Policy Research on Rural Revitalisation and Agricultural Green Low-Carbon Transformation

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Abstract: Drawing on practical experiences from northern Shaanxi, the Guanzhong Plain, and southern Shaanxi, this study employs literature review, data analysis, and case study methods to interpret the policy framework of rural revitalisation and agricultural green and low-carbon transformation, elucidate their intrinsic interconnections, and summarise practical outcomes. The results reveal a deep synergy between the two: rural revitalisation provides the policy framework for agricultural green and low-carbon transformation, while the latter supports the goals of "ecological livability" and "industrial prosperity" under the former. The formulation of relevant policies not only aligns with global trends in climate governance but also addresses the structural problems of traditional agriculture and adapts to the strategic objectives of rural revitalisation. The implementation outcomes in Shaanxi Province are remarkable—northern Shaanxi has achieved a green and low-carbon breakthrough in arid and sandy regions, the Guanzhong Plain has developed efficient circular agriculture, and southern Shaanxi has advanced ecological agriculture and carbon sink economies, all contributing to ecological improvement and income growth for farmers. The study concludes that the integration of rural revitalisation and agricultural green and low-carbon transformation is the only path towards high-quality agricultural and rural development. In the future, technological innovation should underpin the establishment of a "Shaanxi Model" to support the achievement of China's "dual carbon" goals and comprehensive rural revitalisation.

Keywords: Rural revitalisation; Agricultural green and low-carbon transformation; Shaanxi regional practice; Policy framework; Coordinated development

1. Introduction

In the process of comprehensively advancing socialist modernisation in China, the Rural Revitalisation Strategy serves as a core approach to addressing the "three rural issues" (agriculture, rural areas, and farmers) and achieving agricultural and rural modernisation. The green and low-carbon transformation of agriculture is the essential pathway to achieving high-quality rural revitalisation.

This study, based on empirical practices in northern Shaanxi, the Guanzhong Plain, and southern Shaanxi, aims to interpret the policy framework related to rural revitalisation and agricultural green low-carbon transformation from multiple perspectives. It seeks to clarify their intrinsic interconnections, outline the policy background, core contents, implementation pathways, and safeguard mechanisms, and summarise regional practical outcomes. The ultimate goal is to provide theoretical and practical references for promoting synergistic development between rural

revitalisation and green transformation, advancing the "dual carbon" objectives, ensuring national food and ecological security, and fostering common prosperity.

2. Research Methods

2.1 Literature Review Method

This study systematically reviews national and local policy documents, including the Rural Revitalisation Strategic Plan (2018–2022), the Special Action Plan for Building a Supporting System for the Pilot and Demonstration of Green and Low-Carbon Agricultural Development (2023–2025), and the Shaanxi Province Action Plan for Rural Revitalisation and Agricultural Green and Low-Carbon Transformation (2023–2027). In addition, international and domestic literature such as the IPCC Special Report on Climate Change and Land, the China Green Food Development Report (2023), and the Shaanxi Agricultural Green and Low-Carbon Technology Development Report (2023) are reviewed to establish the study's theoretical and policy framework and to understand the policy evolution and current research trends related to rural revitalisation and agricultural green transformation.

2.2 Data Analysis Method

Relevant data on global and Chinese agricultural carbon emissions were collected and organised, including the share of greenhouse gas emissions from agricultural sources, the global warming potential of methane and nitrous oxide, farmland water utilisation efficiency, and agricultural film recycling rates. Changes in key indicators of China's green agriculture (such as green food sales and farmland transfer area from 2018 to 2023), as well as data reflecting the implementation outcomes of key low-carbon agricultural initiatives (such as the coverage of drip irrigation technologies, fertiliser reduction rates, comprehensive straw utilisation, and forestry carbon sink projects), were statistically analysed and compared. This quantitative approach highlights the current status, gaps, and progress of China's agricultural green and low-carbon transformation.

2.3 Case Study Method

The study takes northern Shaanxi, the Guanzhong Plain, and southern Shaanxi as its key research areas, focusing on representative cases of rural revitalisation and agricultural green and low-carbon transformation. These include Yulin's sandland governance combined with photovoltaic agriculture and Yan'an Ansai's "Returning Farmland to Forests + Understorey Planting" model in northern Shaanxi; the circular agricultural industrial chain in Liyuan County, Xianyang, and efficient water-saving agriculture in Linwei District, Weinan, in the Guanzhong Plain; and eco-tea gardens integrated with carbon sequestration in Hanyin County, Hanzhong, and the black fungus and eco-tourism industries in Zhashui County, Shangluo, in southern Shaanxi. Through these cases, the study analyses implementation models, policy delivery pathways, and results across different regions to extract replicable regional experiences.

3. Research Findings

3.1 The Intrinsic Relationship between Rural Revitalisation and Agricultural Green and Low-Carbon Transformation

The rural revitalisation strategy encompasses five dimensions—industrial prosperity, talent cultivation, cultural advancement, ecological livability, and effective governance. The green and

low-carbon transformation of agriculture is embedded throughout these domains, creating a close and interdependent relationship between the two.

3.1.1 Ecological Livability: The Direct Goal of Agricultural Green and Low-Carbon Transformation

The "ecological livability" goal of rural revitalisation aligns closely with the core objectives of agricultural green and low-carbon transformation. Traditional agricultural practices often degrade rural ecosystems, whereas green transformation improves the environment at its source through the adoption of sustainable technologies. For instance, in Ansai District of Yan'an, northern Shaanxi, the "Returning Farmland to Forests + Understorey Planting" model has increased forest coverage to 67%, reduced soil erosion by 40%, and raised farmers' average annual income by CNY 12,000.

3.1.2 Industrial Prosperity: An Economic Pillar of Agricultural Green and Low-Carbon Transformation

The goal of "industrial prosperity" requires building a high-quality agricultural industry system, in which green and low-carbon transformation plays a vital role. Low-carbon agriculture fosters new business models and enhances the value of agricultural products. For example, in Pucheng County of Weinan, located in the Guanzhong Plain, a 50,000-mu green production base for crisp pears was established. The reduction in fertiliser and pesticide use improved fruit sweetness, doubled market prices, and increased farmers' income by approximately CNY 4,000 per mu.

3.1.3 Prosperous Livelihood: The People-Centred Outcome of Agricultural Green and Low-Carbon Transformation

"Prosperous livelihood" represents the fundamental goal of rural revitalisation. Green and low-carbon agricultural transformation improves production efficiency, reduces costs, and expands farmers' income sources. For example, in Mian County, Hanzhong, southern Shaanxi, the "Eco-tourism + Low-carbon Agriculture" model increased farmers' average income by CNY 21,000 in 2023, with tourism-related earnings accounting for 40% of total household income.

3.1.4 Effective Governance: Institutional Synergy for Agricultural Green and Low-Carbon Transformation

"Effective governance" requires establishing a sound institutional framework. The promotion of agricultural green and low-carbon transformation contributes to modernising rural governance structures. For example, in Wugong County, Xianyang, a "Green Agricultural Cooperative Alliance" was established. Through unified agreements and standardised production practices, the average income per mu for cooperative members increased by 25%.

3.2 Policy Context

3.2.1 International Context: Global Climate Governance and the Necessity of Green Agricultural Development

3.2.1.1 Global warming compels a low-carbon transformation of agriculture:

The challenge of global warming is intensifying, with agriculture being a major source of greenhouse gas emissions. According to the IPCC (Table 1), agricultural sources account for 13.5% of anthropogenic emissions globally. As China has pledged to achieve its "dual carbon" goals, advancing green and low-carbon agricultural transformation is imperative [3].

Table 1: Comparison of Global and Chinese Agricultural Carbon Emission Data.

Indicator	Global Data	China Data	Comparative Findings
Share of agricultural GHG emissions	13.5% of total anthropogenic emissions	7–8% of national carbon emissions	Lower proportion in China, but total base is large
Methane (CH_4) global warming potential	28 times CO_2	28 times CO_2	Same as global; livestock emissions require control
Nitrous oxide (N_2O) global warming potential	265 times CO_2	265 times CO_2	Same as global; fertiliser use must be managed
Farmland water resource utilisation rate	60–70% in developed countries	40%	Efficiency two-thirds that of developed countries
Agricultural film recycling rate (2023)		85%	12% increase from 2018

3.2.1.2 Demonstration Role of International Green Agricultural Development Trends

Developed countries have already explored effective pathways for low-carbon agriculture. For instance, the United States has promoted conservation tillage technologies, while Japan has implemented measures to reduce methane emissions from livestock farming. China's promotion of green and low-carbon agricultural transformation thus represents both a proactive response to global challenges and an alignment with prevailing international trends.From 2018 to 2023, China's key indicators of green agriculture have shown continuous improvement. The sales of green-labelled agricultural products increased from approximately CNY 0.91 trillion to CNY 2.1 trillion, marking a growth rate of 130%. The area of farmland transferred expanded from about 490 million mu to 530 million mu, reflecting an 8.2% increase, while the proportion of farmland involved in transfers rose from around 80% to 86%, an increase of 6 percentage points.

3.2.2 Domestic Background: Practical Needs in Addressing Agricultural and Rural Development Challenges

3.2.2.1 Increasing Drawbacks of Traditional Agricultural Production Methods

China's traditional agricultural production is characterised by high resource consumption, serious environmental pollution, and high carbon emission intensity. The average amount of fertiliser used per mu of cultivated land is 1.8 times the world average, and a large volume of crop straw and livestock manure remains unutilised each year [1].

3.2.2.2 Rising Public Demand for a Better Quality of Life

As China's principal social contradiction shifts toward the growing needs of people for a better life, there is an increasing demand for green agricultural products and a pleasant rural ecological environment. However, the supply of green agricultural products remains insufficient, and ecological conditions in some rural areas are still substandard [4].

3.2.2.3 Intrinsic Need for the Implementation of the Rural Revitalisation Strategy

Since the promulgation of the Rural Revitalisation Strategic Plan (2018–2022) in 2018, the green and low-carbon transformation of agriculture has become the crucial link between industrial revitalisation and ecological revitalisation. Without its support, the implementation of rural revitalisation would face substantial obstacles.

3.3 Core Policy Elements

3.3.1 Comprehensive Framework of the Rural Revitalisation Strategy

3.3.1.1 Industrial Revitalisation

Industrial revitalisation constitutes the economic foundation of rural revitalisation. The goal is to transform and upgrade traditional agriculture. By the end of 2023, China's farmland transfer area reached 530 million mu, accompanied by the promotion of smart agricultural technologies and strengthened quality supervision of agricultural products.

For example:

In Yuyang District, Yulin (northern Shaanxi), farmland transfer facilitated the establishment of large-scale maize bases. Through the adoption of advanced irrigation and fertilisation technologies, water and fertiliser use decreased, while yield and product premium increased.

The integration of primary, secondary, and tertiary rural industries has progressed steadily. In 2023, China's rural e-commerce retail sales reached CNY 2 trillion. In Feng County, Baoji (Guanzhong region), an integrated model combining pepper planting, processing, and tourism achieved a total output value of CNY 1.5 billion, raising farmers' per capita income by CNY 18,000.

The development of specialised and advantageous industries has been encouraged under the "one township, one industry; one village, one product" initiative. For instance, in Zhashui County, Shangluo (southern Shaanxi), the black fungus industry reached a total output value of CNY 800 million in 2023, benefiting over 3,000 farming households. [2]

3.3.1.2 Ecological Revitalisation

Ecological revitalisation serves as the green foundation of rural revitalisation. China has advanced the so-called "three rural revolutions": rural sanitation improvement, waste management, and ecological protection. By 2023, the coverage rate of sanitary toilets in rural areas reached 86%. In Huyi District, Xi'an (Guanzhong region), rural sewage treatment models were promoted, and a "waste-to-points" reward system was implemented to encourage public participation. Agricultural non-point source pollution control has been strengthened. In 2023, China's agricultural film recycling rate reached 85%, and the comprehensive utilisation rate of livestock and poultry manure exceeded 80% [1]. In Hanyin County, Ankang (southern Shaanxi), technical interventions were introduced to reduce pollution and enhance agricultural film recycling. Ecological restoration projects have yielded substantial progress [8]. In Shenmu City, Yulin (northern Shaanxi), 1 million mu of sandy land was rehabilitated, achieving a desertification control rate of 93%, while the development of related industries simultaneously increased farmers' income.

3.3.1.3 Cultural, Governance, and Livelihood Revitalisation

These three components constitute the supporting pillars of the rural revitalisation strategy. Cultural revitalisation: Focuses on preserving traditional culture, building public cultural facilities, and promoting rural civility. In Liyuan County, Xianyang (Guanzhong region), cultural heritage

resources were revitalised, community events organised, and families were recognised as "Civilised Households." Governance revitalisation: Emphasises grassroots party building, improved village self-governance, and the rule of law. In Ningqiang County, Hanzhong (southern Shaanxi), the "Party Building + Grid Governance" model was implemented, achieving a 95% satisfaction rate in rural governance. Livelihood revitalisation: Aims to improve rural infrastructure, public services, and social security systems. In Wuqi County, Yan'an (northern Shaanxi), road upgrading and the construction of rural health clinics significantly enhanced living conditions.

3.3.2. Key Measures for Agricultural Green and Low-Carbon Transformation

3.3.2.1 Resource Conservation and Efficient Utilisation

China has strengthened the farmland protection system and promoted technologies that improve soil quality and productivity. In Dali County, Weinan (Guanzhong region), soil improvement techniques have enhanced soil organic matter and increased grain yields. Efficient water-saving irrigation technologies and wastewater recycling systems have been widely promoted; for instance, Yang County, Hanzhong (southern Shaanxi) has advanced irrigation technology adoption and constructed wastewater treatment stations.

3.3.2.2 Reduction and Efficient Use of Agricultural Inputs

Efforts have been made to reduce chemical inputs through soil testing and formulated fertilisation and to strengthen green pest control. In Jia County, Yulin (northern Shaanxi), these technologies reduced fertiliser and pesticide use while improving both the yield and quality of red dates. In Xingping City, Xianyang (Guanzhong region), the adoption of precision feeding technologies and standardised veterinary practices increased feed efficiency and reduced livestock pollution.

3.3.2.3 Resource Utilisation of Agricultural Waste

A comprehensive straw utilisation system has been established, including collection, storage, and processing. In Qishan County, Baoji (Guanzhong region), straw incorporation, processing plants, and biomass power projects were developed. Livestock waste recycling models have also been promoted; for example, Fuxian County, Yan'an (northern Shaanxi) implemented manure-based circular agriculture, which improved apple quality and reduced pollution. Moreover, a recycling system for used agricultural films and pesticide packaging waste has been built, as seen in Linwei District, Weinan, where collection stations and disposal systems have been established [10].

3.3.2.4 Carbon Sequestration and Carbon Sink Enhancement in Agricultural Ecosystems

Forestry construction and eco-projects have been expanded to increase carbon sequestration. In Zhen'an County, Shangluo (southern Shaanxi), ecological forestry projects generated carbon credit income and developed economic forests. In Dingbian County, Yulin (northern Shaanxi), grassland protection systems were implemented, improving vegetation coverage and piloting carbon sink trading. In Hanyin County, Hanzhong (southern Shaanxi), wetland restoration projects and wastewater treatment systems were established to enhance carbon sequestration research [8].

3.4 Implementation Pathways and Safeguard Measures

3.4.1 Government Guidance

Governments at all levels have formulated targeted plans—such as the Shaanxi Provincial Action Plan for Agricultural Green [2] and Low-Carbon Transformation (2023–2027)—to improve infrastructure and provide policy support. For instance, Yulin City (northern Shaanxi) has advanced the construction of high-standard farmland projects [9].

3.4.2 Market Leadership

Market mechanisms are being strengthened to cultivate new agricultural business entities, develop green and low-carbon industries, and improve carbon trading markets. Examples include enterprise-led green brands in Xi'an (Guanzhong region) and Ankang (southern Shaanxi).

3.4.3 Farmer Participation

Farmers are regarded as key actors in promoting green transformation. Local governments have expanded training and benefit-sharing mechanisms to increase engagement. For instance, Xianyang (Guanzhong region) has conducted training programmes, while Ansai District, Yan'an (northern Shaanxi) has organised farmers into industrial cooperatives.

3.4.4 Social Involvement

Research institutions, social organisations, and the public are actively engaged in promoting agricultural innovation and green practices. For example, Northwest A&F University has developed relevant technologies, and the Shaanxi Agricultural Association regularly organises environmental awareness activities [5].

3.5 Safeguard Measures: Strengthening Policy Foundations

3.5.1 Financial Support

Fiscal investment has been increased through special provincial funds (e.g., Shaanxi's dedicated green agriculture fund). Innovative financial products are being introduced to attract private capital—such as rural credit loans by the Shaanxi Rural Credit Union and industrial investment projects in Baoji (Guanzhong region).

3.5.2 Technological Support

R&D capacity has been enhanced through institutions like the Shaanxi Academy of Agricultural Sciences, which develops green technologies. A "Science and Technology Commissioner" system was established to strengthen technology dissemination and promote international cooperation in agricultural innovation.

3.5.3 Talent Development

Efforts have been made to cultivate skilled rural professionals—over tens of thousands of new-type professional farmers were trained in Shaanxi in 2023. Meanwhile, the province has focused on attracting experts and improving grassroots agricultural technical service teams [6].

3.5.4 Institutional Development

Legal and regulatory frameworks have been improved through provincial legislation and policy updates. Standard systems, performance evaluation, and ecological monitoring frameworks are being developed to enhance policy implementation efficiency.

3.6 Regional Achievements in Shaanxi Province

3.6.1 Northern Shaanxi: Green and Low-Carbon Breakthroughs in Sandy Areas

Yulin has promoted a "Photovoltaic + Plantation" model, establishing 100,000 mu of solar-agriculture demonstration parks in 2023, generating 1.2 billion kWh annually [9], cutting 800,000 tonnes of CO_2 emissions, and significantly increasing farmers' income. In Yan'an's Ansai District, under-forest economic models combining herbal planting and carbon sinks covered 50,000 mu, generating CNY 400 million in total output and CNY 800,000 in carbon credit income. The region achieved 93% sandland rehabilitation (Yulin), 67% forest coverage (Ansai), and average farmer income increases exceeding CNY 3,000.

3.6.2 Guanzhong Region: Efficient Circular Agriculture on the Plains

In Liyuan County, Xianyang, an apple-based circular agriculture chain reached a total output value of CNY 6 billion in 2023, raising farmers' per capita income by CNY 23,000. In Linwei District, Weinan, efficient water-saving technologies increased total grain output by 12% to 500,000 tonnes. [10] Across the region, water conservation reached 48%, fertiliser use dropped 30%, and rural incomes rose by over CNY 2,500. Specialised industries such as pepper (CNY 1.5 billion, Feng County) and apple (CNY 6 billion, Liyuan County) demonstrated strong green growth, with an average water saving of 170 m^3 per mu.

3.6.3 Southern Shaanxi: Ecological Agriculture and Carbon Sink Economy

Hanyin County, Hanzhong developed an eco-tea and carbon sink integration model, achieving CNY 1.5 billion in total output and CNY 18,000 in per capita income growth in 2023. Zhashui County, Shangluo combined black fungus production and eco-tourism, generating CNY 800 million from fungus and CNY 1.2 billion from tourism. Across southern Shaanxi, wetland carbon sequestration increased by 18% (Hanyin County) and pesticide use in tea gardens declined by 40%, while average rural income rose by over CNY 2,000. [8] The Zhen'an County forestry carbon sink programme achieved CNY 8 million in annual carbon revenue.

3.7 Implementation Outcomes of Key Measures

By 2023, Shaanxi Province had achieved remarkable progress in the implementation of key measures for agricultural green and low-carbon transformation. In resource conservation, drip irrigation technology covered more than 50 million mu, saving 30–50% of water—such as 30% savings in Yang County's rice fields and 50% in Yuyang District's maize fields. In input reduction, soil testing and formulated fertilisation were applied to 280 million mu nationwide, reducing fertiliser use by 15–35%; in Jia County, fertiliser use for red dates dropped by 25%, and in Hanyin County, pesticide use in tea gardens was reduced by 35%. In waste recycling, straw utilisation reached 88% [7] and livestock manure reuse exceeded 80%; Fuxian County processed over 100,000 tonnes of manure annually. In carbon sink development, forestry carbon sink projects covered 120 million mu nationwide, with an estimated sequestration of 50,000 tonnes of CO_2 in Zhen'an County and 10,000 tonnes in Dingbian County. These achievements show that Shaanxi has established a representative model of regional synergy and innovation, offering replicable experience for promoting agricultural green and low-carbon transformation across China.

4. Research Conclusions

Rural revitalisation and agricultural green and low-carbon transformation are deeply interlinked and mutually reinforcing. The latter provides direct support for achieving the goals of ecological livability, industrial prosperity, improved living standards, and effective governance under the former, while the rural revitalisation strategy establishes the policy and institutional framework necessary for green and low-carbon agricultural development. The integration of the two represents an inevitable path to resolving issues related to agriculture, rural areas, and farmers, as well as to achieving high-quality agricultural and rural development. Regional practices in northern Shaanxi and the Guanzhong Plain have empirically validated the effectiveness of this synergy.

International and Domestic Logics of Policy Formulation: At the international level, these policies align with global climate governance trends, address the challenges posed by agricultural greenhouse gas emissions, and draw lessons from low-carbon agricultural practices in developed countries. At the domestic level, they aim to overcome the high resource consumption and heavy pollution of traditional agriculture, meet people's growing demand for green agricultural products and a beautiful ecological environment, and support the integrated advancement of the "five revitalisations" within the rural revitalisation strategy. The introduction of these policies is therefore both necessary and urgent.

Multi-Dimensional Policy Outcomes: Policy implementation has achieved notable results across multiple dimensions. Rural revitalisation has established a comprehensive framework for promoting the five forms of revitalisation—industrial, ecological, cultural, governance, and livelihood—while agricultural green and low-carbon transformation has developed a fourfold action system focused on resource conservation, input reduction, waste recycling, and carbon sequestration. Through collaboration among government, market, farmers, and society, supported by robust financial, technological, talent, and institutional safeguards, Shaanxi Province has achieved: Ecological improvement (e.g., desertification control and increased carbon sinks); Farmer income growth (average increases above CNY 2,000 per person); Industrial upgrading (enhanced output of characteristic industries); and Carbon emission reduction (annual reductions exceeding 800,000 tonnes). These achievements fully demonstrate the feasibility and effectiveness of the current policy system.

Future efforts to advance rural revitalisation and agricultural green and low-carbon transformation should: Prioritise technological innovation as the core driving force, expanding the use of smart agriculture and intelligent machinery, and strengthening scientific and technological support; Develop the carbon sink economy as a new growth driver, improving the carbon trading market—Shaanxi plans to reach a carbon trading volume of 5 million tonnes by 2030—and enhancing the conversion of ecological value into economic returns; Promote regional coordination by tailoring practices to the characteristics of northern Shaanxi's sandy zones, the Guanzhong Plain, and southern Shaanxi's mountainous areas, forming a differentiated and replicable "Shaanxi Model" to contribute to China's national "dual carbon" goals and comprehensive rural revitalisation.

References

[1] Ministry of Agriculture and Rural Affairs of the People's Republic of China. Special Action Plan for the Construction of a Supporting System for Green and Low-Carbon Agricultural Development Pilots (2023–2025). 2023.

[2] Department of Agriculture and Rural Affairs of Shaanxi Province. Action Plan for Rural Revitalisation and

Agricultural Green and Low-Carbon Transformation in Shaanxi Province (2023–2027). 2023.

[3] Intergovernmental Panel on Climate Change (IPCC). Climate Change and Land: IPCC Special Report. 2019.

[4] China Green Food Development Centre. China Green Food Development Report (2023). Beijing: China Agriculture Press, 2023.

[5] Northwest A&F University. Report on the Development of Green and Low-Carbon Agricultural Technologies in Shaanxi Province (2023). 2023.

[6] Shaanxi Provincial Bureau of Statistics. Shaanxi Statistical Yearbook (2023) [M]. Beijing: China Statistics Press, 2023.

[7] National Bureau of Statistics of China. Statistical Bulletin on National Economic and Social Development (2023). 2024.

[8] Hanzhong Municipal People's Government. Hanyin County Ecological Agriculture Development Plan (2022–2025). 2022.

[9] Yulin Municipal People's Government. Implementation Plan for the Integrated Development of Desert Control and Photovoltaic Agriculture. 2023.

[10] Weinan Municipal People's Government. Linwei District Efficient Water-Saving Agriculture Development Plan (2023–2027). 2023.