies, or value chains, what are the opportunities for incorporating low-emissions practices and approaches?  
● What approaches can simultaneously promote food security and low-emissions food systems? |
| Implementation            | Relevant Resources:  
GFSS Activity Guidance:  
● Climate-Smart Agriculture and Food Systems  
● Natural Resource Management  
● Investing in Livestock and Animal Food Systems  
ProLand guidance:  
● Approaches to sustainable intensification and relevant generalized theories of change.  
● Value chain selection guide that incorporates food loss and waste as one criterion. |
| Monitoring and Evaluation | ● Incorporate climate and agriculture indicators into monitoring and evaluation at multiple levels.  
● Report on the Climate Strategy Systems Target  
● At the Feed the Future Zone of Influence level: EG.3.2-a (Percent of producers who have applied targeted improved management practices or technologies [Zone of Influence level])  
● Activity MEL Plans  
  ○ Climate Standard Indicators: EG.13-6, EG.13-7, EG.13-8, other EG.13 indicators.  
  ○ Feed The Future Indicators: EG.3.2-24, EG.3.2-25 |

### Programming Examples

Some regions tend to offer greater opportunities than others for advancing particular low-emission agricultural practices. For example, livestock-driven deforestation is a dominant opportunity for LEAFS in Latin America, and alternatives to flooded rice production merit attention in many countries in Southeast Asia. However, these patterns are very coarse, and do not provide adequate guidance for
identifying opportunities in a country. A Sustainable Landscapes Opportunities Analysis can address that challenge and can be focused to provide additional detail within the agriculture and food systems. The challenge of generalizing by region becomes even greater when considering system-level possibilities. To identify leading opportunities for a USAID office requires a country-specific look, ideally through a systematic analysis.

To provide USAID field staff with concrete examples of how the elements of LEAFS presented above (practices and systems) can translate into concrete USAID programming, below we present examples from current (2023) programs spanning geographies, funding streams, priorities, and approaches.

**AFRICA**

The Agricultural Development and Value Chain Enhancement (ADVANCE) Activity in Ghana aimed to scale up private sector investment in the maize, rice, and soybean value chains to achieve greater food security among the rural population in northern Ghana while increasing competitiveness in domestic commodity markets. ADVANCE II increased agriculture productivity while reducing crop GHG emission intensity by promoting soil management improvements, crop residue burning reductions, climate smart practices like ripping the soil to sow which minimizes damage to the soil structure, and reducing post-harvest losses.

The Feed the Future Kenya Crops and Dairy Market Systems Activity was a five-year, $65 million investment that worked with the private sector, farmers, cooperatives, agribusinesses, and policy makers to: strengthen market systems; improve dairy animal breeding and health; leverage extension and advisory services—both from the public and private sector; improve access to improved inputs including fodder; and support policy and legislation. An evaluation for the program revealed a “triple win” impact; milk productivity increased by an average of 43 percent between 2019 and 2022, nutrition outcomes improved due to availability of milk products, and methane emissions intensity decreased by an average of 27 percent.

Through the Aceli Africa program, USAID’s anchor commitment of $10 million has secured more than $62 million in commitments, which in total will mobilize $600 million in private sector finance for agriculture in Uganda, Rwanda, Tanzania, and Kenya. For the first two years of Aceli’s operations (September 2020 - September 2022), 569 loans were registered totaling $71 million with 31 lenders. Roughly $13 million (or 18 percent of loans) have supported climate-smart agricultural and food systems practices, including many that support low emissions development pathways such as use of natural fertilizers, environmentally sustainable packaging, soil erosion control, and the use of compost. Aceli is also promoting enabling policies for systemic change and orienting lending towards great impacts, especially related to gender inclusion and climate and environment.
Latin America

The Forest Conservation Agricultural Alliance (FCAA) Activity in Paraguay is incentivizing a shift from traditional agricultural expansion to sustainable livestock production practices in order to avoid deforestation and reduce GHG emissions. FCAA is introducing more efficient production techniques, helping develop land use management plans, and further increasing demand for sustainably produced beef. FCAA is also working with local producers to encourage use of more sustainable practices, including high intensity, short rotation systems, improved water delivery systems, improved pasture vigor through mechanical treatments and special grass seed mixes, and minimum standards for residual forests and windbreaks to create biological corridors between protected areas and forest reserves.

The Sustainable Prosperous Communities activity in Mexico: (1) strengthens capacity for market-oriented sustainable practices through learning communities that facilitate knowledge exchange and social leadership and promote adoption of agroecological practices; (2) Increases access to ethical markets, tailoring interventions to groups and individuals at different stages of development and in value chains; (3) improves access to financing, partnering with financial institutions to expand the range of products; and (4) promotes investment and seed capital aligned with Southern state governments’ objectives and initiatives that support conservation and sustainable development of the region.

In Colombia, the Sustainable Agriculture Activity encourages rural producers and value chain actors to adopt climate smart agriculture practices like agroforestry to increase their income, combat food insecurity, conserve biodiversity, and reduce GHG emissions that result from land use change. It also uses an inclusive market systems development approach and promotes local ownership and programmatic sustainability by partnering with public and private actors to develop and implement regional interventions. The main value chains supported by this activity include coffee, cocoa, dairy, fruit, vegetables, and natural rubber, and the activity is implemented in three geographic corridors, Catatumbo, Caquetá, and Bajo Cauca- Southern Bolivar.

Asia

Green Invest Asia catalyzes private sector investments in agriculture and forestry businesses in Southeast Asia to scale up sustainable production and reduce pressures on tropical deforestation. This helps develop the marketplace for low-emissions agriculture and forestry business models, incorporate social and environmental safeguards into investment decisions, and thereby address a major source of GHG emissions in the region. The program uses an enterprise-driven approach to match investors and businesses and to reduce barriers to investment.

Trees Outside of Forests (TOFI) In India is working to bring inclusive environmental and livelihood benefits at scale by increasing the area of tree cover outside forests through multi-stakeholder engagements in seven states- Andhra Pradesh, Assam, Haryana, Odisha, Rajasthan, Tamil Nadu, and Uttar Pradesh. It will pursue viable, inclusive and locally appropriate opportunities for scaling up the establishment of trees outside forests, with a greater emphasis on agroforestry. Expected outcomes
include 2.8 million hectares of new land under trees outside of forests, 420 million tonnes of carbon dioxide equivalent sequestered, 13.1 million people benefiting from improved livelihood opportunities, and $50 million leveraged to boost the expansion of trees outside of forests. Key interventions include co-learning centers, knowledge dissemination platforms, strengthened enabling environment, multi-stakeholder innovation platforms, certified quality tree planting material, TOFI champions, and a payment for ecosystems services scheme.

The Cereal Systems Initiative for South Asia (CSISA) project in Bangladesh, now on Phase III, focuses on scaling-out innovative crop management practices and technologies to smallholder farmers, while also providing a strategic overarching framework that guides and supports inter-related projects. CSISA focuses on applied research including on the following topics:

- Directly sown rice to address labor and energy constraints to precision rice establishment
- Managing risk by coping with climate extremes: Early wheat for combating heat stress
- Crop management practices with low emission co-benefits such as reduced tillage, greater water use efficiency with reduced pumping, and strategic use of fertilizer that increases efficiency and reduces
- Increasing the capacity of national agricultural research and extension systems (NARES) to conduct participatory science and technology evaluations

GLOBAL

The Business Case for Collective Landscape Action reduces agricultural commodity-driven deforestation using three components: (1) Facilitation of multi-stakeholder landscape action plans and enhanced local capacity; (2) Increased disclosure of information on the performance of these landscapes and jurisdictions; and (3) The development of innovative financing mechanisms to support investment in high-performing landscapes and stabilize key deforestation frontiers. Expected results include 12.1 million tons of carbon dioxide emissions reduced through 2030; 1.8 million hectares under improved natural resource management; more than 12,000 people receiving economic co-benefits such as improved livelihoods; and $30 million of international finance mobilized for climate action. The activity is piloting its work at landscapes in Peru, Ecuador, Colombia, and Indonesia, plus five states in Brazil.
Relevant Resources

Activity Design Guidance

GFSS Activity Design Guidance, including:
- Climate-Smart Agriculture and Food Systems
- Natural Resource Management
- Investing in Livestock and Animal Food Systems

Sustainable Landscapes
- Eight Generalized Theories of Change, Including for Sustainable Cattle Production and Sustainable Supply Chains
- A Sourcebook for Community-Based Forestry Enterprise Programming

Assessments of opportunities across Agriculture and Food Systems and Related Tools
- Global Assessments of Promising Landscape Productivity Enhancement Approaches
- Agriculture's Footprint: Designing Investment in Agricultural Landscapes to Mitigate Tropical Forest Impacts
- Five Case Studies on Approaches to Reduce Agriculture-Driven Deforestation

Monitoring, Reporting, and Verification for Livestock and Agroforestry
- CCAFS InfoNote: Monitoring, reporting and verification of greenhouse gas emissions from livestock: current practices and opportunities for improvement
- Peer-reviewed report: Measurement, reporting and verification of livestock GHG emissions by developing countries in the UNFCCC: current practices and opportunities for improvement. CCAFS Report No. 17. Also available in French and Spanish.
- CCAFS Info Note: Making trees count in non-Annex I countries
- CCAFS Info Note: Making trees count in Latin America and the Caribbean
- CCAFS Info Note: Making trees count in Africa