

Bridging the Financing Gap in Regenerative Agriculture: Solutions for Policy and Practice

By Tatenda Mambo, Irene Herremans, and Guillaume Lhermie.

ACKNOWLEDGMENTS

We extend our sincere gratitude to the **Canadian Federation of Agriculture and the Deans Council Agriculture, Food & Veterinary Medicine** for their invaluable support in the development of this report. Their guidance and contributions have been instrumental in shaping our analysis and insights.

We also wish to express our deep appreciation to all the **public and private funding partners** who generously provided data for this study. Their collaboration and transparency have been essential in enhancing our understanding of the agri-food research landscape and funding trends.

This report would not have been possible without the collective efforts of all stakeholders involved, and we are grateful for their commitment to advancing **agricultural research and innovation in Canada**.

TABLE OF CONTENTS

ABSTRACT *ii*

INTRODUCTION *1*

METHODS..... *4*

FINDINGS *5*

PRACTICAL RECOMMENDATIONS..... *9*

CONCLUSION *11*

REFERENCES *12*

BRIDGING THE FINANCING GAP IN REGENERATIVE AGRICULTURE: SOLUTIONS FOR POLICY AND PRACTICE

By Tatenda Mambo, Irene Herremans, and Guillaume Lhermie.

The Simpson Centre, Faculty of Veterinary Medicine, University of Calgary, Calgary, AB, Canada

Haskayne School of Business, University of Calgary, AB, Canada

guillaume.lhermie@ucalgary.ca

ABSTRACT

The transition to regenerative agriculture (RA) presents significant opportunities for sustainability and resilience but is hindered by financial and structural barriers. This relevant review explores the role of sustainable finance in supporting RA adoption, emphasizing the need for innovative financial instruments, policy reforms, and improved environmental, social and governance (ESG) measurement frameworks. The analysis highlights key financial barriers, including the bankability gap caused by the misalignment of short-term costs and long-term benefits, limited access to tailored financial products, and inadequate risk assessment tools. Existing and emerging financial mechanisms which include green bonds, sustainability-linked loans, impact investing, and fintech solutions are evaluated for their potential to bridge these gaps.

Polymakers and financial institutions play a critical role in addressing these challenges by developing targeted support mechanisms, including subsidies, low-interest loans, and ecosystem service payments. Additionally, the establishment of standardized ESG metrics and improved data collection methods is essential to demonstrate the financial viability of RA and attract investment. The integration of environmental data into risk assessment can facilitate more favorable insurance policies, ensuring financial security for farmers transitioning to regenerative practices.

By aligning sustainable finance with RA, stakeholders can unlock its full potential, fostering a resilient agricultural sector that balances economic viability with environmental and social benefits. Future research should focus on refining financial models and impact measurement tools to enhance investor confidence and policy effectiveness in scaling RA adoption.

PRACTICAL RECOMMENDATIONS

- **Advance Policy and Financial Collaboration:** Foster coordinated efforts between governments and financial institutions to develop long-term, regenerative-aligned funding mechanisms.
- **Enhance ESG Measurement Frameworks:** Develop standardized, sector-specific tools for measuring ESG impacts in agriculture to improve investment confidence and sustainability tracking.
- **Promote Data-Driven Innovation:** Support the integration of financial technology (fintech) to improve the precision, accessibility, and verification of ESG data, particularly for smallholder farmers.
- **Expand Green Financial Products:** Address the gap in financial instruments tailored to agriculture's green transition by aligning them with national taxonomies and sustainability disclosure standards.
- **Support RA Transition Strategies:** Mitigate high upfront costs through targeted financial mechanisms such as grants, subsidies, and ecosystem service payments, and promote phased adoption strategies.
- **Modernize Agricultural Insurance:** Design insurance products that reflect the long-term ecological and financial benefits of regenerative agriculture, incorporating environmental data into risk assessments.

- **Strengthen Policy and Governance Frameworks:** Implement regulatory incentives, reduce adoption barriers, and provide targeted funding and research to support RA practices.
- **Encourage Stakeholder Engagement:** Involve farmers in policy design to ensure alignment with practical challenges and opportunities and promote advocacy to raise awareness of RA's benefits.

INTRODUCTION

Regenerative agriculture (RA), promoted as a solution to the negative environmental effects of conventional agriculture (CA) and the eroding social systems within agriculture, has been growing in popularity (1–3). RA enhances sustainability by promoting ecological balance and resilience aiming to improve soil health, water quality, biodiversity, and carbon sequestration (1,4), while also mitigating vulnerabilities to climate change (4–6). Integrating RA into food systems creates resilient, sustainable agricultural landscapes, ensuring food security and farming community viability (6). RA also diversifies farm income through natural capital markets like carbon, payment for ecosystem services, and biodiversity credits, providing financial incentives for sustainable practices (4,7). Despite its benefits, farmers face significant financial barriers when transitioning to RA (1). Traditional financial models are often not designed to support the unique needs of regenerative farmers, creating a gap in bridging the transition between CA and RA. If RA is to expand and alleviate sustainability concerns, it needs financial support in the form of sustainable finance that takes in to account social and ecological outcomes in determining returns.

Finance plays a crucial role in driving agricultural transitions by providing the necessary capital and incentives for farmers to adopt sustainable practices. Under the umbrella of sustainable finance - “*finance to support sectors or activities that contribute to the achievement of, or the improvement in, at least one of the relevant sustainability dimensions*”- (8 p.2), the finance sector has developed financial tools and products aimed at providing not only economic returns, but also environmental, social and governance returns (ESG) (9,10). These products and approaches come in many forms as depicted in Table 1. While this innovation has been taking place, there remains a gap in the capital available to producers trying to transition to RA. This stems from issues that includes misaligned return schedules as RA does not fit into financial portfolios, limited data on the performance and returns of RA, and insufficient derisking tools and strategies.

Table 1. List of Sustainable finance tools and their definitions.

Sustainable Finance Tool	Definition
Green Bonds	<i>“any type of bond instrument where the proceeds will be exclusively applied to finance or refinance, in part or in full, new and/or existing eligible green projects and which are aligned with the four core components of the GBP(green bond principles)”</i> (8 p.7)
Social Bonds	Bonds with proceeds earmarked for projects aimed at generating positive social impact (11).
Sustainability Bonds	Bonds with proceeds earmarked for projects aimed at generating positive environmental and social impact (11).
Sustainability-Linked Bonds (SLBs)	Issuer makes a commitment to achieve pre-defined key sustainable performance targets, and the financial characteristics of the bond depend on the achievement of key performance indicators (KPIs). Proceeds go towards general purposes (11).
Green Loans	loans in which all proceeds are used exclusively to finance projects with clear environmental benefits. They are typically smaller and privately arranged, following the Green Loan Principles, and align with the environmental standards set by the Green Bond Principles (12).
Sustainability-Linked Loans (SLLs)	a type of financing that incentivizes borrowers to improve their environmental, social, and governance (ESG) performance by linking loan terms -most commonly interest rates- to the achievement of predefined sustainability targets (13).
Impact Investing	“investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return.” (14).
Blended Finance	a financing approach that leverages public or development funds to attract private investment in low- and middle-income countries. By using public capital to absorb early risks, it helps mobilize larger-scale private finance for sustainable development (15).
Transition Finance	directs capital toward reducing emissions in high-emitting, hard-to-abate sectors that are vital to the economy but often excluded from green finance. It uses instruments like

	transition bonds and sustainability-linked loans, though clear criteria are needed to ensure credibility. (16)
Financial Technology (Fintech)	refers to a financial industry that uses technology to improve financial activities. Emerging from the intersection of finance and technology, fintech includes innovations such as cryptocurrencies, mobile payments, crowdfunding, peer-to-peer lending, and robo-advisory services (17).

ESG investing entails incorporating environmental, social, and governance criteria into investment decisions, aiming to promote sustainable economic development and address global challenges such as climate change and social inequality, aligning with the Sustainable Development Goals (18,19). Environmentally, ESG investing encourages sustainable land use, water conservation, biodiversity protection, and emissions reductions. This includes support for practices such as carbon sequestration, reduced chemical inputs, and climate-resilient land management techniques like no-till farming, cover cropping, and rotational grazing (4). Socially, ESG investing encourages fair labor practices, empowers smallholder farmers, and strengthens food security, helping to create more equitable agricultural systems. From a governance perspective, ESG frameworks prioritize transparency in reporting, ethical conduct, robust sustainability metrics, and certification schemes (20). Investors seek organizations with strong oversight, stakeholder participation and compliance with environmental standards (4,20).

While a focus on ESG returns is welcome, reflecting the societal need for the finance and investment sectors to have a stake in the sustainability of the planet and social systems, ESG reporting and standards leave much to be desired. The measurement of ESG returns is complex due to the lack of standardization and transparency in ESG reporting, which poses challenges in assessing the impact of ESG investments (10). Different methods have been developed to measure ESG returns, including using ESG disclosure scores to assess how ESG performance affects returns (19). While ESG reporting and metrics are lacking, investors do not necessarily sacrifice returns for sustainability (19–21). ESG expenditures are integral to achieving long-term financial gains and securing a competitive edge (21). Improved ESG scores are strongly correlated with enhanced financial performance, as companies that strengthen their ESG practices consistently demonstrate more positive financial outcomes, making ESG metrics reliable indicators of future success (21).

The role of finance is not only to provide capital but also to de-risk the transition process through mechanisms like concessional funds (more generous terms than market loans, i.e. lower interest rate, longer repayment periods) and guarantee schemes, which make investments in sustainable agriculture more attractive to private investors (4). Additionally, financial institutions are increasingly recognizing the importance of aligning their portfolios with environmental objectives, as seen in the development of sustainability-linked loans that tie financial terms to the achievement of specific ESG targets (22). Despite these advancements, challenges remain, such as the need for more comprehensive data on the long-term benefits of sustainable practices and the development of financial products that are accessible to smallholder farmers, who are often excluded from formal financial markets (9,23). Furthermore, advancements are necessary if the finance sector is to develop consistent metrics and standards on ESG reporting and disclosures. Overall, finance is a pivotal enabler of agricultural transitions, providing the necessary resources and incentives to shift towards more sustainable and resilient agricultural systems.

The J-Curve model as illustrated in Figure 1 shows how RA faces challenges fitting into typical investment models based on the relationship between investments and returns over time. In the initial investment phase, farmers face high upfront costs for equipment, seeds, and soil restoration. Yields may decline or remain stagnant as the land adjusts, reflecting the downward slope of the J-Curve where financial returns are initially negative despite the investment (23,24). During the adjustment period, farmers face yield variability as ecosystems stabilize. This phase, lasting several years, brings financial challenges like reduced profitability and cash flow issues, often leading farmers to consider reverting to conventional methods. Misaligned incentives, such as short-term financial pressures and limited credit access, can further discourage maintaining RA practices despite their long-term benefits (23,24). Over time, RA yields long-term gains as soil health, biodiversity, and productivity improve. The J-Curve rises, showing initial investments paying off. Farmers benefit from reduced input costs, higher climate resilience, and improved yields, leading to financial stability (23). Financial support mechanisms, like low-interest loans and subsidies, can mitigate early-stage risks and encourage commitment to regenerative practices (24). The sustainability and resilience phase marks the long-term upward trajectory of the J-Curve, where RA becomes economically viable and ecologically beneficial (23). Farmers enhance financial outcomes and contribute to environmental benefits like carbon sequestration and ecosystem restoration. Supportive financial frameworks are needed to incentivize sustainable practices and help farmers through the initial transition (24).

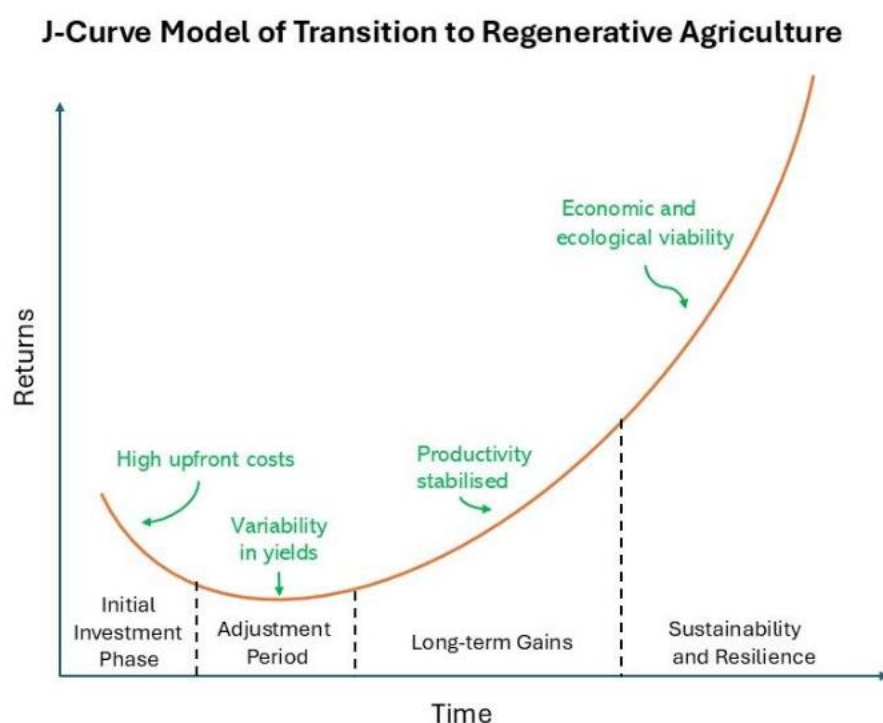


Figure 1. J-Curve model of agricultural transition.

This short relevant review examines the existing literature on the availability of capital to enable a transition to RA. In service of this goal, the paper addresses this by investigating 1) the needs of farmers when transitioning to RA, 2) availability of transition tools from the finance and investment sectors to enable the transition, and 3) the policy environment that facilitates this transition. This exercise is necessary due to the pivotal role capital plays in enabling such a shift in the context of a capitalist system. Furthermore, the current and worsening environmental and climatic challenges linked to agriculture can be alleviated through a shift to regenerative practices which would bolster resilience. Since RA does not align with conventional financial portfolios and return structures, it is crucial to investigate how financial instruments and policies can be utilized to meet this significant societal need.

METHODS

This relevant review utilizes a narrative approach to examine the role of sustainable finance in facilitating the transition to RA. A comprehensive search was conducted using academic databases, including Scopus, Web of Science, Google Scholar, and EBSCO, to identify relevant peer-reviewed literature, reports, and policy documents. The selection criteria prioritized studies published between 2014 and 2024 to ensure the inclusion of recent developments in sustainable finance, ESG investment frameworks, and RA. The reviewed studies are largely qualitative and were reviewed to provide a broad perspective on financial mechanisms, barriers, and policy interventions related to RA.

The search strategy incorporated a combination of keywords and Boolean operators to capture a wide range of relevant literature. Key search terms included "sustainable finance," "green finance," "ESG investment," "regenerative agriculture," "agricultural finance," "agricultural transition," "financial barriers in agriculture," "impact investing," "sustainable farming incentives," "agricultural risk management," and "transition finance." References cited in key studies were also reviewed to identify additional relevant sources. The literature was synthesized thematically to assess financial challenges, emerging financial instruments, and policy interventions aimed at promoting RA.

FINDINGS

THE FARMER PERSPECTIVE

While literature can be found on the challenges that exist in transitioning to RA, little is written from the farmers' perspective. Understanding their unique challenges and aspirations is crucial for developing tailored solutions that empower farmers to embrace regenerative practices effectively. Instead, much of the transition barriers are presented from the sector perspective. The following section highlights concerns relative to producers that affects their ability to transition.

The transition to RA requires a fundamental paradigm shift, as many producers perceive risk in moving away from conventional methods despite the long-term benefits (20,23). Psychological barriers, such as fear of financial loss and uncertainty about new techniques, often prevent farmers from embracing regenerative practices. Farmers' values, motivations, and deeply ingrained mental models influence their willingness to adopt new agricultural practices (25). Emotional resilience and a sense of purpose are essential, as the transition process can be challenging and may involve trial and error. Research suggests that farmers who view RA as part of a broader environmental stewardship ethic are more likely to persevere, even when facing difficulties (25). Overcoming psychological barriers necessitates comprehensive education and awareness programs that highlight the economic, environmental, and social advantages of sustainable farming. Additionally, peer support and community engagement play a crucial role in this shift, as farmers benefit from sharing experiences, learning from those who have successfully transitioned, and gaining reassurance from networks of like-minded individuals (7,26). Access to such communities helps reinforce cultural and emotional shifts, reducing isolation and boosting confidence while providing practical guidance for overcoming common obstacles (26).

Financial constraints remain a significant barrier to regenerative agriculture, particularly for small farms that often struggle to access capital through traditional financial institutions due to perceived risks such as weather variability, regulatory changes, and high transition costs (23). Many regenerative operations do not align with conventional financing models, complicating efforts to secure funding for essential investments like soil restoration, cover cropping, and reduced tillage (20). These investments are typically immobile and lack resale value, as they are embedded in the land itself. Transitioning often entails substantial upfront costs for new equipment, seeds, and infrastructure—expenses that are especially burdensome for farms operating on narrow margins and lacking immediate returns (20,26). Additional costs may include soil amendments and organic inputs needed to initiate regenerative processes (23). Moreover, many of these practices demand sustained financial commitment; for example, cover cropping and composting require ongoing management before yielding observable benefits. The delayed visibility of outcomes such as improved soil health and water retention further complicates farmers' ability to justify these expenditures in the short term (23,26).

Insurance plays a critical role in supporting the transition to regenerative agriculture (RA) by helping to mitigate the financial risks associated with adopting new practices. Farmers often face uncertainties such as temporary yield declines, unpredictable weather, and unstable market access—challenges that traditional insurance models are not well-equipped to address (20,23). Most conventional crop insurance programs prioritize short-term yield stability over long-term soil health, creating a disconnect between regenerative practices and existing coverage options. This misalignment contributes to perceptions of financial risk, discouraging farmers from adopting RA despite its long-term benefits (27). Furthermore, many current insurance and subsidy systems are structured to favor conventional farming methods, reinforcing farmer reluctance to transition due to concerns about income security (27). Given that RA transitions typically span three to five years and may involve interim revenue losses, the development of tailored insurance products is essential to support farmers through this adjustment period (27).

THE FINANCE SECTOR PERSPECTIVE

RA is gaining traction as a sustainable alternative to conventional farming with a select few financial institutions and investment firms playing pivotal roles in supporting these initiatives. Social financiers, commercial banks, and other stakeholders increasingly recognize the potential of RA to enhance resilience and sustainability in food systems. This growing interest is reflected in the diverse range of financial entities involved in promoting regenerative practices.

FINANCE OPTIONS FOR RA

Social financiers are actively engaging in RA by providing necessary capital to support these initiatives. They focus on enhancing social and ecological resilience within food systems, although challenges remain in aligning funding with the most effective projects (28). The Regenerative Food System Investment (RSFI) forum is a notable platform where stakeholders discuss and promote investment in regenerative food systems (28).

Commercial banks, particularly in China, are increasingly involved in green finance, which includes supporting sustainable agricultural practices. These banks are developing innovative financial products, such as "Green Farmer Insurance," to mitigate environmental risks and promote sustainable agriculture (Yang, 2024). The involvement of commercial banks in green finance is part of a broader trend towards environmental sustainability and is crucial for mobilizing the large-scale investment needed for RA (Yang, 2024).

Various stakeholders, including government and corporate entities, are showing interest in RA. This support is crucial for overcoming institutional, political, and economic barriers that hinder the transition to regenerative practices (4,20). The discourse around RA is supported by a coalition of diverse actors, including those from the corporate sector, who contribute to its overarching narrative and potential for transformation (29). While the involvement of financial institutions, carbon credit investment firms, agrochemical companies, and large food and beverage companies in RA is promising, there are concerns about the potential for "co-optation and greenwashing," which could dilute the transformative potential of these initiatives (30). Ensuring that investments genuinely support regenerative practices and do not merely serve as a marketing tool is essential for the long-term success of these efforts (29).

CHALLENGES IN FINANCING RA

Despite its environmental benefits, financing RA presents several challenges that hinder its widespread adoption. These challenges are multifaceted, involving financial, institutional, and data-related barriers.

One of the primary financial obstacles is the "bankability gap," where financiers lack confidence that investments in regenerative practices will meet their risk and reward standards (4). Although capital is available globally, money is not flowing to agricultural producers at the speed and scale required to support RA (4). Additionally, most agricultural financing structures operate on short-term time horizons with rigid repayment schedules, misaligned with the long-term benefits of regenerative practices (4). The typical 8- to 12-year fund horizon is often insufficient, as RA requires significant upfront investment and may initially lead to lower yields before long-term benefits materialize (4).

A significant challenge to financing RA is the lack of comprehensive data on its performance. Without a widely accepted evidence base comparable to conventional agriculture, investors and lenders struggle to assess the costs and benefits accurately (4). This creates a cycle where the lack of data impedes financing, and the lack of financing limits data collection, further stalling investment in regenerative practices (4).

Beyond institutional and data barriers, RA often faces difficulties in accessing capital, especially compared to conventional farming. Funding does not always reach the stakeholders best positioned to advance regenerative goals (28). Additionally, the middle of the food value chain, which is crucial for regenerative practices, remains severely underfunded, limiting the scalability of these systems (28). This part of the chain which includes processing, distribution, and aggregation plays a vital role in connecting regenerative producers to markets but is often overlooked in investment strategies. Complex and unpredictable regulations further deter investment in RA (31), while the inability to predict market trends and secure necessary premiums for regenerative products adds financial uncertainty (31). In some regions, such as Kenya, poor post-harvest processing and storage infrastructure, which are energy-intensive, exacerbate financial challenges. The high cost of energy infrastructure and the preference for large-scale project financing limit the benefits for small-scale regenerative practices (20).

Another critical barrier to financing regenerative agriculture lies in the valuation and market differentiation of regenerative products. Unlike certified organic or fair-trade goods, regenerative products often lack standardized labeling or widely recognized certification systems, making it difficult for consumers and buyers to identify and reward regenerative practices (20). This lack of differentiation undermines the ability of producers to command price premiums that reflect the environmental and social benefits of their methods. Furthermore, the absence of consistent metrics for measuring regenerative outcomes complicates efforts to quantify their added value, both in ecological terms and in market positioning (20). As a result, investors face uncertainty in projecting returns, and producers struggle to justify the higher costs associated with regenerative transitions, further stalling the flow of capital into these systems (32).

Despite these challenges, emerging financial models present opportunities for growth. Social finance is being explored as a means to bridge the financing gap, though its implementation requires careful consideration of impact metrics and diversity maintenance (28). Developing outcome-based programs with clear financial incentives, particularly in areas such as carbon sequestration and water management, could help attract more investment (31). Additionally, innovative approaches like integrating agriculture with tourism, as seen in Bali, may provide mutually beneficial economic opportunities to support regenerative practices (4,20,32).

While RA faces considerable financing hurdles, innovative financial instruments, regulatory reforms, and data-driven investment models could help unlock its potential. Addressing these challenges through collaborative efforts between governments, financial institutions, and agricultural stakeholders is essential for scaling regenerative practices and fostering a more sustainable food system.

POLICY PERSPECTIVE

Policy is a fundamental driver in the transition to RA, as it establishes the necessary frameworks to promote sustainable practices while addressing economic and environmental challenges. To facilitate the transition to RA, it is vital that policies be guided by agroecological principles, incorporating land-use patterns, soil fertility management, and pest control strategies to ensure environmental sustainability (33). This can be advanced through aligning policies with global initiatives such as the United Nations Convention to Combat Desertification which seeks to protect land and mitigate its degradation (34). Additionally, balancing economic viability with ecosystem services is essential, as policies must encourage land productivity without compromising soil health and biodiversity. Social sustainability also plays a critical role, as equitable policies that promote food security and self-sufficiency enhance the long-term adoption of RA (33). By fostering these dimensions, policymakers can create an enabling environment for RA to become mainstream.

The role of international governance in advancing RA is also crucial. Global initiatives, such as the UN's Global Soils Partnership (GSP), provide frameworks for assessing soil-carbon impact and guiding policy development (35). Establishing performance indicators, such as those outlined in the 4/1,000 Initiative, allows policymakers to track the benefits of RA and allocate resources effectively (36). By aligning national policies with international sustainability goals, governments can accelerate RA adoption and enhance global food security.

Financial incentives remain a key policy tool for encouraging RA adoption by addressing economic barriers, reshaping incentives, and fostering investment in sustainable farming practices. Historically, agricultural subsidies have favored conventional farming, making it financially difficult for farmers to justify transitioning to RA (33). Programs such as crop insurance subsidies can reduce the financial risks farmers face when transitioning to regenerative methods (37). However, widespread adoption of RA requires clearer regulatory definitions and guidelines to ensure that financial support is effectively targeted (37). By restructuring subsidies to support biodiversity-friendly methods and regenerative techniques, policymakers can create a more balanced economic environment that encourages sustainable practices (23). Additionally, access to tailored financial products such as sustainability-linked loans (SLLs) and government-backed guarantees, can help farmers overcome initial investment barriers and mitigate financial risks associated with transition (24). Examples of this exist in the UK where collaborative models like the Green Farm Collective (GFC) demonstrate how policy can facilitate partnerships between farmers and financial institutions to drive sustainable agricultural investments (7).

A critical aspect of policy-driven financial support is investment in research and technology transfer. Government-backed initiatives can accelerate the adoption of RA by funding knowledge-sharing networks and training programs that equip farmers with expertise in soil health management, crop diversification, and carbon sequestration (35). Again, performance indicators, such as those proposed by the 4/1,000 Initiative, can help ensure that funding is directed toward projects yielding measurable environmental and economic benefits (35). Furthermore, policies supporting blended finance mechanisms have proven effective in accelerating the adoption of regenerative farming by distributing costs and risks across multiple stakeholders (38).

Government policies must align with financial sector strategies to support RA. Repurposing agricultural subsidies to support regenerative transitions is essential (24). The finance sector can collaborate with policymakers to design regulatory frameworks, tax incentives, and funding mechanisms that encourage large-scale investment in sustainable agriculture (24). Institutional investors are increasingly recognizing RA's long-term profitability, suggesting financial policies should attract large-scale capital into the sector (7).

Beyond financial mechanisms, policy must also consider the social and cultural factors influencing farmers' decision-making. Research highlights that the influence of agrochemical companies and historical farming practices can create resistance to RA adoption (25). Policies that integrate farmer engagement, social support networks, and education programs can facilitate cultural shifts necessary for widespread adoption (25). Additionally, recognizing the subjective and emotional aspects of farming can help policymakers design programs that resonate with farmers' values, making RA transitions more sustainable.

Blended finance approaches represent a promising avenue for scaling RA through coordinated public and private funding. Government-led fiscal incentives, such as tax holidays and subsidized loans, can encourage private investment in RA initiatives (38). Additionally, repurposing existing agricultural subsidies to support RA rather than conventional industrial farming can further enhance the financial feasibility of sustainable agriculture (24). By fostering multi-stakeholder collaboration, policies can bridge the gap between traditional public sector funding and private capital investments, driving the systemic transformation of agricultural practices.

PRACTICAL RECOMMENDATIONS

Overcoming the barriers to scaling sustainable finance in RA requires a multi-faceted approach, including policy reforms, improved data collection, and innovative financial instruments. Governments and financial institutions must work together to develop specialized funding mechanisms that align with the long-term nature of regenerative practices. Additionally, enhancing impact measurement frameworks and integrating ESG considerations will be critical in attracting investment and demonstrating the viability of RA.

NEED FOR BETTER STANDARDS AND MEASUREMENTS

The development of better measurement tools for ESG impact in agriculture is crucial for enhancing sustainability and aligning with broader environmental goals. Robust ESG metrics are increasingly used to set targets and measure impact in various sectors, including agriculture (39). In the agricultural sector, standardized measurement and verification tools are needed to assess environmental outcomes effectively. Collaboration between government, private sector, and farmers is essential to establish best practices for data measurement and verification, which can build confidence and incentivize innovation in measurement tools (7). The Global Farm Metric offers a framework for measuring farm sustainability across environmental, economic, and social dimensions, providing a comprehensive approach to ESG impact assessment (7). Additionally, integrating financial technology (fintech) in agriculture can enhance the precision and accessibility of ESG data, supporting smallholder farmers in adopting sustainable practices and contributing to multiple Sustainable Development Goals (SDGs) (9).

The availability of financial products specifically designed for green transition in agriculture is limited, indicating a gap in the financial support needed for comprehensive ESG measurement and impact (22). National green taxonomies and sustainable finance disclosure regulations can guide the development of ESG measurement tools by providing clear criteria and standards for sustainable practices (4). These frameworks help align financial products with sustainability goals and ensure that the measurement of ESG impacts is consistent and comparable across different contexts. Overall, integrating advanced measurement tools, supported by collaborative frameworks and financial incentives, is essential for accurately assessing and enhancing ESG impacts in agriculture, promoting a more sustainable and resilient agricultural sector.

RESTRUCTURING INCENTIVES FOR RA ADOPTION

Adopting regenerative agriculture (RA) offers considerable long-term benefits for soil health, biodiversity, and climate resilience, but widespread adoption is hindered by significant upfront costs, transitional risks, and financial uncertainty. To address these barriers, incentive structures must be redesigned to align financial, policy, and market mechanisms with the long-term sustainability goals of RA.

One of the most immediate challenges farmers face is the high cost of transitioning to regenerative systems, including investments in equipment, soil amendments, seeds, and training (24,32). The transition period is also often marked by short-term yield declines, further straining farm profitability (23). To mitigate these burdens, practical strategies such as equipment rental, cooperative ownership models, and phased field-level adoption can help spread costs and risk. Public financial support in the form of grants, subsidies, and ecosystem service payments is also essential to lower entry barriers and ensure equitable access to RA (27).

Despite these challenges, new financial models offer promising opportunities. Social finance is gaining traction as a way to bridge the capital gap for farmers, though its success depends on robust impact metrics and attention to social equity and diversity (28). Outcome-based programs that reward measurable ecosystem services—such as carbon sequestration, water management, and biodiversity improvements—can attract private investment by linking payments to verified environmental performance (31). Carbon credit markets, supply chain finance, and green bonds also enable the monetization of RA's ecological benefits, offering alternative revenue streams and enhancing financial resilience (24). Integrated economic approaches, such as combining agriculture with ecotourism—as demonstrated in parts of Bali—illustrate how diversified rural economies can reinforce the financial viability of regenerative practices (4,20,32).

Traditional crop insurance models often emphasize short-term yield stability and fail to capture the risk-reducing benefits of regenerative systems over time (23,37). To better support RA, insurance products must evolve to incorporate ecological indicators and recognize improvements in soil health, diversified cropping, and climate resilience (20). Incorporating environmental data into risk assessments and promoting collective adoption can further reduce premiums and improve accessibility (7,37). Public-private partnerships have a vital role to play in piloting and scaling insurance models tailored to RA's unique risk profiles.

Supportive governance is equally crucial to restructuring incentives. Existing subsidy and insurance systems often favor conventional practices, unintentionally discouraging innovation (23,37). To overcome this, governments should implement policies that reward regenerative outcomes, such as reduced chemical inputs, enhanced biodiversity, and soil restoration (26). Strategic investments in research, education, and extension services are also needed to support knowledge transfer and farmer capacity-building. Importantly, policies should be co-designed with farmers and local stakeholders to ensure they are context-specific and responsive to practical realities on the ground (20,26).

CONCLUSION

The transition to RA offers significant environmental and economic benefits but is hindered by financial, educational, and structural barriers. High upfront costs, delayed returns, and misaligned subsidies make adoption challenging, necessitating innovative financial mechanisms. Education and technical support are crucial, as many farmers lack access to training on RA practices. Expanding advisory services, peer networks, and research-backed programs can ease implementation and reduce uncertainty. Meanwhile, policy reforms must align subsidies and incentives with sustainability goals, ensuring RA is financially viable.

Creating strong market incentives can further drive adoption. The J-Curve model highlights the need for targeted financial and policy support during the early transition phase, where financial risks are highest. Ultimately, a coordinated approach integrating finance, education, policy, and market alignment is essential for scaling RA. By addressing short-term challenges and fostering long-term resilience, stakeholders can ensure RA becomes a sustainable, profitable, and widely adopted agricultural model.

REFERENCES

1. Giller KE, Hijbeek R, Andersson JA, Sumberg J. Regenerative Agriculture: An agronomic perspective. *Outlook Agric.* 2021 Mar 1;50(1):13–25.
2. Mambo T, Lhermie G. The Futures for Regenerative Agriculture: Insights from the Organic Movement and the Tussle with Industrial Agriculture. *Front Sustain Food Syst* [Internet]. 2024 Nov 18 [cited 2024 Nov 28];8. Available from: <https://www.frontiersin.org/journals/sustainable-food-systems/articles/10.3389/fsufs.2024.1455024/abstract>
3. Rhodes CJ. The Imperative for Regenerative Agriculture. *Science Progress.* 2017 Mar 1;100(1):80–129.
4. Bashan A, Mishra A, Haynes D. Financing for Regenerative Agriculture [Internet]. The Rockefeller Foundation; 2024 [cited 2025 Feb 14]. Available from: <https://www.rockefellerfoundation.org/reports/financing-for-regenerative-agriculture/>
5. Newton P, Civita N, Frankel-Goldwater L, Bartel K, Johns C. What Is Regenerative Agriculture? A Review of Scholar and Practitioner Definitions Based on Processes and Outcomes. *Frontiers in Sustainable Food Systems* [Internet]. 2020 [cited 2024 Feb 16];4. Available from: <https://www.frontiersin.org/articles/10.3389/fsufs.2020.577723>
6. Reidsma P, Accatino F, Appel F, Gavrilesco C, Krupin V, Manevska Tasevska G, et al. Alternative systems and strategies to improve future sustainability and resilience of farming systems across Europe: from adaptation to transformation. *Land Use Policy.* 2023 Nov 1;134:106881.
7. Allan A, Avery H, Endsor C. Financing a farming transition: Key Enablers and Recommendations. Green Finance Institute; 2022.
8. Migliorelli M. What Do We Mean by Sustainable Finance? Assessing Existing Frameworks and Policy Risks. *Sustainability.* 2021 Jan;13(2):975.
9. Alamsyah RTP, Wulandari E, Saidah Z, Hapsari H. Discovering sustainable finance models for smallholder farmers: a bibliometric approach to agricultural innovation adoption. *Discov Sustain.* 2024 Dec 1;5(1):1–23.
10. Johnson C. The measurement of environmental, social and governance (ESG) and sustainable investment: Developing a sustainable new world for financial services. *Journal of Securities Operations & Custody* [Internet]. 2020 Sep 1 [cited 2025 Feb 19]; Available from: <https://hstalks.com/article/5872/the-measurement-of-environmental-social-and-govern/>
11. Green, Social, and Sustainability (GSS) Bonds Market Update [Internet]. The World Bank; 2023. Available from: <https://thedocs.worldbank.org/en/doc/98c3baab0ea4fc3da4de0e528a5c0bed-0340012023/original/GSS-Quarterly-Newsletter-Issue-No-2.pdf>
12. World Bank [Internet]. [cited 2025 Jun 8]. Climate Explorer: Green Loans. Available from: <https://www.worldbank.org/en/news/feature/2021/10/04/what-you-need-to-know-about-green-loans>
13. De La Orden R, De Calonje I. Sustainability-Linked Finance: Mobilizing Capital for Sustainability in Emerging Markets. 2022 [cited 2025 Jun 8]; Available from: <https://www.sidalc.net/search/Record/dig-okr-1098636872/Description>

14. The Global Impact Investing Network [Internet]. [cited 2025 Jun 8]. What you need to know about impact investing. Available from: <https://thegiin.org/publication/post/about-impact-investing/>
15. OECD [Internet]. [cited 2025 Jun 8]. Blended finance. Available from: <https://www.oecd.org/en/topics/sub-issues/leveraging-private-finance-for-development/blended-finance.html>
16. ISF - Transition Finance [Internet]. [cited 2025 Jun 8]. Available from: <https://smith.queensu.ca/centres/isf/resources/primer-series/transition-finance.php>
17. Jourdan Z, Corley JKen, Valentine R, Tran AM. Fintech: A content analysis of the finance and information systems literature. *Electron Mark*. 2023;33(1):2.
18. Zhong W. An analysis of focusing on ESG investment. *Highlights in Business, Economics and Management*. 2023 Aug 31;17:8–13.
19. Bekaert G, Rothenberg R, Noguer M. Sustainable investment – Exploring the linkage between alpha, ESG, and SDGs. *Sustainable Development*. 2023;31(5):3831–42.
20. Obregon JF, Aguanno M, Brooking M, Arjaliès DL. Advancing Regenerative Agriculture in Canada: Barriers, Enablers, and Suggestions. *Business Publications [Internet]*. 2023 Jan 1; Available from: <https://ir.lib.uwo.ca/iveypub/66>
21. Coelho R, Jayantilal S, Ferreira JJ. The impact of social responsibility on corporate financial performance: A systematic literature review. *Corporate Social Responsibility and Environmental Management*. 2023;30(4):1535–60.
22. Muižniece K, Pilecka-Ulcugaceva J, Grinfelde I. TRANSITION FINANCING IN AGRICULTURE: BALTIC COUNTRY CASE STUDY. *Research for Rural Development*. 2024;39:238–42.
23. Bosma D, Hendriks M, Appel M. Regenerative finance solutions to restore and conserve biodiversity. 2022;
24. Thiagarajan R, Donohue J, Willington L, Im H, Roy P. Driving institutional investment in regenerative agriculture at scale. 2024;
25. Gosnell H, Gill N, Voyer M. Transformational adaptation on the farm: Processes of change and persistence in transitions to ‘climate-smart’ regenerative agriculture. *Global Environmental Change*. 2019 Nov 1;59:101965.
26. Moore F. Supporting farmers in agro-ecological transition: a systems perspective of regenerative grazing in Wales [Internet]. University of Hull; 2023 [cited 2025 Feb 24]. Available from: <https://hull-repository.worktribe.com/OutputFile/4871240>
27. Petry D, Avanzini S, Vidal A, Bellino F, Bugas J, Conant H, et al. Cultivating farmer prosperity: Investing in Regenerative Agriculture. *WBCSD*; 2023.
28. Stephens P. Social finance investing for a resilient food future. *Sustainability (Switzerland)*. 2021;13(12).
29. Gordon E, Davila F, Riedy C. Regenerative agriculture: a potentially transformative storyline shared by nine discourses. *Sustain Sci*. 2023 Jul 1;18(4):1833–49.
30. Tittonell P, El Mujtar V, Felix G, Kebede Y, Laborda L, Luján Soto R, et al. Regenerative agriculture—agroecology without politics? *Frontiers in Sustainable Food Systems [Internet]*. 2022 [cited 2024 Jan 3];6. Available from: <https://www.frontiersin.org/articles/10.3389/fsufs.2022.844261>

31. Lemke S, Smith ,Nathan, Thiim ,Christian, and Stump K. Drivers and barriers to adoption of regenerative agriculture: cases studies on lessons learned from organic. International Journal of Agricultural Sustainability. 2024 Dec 31;22(1):2324216.
32. Pedley R. Regenerative Farm Blueprint. 2024;
33. Al-Kaisi MM, Lal R. Aligning science and policy of regenerative agriculture. Soil Science Society of America Journal. 2020;84(6):1808–20.
34. UNCCD [Internet]. [cited 2025 May 7]. Convention. Available from: <https://www.unccd.int/convention/overview>
35. Codur AM, Watson J. Climate smart or regenerative agriculture? 2018;
36. The “4 per 1000” Initiative and its implementation | Department of Economic and Social Affairs [Internet]. [cited 2025 May 7]. Available from: <https://sdgs.un.org/partnerships/4-1000-initiative-and-its-implementation>
37. Russell C. ECONOMIC EVALUATION OF THE IMPACT OF REGENERATIVE AGRICULTURE ON FARMER RISK. [Texas]: Texas A&M University; 2022.
38. Havemann T, Negra C, Werneck F. Blended finance for agriculture: exploring the constraints and possibilities of combining financial instruments for sustainable transitions. Agric Hum Values. 2020 Dec 1;37(4):1281–92.
39. de la Orden R. Sustainability-Linked Finance : Mobilizing Capital for Sustainability in Emerging Markets. International Finance Corporation, Washington, DC; 2022.