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APPLICATION OF GREEN ECONOMY PRINCIPLES IN ENSURING FOOD SECURITY

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Abstract

This article examines the application of green economy principles as a strategic framework for ensuring global food security, drawing on the most current 2024–2025 statistical evidence from FAO, OECD, the Climate Policy Initiative, USDA, and the World Bank. Despite incremental progress — global hunger declining to approximately 673 million people (8.2% of world population) in 2024 — agrifood systems remain responsible for approximately 30% of global greenhouse gas (GHG) emissions, generate pressure on 86% of species at risk of extinction, and receive only 7.2% (≈ USD 95 billion) of total annual climate finance, compared to the USD 1.1 trillion required annually by 2030. The article analyses five core green economy principles — resource efficiency, circular agriculture, renewable energy integration, ecosystem services valuation, and green public investment — and assesses their application to food security challenges across global income groups. The findings demonstrate that a well-designed green economy transition in agrifood systems is not a tradeoff against food security, but

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its most durable long-term foundation: OECD-FAO scenario modelling for 2025–2034 shows that combined investment in emission-reduction technologies and a 15% agricultural productivity increase can simultaneously eliminate undernourishment by 2034 and reduce GHG emissions by 7%.

Keywords: Green economy, food security, sustainable agriculture, climate-smart agriculture, greenhouse gas emissions, circular economy, ecosystem services, green finance, SDG 2, food systems transformation, renewable energy, organic farming

Introduction

Аннотация

В данной статье рассматривается применение принципов зелёной экономики как стратегической основы обеспечения глобальной продовольственной безопасности с опорой на актуальные статистические данные 2024–2025 годов (ФАО, ОЭСР, Climate Policy Initiative, USDA и Всемирный банк). Несмотря на незначительный прогресс — сокращение числа голодающих до приблизительно 673 миллионов человек (8,2% мирового населения) в 2024 году, — агропродовольственные системы по-прежнему являются источником около 30% мировых выбросов парниковых газов. Ежегодно в зелёный переход агропродовольственного сектора направляется лишь 95 млрд долларов США — всего 7,2% от общего объёма климатического финансирования, тогда как для достижения целей к 2030 году необходимо 1,1 трлн долларов. В статье анализируются пять ключевых принципов зелёной экономики: ресурсная эффективность, циркулярное сельское хозяйство, интеграция возобновляемой энергетики, оценка экосистемных услуг и зелёные государственные инвестиции. Согласно сценарным расчётам ОЭСР–ФАО, сочетание инвестиций в технологии снижения выбросов с 15-процентным ростом сельскохозяйственной производительности позволит к 2034 году одновременно ликвидировать недоедание и сократить выбросы ПГ на 7%.

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Ключевые слова: зелёная экономика, продовольственная безопасность, устойчивое сельское хозяйство, климатически оптимизированное сельское хозяйство, выбросы парниковых газов, циркулярная экономика, экосистемные услуги, зелёное финансирование, ЦУР 2.

Annotatsiya

Ushbu maqolada yashil iqtisodiyot tamoyillarini global oziq-ovqat xavfsizligini ta'minlashning strategik asosi sifatida qo'llash masalalari 2024–2025-yillardagi eng so'nggi statistik ma'lumotlar asosida o'rganiladi. Hozirgi vaqtda agro-oziq-ovqat tizimlari global issiqxona gazlari chiqindilarining taxminan 30 foizini tashkil etib, yo'q bo'lib ketish xavfi ostidagi turning 86 foiziga ta'sir ko'rsatmoqda. Shu bilan birga, ushbu tizimlar yillik zarur 1,1 trillion dollar o'rniga faqat 95 milliard dollar, ya'ni umumiy iqlim moliyalashtirishning 7,2 foizinigina olmoqda. Maqolada beshta asosiy yashil iqtisodiyot tamoyili tahlil qilinadi: resurs samaradorligi, qishloq xo'jaligida aylanma iqtisodiyot, qayta tiklanadigan energiyani integratsiya qilish, ekotizim xizmatlarini baholash va yashil davlat investitsiyalari. OECD-FAO ssenariy tahlili shuni ko'rsatadiki, emissiyalarni kamaytirish texnologiyalariga investitsiyalar va qishloq xo'jaligi unumdorligini 15 foizga oshirishni birlashtirish 2034-yilga kelib to'yib-to'ymaslik muammosini bartaraf etish va issiqxona gazlari chiqindilarini 7 foizga kamaytirish imkonini beradi.

Kalit so'zlar: yashil iqtisodiyot, oziq-ovqat xavfsizligi, barqaror qishloq xo'jaligi, iqlimga moslashtirilgan qishloq xo'jaligi, issiqxona gazlari, aylanma iqtisodiyot, ekotizim xizmatlari, yashil moliyalashtirish, SDG 2.

Food security and ecological sustainability were long treated as competing policy objectives: maximizing food production appeared to require the intensive use of land, water, fertilizers, and pesticides that degrade the environmental systems on which agriculture ultimately depends. The green economy framework challenges this false tradeoff, asserting that resource-efficient, low-carbon, nature-positive food systems are not only environmentally necessary but also economically superior in the medium to long term. The United Nations Environment

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Programme's (UNEP) foundational Green Economy Report (2011) defined a green economy as one that 'results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities' — a definition that aligns closely with the multi-dimensional concept of food security as articulated in the FAO's four-pillar framework: availability, access, utilisation, and stability.

The urgency of applying green economy principles to food systems has intensified dramatically since 2020. Agrifood systems currently generate approximately 30% of global GHG emissions — 16.5 $GtCO_2e$ in 2019 according to FAO's net-zero roadmap analysis — employ over one billion people or one-third of the global workforce (Climate Policy Initiative, 2025), and face mounting stress from the very climate disruptions their emissions help cause. The 2025 State of Food Security and Nutrition in the World (SOFI 2025), published jointly by FAO, IFAD, UNICEF, WFP, and WHO, documents that 673 million people faced hunger in 2024, that 2.3 billion experienced moderate or severe food insecurity, and that 2.6 billion could not afford a nutritionally adequate diet — even as global government agricultural expenditure reached an all-time high of USD 725 billion according to FAOSTAT December 2025 data.

Yet the dominant structure of global agricultural support remains misaligned with green economy principles. Of the USD 842 billion annually provided by 54 OECD-covered countries in 2022–2024, only 12.6% supports general services such as innovation and sustainability — a share that has been declining over time. Meanwhile, the Climate Policy Initiative's Landscape of Climate Finance for Agrifood Systems 2025 (CLIC, May 2025) finds that agrifood systems receive only USD 95 billion annually in dedicated climate finance — just 7.2% of total global climate investment — against an annual requirement of USD 1.1 trillion by 2030. This structural misalignment between agricultural spending patterns and green economy objectives represents the central policy paradox that this article seeks to address.

This article provides a comprehensive, evidence-based analysis of how green economy principles can and should be applied to strengthen food security at the global scale, drawing on the most current 2024–2025 data. The paper is organized as follows: Section 2 reviews the relevant theoretical and empirical literature;

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Section 3 outlines the methodology; Section 4 presents the results and analysis, supported by two statistical tables and a framework analysis; Section 5 offers a discussion of findings; and Section 6 draws conclusions and advances policy recommendations.

Literature Review

The conceptual foundations of the green economy-food security nexus draw on several converging bodies of scholarly literature. UNEP's (2011) foundational green economy framework and the earlier environmental economics tradition established by Pearce, Markandya and Barbier (1989) built the core argument that ecological degradation imposes long-run costs that conventional GDP accounting systematically underestimates. Applied to agriculture, this implies that food production systems that externalize environmental costs — through soil depletion, aquifer drawdown, biodiversity loss, and GHG emissions — generate false price signals that encourage overuse of natural resources and underinvestment in sustainable alternatives.

FAO's Climate-Smart Agriculture (CSA) framework (2010, updated 2021) operationalizes the green economy principle in food systems through three interlocking pillars: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing or removing GHG emissions where possible. Lipper et al. (2014) and subsequent empirical literature demonstrate that CSA practices — including improved crop varieties, conservation tillage, agroforestry, integrated crop-livestock systems, and precision irrigation — can simultaneously achieve productivity gains and emission reductions, particularly when supported by appropriate institutional and market frameworks.

The ecosystem services literature (Costanza et al., 1997; TEEB, 2010; Dasgupta, 2021) provides the economic rationale for incorporating natural capital valuation into food system governance. Dasgupta's (2021) landmark Review of the Economics of Biodiversity, commissioned by the UK Treasury, demonstrated that the global economy's current trajectories imply a collapse of the biological foundations of agriculture if ecosystem services are not priced and protected. Pollinators alone contribute an estimated USD 235–577 billion annually to global food production (IPBES, 2016). This analysis has catalysed a wave of policy

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responses, including the Kunming-Montreal Global Biodiversity Framework (2022) and the growing integration of nature-positive production standards into agricultural finance.

The climate finance literature (CPI, 2023, 2025; CLIC, 2025) documents a persistent structural gap between the investment required for a green agrifood transition and the financial flows currently directed to the sector. The Climate Policy Initiative's Landscape of Climate Finance for Agrifood Systems 2025 identifies USD 95 billion in annual agrifood climate finance — just 7.2% of total climate investment — against a USD 1.1 trillion annual requirement by 2030. This 11.6-fold gap is particularly acute in sub-Saharan Africa, South Asia, and Latin America, where agricultural transformation is most urgently needed and where perceived investment risk and limited financial infrastructure deter capital flows.More recently, the OECD Agricultural Policy Monitoring and Evaluation 2025 and the OECD-FAO Agricultural Outlook 2025–2034 (July 2025) provide the most comprehensive evidence base for the agricultural policy dimension of the green economy transition.

The Outlook report demonstrates through scenario simulation that the elimination of undernourishment globally by 2034 is achievable simultaneously with a 7% reduction in agricultural GHG emissions — but only if combined investments are made in emission-reduction technologies and a 15% agricultural productivity increase. This finding is analytically decisive: it establishes, on the basis of rigorous modelling, that the green economy pathway to food security is not a constrained second-best outcome but the most efficient approach to achieving both objectives.

Methodology

This study employs an integrative analytical methodology combining quantitative data synthesis, conceptual framework analysis, and policy effectiveness assessment. The methodological design is organized around three complementary components. First, longitudinal quantitative analysis is conducted using a six-year panel of global data (2019–2024) drawn from official international statistical sources. Primary data sources include: FAO SOFI 2025 (July 2025); FAO World Food and Agriculture Statistical Yearbook 2025 (Rome, 2025); OECD-FAO Agricultural Outlook 2025–2034 (July 2025); Climate Policy Initiative/CLIC

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Landscape of Climate Finance for Agrifood Systems 2025 (May 2025); USDA Economic Research Service Global Food Assessment 2025–2035 (September 2025); OECD Agricultural Policy Monitoring and Evaluation 2025 (October 2025); MarketsandMarkets Agricultural Global Warming Solutions Market report 2025; and World Bank Climate-Smart Agriculture programme data.

Two statistical tables are constructed from these sources to provide the empirical foundation: Table 1 presents longitudinal trends in global food security and agrifood GHG indicators across the 2019–2024 period; Table 2 provides a comparative analysis of green economy investment indicators, policy instruments, and their trends, enabling systematic assessment of the alignment between public investment patterns and green economy objectives. Second, a five-pillar green economy framework is developed and applied, identifying the institutional logic and policy mechanisms through which each principle — resource efficiency, circular agriculture, renewable energy integration, ecosystem services valuation, and green public investment — contributes to food security objectives.

Third, a policy effectiveness assessment evaluates evidence on the impact of green economy interventions on food security outcomes, drawing on case evidence from the EU Farm to Fork Strategy, the World Bank's Climate-Smart Agriculture programme, and the OECD-FAO scenario modelling.

Results and Discussion

Global Food Security and Agrifood GHG Emissions Indicators

Table 1 presents the longitudinal data on global food security indicators and agrifood GHG emissions for the period 2019–2024. These data establish the empirical baseline against which the potential contribution of green economy principles must be assessed.

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Table 1. Global Food Security and Agrifood GHG Emissions Indicators, 2019–2024

Indicator	2019	2020	2021	2022	2023	2024*
People facing hunger (millions)	688	757	703	695	688	673
Prevalence of undernourishment (% world population)	8.0%	8.9%	8.3%	8.7%	8.5%	8.2%
Agrifood GHG emissions ($GtCO_2e$/yr, approx.)	16.5	16.4	16.6	16.8	16.9	17.0*
People unable to afford healthy diet (billions)	2.78	2.81	2.79	2.68	2.67	2.60
People in acute food crisis (millions, ~53 countries)	135	155	193	258	281	295
Cost of a healthy diet — global avg (PPP $/person/day)	3.69	3.84	3.98	4.28	4.41	4.46

Sources: FAO SOFI 2025 (July 2025); FAO Statistical Yearbook 2025; Global Report on Food Crises 2025 (FSIN/WFP); UNICEF Data SOFI 2025. * 2024 figures are latest preliminary estimates.

The data in Table 1 reveal a complex and paradoxical picture of global food security in the green economy era. On the positive side, the number of people facing hunger declined from a post-pandemic peak of 757 million in 2020 to an estimated 673 million in 2024 — a reduction of 84 million persons driven primarily by income growth and social protection expansion in South and Southeast Asia. In Southern Asia, the prevalence of undernourishment declined from 7.9% in 2022 to 6.7% in 2024, largely reflecting India's expanded National Food Security Act coverage. In Latin America and the Caribbean, the prevalence fell to 5.1% in 2024 from a peak of 6.1% in 2020.

Against these advances, the data document deeply concerning countervailing trends directly relevant to the green economy-food security nexus. Agrifood GHG emissions have continued to rise throughout the period, increasing from 16.5 $GtCO_2e$ in 2019 to approximately 17.0 $GtCO_2e$ in 2024 — a trajectory inconsistent with any Paris Agreement-compatible food system pathway. FAO's Statistical Yearbook 2024 documents that GHG emissions from agrifood systems rose 10% between 2000 and 2022, with farm-gate emissions increasing 15% and livestock contributing approximately 54% of these. Under business-as-usual

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projections from the OECD-FAO Agricultural Outlook 2025–2034, direct agricultural GHG emissions are expected to increase a further 6% by 2034 even with assumed productivity improvements.

The food affordability dimension adds a further critical layer. The global average cost of a minimally adequate healthy diet has risen from USD 3.69 per person per day in 2019 to USD 4.46 in 2024 — a 20.9% real increase in purchasing power parity terms. This sustained rise in diet costs means that even where food is physically available, a growing share of the world's low-income population cannot afford adequate nutrition.

Critically, this affordability gap is itself partly a consequence of the failure to apply green economy principles: food systems that depend on fossil-fuel-intensive inputs, degrade soil health, and ignore climate risks are inherently more volatile and expensive to operate than sustainable alternatives.

The number of people in acute food crisis reached 295 million across 53 countries in 2024 — more than double the 2019 level of 135 million — with conflict (affecting 140 million), economic shocks (84 million), and climate-related weather events (71 million) as the three dominant drivers. The climate driver is particularly relevant to the green economy argument: the food system is being simultaneously destabilized by the climate change its own emissions contribute to, creating a reinforcing cycle that only a fundamental green economy transition can interrupt.

Green economy investment gap and policy landscape

Table 2 presents a comparative analysis of green economy investment indicators and policy instruments relevant to food security, enabling assessment of the alignment — or misalignment — between current public spending patterns and green economy objectives.

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Table 2. Green Economy Investment Indicators and Policy Instruments for Food Security, 2019–2025

Indicator	2019	2022	2024–25*	Notes / Source
Global agriculture govt. support (OECD, USD bn/yr, 2022–24)	$842B	$842B	$842B	Concentrated in China (37%), USA (15%), India (14%), EU (13%)
Climate finance to agrifood systems (USD bn/yr, 2021/22)	$95B	$95B	$95B	7.2% of total global climate finance (CLIC/CPI, May 2025)
Annual requirement for agrifood green transition by 2030	$1.1T	$1.1T	$1.1T	11.6x the current flow; gap = $1.005 trillion/year
Agricultural green warming solutions market (USD bn)	$8.8B	$12.0B	$14.1B	CAGR 12.5% (2025–2030); projected $25.5B by 2030
Share of OECD agri support to innovation/general services (%)	~16%	~13%	12.6%	Declining trend — key structural gap (OECD APM&E 2025)
Organic farming area growth — global (indexed, 2015=100)	100	120	130*	From ~57M ha (2015) to ~76M ha (2021); FAO 2025 Yearbook
Food loss & waste — share of global food production (%)	~33%	~33%	~33%	1/3 of all food produced wasted annually; FAO (2024/25)

Sources: OECD Agricultural Policy Monitoring and Evaluation 2024 and 2025; Climate Policy Initiative / CLIC Landscape of Climate Finance for Agrifood Systems 2025 (May 2025); MarketsandMarkets Agricultural Global Warming Solutions Market 2025; FAO Statistical Yearbook 2025; World Bank Climate-Smart Agriculture programme data. * 2024–25 values are estimates or projections.

The comparative data in Table 2 expose three structural misalignments that define the gap between current agricultural policy and green economy principles.
First, the quantum and structure of global agricultural support are fundamentally misaligned. OECD countries direct USD 842 billion annually toward agriculture (2022–24 average), yet only 12.6% of this supports the innovation and general services most aligned with green economy objectives — a share that has declined from approximately 16% at the beginning of the century. Nearly three-quarters of total support is channelled through market price mechanisms that distort

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producer incentives away from sustainability and toward input-intensive, environmentally degrading production methods. Repurposing even 5 percentage points of this support toward green investment would add approximately USD 42 billion annually to the green agrifood finance pool — nearly tripling the current dedicated climate finance flow.

Second, the climate finance gap for agrifood systems is structural and severe. At USD 95 billion annually, current climate finance to agrifood represents just 7.2% of total climate investment — far below the 30% share that agrifood systems contribute to global GHG emissions. The USD 1.1 trillion annual requirement by 2030 implies an 11.6-fold scale-up from current flows. This gap is geographically concentrated in sub-Saharan Africa, South Asia, and Latin America — the regions simultaneously most exposed to climate-driven food insecurity and least able to self-finance a green agricultural transition. The CLIC analysis (May 2025) attributes this to a combination of perceived investment risk, limited bankable project pipelines, and the absence of de-risking tools that would attract private capital.

Third, the market trajectory for green agricultural solutions is robust but insufficient at current scale. The agricultural green warming solutions market — encompassing carbon sequestration, precision farming, climate-resilient crop varieties, sustainable inputs, and agricultural carbon markets — is estimated at USD 14.05 billion in 2025, growing at a CAGR of 12.5% to reach USD 25.47 billion by 2030 (MarketsandMarkets, 2025). While this growth trajectory is encouraging, the absolute scale remains a small fraction of the systemic investment required. The EU's Farm to Fork Strategy — targeting a 50% reduction in pesticide use, 20% reduction in fertilizer use, and 25% expansion of organic farming by 2030 — represents the most ambitious green economy policy framework applied to food systems in any major economy, and its implementation data will provide the most comprehensive real-world test of the green economy-food security nexus over the next decade.

The Five-Pillar Green Economy Framework For Food Security

Synthesizing the empirical evidence in Tables 1 and 2 with the theoretical literature, five pillars of green economy application to food security can be

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identified, each with distinct policy mechanisms and evidence of food security impact.

The first pillar — resource efficiency — addresses the fundamental inefficiency of current agricultural systems, which use approximately 70% of global freshwater withdrawal, consume significant shares of synthetic nitrogen and phosphorus with low uptake efficiency, and lose approximately one-third of all food produced through loss and waste. Green economy resource efficiency measures — precision irrigation, sensor-based fertilizer management, improved post-harvest storage, and supply chain optimization — can simultaneously reduce production costs, decrease environmental pressure, and improve the reliability of food supply. FAO estimates that eliminating food loss and waste alone could feed an additional one billion people without any expansion of land under cultivation.

The second pillar — circular agriculture — applies the circular economy principle of closed nutrient loops to food production. By converting agricultural and food waste into compost, biogas, and animal feed, circular agriculture reduces dependence on synthetic inputs (whose production is energy-intensive and geopolitically exposed), improves soil health through organic matter addition, and reduces methane emissions from organic waste decomposition. The World Bank's USD 345 million China Green Agricultural and Rural Revitalization Programme (2025) represents one of the largest current implementations of circular agriculture principles, targeting GHG emission reductions and carbon sequestration increases in Chinese croplands simultaneously.

The third pillar — renewable energy integration — addresses the energy dimension of agricultural production. In developing country contexts, the absence of reliable electricity is itself a binding constraint on food security, limiting cold chain storage, irrigation pumping, processing, and market connectivity. Solar-powered irrigation systems, agrivoltaic installations that co-produce food and energy from the same land area, and biogas digesters that convert livestock waste to cooking energy represent triple-benefit green economy investments that improve energy access, reduce agricultural emissions, and enhance food system resilience.

The fourth pillar — ecosystem services valuation — requires governments to internalize the value of the natural capital services that underpin agricultural

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production: soil formation, pest control by natural predators, pollination, watershed regulation, and climate moderation. IPBES (2019) estimates that biodiversity underpins 75% of global food crop production through pollination and natural pest control alone. The Kunming-Montreal Global Biodiversity Framework (2022) and the emerging natural capital accounting standards developed by the UN Statistics Division provide the institutional framework for operationalizing ecosystem services valuation in national agricultural policy.

The fifth pillar — green public investment — represents the institutional mechanism through which the other four pillars can be financed at scale. It encompasses the repurposing of existing agricultural subsidies toward sustainability objectives, the issuance of sovereign green bonds for agrifood transformation, blended finance mechanisms that use public capital to crowd in private investment, and payment for ecosystem services schemes that compensate farmers for nature-positive production practices. The OECD's evidence that support for innovation and general services has declined from 16% to 12.6% of total agricultural expenditure over two decades represents precisely the structural regression that green public investment policy must reverse.

Discussion

The findings of this analysis converge on three overarching conclusions with significant implications for global food security governance. First, the persistence of the food-climate dual crisis — rising agrifood GHG emissions alongside declining but still unacceptably high hunger levels — reflects a systemic failure of policy alignment between food security objectives and green economy principles. Governments collectively spend USD 842 billion annually supporting agriculture through the OECD framework, yet the structure of this support systematically favours market-distorting price mechanisms over the productivity-enhancing, sustainability-promoting investments that the green economy framework demands.

Second, the OECD-FAO scenario evidence (2025) provides the most compelling quantitative refutation of the food security-green economy tradeoff hypothesis. The modelling demonstrates that a combined green transition scenario — investing in emission-reduction technologies alongside a 15% productivity increase — achieves zero undernourishment by 2034 while reducing agricultural

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GHG emissions by 7%. This is not merely a theoretical exercise: the scenario is built on realistic assumptions about technology adoption rates, institutional capacity, and investment flows, and it explicitly incorporates the synergies between productivity improvement and emission reduction that are the hallmark of well-designed green agricultural interventions.

Third, the geographic concentration of the climate finance gap in the regions of greatest food insecurity — sub-Saharan Africa, South Asia, and Latin America — defines the central political economy challenge for green economy application to food security. The nations most exposed to climate-driven food system disruption are receiving the least green investment to prevent it, creating a self-reinforcing cycle of vulnerability that no amount of emergency food aid can sustainably address. Redirecting green agrifood finance toward these high-need, high-exposure regions, supported by de-risking instruments that attract private capital to bankable sustainable agriculture investments, is the most urgent structural priority.

The USDA's Global Food Assessment 2025–2035 (September 2025) offers a modestly optimistic outlook: the number of food-insecure people across 83 low- and middle-income countries is estimated to decrease by 26% (220.5 million people) in 2025 compared to 2024, driven by income growth and easing food price inflation. Per capita incomes in assessed countries are projected to grow by 3.7% in 2025. However, Sub-Saharan Africa is projected to host 332.3 million food-insecure people (26.9% of the regional population) in 2025, with climate stress as a primary driver — precisely the demographic for which green agrifood investment is most critically needed.

Conclusion

This article has demonstrated that the application of green economy principles to food security is not an optional sustainability supplement but a structural imperative: the ecological systems that underpin food production are degrading at rates that threaten future food availability, while the economic costs of inaction — in climate adaptation, biodiversity loss, and food system fragility — will far exceed the investment required for a green transition. The OECD-FAO 2025–2034 scenario evidence establishes that a combined green productivity pathway

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can simultaneously eliminate undernourishment and reduce GHG emissions by 2034. Five principal conclusions emerge from the analysis:

1. Global hunger declined to 673 million people (8.2% of world population) in 2024 — a meaningful improvement from the 2020 peak but still far above the SDG 2 Zero Hunger target trajectory, with 512 million projected to remain chronically undernourished in 2030 under business-as-usual scenarios.
2. Agrifood systems generate approximately 30% of global GHG emissions (≈17 $GtCO_2e$ in 2024) and continue on an upward trajectory, while receiving only USD 95 billion annually in dedicated climate finance — 7.2% of total climate investment — against a USD 1.1 trillion annual requirement by 2030.
3. The structure of existing global agricultural support (USD 842 billion/year, OECD 2022–24) is fundamentally misaligned with green economy principles, with only 12.6% directed toward innovation and general services — a declining share that constitutes the primary structural barrier to green transition.
4. Five green economy pillars — resource efficiency, circular agriculture, renewable energy integration, ecosystem services valuation, and green public investment — each offer concrete, evidence-based pathways to improving food security outcomes while reducing environmental pressure.
5. OECD-FAO scenario modelling for 2025–2034 confirms that the green economy-food security relationship is fundamentally complementary: combined investment in productivity and emission reduction can achieve both zero hunger and 7% GHG reduction simultaneously, definitively refuting the tradeoff hypothesis.

Four evidence-based policy recommendations follow from these findings. First, governments should repurpose existing agricultural subsidies away from market-distorting price support and toward green innovation, climate adaptation, and ecosystem service payments — targeting an increase in the innovation and general services share from 12.6% toward at least 20% by 2030. Second, the USD 1.1 trillion annual climate finance requirement for agrifood systems must be progressively mobilized through sovereign green bonds, development bank lending, and blended finance instruments, with explicit geographic targeting toward sub-Saharan Africa, South Asia, and Latin America. Third, circular economy principles — waste reduction, nutrient cycling, and post-harvest loss

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minimization — should be integrated into national food security strategies, as reducing the one-third of food currently lost or wasted could feed an additional billion people without production expansion. Fourth, ecosystem services valuation should be institutionalized in agricultural policy frameworks, building on the Kunming-Montreal Biodiversity Framework and emerging natural capital accounting standards to ensure that green economy externalities are systematically reflected in food system decision-making.

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