



YOUNG SCIENTISTS GROUP

Transforming agrifood systems through climate resilient agricultural practices:

A youth perspective



**Transforming agrifood systems
through climate resilient
agricultural practices:**
A youth perspective

World Food Forum

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About the World Food Forum

The World Food Forum (WFF) was launched in 2021 as an independent network of partners hosted by the Food and Agriculture Organization of the United Nations. It serves as the premier global platform to actively shape agrifood systems for a better food future, accelerating the achievement of the Sustainable Development Goals . Through youth action, science and innovation, and investment, the WFF forges new paths of action and multi-sector partnerships for agrifood impact at the local, regional and global levels to achieve a more sustainable, resilient, inclusive and hunger-free food future for all.

Within this framework, the WFF Global Youth Action Initiative was established to harness the passion and power of youth, and to incite positive action for agrifood systems through youth empowerment. It acts as a catalytic movement and driver of youth engagement in food governance and serves as a knowledge center and innovation lab, fostering and inspiring youth-led solutions. It thus actively contributes to the implementation of the UN Youth 2030 Strategy and enhances youth engagement in the follow-up to the 2021 UN Food Systems Summit.

The WFF Global Youth Action Initiative is implemented through a set of thematic programmes that leverage intergenerational and cross-sectoral collaboration around policy, innovation, education, culture and local action.

About the World Food Forum Young Scientists Group

The mission of the World Food Forum (WFF) Young Scientists Group (YSG) is to provide scientific evidence and technical knowledge to the various initiatives of the WFF, and to develop research on topics of concern to youth related to agrifood systems transformation. Established in 2022, the YSG has completed two cohorts. Its third cohort began activities in May 2025 as part of a two-year tenure (2025–2027).

The composition of the YSG reflects the Food and Agriculture Organization of the United Nations' four betters: better production, better nutrition, a better environment and a better life, leaving no one behind. The diversity of YSG members' expertise mirrors the diversity of challenges and solutions associated with achieving agrifood systems transformations and the Sustainable Development Goals.

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Abbreviations

ACE – Action for Climate Empowerment

ACIAR – Australian Centre for International Agricultural Research

AEEU YN – Agroecology Europe Youth Network

AFSA – Alliance for Food Sovereignty in Africa

BVAT – BioVision Africa Trust

CABI – Centre for Agriculture and Bioscience International

CEJA – European Council of Young Farmers

CGIAR – Consultative Group for International Agricultural Research

EEA – European Environment Agency

EOA – ecological organic agriculture

EU – European Union

FAO – Food and Agriculture Organization of the United Nations

FI – frugal innovation

HLPE – High Level Panel of Experts on Food Security and Nutrition

ICT – information and communication technology

IFAD – International Fund for Agricultural Development

ILO – International Labour Organization

INRAE – French National Research Institute for Agriculture, Food and Environment

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPCC – Intergovernmental Panel on Climate Change

IPM – integrated pest management

NGO – non-Governmental organization

OECD – Organisation for Economic Co-operation and Development

SDG – Sustainable Development Goal

UN – United Nations

UNCCD – United Nations Convention to Combat Desertification

UNDP – United Nations Development Programme

UNFCCC – United Nations Framework Convention on Climate Change

USDA – United States Department of Agriculture

WFF – World Food Forum

Abstract

Youth-led innovations in climate resilient agricultural practices are emerging as pivotal drivers of agrifood systems transformation. This research conducts a systematic literature review of peer-reviewed articles and institutional reports to synthesize current knowledge on youth engagement in climate resilient agricultural practices, focusing on soil health, water management, integrated pest and disease control, pollinator conservation and gender-inclusive practices.

The review is complemented by case studies of five youth-led or co-led initiatives, one from each region of the Food and Agriculture Organization of the United Nations (FAO) and analyzed through a common framework encompassing: (1) background and context, (2) a case description, and (3) outcomes and impacts. This analysis explores how youth initiatives contribute to agricultural productivity, climate resilience and environmental sustainability across diverse geographic and socio-economic contexts, as well as their potential to address global challenges in food security and environmental change.

Key drivers, challenges and opportunities shaping the implementation of youth climate resilient agricultural practices were identified, drawing on the The Status of Youth in Agrifood Systems report (FAO, 2025) and other peer-reviewed materials. Special attention is given to how these factors influence the scalability, visibility and long-term impact of climate resilient agricultural practices within agrifood systems. The study also examines policy frameworks and support systems needed to enhance environmental education, participatory learning and inclusive monitoring tools that enable rural communities to contribute meaningfully to global climate goals.

Findings show that young people are integrating traditional knowledge with scientific approaches to lead climate resilient agroecological transformations, fostering food security, biodiversity conservation, bioeconomy development, ecosystem services, economic empowerment and social equity in vulnerable regions. The study recommends strengthening youth support systems by integrating climate resilient agricultural practices into education, institutionalizing participatory learning models (e.g., cooperatives and living labs), expanding youth access to information and communication technology (ICT)-based monitoring and decision-support tools, ensuring their inclusion in agricultural and climate policymaking and advancing inclusive climate-related financing mechanisms. Collectively, these strategies provide a coherent framework for positioning youth as co-designers of more resilient and sustainable agrifood systems.

Keywords: *agrifood systems, climate resilience, environmental sustainability, food security, youth-led innovation, climate-resilient agriculture, biodiversity conservation, bioeconomy.*

1. Introduction

As the generation that will inherit the consequences of today's agricultural decisions, young people are realizing that transforming agrifood systems through climate resilient agriculture practices is not just an environmental imperative, but a fundamental requirement for their future food security and livelihoods. Following conventions of both the United Nations (UN) and the Food and Agriculture Organization of the United Nations (FAO), their study defines youth as individuals between the ages of 15 and 35 years, recognizing that agricultural engagement patterns and life-course transitions vary across regions and socio-economic contexts (FAO, 2014; UN, 2018). Based on FAO's framework, climate resilient agricultural practices refers to practices that enable farming systems to "anticipate and prepare for, as well as adapt to, absorb and recover from the impacts of changes in climate and extreme weather" (Alvar-Beltrán *et al.*, 2021). These practices must demonstrate measurable contributions to: (1) productivity enhancement, (2) climate adaptation and resilience building, and (3) mitigation of greenhouse gas emissions. While the importance of adopting such practices is widely recognized by international organizations, governments and agricultural stakeholders (FAO, 2021a; Intergovernmental Panel on Climate Change/IPCC, 2019; World Bank, 2021), a comprehensive understanding of the specific drivers and mechanism for their implementation and scaling remains crucial for global agrifood systems transformation.

Critically, the pivotal role of youth as agents of change within this transformation is often underestimated, despite evidence showing that climate change disproportionately affects communities with considerable young populations, yet "the level of youth participation in climate action and agriculture is low" (International Fund for Agricultural Development/IFAD, 2019). These demographics, particularly in rural and vulnerable contexts, are not merely recipients of climate adaptation strategies but are emerging as dynamic innovators and leaders, uniquely positioned to drive sustainable change (White, 2012). Their capacity to integrate traditional ecological knowledge with modern scientific approaches, coupled with their entrepreneurial spirit and digital literacy, offers a powerful, yet often under-examined, force for agricultural innovation (Leavy and Smith, 2010; Proctor and Lucchesi, 2012). However, there is a significant research gap in analyzing how youth-led initiatives specifically contribute to enhanced productivity, climate resilience and environmental sustainability, and what factors influence their ability to scale and achieve lasting impact within complex agrifood systems (Yeboah *et al.*, 2020).

According to FAO (2021), "Agrifood systems are all the interconnected activities and actors involved in getting food from field to fork and include everything from how food is grown, harvested, processed, packaged, transported, distributed, traded, bought, prepared, eaten and eventually disposed of. They also include non-food agricultural products such as forestry, feedstock, biomass for biofuels and fibres".

In this study, we address the research gap by investigating how youth-led innovations in climate resilient practices are emerging as critical contributors to the transformation of agrifood systems. The objectives of this report are: (1) to assess the effectiveness of youth-led climate resilient practices in enhancing productivity, climate resilience and environmental sustainability across diverse geographic and socio-economic contexts; (2) to identify key drivers, challenges and opportunities that influence the scaling and transformative potential of youth engagement in advancing food security within agrifood systems; and (3) to examine what policy frameworks and support systems are needed to enhance youth capacity for meaningful contribution to global climate goals.

2. Methodology

This report employs a mixed-methods research approach combining a literature review with illustrative case study examples. For the literature review, PRISMA guidelines were followed across multiple databases including Web of Science, PubMed, and Google Scholar as well as institutional reports published by FAO, IFAD, World Bank and CGIAR between 2010 and 2025. Search terms combined three key concept clusters: youth-related terms (“youth” or “young people” or “young farmers” or “rural youth”), climate resilient practice terms (“climate resilience” or “climate adaptation” or “climate-smart agriculture” or “sustainable agriculture”), and impact terms (“agrifood system” or “productivity” or “innovation” or “transformation”).

To complement the literature review, five case studies were selected to demonstrate the geographic diversity and contextual variation of youth-led climate resilient practices across FAO regions. These cases serve to illustrate mechanisms through which youth implement climate resilient practices and their pathways to agrifood systems transformation, rather than providing comprehensive regional representation. These include culinary agri-ecotourism initiatives in India that combine biodiversity conservation with rural bioeconomy development (Asia and the Pacific); ecological organic agriculture practices across value chains in Morocco (Near East and North Africa); agro-sylvo-pastoral systems in Burkina Faso integrating farming, forestry and livestock (Africa); the Agroecology Europe Youth Network engaging young farmers, researchers and activists in policy advocacy and practice (Europe and Central Asia); and the youth-led agroecology movement in Puerto Rico that is advancing food sovereignty and resilience (Latin America and the Caribbean). Each case was analyzed through a common framework of background and context, case description, and outcomes and impacts, enabling a cross-regional comparison of how youth implement agricultural practices that enhance productivity, support biodiversity, foster bioeconomy development, reinforce ecosystem services and strengthen climate adaptation in vulnerable contexts.

3. Youth-led climate resilient agricultural practices: background and context

Global agriculture faces the critical challenge of feeding 9.7 billion people by 2050 while reducing its 24 percent contribution to global greenhouse gas emissions. Climate change intensifies this challenge through extreme weather events, altered precipitation patterns, heat stress, and increased diseases and pests that disproportionately affect smallholder farming systems (IPCC, 2019; Lipper *et al.*, 2014).

Youth represent 60 percent of the global unemployed population, yet constitute only 10 to 20 percent of agricultural extension program participants despite comprising 40 percent of the agricultural workforce in developing countries (FAO, 2014; IFAD, 2019). This demographic paradox creates both challenges and opportunities for agricultural transformation, as youth bring technological literacy, innovation capacity and long-term investment horizons to climate adaptation efforts (Leavy and Smith, 2010). This chapter examines some key approaches that collectively enhance productivity, build resilience, reduce emissions and address global agricultural challenges, food insecurity and environmental challenges.

3.1. Soil and land management

Soil degradation affects 1.5 billion hectares globally, reducing agricultural productivity by 20 to 25 percent while contributing 10 to 12 percent of global CO₂ emissions (UNCCD, 2017). Climate resilient soil management practices address this through carbon sequestration, improved water retention, and enhanced nutrient cycling (Srinivasarao *et al.*, 2016). Literature shows youth leadership in conservation agriculture adoption, with studies documenting 30 to 45 percent faster uptake rates among farmers under 35 years of age compared to older cohorts (Kassie *et al.*, 2015; Khonje *et al.*, 2015). Youth-led initiatives integrate digital soil monitoring technologies with traditional practices, achieving 15 to 25 percent improvements in soil organic matter within 3–5 years (Naorem *et al.*, 2023).

A study has found a 35 percent reduction in soil erosion and a 20 percent improvement in water retention by practicing no-till and reduced tillage (Gonzalez-Sanchez *et al.*, 2021); and 18 percent increase in soil organic carbon and a 25 percent reduction in synthetic fertilizer requirements has been found with use of cover crop and mulching (Poeplau and Don, 2015); a 22 percent yield stability improvement under climate stress conditions was found due to strategic crop rotation (Seufert and Ramankutty, 2017). Youth leverage social media platforms to share soil health data, creating peer-learning networks that accelerate practice adoption by 40 to 60 percent compared to traditional extension approaches (Fabregas *et al.*, 2019). Mobile soil testing applications enable real-time nutrient management decisions, improving fertilizer use efficiency by 20 to 30 percent (Beza *et al.*, 2017).

3.2. Water management systems

Agriculture consumes 70 percent of global freshwater resources, while climate change increases water scarcity for 2 billion people (UN-Water, 2021). Climate resilient water management reduces consumption while maintaining productivity through precision technologies and alternative water sources (Grafton *et al.*, 2018). Youth demonstrate 50 to 70 percent higher adoption rates of precision irrigation technologies compared to farmers over 50 years of age, driven by digital literacy and risk-taking propensity (Tey and Brindal, 2012). Studies document youth-led implementation of drip irrigation systems achieving 25 to 40 percent water use reduction while maintaining or increasing yields (Lamm *et al.*, 2021). Similarly, some studies have shown drip irrigation and precision application contributing to 35 percent water savings and 15 percent yield increase in semi-arid regions (Ayars *et al.*, 2015). Solar-powered systems have been found to contribute to a 60 percent reduction of irrigation costs and improved energy independence (Chandel *et al.*, 2015). Youth integrates artificial intelligence and Internet of Things sensors for automated irrigation scheduling, achieving 28 percent improvement in water use efficiency compared to traditional timing methods (Kamienski *et al.*, 2019).

3.3. Pollinator and biodiversity protection

Pollinator decline threatens from USD 235 to 577 billion in annual crop production globally, while agricultural intensification reduces on-farm biodiversity by 20 to 30 percent (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services/IPBES, 2016). Climate resilient practices must restore ecological services while maintaining productivity (Potts *et al.*, 2016). University and secondary school programs demonstrate that youth education increases pollinator-friendly practice adoption by 40 to 55 percent within farming communities (Goulson *et al.*, 2015). Youth-led habitat restoration projects achieve 25 to 35 percent increases in native bee populations within 2 to 3 years (Kremen *et al.*, 2018).

A study found that by flowering plant corridors, there was a 30 percent increase in beneficial insect populations and a 12 percent improvement in crop pollination services (Blaauw and Isaacs, 2014); native habitat restoration contributed to a 40 percent increase in pollinator species diversity and 18 percent yield stability improvement (Garibaldi *et al.*, 2016). Pesticide reduction protocols caused a 50 percent decrease in pollinator mortality and maintained pest control effectiveness through integrated pest management (IPM) (Lechenet *et al.*, 2017). Youth environmental education programs create multiplier effects, with participants influencing family farming decisions and generating community-wide practice changes affecting 150 to 200 hectares per educated youth (Hill *et al.*, 2019).

3.4. Integrated pest and disease management

Climate change alters pest and disease pressure, with 20 to 40 percent yield losses projected without adaptive management (Savary *et al.*, 2019). IPM provides climate resilient alternatives to pesticide-dependent systems while reducing environmental impacts (Zhou *et al.*, 2024). Digital pest monitoring applications show 60 to 80 percent higher usage rates among farmers under 35, enabling precise intervention timing and 25 to 30 percent reduction in pesticide applications (Preti *et al.*, 2021). Youth-led biological control programs achieve 35 to 45 percent pest suppression rates comparable to chemical alternatives (Bale *et al.*, 2008).

Some practices include: Biological control agents causing a 40 percent reduction in pesticide use maintained 90 to 95 percent pest control efficacy (van Lenteren *et al.*, 2018); predictive pest models lead to a 30 percent improvement in treatment timing and a 20 percent reduction in crop losses (Donatelli *et al.*, 2017). Youth integrates automated pest traps with mobile data collection, enabling real-time pest population monitoring and reducing scouting time by 50 to 70 percent while improving intervention accuracy (Karar *et al.*, 2021).

3.5. Integrating traditional and scientific knowledge

3.5.1. The complementary nature of traditional and scientific knowledge

Agricultural development demonstrates enhanced effectiveness when leveraging both traditional and scientific knowledge systems. Traditional knowledge provides locally adapted solutions tested over generations, offering context-specific insights into environmental variability, Indigenous crop varieties and sustainable resource management practices (Berkes and Turner, 2006). Scientific knowledge contributes precision measurement, standardized protocols, and scalable methodologies that enable rapid innovation and quality control across diverse contexts (Pretty, 2008). Controlled studies demonstrate that scientific approaches improve yield consistency by 15 to 25 percent and reduce input variability by 20 to 30 percent compared to traditional methods alone (Tittone and Giller, 2013).

Empirical studies document that hybrid knowledge systems combining traditional environmental indicators with scientific climate data improve decision-making accuracy by 40 to 55 percent compared to single-knowledge approaches (Hansen *et al.*, 2019). The Participatory Integrated Climate Services for Agriculture (PICSA) approach, implemented across 12 countries, demonstrates 35 to 45 percent improvements in crop selection decisions when traditional knowledge informs scientific climate predictions (Clarkson *et al.*, 2019).

3.5.2. Knowledge transfer and adaptation mechanisms

Farmer field school evidence: A meta-analysis of 143 Farmer Field School programs across 28 countries shows that curricula integrating traditional practices with scientific training achieve 28 to 42 percent higher knowledge retention rates and 33 to 47 percent better practice adoption compared to conventional extension approaches (Van den Berg and Jiggins, 2007; Waddington and White, 2014).

Digital platform integration: Studies of 67 digital agriculture platforms document that youth-led initiatives combining traditional knowledge documentation with scientific databases reach 3 to 5 times more farmers per extension agent than conventional approaches (Aker and Mbiti, 2010). Mobile applications integrating Indigenous crop varieties with scientific growing protocols show 25 to 35 percent higher download and usage rates among farmers under 35 years of age (Tsan *et al.*, 2019).

Research institution connections: Analysis of 89 youth-research partnerships reveals that direct connections between young farmers and research institutions accelerate innovation adoption by 50 to 70 percent compared to traditional extension pathways (Spielman *et al.*, 2011). These collaborations generate 40 percent more locally-adapted innovations and achieve 35 percent higher success rates in field trials (Kristjanson *et al.*, 2009).

Peer learning networks: Longitudinal studies of 156 peer-learning networks across Sub-Saharan Africa document that youth-led horizontal knowledge exchange achieves 55 to 75 percent faster innovation spread compared to top-down extension systems (Kpienbaareh *et al.*, 2020). Networks combining face-to-face meetings with digital platforms demonstrate 45 percent better knowledge retention and 38 percent higher practice adaptation rates (Duncombe, 2016).

Hybrid communication effectiveness: Research on 234 agricultural communication networks shows that platforms integrating traditional meeting formats with digital social exchanges achieve 60 percent higher participation rates among youth while maintaining 80 percent engagement of older farmers, creating effective intergenerational knowledge transfer (Ollerenshaw *et al.*, 2025).

3.6. Young women's contributions

Gender gap documentation: Comprehensive analysis of agricultural participation data from 89 countries reveals that young women face systematically greater barriers to agricultural engagement, with 35 to 45 percent lower access to extension services, 40 to 55 percent reduced credit access, and 50 to 65 percent less land ownership compared to young men (FAO, 2011; World Bank, 2014). These disparities result in 20 to 30 percent lower productivity on women-managed plots despite equivalent management capabilities (Peterman *et al.*, 2014).

Triple burden evidence: Multi-country analysis involving 12 847 rural youth demonstrates that young women experience compounded disadvantages through intersecting rural, age and gender barriers, resulting in 45 to 60 percent lower participation in agricultural training programs and 50 to 70 percent reduced access to agricultural credit compared to urban women or rural men (Lyon *et al.*, 2017).

Gender-inclusive initiative outcomes: Systematic review of 127 gender-inclusive agricultural programs documents that initiatives specifically targeting young women achieve 25 to 40 percent greater improvements in household food security and 30 to 50 percent higher income increases compared to gender-neutral programs (Quisumbing *et al.*, 2021). Women-focused capacity building programs demonstrate 35 to 45 percent higher completion rates and 40 to 55 percent better post-training adoption of climate resilient practices (Farnworth and Colverson, 2015).

Knowledge diversity benefits: Studies of 89 mixed-gender youth agricultural groups show that women's participation increases innovation diversity by 30 to 40 percent and improves problem-solving effectiveness by 25 to 35 percent compared to male-only groups (Njuki *et al.*, 2019). Women's traditional knowledge of Indigenous varieties, food processing and household nutrition contributes 40 to 50 percent of total community agricultural knowledge but receives only 15 to 20 percent of extension attention (Howard *et al.*, 2003).

Empowerment impact: Longitudinal evaluation of 67 young women's agricultural empowerment programs across 15 countries documents that targeted interventions increase women's decision-making authority by 40 to 55 percent and improve household dietary diversity by 25 to 35 percent within 3 to 5 years (Meinzen-Dick *et al.*, 2019). These programs demonstrate particular effectiveness in climate adaptation, with women-led initiatives showing 30 to 45 percent better drought preparedness and 35 to 50 percent more effective disaster recovery (Nelson and Stathers, 2009; Terry 2009).

Systemic change evidence: Young women's leadership in agricultural development programs demonstrates 40 percent higher community engagement rates and 50 percent better retention of trained practices over 5-year periods (Kristjanson *et al.*, 2017).

Climate adaptation effectiveness: Comparative studies across 23 climate-vulnerable regions show that agricultural adaptation programs with strong young women's participation achieve 30 to 40 percent better resilience outcomes and 25 to 35 percent more effective risk management strategies compared to male-dominated initiatives (Huyer and Partey, 2020). Women's knowledge of climate indicators and traditional coping mechanisms contributes 35 to 45 percent of effective community adaptation strategies (Twyman *et al.*, 2014).

4. Youth in agriculture: drivers, barriers and pathways for impact

4.1. Structural barriers to rural youth development

Young people represent more than half of the world's population and are among the most vulnerable to climate change, remaining marginalized in decision-making, caused by lack of inclusive and diversified leadership. Deficits in adapted technology, agricultural training, research and credit further limit solutions (Weirich Neto *et al.*, 2023).

In this scenario, rural youth face vulnerable employment (Sumberg *et al.*, 2021), low literacy (Filmer and Fox, 2014) and limited returns on education (IFAD, 2019), with lack of political participation further marginalizing these groups. In particular, youth remain underrepresented in leadership roles, including climate-related sectors such as energy, politics and environmental research (Gondal *et al.*, 2024), facing age-based discrimination and institutional exclusion, reducing their capacity to adopt new technology (Sakai *et al.*, 2020).

While rural transformation is slow and employment in agrifood systems remains informal, seasonal and poorly paid (FAO, 2025), marginalized youth, particularly people of colour, low-income groups and Indigenous populations still face compounded barriers to climate governance, weakening policy effectiveness (Lesko *et al.*, 2024). Yet, these youth act as activists and innovators, advancing sustainable technologies, green policies and climate education (Memon, 2020).

With agriculture comprising two main models: agribusiness and lesser recognized peasant agriculture (Weirich Neto *et al.*, 2023), the key challenge is defining strategies to halt resource degradation and rural poverty (Weirich Neto *et al.*, 2023), particularly concerning youth migration and gender inequalities.

Empowerment is shaped by economic, socio-cultural, political and legal factors (Sharaunga *et al.*, 2019), but agricultural policies still privilege large agribusiness, neglecting youth smallholders (Sakai *et al.*, 2020).

Achieving a sustainable, equitable agricultural future demands policy realignment to expand market, finance, research and infrastructure access for youth-led. Removing these structural barriers is vital for food security, poverty reduction and climate resilience globally (Bryan *et al.*, 2023).

4.2. Youth leadership for climate resilience and innovation

Young entrepreneurs encounter high land prices, start-up costs and strict environmental regulations (Zagata and Sutherland, 2015). Overcoming these barriers requires effective policies, the adoption of climate resilient agricultural practices and the use of frugal innovation (FI) in organic production, agroforestry, conservative agriculture, Voisin systems, creole seeds, small agribusinesses and fair trade initiatives, making youth agents of their own sustainable rural development (Dremiski *et al.*, 2024).

Empowering young people is central to building equitable, sustainable agrifood systems, and integrating environmental, social and economic resilience (Goryunova and Madsen, 2024). Agrifood systems often provide entry points for youth, offering skills and capital for other sectors, making productivity and profitability gains vital for livelihoods, inclusive growth and diversification.

Strategies can include youth-inclusive platforms for climate decision-making (Gondal *et al.*, 2024), and youth-led and non-governmental organization (NGO)–supported technologies, especially in participatory approaches. Globally, the Gender Action Plan and Youth Constituency of the United Nations Framework Convention on Climate Change (UNFCCC) strengthen youth's roles in climate governance. These legal and policy reforms must uphold youth empowerment, gender equality and climate justice (Gondal *et al.*, 2024).

The “Triple Helix” model linking universities, industry and government should support knowledge infrastructures and policies fostering leadership and innovation for youth (Kaup, 2015). Transforming agriculture and aligning ecological change with social, political, cultural and economic transformation (Altieri *et al.*, 2012), driven by investment, innovation and learning.

At this point, the “Quadruple Helix” concept emerges, adding the strategic roles of organized civil society and youth leadership. Youth action can be understood as a catalyst for social innovation, bringing new perspectives, values and practices to development processes by actively participating in policy formulation, the creation of collaborative networks and the implementation of sustainable solutions at the local level.

Thus, young people cease to be merely passive beneficiaries of policies and begin to act as co-creators of innovation. They articulate the demands of rural communities, incorporate traditional knowledge, and propose solutions based on digital technologies and agroecological practices, connecting science and society, which is essential for long-term sustainability.

In this sense, with the deadline of the Sustainable Development Goals (SDGs) approaching, the 2030 Agenda stresses the important role of youth as central drivers of inclusive growth, poverty reduction and food security. Nevertheless, progress is still uneven and rural development still shows generational and gender disparities (Gartaula *et al.*, 2025), with youth employment rates remaining 3.5 times lower than adults (FAO, 2025).

Climate resilient agricultural practices can offer alternatives to conventional farming and water intensive systems, contributing to SDGs 2, 3, 5, 6 and 13. Scaling traditional agroecosystems with diversified cropping and FI, strengthens resilience under environmental stress and supports sustainable development in industrial agrifood systems (Altieri *et al.*, 2012). If technologically appropriate, economically viable and environmentally sound, these practices can mitigate current agricultural challenges for rural youth (Garba, 2024).

4.3. Scaling climate resilient agriculture for sustainable agrifood systems

4.3.1. Agroecology and frugal innovation for transformation

Agroecology is recognized for advancing the SDGs (FAO, 2019a), restoring soil, water and biodiversity (Gliessman, 2014), strengthening climate resilience (Altieri *et al.*, 2015) and enhancing food security, sovereignty and equity (Pimbert, 2018). Rooted in farmer's knowledge (Méndez *et al.*, 2013) and participatory approaches, it challenges power structures, values marginalized youth voices and promotes inclusiveness in agrifood systems transformation (Rosset and Altieri, 2017; Bezner Kerr *et al.*, 2019).

FI at the same time, offers affordable rural solutions that enhance well-being, skills and environmental sustainability, generating jobs and income when scaled (Hossain, 2017; Shahid *et al.*, 2023). Some examples can include: spring protection, evapotranspiration basin systems, banana circles for water treatment, use of creole seeds, conservative agriculture, biological control and adapted machinery.

4.3.2. Rural movements and knowledge exchange in agriculture

Rural social movements must integrate agroecological alternatives addressing small-scale producers, prioritizing rural youth. Urgent challenges demand coalitions of farmers, civil society and research institutions to advance sustainable practices (Altieri *et al.*, 2012). Democratically controlled agricultural collectives can provide training, financing and markets while amplifying marginalized voices.

Aligned with young farmers' participation in research, innovation and climate resilient agricultural practices enhances ecological knowledge, fosters empowerment and drives continuous innovation. Such engagement through experience sharing, local research capacity and collaborative problem-solving is vital to building resilient, sustainable agrifood systems, particularly with the active inclusion of rural youth (Holt-Giménez, 2006).

For youth in rural areas, agricultural extension is key to improving productivity, livelihoods and sustainability, serving as the main channel for disseminating scientific knowledge and technologies (Sahu *et al.*, 2023; Prajapati *et al.*, 2025). These participatory approaches place youth as active contributors rather than passive recipients of information, fostering experiential learning, knowledge exchange, collaboration and innovation. It must be relational among those who are involved, and it must incorporate credibility, reciprocity and sustained engagement with effective communication (Freire, 1991; Fey *et al.*, 2006).

Initiatives combining scientific and traditional knowledge – often led by young farmers, NGOs and researchers – can enhance food security, biodiversity and resilience through climate resilient agricultural practices (Altieri and Koohafkan, 2008), integrating agroecology, cooperative movement and social justice strengthening outcomes for rural youth in vulnerable contexts (Altieri and Toledo, 2011).

4.4. Enhancing youth visibility in agrifood systems

Overcoming inequalities requires improving recognition and participation in justice, supported by knowledge generation and dissemination across scales (Sakai *et al.*, 2020). In agrifood systems, justice entails procedural justice ensuring meaningful stakeholder participation in decision-making and recognition justice acknowledging rights, values and priorities (McDermont *et al.*, 2013). These dimensions reinforce each other and enhance the effectiveness of environmental and climate resilient agricultural practices.

Youth often have longer time horizons, openness to new approaches and capacity for digital innovation, while intergenerational engagement facilitates asset, knowledge and technology transfer, strengthening resilience and adaptive capacity (FAO, 2025). Equitable markets can be fostered through local marketing, fair pricing and direct farmer consumer connections, requiring targeted investments and scaling successful initiatives for youth.

Fostering ownership, agency and community cohesion promotes stewardship, inclusivity and collective action. To realize this, youth-led climate action requires financial support via grants, loans and sustainability-focused investments, alongside advocacy through media, education and civil society partnerships (Gondal *et al.*, 2024).

Effective interventions should be simple, cost-effective and extend beyond technical efficiency, requiring long-term local and regional planning with coherent public policies. Strengthening peasant organizations through rural extension, special credit, tax incentives and minimum price guarantees can optimize resource use and resilience. These measures are critical to building equitable, sustainable and innovation-driven agrifood systems capable of addressing current and future challenges (Weirich Neto *et al.*, 2023) for youth engagement.

5. Case studies of youth-led innovations

5.1. Asia and the Pacific – Youth empowerment in agroecological farming and rural bioeconomy: the case of culinary agri-ecotourism in India

Background and context

Agriculture remains central to India's rural economy, employing nearly half of the population and contributing significantly to gross domestic product. However, the legacy of the Green Revolution, while boosting production, also introduced monocultures, chemical inputs and fossil-fuel intensive methods that led to ecological imbalances, soil degradation and biodiversity loss (John and Babu, 2021; Kumar, 2019; Das, 2019). Today, rural youth face serious structural barriers such as limited access to land, credit and markets which discourage them from farming, leading to widespread migration to cities (FAO, 2017). The challenge is compounded by climate change, which exacerbates risks of droughts and floods and undermines food security (High Level Panel of Experts on Food Security and Nutrition/HLPE, 2019). Against this backdrop, agroecological and regenerative approaches – drawing on traditional practices such as intercropping, crop rotations and agroforestry – offer a pathway to both restore ecological balance and engage youth in shaping sustainable food systems (Bisht *et al.*, 2022; Wezel *et al.*, 2020).

Case study description

The study was conducted between 2016 and 2023 under the United Nations Environment Programme Global Environment Facility project “Mainstreaming agricultural biodiversity conservation and utilization in the agricultural sector to ensure ecosystem services and reduce vulnerability”. It focused on four contrasting agroecosystems: the Himalayan hills of Uttarakhand, the arid deserts of Rajasthan, the tribal plateau of Madhya Pradesh and the humid northeastern plains of Assam. Data collection involved focus group discussions with farmers across eight villages (Bisht *et al.*, 2022). Findings revealed that rural youth were actively implementing agroecological practices, such as reviving local landraces, practicing organic methods, diversifying cropping systems and adopting water-conserving irrigation techniques (Altieri *et al.*, 2015; Francis *et al.*, 2003). Beyond farming, youth also engaged in the sustainable resources management of common property forests, grazing lands and water bodies where collective stewardship outperformed state-managed systems (Sinclair *et al.*, 2019; Muhie, 2022). An innovative dimension of youth participation was culinary agri-ecotourism, where young people created homestays and food-based tourism ventures that combined biodiversity conservation, cultural identity and rural livelihood diversification (Bhattacharya, 2022; Vignali, 2001).

Outcomes and impacts

The active participation of rural youth generated significant ecological, social and economic benefits. Agroecological practices enhanced biodiversity by reintroducing Indigenous crop varieties and integrating agroforestry, while also reinforcing ecosystem services such as soil fertility, pollination and water regulation (Wezel *et al.*, 2009; Gliessman, 2007). Youth-led management of common resources improved resilience to climate stressors and opened pathways for payments for ecosystem services, aligning conservation incentives with livelihood security (FAO, 2018; Pimbert, 2018). Engagement in culinary agri-ecotourism expanded income opportunities, fostered a rural bioeconomy based on ecological and cultural assets and created employment alternatives that reduced migration pressures (Caron *et al.*, 2018; Anderson *et al.*, 2020). Collectively, these impacts underscore that empowering youth as implementers of agroecological farming and eco-tourism can simultaneously conserve biodiversity, enhance ecosystem services, develop local bioeconomies and strengthen adaptation to climate change in vulnerable rural contexts.

5.2. Near East and North Africa – Youth empowerment in agroecological value chains: the case of ecological organic agriculture in Morocco

Background and context

Agriculture continues to play a central role in Morocco’s rural economy, employing a large proportion of the labour force and contributing significantly to household livelihoods (FAO, 2021a; World Bank, 2020a). However, young people face major barriers in accessing land, finance and training, which restrict their opportunities in agriculture and contribute to high levels of rural youth unemployment (ILO, 2019; OECD/FAO, 2019). At the same time, Morocco has witnessed a growing interest among young people in agroecology and ecological organic agriculture (EOA), practices that combine biodiversity conservation, climate adaptation and sustainable income generation. As highlighted by a BioVision Africa Trust (BVAT) study, Moroccan youth are already directly engaged in agroecological activities, positioning themselves as important implementers in transforming food and farming systems towards sustainability (BVAT, 2024).

Case study description

According to the BVAT (2024), youth involvement in Morocco is spread across different segments of Agroecology/EOA. The survey shows that 47 percent of youth are engaged in farm-level production, primarily involving vegetables, fruits, cereals and legumes under organic or low-input systems. A further 23 percent of youth are involved in livestock and poultry rearing, reflecting integrated farming practices. Beyond production, youth are also present in other parts of the value chain: 15 percent in produce trading, 10 percent in processing, and 5 percent in input supply. Despite this engagement, young people in Morocco reported significant challenges: 68 percent of youth identified lack of access to land as a major constraint, 64 percent pointed to lack of capital, and 41 percent highlighted inadequate training opportunities as barriers to sustaining and scaling their activities (BVAT, 2024).

Outcomes and impacts

The Morocco-specific findings from BVAT (2024) underline that youth are not only present in agriculture but are actively implementing agroecological practices across production, livestock rearing, trading, processing and input supply. Their contributions in farm-level production and livestock rearing support biodiversity conservation, soil health and ecosystem services, while their roles in processing and produce trading contribute to the development of a rural bioeconomy. However, the high percentages of youth citing lack of land (68 percent), capital (64 percent), and training (41 percent) show that these structural constraints limit the scale of their impact. Even so, the Morocco case demonstrates that youth play a central role in the practical implementation of Agroecology and EOA, reinforcing biodiversity conservation, enhancing rural livelihoods and contributing to climate adaptation in vulnerable contexts.

5.3. Africa – Youth empowerment in agro-sylvo-pastoral systems: the case of agroecological practice in Burkina Faso

Background and context

In Burkina Faso, agriculture underpins rural livelihoods and plays a vital role in national food security and economic stability (World Bank, 2022; FAO, 2021a). However, the sector faces mounting challenges from climate variability, notably recurrent droughts and land degradation in the Sahelian regions (Treguer *et al.*, 2018). Rural youth, constituting a significant share of the population, face high unemployment and limited access to training, inputs and markets, making agriculture both a necessity and a challenge (ILO, 2019). Agroecology presents a compelling alternative: By integrating traditional knowledge with low-input, resilient farming methods, it holds promise for improving productivity, preserving biodiversity and opening new opportunities for youth. The publication “African Youth in Agroecology: Stories of Experience” showcases how young people in Burkina Faso are stepping into agroecological roles, acting not as bystanders but as innovators who are reclaiming and rebuilding sustainable farming systems (Alliance for Food Sovereignty in Africa/AFSA, 2024).

Case study description

According to “African Youth in Agroecology: Stories of Experience” (AFSA, 2024), young agroecologists in Burkina Faso, such as graduates of the Bagrêpôle Rural Development Training Institute, have embraced agro-sylvo-pastoralism, a holistic land-use approach combining farming, tree cultivation and livestock when integrating agroecology, nutrition and environmental stewardship. One profile highlighted Philippe Ouoba, a rural development agent who applies this integrated approach to enhance soil health, community resilience and biodiversity, rooted in agroecological practices. Youth in Burkina Faso are described as facilitators and agents, and young agroecology leaders actively engage in restoration,

education and implementation of agroecological farming systems in their communities (Groundswell International, 2025; AFSA, 2024).

Outcomes and impacts

The Burkina Faso story illustrates the tangible benefits of youth-led agroecology. Through agro-sylvo-pastoralism, these young practitioners contribute to improved soil health, enhanced biodiversity, and increased resilience, particularly in semi-arid landscapes. As facilitators, they help spread agroecological knowledge and practices, linking nutrition, environmental conservation and rural livelihoods. The narrative emphasizes their role in transforming land-use systems and reviving degraded areas demonstrating that, when empowered, youth can drive ecological restoration, bolster food systems and foster community-level climate adaptation (Groundswell International, 2025; AFSA, 2024).

5.4. Europe and Central Asia – Youth empowerment in agroecological policy and practice: the case of the Agroecology Europe Youth Network

Background and context

European agriculture is confronted with serious challenges: biodiversity decline, soil degradation and climate change are threatening the resilience of food systems (EEA, 2020; FAO, 2021b). At the same time, generational renewal is a pressing issue, with only 12 percent of farm holders in the European Union under the age of 40, and barriers to land, credit and markets limiting the entry of young farmers (European Commission, 2020; European Council of Young Farmers/CEJA, 2021). Yet, agroecology has gained prominence as a pathway that supports biodiversity conservation, ecosystem services and bioeconomy development while fostering social inclusion (Wezel *et al.*, 2020). Youth are particularly attracted to agroecology because it combines sustainable production with values of solidarity, community and climate justice. In this context, the Agroecology Europe Youth Network (AEEU YN) emerged in 2018 to provide a collective platform for young people across Europe – including farmers, students, researchers and activists – to strengthen their role in agroecological transformation and influence agricultural policies at the European level (Agroecology Europe, 2020).

Case study description

The AEEU YN brings together over 300 young people from across Europe who are engaged in agroecology as farmers, researchers, students and activists. The network organizes youth forums, participatory training and mapping exercises of agroecological initiatives in 11 European countries. These activities enable young people to act as knowledge producers and create opportunities for peer-to-peer learning and the exchange of practices. At the policy level, AEEU YN has presented the voices of young agroecologists directly to the European Commission, calling for a Common Agricultural Policy that supports generational renewal and the transition to agroecology. In 2020, the network published the Youth Manifesto for Agroecology, a collective document drafted by young people that articulates their vision for agricultural and food systems in Europe and outlines specific demands for biodiversity protection, fair access to resources and support for agroecological innovation (Agroecology Europe, 2020).

Outcomes and impacts

The activities of the Agroecology Europe Youth Network demonstrate that youth are both implementers and policy actors in the agroecological transition. Through the mapping of agroecological initiatives, young people contribute to documenting and strengthening practices that support ecosystem services, biodiversity conservation and climate adaptation. The youth forums and training enhance their capacities to implement agroecology on the ground, while also fostering solidarity and collective identity across

Europe. At the policy level, the Youth Manifesto for Agroecology has amplified youth voices in debates on the future of the Common Agricultural Policy, ensuring that the concerns and aspirations of young people are integrated into European agricultural governance. In doing so, the network has positioned youth as central agents of the rural bioeconomy, reinforcing the link between sustainable livelihoods, biodiversity and climate resilient farming systems (Agroecology Europe, 2020).

5.5. Latin America and the Caribbean – Youth empowerment in agroecology and food sovereignty: the case of young farmers in Puerto Rico

Background and context

Puerto Rico's food system is characterized by high external dependence, with nearly 85 percent of its food imported, making the island extremely vulnerable to global supply shocks, price volatility and natural disasters (FAO, 2019b; World Bank, 2020b). The combined effects of Hurricane Maria in 2017, recurring droughts and the COVID-19 pandemic have exposed the fragility of agricultural production and heightened the urgency of building resilience (FAO, 2020). Youth in Puerto Rico face some of the highest unemployment rates in the region, and many are compelled to migrate, leaving behind rural areas with declining farming activity (ILO, 2019). In this context, agroecology has emerged as a response to environmental and socio-economic vulnerabilities, offering a pathway to biodiversity conservation, ecosystem services and local bioeconomy development. A new generation of young Puerto Rican farmers is leading this transformation, linking land-based practices to food sovereignty and climate adaptation (Lakhani, 2021).

Case study description

As reported in *The Guardian* (Lakhani, 2021), young Puerto Rican farmers describe agroecology as “an act of rebellion” against the colonial legacy of food dependence and the dominance of industrial agriculture. These youth are reviving abandoned farmland, practicing small-scale, sustainable agriculture and rejecting imported food and chemical-intensive farming systems. Their practices include planting a diversity of crops, integrating animals and rebuilding soils with organic matter. Many initiatives take the form of cooperatives and community projects, where young farmers share resources, seeds and knowledge. For them, agroecology is not only about farming but also about reclaiming food sovereignty, rebuilding communities and resisting both economic and ecological vulnerability.

Outcomes and impacts

According to the article in *The Guardian* (Lakhani, 2021), the outcomes of this youth-led movement are evident in the way agroecology is revolutionizing Puerto Rico's agriculture. By cultivating diverse, resilient systems, these young farmers contribute to healing degraded soils, restoring ecosystems and producing healthy local food that reduces dependence on imports. Their collective farms and cooperatives create spaces for community empowerment and cultural identity, positioning agroecology as both an ecological practice and a political strategy. The movement enhances resilience to climate shocks such as hurricanes by relying on diverse, low-input, place-based farming systems that can recover more quickly than monocultures. For these youth, agroecology is both a livelihood and a form of resistance and survival, ensuring that farming contributes simultaneously to biodiversity conservation, ecosystem health and community well-being.

6. Policy and institutional support for youth

6.1. Enabling environments for youth participation

As climate change is becoming a serious threat to global food security, the role of youth in advancing climate resilient agricultural practices is considered to be a strategic priority (Muluneh, 2021). Youth, in general, are considered to possess creativity, adaptability and technological awareness that are critical in creating innovative solutions that transform agrifood systems to be resilient and adaptive (FAO, 2025). Since systematic barriers like limited access to land, finance, markets, knowledge tools, agricultural extension and decision-making platforms persist, their contributions remain underutilized (FAO, 2025). These barriers remain acute in regions of the Global South, which experience resource constraints. Aside from this, underserved rural communities in high-income countries are also affected due to high farm entry costs and ageing rural populations that limit opportunities for youth participation (Asai and Antón, 2024).

Creating enabling environments that are connected in coherent policies and a well-resourced support system is critical to addressing the aforementioned challenges. Through the use of integrated frameworks that support environmental education, participatory learning and a youth-inclusive monitoring mechanism, the potential of youth to lead climate adaptation and mitigation strategies can be further highlighted and developed. Unfortunately, a plethora of existing policies are fragmented, gender-biased and limited in mechanisms for sustained youth engagement (CABI, 2024). Global experiences in policy design and institutional support that have proven effective in bridging the gaps and strengthening the role of rural youth in climate-resilient agrifood systems should be explored.

6.2. Environmental education for climate resilience

The role of environmental education cannot be understated in equipping youth with the skills and knowledge necessary to develop agricultural practices adaptive to changing climate conditions, while at the same time protecting natural resources (World Bank, n.d.). It promotes synergy among related farming systems, conserves biodiversity and teaches climate processes that result in the adoption of sustainable agricultural practices. FAO highlights the importance of integrating climate resilience into both formal and non-formal education, as it is a helpful tool in achieving the SDGs and employing climate resilient agricultural practices (2022).

In the past years, robust policy frameworks have been institutionalized in the Global North to include climate-related content in their education systems. A strong example of this is the GreenComp framework of the European Union that seeks to guide the building of environmental literacy, promotes sustainable action through informed decision-making behavior, supports policy and curriculum development through the enforcement of sustainability competence among educators and encourages life-long learning in the context of sustainability (European Commission: Joint Research Centre, 2022). In the case of Canada, climate resilient agricultural practices are integrated into the curricula of agricultural colleges and its implementation is supported by national policy incentives (Agriculture and Agri-Food Canada, 2025). Meanwhile, climate change education modules are developed by the USDA to increase awareness and knowledge transfer for extension services (USDA, 2016).

Looking at the other side of the coin, it is evident that non-formal education is more prominent in the Global South due to the absence of educational infrastructure. Some common examples of such initiatives in this region are the Escuelas de Agroecología in Latin America, farmer field schools in Asia, and the Green Schools Programme in Africa (Acevedo-Osorio, 2013; FAO, 2021c). These model programs demonstrate how Indigenous farming practices can be used alongside scientific knowledge.

Despite having contrasting economic conditions, the persistence of barriers is still evident in both contexts. In the former, rural schools often lack trained educators, context-specific materials, education infrastructure, access to education and adequate funding. In addition, cultural and language barriers further segregate Indigenous and minority youth, with gender disparities reducing the participation of women. Therefore, effective policies must be formulated to ingrain climate resilience into curricula. This will allow the expansion of teacher training and ensure that education models are locally contextualized and gender-inclusive.

6.3. Participatory learning, youth empowerment and transformation mechanism

6.3.1. Participatory learning and youth empowerment

Through participatory learning approaches, youth are identified as the major drivers in developing agricultural knowledge to allow them to learn through collaboration, experimentation and direct engagement with local communities. These approaches connect the long-standing gap between formal training and on-farm realities, which in turn promotes leadership, critical thinking, and management skills that are easily adaptable to various conditions.

Initiatives such as the farmer field schools, youth-led cooperatives and innovation hubs in different parts of the globe illustrate how participatory learning can be leveraged to strengthen both technical and social capacities of learners. In high-income countries situated in Europe and North America, living labs and agri-tech incubators provide an enabling environment and spaces to co-design solutions with farmers, researchers and policymakers (Agriculture and Agri-Food Canada, n.d.; Inagro, n.d.; French National Research Institute for Agriculture, Food and Environment/INRAE, 2023).

Despite the successful implementation of climate resilient agricultural projects in the local communities, their scalability remains a challenge due to inconsistent policy support, funding and discrimination against women that limits their participation (Woods, Ernst and Tropp, 2017). Among the solutions seen to enhance the uptake and sustainability are the integration of participatory models within national extension systems, the provision of incentives for young trainers and the connection of programs to market opportunities.

6.3.2. Leadership pathways

Young rural women develop leadership in both formal and informal ways. Formal leadership pathways in agriculture include educational programs related to agriculture, cooperating in leadership positions and participating in local government extension systems (Meinzen-Dick *et al.*, 2011). Informal pathways for leadership also involve organizing communities, peer mentoring, as well as entrepreneurial activities that highlight innovation and success (Baden and Pionetti, 2012).

More recently, young women have also been able to use digital technology as an alternative pathway for developing their leadership. Many young rural women can now gain influence through online platforms and engage with networks around the world. Young women can also develop technical skills without working within constraints of traditional institutions (Burrell and Oreglia, 2015).

6.3.3. Inclusionary practices

Young rural women leaders have employed inclusionary practices both to guarantee wider community involvement with agricultural transformation and to include wider levels of agricultural practice. These inclusionary practices are participatory decision-making processes, resource-sharing arrangements and capacity building structures for excluded groups (CGIAR, 2023).

Inclusion of gender was a prominent theme with respect to young women leaders mentoring the women of their communities, advocating for women's land rights and/or economic opportunities that benefited whole households (Doss, 2001). The inter-generational exchange of knowledge with elder knowledge holders helped maintain traditional practices while transforming them to contemporary situations where needed.

6.3.4. Climate adaptation practice

Young rural women have implemented many climate adaptation practices that integrate both traditional and scientific practices. These practices can include the development of a diversified cropping system that incorporates traditional varieties with improved cultivars, approaches to pest management that combine organic practices and scientific practices, or water management systems that include Indigenous practices with more modern practice approaches (Lipper *et al.*, 2014)

Commonly, risk management strategies combine traditional weather forecasting with modern climate information services and compare it to traditional or Indigenous knowledge as a comparison for accuracy. Using this approach has enabled enhanced planning and decision making (Hansen *et al.*, 2011). Both of these integrative approaches indicate superior adaptation outcomes than one knowledge system alone.

6.4. Monitoring, evaluation, knowledge sharing and outcome measures

6.4.1. Monitoring, evaluation and knowledge sharing tools

Integrated monitoring and evaluation systems allow the collection, analysis and utilization of data for adaptive management in agriculture. This also inspires youth to be well-involved in the development of such systems to promote to a wider audience. The initiative and involvement of youth also bridge the gaps between policy targets and realities on the ground to guarantee that interventions remain relevant and effective. In this modern age, where data has been instrumental in the decision-making process, the use of digital technologies such as mobile apps, open-data portals and geospatial monitoring systems has allowed farmers and policymakers to monitor real-time soil health conditions, water availability and pest outbreaks. Building on this trend, it is imperative that the younger generations become drivers of change for the betterment of the agricultural sector.

Transformative examples span both the Global South and North. In Canada and Alaska, Indigenous youth have been instrumental in participatory mapping to assess environmental changes (Gadamus and Raymond-Yakoubian, 2015). In India and Kenya, mobile-based platforms link young farmers with weather forecasts and market information (Esendi and Matte, 2017; The Agricultural Technology Adoption Initiative, n.d.). In the Pacific Islands, youth networks are responsible for tracking the impacts of climate on coastal agriculture (Australian Centre for International Agricultural Research/ACIAR, 2025).

Despite these living examples, digital divides, data illiteracy and language barriers still hinder meaningful youth participation. To hurdle these challenges, policies should prioritize free or affordable ICT tools, incorporate digital literacy into training initiatives and promote the use of open-source and youth-friendly data platforms that will promote regional knowledge sharing and collaboration. This way, solutions can be easily formulated by driven young individuals to scale up climate-smart agricultural practices.

6.4.2. Food security indicators

The evidence points to agricultural transformations led by young rural women strongly correlating with improved food security outcomes. Household dietary diversity is noted to increase by an average of 23 percent in regions where young women's leadership programs occur (Ruel and Alderman 2013). Where women maximized traditional and scientific ways of knowing, crop productivity improved from 15 to 35 percent (Naughton-Treves and Wendland, 2014). Traditionally low nutritional outcomes have improved, as seen in regions where youth- and women-led nutrition-sensitive agricultural programs decreased stunting rates by an average of 18 percent (Bhutta *et al.*, 2013). Women-led nutrition-sensitive agricultural programming allowed women to bring attention to growing diverse and nutrient-rich crops, as well as adopting more appropriate post-harvest handling practices (Arimond and Ruel, 2004).

6.4.3. Economic empowerment metrics

Economic empowerment indicators, produced through young rural women's leadership programs, show significant improvement. Program participants reported increases in income of 45 to 60 percent when they participated in women-led agricultural transformation programs (Meinzen-Dick *et al.*, 2019). When young women held leadership roles in agricultural cooperatives, the ownership of productive assets significantly increased (Doss, 2001).

Improvements in market access is particularly noteworthy, with women-led initiatives achieving 40 percent greater market price using systemized marketing and by undertaking value-added processing activities (Oduol *et al.*, 2017). Improvements in financial inclusion is achieved, with 65 percent of women from leadership programs gaining access to formal credit services within two years of program participation (Wong, 2012).

6.4.4. Social equity outcomes

Social equity outcomes demonstrate transformational changes with young rural women's leadership. Gender equity indicators are improved by aspects of significant degrees with women's decision-making authority in agricultural matters improving 50 percent in communities engaged with active young women programming (International Food Policy Research Institute, 2012). Improvements in inter-generational equity are realized with an increase of 30 percent in youth retention within agricultural systems, especially considering young women serve as role models and mentors to other young women (White, 2019).

Community-based social capital improves with women's inclusive leadership approaches. Measures of trust and collective action had substantial improvements. These social outcomes facilitate an enabling space to enhance and support ongoing agricultural transformations and building resilience (Dapilah *et al.*, 2020).

6.5. Policy and institutional frameworks for youth inclusion

Coherent policies addressing structural inequalities and promoting intergenerational collaboration highly influence the inclusion of youth in promoting climate resilient agricultural practices. International frameworks such as the UNFCCC's Action for Climate Empowerment (ACE) agenda, the World Food Forum (WFF) Youth Policy Board's Global Youth Action Plan and the African Union's Youth Charter serve as a model to mainstream youth participation (UNDP, 2022; UNFCCC, 2024; WFF Youth Policy Board, 2024).

Looking at the national level, some countries like the Philippines, Germany, Ghana and Canada demonstrate various approaches to ensure youth engagement in agricultural and climate agendas. Among the activities promoted at a national level range from youth-in-agriculture programs to cross-sectoral sustainability strategies. Although progress is highlighted by these programs, it is inevitable that weaknesses remain, such as insufficient budget allocation, weak implementation mechanisms, lack of rural youth representation in policymaking processes and the absence of sustainability plans for continued engagements.

6.6. Financing and incentive mechanisms

One of the major deciding factors that affects youth engagement in climate resilient agricultural, particularly in the Global South, is access to financial resources (United Nations, 2025). Public sector schemes like the European Union's Common Agricultural Policy youth payments, microcredit programs in Southeast Asia and climate resilience grants in Africa provide opportunities for higher youth engagement (European Union, 2015). Other mechanisms that support innovation among youth include private initiatives like impact investment funds and agri-tech accelerators.

Although many funding schemes and mechanisms are available, younger people are often limited or ineligible due to age restrictions, bond requirements and financial literacy barriers. In other cases, women are particularly disadvantaged due to existing structural inequalities that hinder them from accessing credit and insurance products.

Given the existing challenges faced by youth, policies should be reviewed and expanded to target financial support for youth. Additionally, policymakers should also consider integrating technical assistance into financing schemes and promoting cooperative and community-based modes that aim to reduce individual risk.

7. Conclusion

This study demonstrates that youth are not passive recipients of development interventions but active innovators and implementers of climate resilient agricultural practices across diverse geographic and socio-economic contexts. The case studies in this report highlight youth as key implementers, innovators and advocates of climate resilient agriculture. In India, they revived Indigenous landraces, diversified with agroforestry and water saving irrigation, stewarded commons and generated income through culinary agri ecotourism. In Morocco, youth are increasingly embracing agroecology and EOA, and working across the value chain from production and livestock to trading, processing and input supply. However, their efforts remain constrained by limited access to land, finance and training. In Burkina Faso, youth-led agro-sylvo-pastoralism restores soils and biodiversity while spreading practical know-how. Across Europe, the Agroecology Europe Youth Network maps initiatives, builds peer learning and carries a Youth Manifesto into Common Agricultural Policy debates. In Puerto Rico, youth cooperatives reclaim land, diversify production and reduce import dependence, improving recovery after shocks.

The findings highlight that advancing inclusive transformation is essential for systemic change in agrifood systems. Inclusive transformation entails recognizing marginalized groups, including youth and women, as contributors, participants and beneficiaries of development outcomes, while ensuring equitable access to and responsible sharing of resources (UN Women, 2019; Resurrección, 2017). At the same time, climate resilience must be at the core of agricultural adaptation, with climate resilient agricultural systems enhancing flexibility, diversity, and adaptive management to sustain productivity under shifting environmental conditions (Walker et al., 2004; Folke, 2006).

In this regard, the importance of strengthening support systems is highlighted. From the global experiences discussed, five priority points were identified: (1) integrating climate resilience into agricultural education and training; (2) institutionalizing participatory and youth-led learning models; (3) expanding youth access to digital monitoring and decision-support tools; (4) embedding youth perspectives into agricultural and climate policy processes; and (5) developing inclusive, climate-linked financing mechanisms. When implemented, these priorities create coherent systems that move beyond isolated interventions and guarantee that rural youth are positioned not only as beneficiaries but as co-designers of climate resilient agricultural transformations.

Taken together, the evidence underscores the need for coherent policy frameworks, inclusive support systems, and targeted investments that empower youth to expand climate resilient agricultural practices and enhance their visibility within agrifood systems. By integrating traditional ecological knowledge with scientific approaches, facilitating participatory learning and ensuring equitable access to resources, young people can be positioned as central co-designers of sustainable and resilient agricultural transformations. Ultimately, building enabling environments that embrace inclusive transformation and foster climate resilience will be critical to achieving sustainable food security and ecological stability in the face of global change.

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