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How Can the Protection of Important Agricultural Heritage Sites Contribute to the Green Development of Agriculture: Evidence from China

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Abstract: The protection of agricultural heritage sites has become a global human responsibility and consensus. However, the potential effect of agricultural heritage sites on the green development of agriculture has currently been ignored. Since ancient times, China has been founded on agriculture, and the number of important agricultural cultural heritages ranks first in the world, with strong representativeness. The two-way fixed effects model was employed to empirically test the positive impact of agricultural heritage site protection on the green development of agriculture, utilising data from 30 provincial units in China over a 21-year period from 2001 to 2021 in this paper. Additionally, a mediating effect model was used to test the potential mechanism. The specific conclusions are as follows: firstly, the protection of agricultural heritage sites has a significant positive effect on the green development of agriculture; secondly, the protection of agricultural heritage sites can advance the agricultural industrial structure, increase the land transfer rate, strengthen the construction of new agricultural management organisations, enhance financial investment in supporting, and promote green technology innovation. The five paths were found to have passed the mediation effect test. Thirdly, the positive effect of protecting agricultural heritage sites on the green development of agriculture is heterogeneous. Specifically, the effect is more pronounced in the eastern and central regions, particularly in areas with higher levels of AI development and lower urbanisation. The ultimate objective is to utilise evidence from China to develop nature-based solutions for the protection and utilisation of agricultural heritage and green development of agriculture in other world agricultural heritage sites.

Keywords: agricultural heritage sites; agriculture; green development; total factor productivity

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1. Introduction

In response to the growing threat of climate change and ecological pollution, there have been significant shifts in human production and life [1,2]. As of 2015, the global food system was responsible for the production of 1.8 billion tons of carbon dioxide equivalent per year, representing approximately 34% of the total greenhouse gas emissions [3]. This figure is particularly concerning in some areas dominated by agricultural production [4]. This clearly demonstrates that the agricultural industry is facing significant pressure to reduce emissions [5]. It is imperative to accelerate the transition from traditional agriculture to a green, circular and high-quality model, which is vital to achieving the United Nations

Sustainable Development Goal of sustainable consumption and production patterns. Since the launch of the "Dynamic Conservation and Adaptive Management of Globally Important Agricultural Heritage Systems (GIAHS)" initiative by the Food and Agriculture Organization (FAO) of the United Nations in 2002, the protection of significant agricultural heritage sites has emerged as a shared concern for humanity (https://www.fao.org/giahs/zh/, accessed on 9 January 2025).

The professionalisation of heritage conservation began in the 19th century, with its representative achievements emerging in Europe and North America [6]. The establishment of Yellowstone National Park in 1872 marked the first time a "wilderness" area was preserved and managed for recreational purposes in the world [7]. This was followed by the protection of natural regions as cultural heritage sites, represented by the United States, which systematically separated "culture" from "nature". Human beings are the custodians of the agricultural wisdom of the past, and it is their responsibility to safeguard this heritage [8]. This can be achieved by ensuring the proper preservation and advancement of traditional agricultural practices, ethnic minority ecological agricultural concepts, and local resource management technologies [9]. Japan's traditional agricultural landscape Satoyama system emphasises reducing the use of pesticides and chemical fertilisers. The agricultural production process only relies on the circulation and symbiosis of the natural ecosystem to stimulate agricultural land production efficiency, which significantly reduces the environmental burden in the agricultural production process and improves agricultural output in the long term [10]. The Italian region of Tuscany has a longstanding tradition of agricultural production, encompassing the cultivation of olives and grapes. The region places significant emphasis on the utilisation of organic methodologies, encompassing the application of organic fertilisers and planting techniques, while concurrently relying on traditional farming practices to enhance land productivity [11]. China's terraced field landscape represents a world-renowned cultural heritage, characterised by the profound wisdom of harmonious coexistence between humanity and the natural environment [12]. Farmers in Yunnan, Fujian and other regions employ a range of sustainable agricultural techniques, including crop rotation, intercropping and soil and water management practices, which have been passed down from generation to generation and adapted to suit local conditions [13]. Over the past few hundred years, the efficiency of agricultural production and the environmental benefits have been simultaneously enhanced, and the land remains fertile to this day. It can be seen, therefore, that the interactive relationship between agricultural heritage and green development of agriculture reflects the organic combination of traditional agricultural wisdom and modern green development. In other words, the protection of agricultural heritage represents the principal means of promoting the green development of agriculture.

Therefore, we choose China as the research object to study the impact of agricultural heritage on the green development of agriculture, mainly based on the following considerations: Firstly, China has been granted a total of 22 globally important agricultural heritage sites as of 2023, keeping the number first in the world [14]. Secondly, agricultural heritage in developed countries such as the European Union and the United States focuses on ecological protection, while China's agricultural cultural heritage focuses more on realising farmers' income increase. There have been a lot of studies on the environmental effects of agricultural cultural heritage in developed countries such as the European Union and the United States, such as the reduction of carbon emissions in agriculture, the enhancement of air quality in the countryside, and the treatment of agricultural pollutants [15,16], but there are very few discussions on the effects of China's agricultural cultural heritage in terms of the environment. Based on the above two points, the conclusions of our study can be generalised and applied to other world agricultural heritage areas, and will be a unique reference for developing countries, in particular, to utilise agricultural heritage to solve the problem of green agricultural transformation.

In light of the necessity for human beings to coexist and flourish alongside their environment, the concept of green development in agriculture has garnered significant interest from international scholars [17–19], with a particular emphasis on quantitative measurement, spatiotemporal evolution, and the analysis of influencing factors, in particular, studies focusing on the European Union and the United States have become more mature [20]. First, in terms of quantitative measurement, some scholars have defined it from different perspectives, including the attribution of green characteristics to agriculture [21], the measurement of circular agricultural transformation [22], and the digital empowerment of agriculture [23]. They have also attempted to quantify the green development of agriculture through the construction of a multi-dimensional indicator system, the utilisation of the input–output DEA model, and the incorporation of proxy variables such as agricultural emission reduction [24]. Nevertheless, only a select few are able to assess the efficiency of agricultural green production from a standpoint of optimal advancement, employing the more precise super-efficient SBM-GML model within the input–output DEA model to encapsulate the nuances of green development of agriculture. Second, in terms of spatiotemporal evolution, the majority of extant studies have conducted short-term panel data analysis based on a specific region (either a province or a county), focusing exclusively on the differences between units within the region [25]. There is a paucity of studies that are able to simultaneously display the green development of agriculture in various provinces in China in terms of both time and space. Finally, in terms of influencing factors, existing studies have identified a number of factors that may affect the green development of agriculture. These include agricultural-related policies [26], agricultural technological innovation [27], agricultural labour transfer [28] and changes in agricultural land use [29]. However, there is a lack of consideration of the core driving force behind these factors, namely the role of agricultural heritage protection as one of the external shocks. At the same time, there have been studies showing that AI (Artificial Intelligence) technology, as the most cutting-edge technology, when combined with the oldest agricultural industry and agricultural culture, will promote the development of agriculture in the direction of more efficient, greener and more sustainable [30], but there is no clear explanation of the specific mechanism of action of AI technology.

Based on the above analysis, our research may have the following marginal contributions: Firstly, previous studies have not been precise in terms of time and regional scale in measuring green development of agriculture. We use provincial panel data from 30 provinces in China (excluding Tibet, Hong Kong, Macao and Taiwan due to data availability) from 2001 to 2021 to measure the level of green development of agriculture in China and reveal its spatio-temporal evolution characteristics compared to case studies or single-year cross-sectional studies. Secondly, previous studies have not explored the relationship between agricultural cultural heritage and the green development of agriculture. We use the two-way fixed effect model to explore the specific impact effects and possible mechanisms of the protection of important agricultural heritage sites in China on green development of agriculture. Finally, previous studies on the environmental effects of green development of agriculture in the United States and the European Union have focused on pollution control and environmental improvement. However, we use evidence from China to determine how the protection of agricultural heritage sites promotes the coordination of agricultural transformation and environmental sustainability. We hope that China's experience can be shared with countries rich in agricultural heritage sites to address agricultural carbon emissions, respond to climate change, and achieve agricultural green transformation.

2. Theoretical Analysis and Research Hypothesis

2.1. The Direct Impact of the Protection of Important Agricultural Heritage Sites on the Green Development of Agriculture

According to the 1972 convention concerning the protection of the world's cultural and natural heritage, world heritage is a group of monuments and sites of cultural heritage, traditional culture and natural landscapes recognised by all humanity as possessing outstanding characteristics, universal value and contemporary significance [31]. By 2024, there will be a total of 1223 world heritage sites worldwide, including 952 cultural heritage sites, 231 natural heritage sites, and 40 dual cultural and natural heritage sites [32]. Agricultural heritage sites refer to the unique agricultural production systems created and transmitted by humans in long-term synergistic development with their environment [33].

Agricultural heritage plays an integral role in the historical and cultural development of agriculture [34]. Furthermore, it represents a valuable resource for the advancement of sustainable agricultural practices in the modern era. It is imperative that effective and important agricultural heritage sites are adequately protected and fully utilised if the modernisation and green transformation of the agricultural industry are to be achieved, and if food security and improvements to the ecological environment are to be ensured [35]. China is a global leader in the protection and designation of significant agricultural heritage sites. As of 2024, China has successfully declared 22 projects as globally important agricultural heritage sites, a number that places it first among all countries in this regard. Since May 2013, China has spearheaded the implementation of a national-level plan for the protection of its significant agricultural heritage, with the release of a total of 188 projects in seven phases. Nevertheless, in the past, scholars have overlooked the potential of the important agricultural heritage sites protection plan to facilitate the green development of agriculture. In light of the above, this article seeks to integrate the analysis of China's protection of its important agricultural heritage sites with that of its green development of agriculture, with a view to examining the role played by the former in promoting the latter. The potential value of enhancing green total factor productivity in agriculture [36].

First, in the process of protecting agricultural heritage sites, the government generally encourages local farmers to adopt original planting patterns and green production methods through subsidies and incentives, which is reflected in the reduction in chemical fertilisers and pesticides, and the improvement of production efficiency of land and resources. Second, agricultural heritage sites often contain local traditional agricultural knowledge and farming techniques, and these elements ensure that agricultural heritage sites endure throughout history, and therefore can provide modern agriculture with the wisdom of green development and help local agricultural transformation to achieve efficient and green production [37]. Finally, the protection of agricultural heritage sites not only enhances the soft power of agricultural culture, but also increases the added value of agricultural products and improves market competitiveness [38]. Therefore, the protection of agricultural heritage sites by the Chinese government will have a direct impact on the improvement of green total factor productivity in agriculture.

Based on the above analyses, we propose research hypothesis 1:

Hypothesis 1 (H1) : *The protection of important agricultural heritage sites can contribute to the green development of agriculture.*

2.2. The Indirect Impact of the Protection of Important Agricultural Heritage Sites on the Green Development of Agriculture

2.2.1. The Intermediary Role of Land

Agriculture depends on land, and land plays a crucial role in the process of greening agriculture [39]. In the process of preserving agricultural heritage sites, governments often encourage farmers to transfer land in order to avoid the abandonment of these pristine agricultural lands due to the exodus of labour. In China, it is generally the village collectives that organise and facilitate the transfer of land in the agricultural heritage site areas to large-scale agribusinesses, which then hire workers (local farmers who have mastered traditional farming techniques) to run large-scale operations. In comparison to the initial, modest agricultural production techniques observed within the designated agricultural heritage sites, the implementation of expansive and concentrated agricultural production methodologies has the potential to enhance the economic viability of agricultural production, promote environmental sustainability, optimise the allocation of resources, and advance the overall green total factor productivity in agriculture.

Based on the above analyses, we propose research hypothesis 2:

Hypothesis 2 (H2) : *The protection of important agricultural heritage sites can promote land transfer, which in turn can promote the green development of agriculture.*

2.2.2. The Intermediary Role of Industry

The question of the reasonableness of the structure of the agricultural industry is inextricably linked to the question of its capacity to undergo a green transformation. The protection of agricultural heritage sites entails the advocacy of traditional farming practices [40]. However, this rejection of novel technologies may result in a constrained growth trajectory for the primary agricultural industry, potentially leading to the impoverishment of local communities. Accordingly, the Chinese government is inclined to promote the rational commercialisation of the landscape value of agricultural heritage sites and the development of scenic spots through collaboration between villages and enterprises. This approach is expected to facilitate the growth of the tertiary industry (agricultural services) within the agricultural sector, which in turn is likely to result in the employment of local farmers and an increase in their incomes. Furthermore, the expansion of the service sector within the agricultural industry signifies an advanced transformation, which will facilitate an increase in the green total factor productivity in agriculture.

Based on the above analyses, we propose research hypothesis 3:

Hypothesis 3 (H3) : *The protection of important agricultural heritage sites can promote the structural upgrading of the agricultural industry, which in turn can promote the green development of agriculture.*

2.2.3. The Intermediary Role of Labour Cooperation

It is the farmers themselves who are the key driving force of agricultural production and agricultural emission reduction. They can effectively promote the green development of agriculture through joint operation in a cooperative way [41]. In instances where the Chinese government implements the protection of significant agricultural heritage sites, it frequently encourages the establishment of new agricultural management organisations (predominantly cooperatives). These cooperatives enable farmers to purchase shares and receive dividends through diverse avenues, including technology, labour, or capital. This approach aims to optimise overall welfare. The construction of farmer cooperatives can facilitate the effective integration of the resources associated with agricultural heritage sites. Furthermore, it can promote and implement standardised green agricultural technologies in a more efficient manner, enhance the degree of farmer organisation, and thus enhance the green total factor productivity in agriculture.

Based on the above analyses, we propose research hypothesis 4:

Hypothesis 4 (H4) : *The protection of important agricultural heritage sites can promote the construction of new agricultural management organisations, which in turn can promote the green development of agriculture.*

2.2.4. The Intermediary Role of Finance

The advancement of sustainable agricultural practices is contingent upon the provision of financial resources [42]. The dual objectives of environmental protection and the enhancement of agricultural production efficiency necessitate a substantial capital investment. The protection plan for China's significant agricultural heritage sites inherently entails an expansion in local agricultural-related financial expenditure [43]. This is primarily manifested in the guidance of capital towards green agricultural initiatives through the realignment of financial structures, the promotion of the advancement of agricultural heritage sites under protection, and consequently, an enhancement in the green total factor productivity in agriculture.

Based on the above analyses, we propose research hypothesis 5:

Hypothesis 5 (H5) : *The protection of important agricultural heritage sites can promote agricultural-related financial expenditures, which in turn can promote the green development of agriculture.*

2.2.5. The Intermediary Role of Technology

In the context of the rapid development of information technology across a range of sectors, digital agriculture is experiencing a period of significant growth. There is an increasing focus on the pivotal role that technology plays in enabling a transformation of the agricultural sector towards greater sustainability. In light of the stringent regulations governing the safeguarding of agricultural heritage sites, local agricultural enterprises are compelled to enhance traditional production techniques, curtail agricultural non-point source pollution and industrial emissions, and pursue cleaner production practices. The integration of traditional farming wisdom and modern green technology has also led to an enhancement in the green total factor productivity in agriculture [44].

Based on the above analyses, we propose research hypothesis 6:

Hypothesis 6 (H6) : *The protection of important agricultural heritage sites can promote green innovation, which in turn can promote the green development of agriculture.*

The framework of our study is shown in Figure 1.

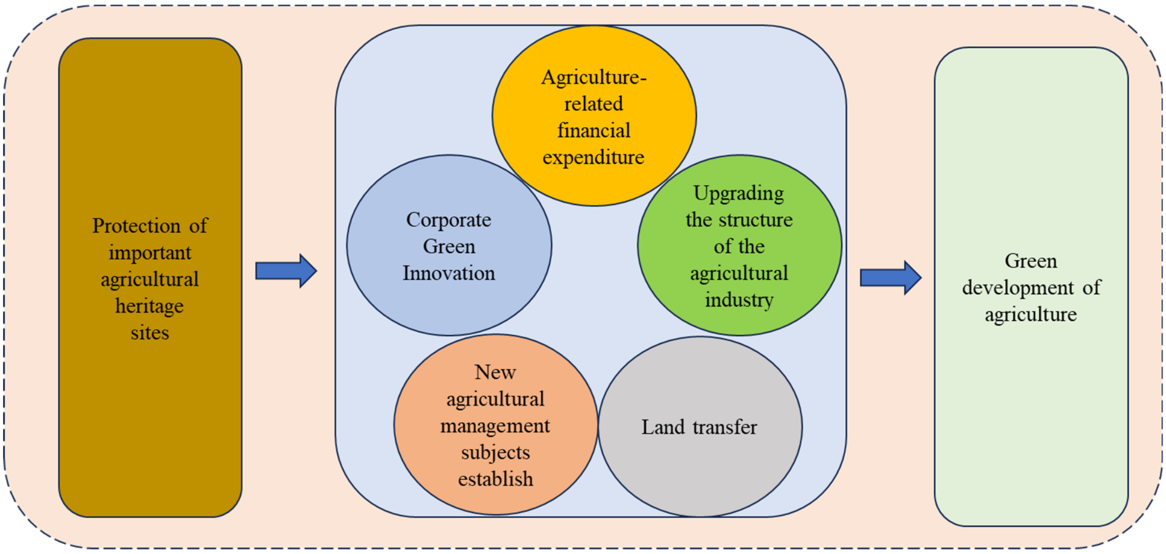


Figure 1. Theoretical framework of important agricultural heritage site protection in China for green development of agriculture.

3. Study Design

3.1. Research Methods

This paper primarily addresses the question of whether an increase in the protection intensity of significant agricultural heritage sites in China can markedly enhance green total factor productivity in agriculture across various provinces, thereby facilitating the green development of agriculture. Accordingly, referring to the existing study [45], our paper employs the number of significant agricultural heritage sites in each province of China as a proxy variable for the protection of agricultural heritage sites, while the green total factor productivity in agriculture of each province serves as a proxy variable for the green development of agriculture. On this basis, a benchmark model is constructed to examine the impact of the protection of agricultural heritage sites on the green development of agriculture. The formula of the constructed two-way fixed effect model is as follows:

$$Greening_{it} = \beta_0 + \beta_1 Heritage\ sites_{it} + \beta' Controls_{it} + \mu_i + v_t + \varepsilon_{it} \tag{1}$$

In Formula (1), $Greening_{it}$ is the explained variable, that is, the green total factor productivity in agriculture of the ith province in the tth year; $Heritage\ sites_{it}$ is the core explanatory variable, that is, the number of recognised important agricultural heritage sites in the ith province in the tth year; and $Controls$ is a series of control variables. β_0 is a constant term, μ_i represents the province fixed effects in this model, v_t represents the time fixed effects in this model, and ε represents the error term.

3.2. Data Source

We mainly use panel data from 30 provinces at the provincial level in China for a period of 21 years from 2001 to 2021. The main data come from the following two aspects: first, the data on socio-economic development variables are all from the *China Statistical Yearbook* and provincial statistical bulletins; second, the data on natural geographical variables (such as precipitation and temperature) are obtained by ArcGIS 10.8 in each province, and some missing values are filled by interpolation.

3.3. Indicators Selection and Variables Description

3.3.1. Explained Variable

The implementation of agricultural production activities within designated agricultural heritage areas has the potential to yield not only the anticipated output, but also the unanticipated output resulting from the excessive utilisation of chemical fertilisers and pesticides. This may include the generation of agricultural carbon emissions, which were not originally considered within the scope of the project. The "expected output" and "non-expected output" are incorporated into an index system framework, employing the super-efficient Slacks-Based Measurement–Globe–Malmquist–Luenberger (SBM-GML) index measurement method to assess the green total factor productivity in agriculture (*Greening*) of each region at the provincial level (As super-efficient SBM-GML directly measures the month-on-month growth index of agricultural green total factor productivity, and given the necessity of utilising the absolute value of agricultural green total factor productivity in our empirical research rather than the growth rate, we have converted it according to the sample base period and employed the converted result as the explained variable of our empirical model). The super-efficient SBM-GML index model is an efficiency evaluation method based on a dynamic perspective, and the model is one of the models in Data Envelopment Analysis (DEA), which extends the traditional SBM model by allowing the efficiency value of a decision unit to exceed 1, which enables further measurement, differentiation, and ranking of the decision units in a more effective way [46].

Referring to existing studies [47,48], the input and output indicators employed in the calculation of the green total factor productivity in agriculture are presented in Table 1.

Table 1. The input indicators and output indicators system for green total factor productivity in agriculture.

Indicator Type	Type	Indicator Name	Indicator Definition	Unit
Input and output indicators for green total factor productivity in agriculture	Agricultural Input	Agricultural Labour Input	Employment in the primary sector	10,000 persons
		Agricultural Land Input	Sum of cropped area and aquaculture area	1000 hm^2
		Fertiliser Input	Amount of agricultural fertiliser (pure equivalent) used	10,000 tons
		Agricultural Machinery Input	Total power of agricultural machinery	10,000 kW
		Agricultural Diesel Input	Amount of agricultural diesel used	10,000 tons
		Agricultural Plastic Film Input	Amount of agricultural plastic film used	10,000 tons
		Pesticide Input	Amount of pesticides used	10,000 tons
		Agricultural Water Input	Area of effective irrigation	1000 hm^2
	Agricultural Output	Desired Output	Total output value of agriculture, forestry, animal husbandry, and fishery	100 million yuan
		Undesired Output	Agricultural carbon emissions	10,000 tons

3.3.2. Core Explanatory Variables

This paper takes the protection of agricultural heritage sites (*Heritage sites*) as the core explanatory variable and employs the total number of globally important agricultural heritage sites (GIAHSs) and China-Nationally Important Agricultural Heritage Sites (China-NIAHSs) successfully approved of each province in China from 2001 to 2021 as the number of important agricultural heritage sites recognised. This is because an increase in the number of recognitions reflects an improvement in social awareness of the protection of agricultural heritage sites, which in turn promotes the mutual promotion of protection practices, the clarification of protection goals, and the accumulation of practical experience. Furthermore, referring to the existing study [45], the number of recognitions can be used as an indicator to quantify the effectiveness of protection and to intuitively reflect the progress of protection work.

3.3.3. Mediating Variables

In light of the preceding theoretical analysis, firstly, we have selected the land transfer rate of each province (*Land*) as the proxy variable for the land-level mechanism. Secondly, the ratio of the agricultural tertiary industry (service industry) to the total agricultural output value of each province (*Industry*) has been chosen as the proxy variable for the industry-level mechanism. Thirdly, the ratio of the number of agricultural cooperatives to the total rural population in each province (*Cooperation*) is selected as the proxy variable for the labour organisation-level mechanism. Fourthly, the amount of agriculture-related financial expenditure in each province (*Finance*) is chosen as the proxy variable for the financial-level mechanism. Fifthly, the amount of green patent authorisations in each province (*Technology*) is selected as the proxy variable for the technology-level mechanism.

3.3.4. Control Variables

In addition, in order to avoid empirical bias caused by omitted variables, referring to existing study [49], we mainly selected control variables from three aspects: First, in agriculture, we selected three variables: facility agriculture (reflected by the ratio of facility agriculture area to crop planting area) (*Facility*), leisure agriculture (reflected by the ratio of annual operating income of leisure agriculture to total agricultural output value) (*Leisure*) and agricultural disaster area (*Disasters*). Second, in environmental protection, we selected two variables: nature reserve construction (reflected by the ratio of the area of nature reserves to the total area of the region) (*Reserves*) and industrial pollution control investment (*Investment*). Finally, in the natural environment, we selected two variables: annual average precipitation (*Precipitation*) and annual average temperature (*Temperature*).

The definition of specific variables and the descriptive statistical analysis are presented in Table 2.

Table 2. Descriptive statistical analysis of related indicators.

Type	Variables	Definition	Mean	Std_Dev	Min	Max
Explained variable	*Greening*	Green total factor productivity in agriculture calculated by the super-efficient SBM-GML index method	1.021	0.058	0.058	1.693
Core explanatory variable	*Heritage sites*	Number of agricultural heritage sites recognised	1.411	2.411	0.000	15.000
Mediating variables	*Land*	Land transfer rate (%)	25.091	18.078	1.524	75.389
	Industry	Output value of agricultural services/total agricultural output value	0.043	0.020	0.014	0.125
	Cooperation	Amount of cooperatives in rural areas/rural population	28.359	23.638	1.512	107.555
	Finance	Amount of agriculture-related financial expenditure (billion yuan)	335.454	309.626	0.440	1339.360
	Technology	Amount of green patent authorizations	2331.432	4274.125	4.000	23,663.000

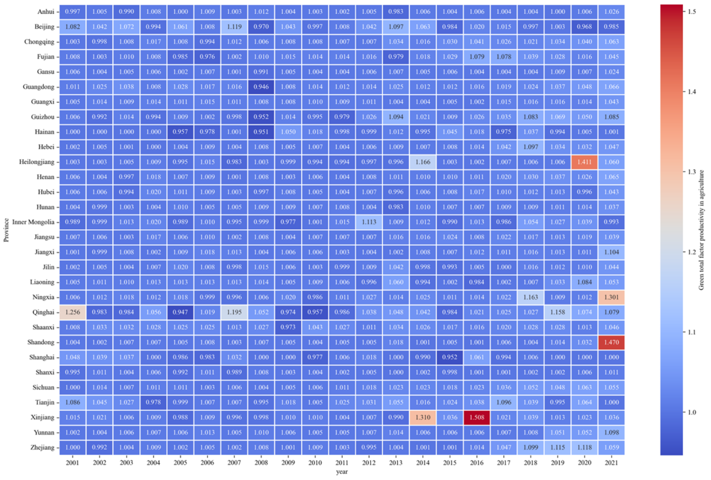
Table 2. *Cont.*

Control variables	*Facility*	Facility agriculture area/crop planting area	16.736	23.762	0.045	130.807
	Leisure	Annual operating income of leisure agriculture/total agricultural output value	0.098	0.109	0.007	0.524
	Reserves	Area of nature reserves/total area of the region	8.867	5.822	2.000	30.000
	Disasters	Area of crops affected by disasters (thousand hectares)	911.559	778.047	778.047	3178.500
	Investment	Industrial pollution control investment (100 million yuan)	17.334	16.654	0.314	88.952
	Precipitation	Average annual precipitation	0.003	0.001	0.001	0.006
	Temperature	Annual average temperature	12.453	5.980	−3.280	24.175

4. Results Analysis

4.1. Regional Distribution Characteristics

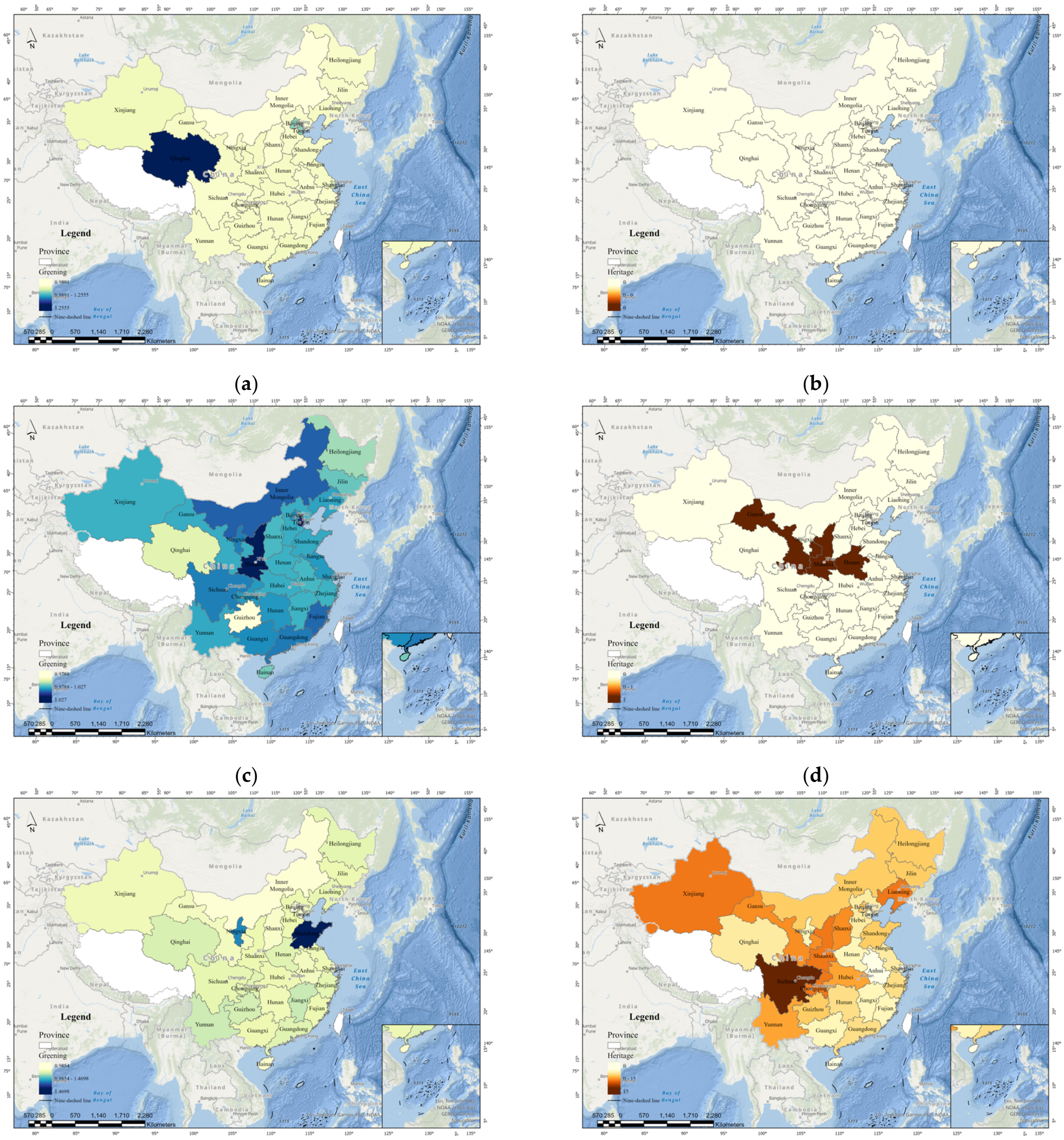
Figure 2 illustrates the specific results of green total factor productivity in agriculture for each province, as measured by the super-efficient SBM-GML index method. The number of agricultural heritage sites identified according to the selection principles is also depicted. The results show that, from the time series analysis, the green total factor productivity in agriculture shows an increasing trend but with greater volatility. With regard to the provinces, at the conclusion of the sample period, Shandong and Ningxia exhibited relatively elevated levels of green total factor productivity in agriculture.



Province	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Anhui	0.997	1.005	0.990	1.008	1.000	1.009	1.003	1.012	1.004	1.003	1.002	1.005	0.983	1.006	1.004	1.006	1.004	1.004	1.000	1.006	1.026
Beijing	1.082	1.042	1.072	0.994	1.061	1.008	1.119	0.970	1.043	0.997	1.008	1.042	1.097	1.063	0.984	1.020	1.015	0.997	1.003	0.968	0.985
Chongqing	1.003	0.998	1.008	1.017	1.008	0.994	1.012	1.006	1.008	1.008	1.007	1.007	1.034	1.016	1.030	1.041	1.026	1.021	1.034	1.040	1.063
Fujian	1.008	1.003	1.010	1.008	0.985	0.976	1.002	1.010	1.015	1.014	1.014	1.016	0.979	1.018	1.029	1.079	1.078	1.039	1.028	1.016	1.045
Gansu	1.006	1.004	1.005	1.006	1.002	1.007	1.001	0.991	1.005	1.004	1.004	1.006	1.007	1.005	1.006	1.004	1.004	1.004	1.009	1.007	1.024
Guangdong	1.011	1.025	1.038	1.008	1.028	1.017	1.016	0.946	1.008	1.014	1.012	1.014	1.025	1.012	1.012	1.016	1.019	1.024	1.037	1.048	1.066
Guangxi	1.005	1.014	1.009	1.014	1.011	1.015	1.011	1.008	1.008	1.010	1.009	1.011	1.004	1.004	1.005	1.002	1.015	1.016	1.016	1.014	1.043
Guizhou	1.006	0.992	1.014	0.994	1.009	1.002	0.998	0.952	1.014	0.995	0.979	1.026	1.094	1.021	1.009	1.026	1.035	1.083	1.069	1.050	1.085
Hainan	1.000	1.000	1.000	1.000	0.957	0.978	1.001	0.951	1.050	1.018	0.998	0.999	1.012	0.995	1.045	1.018	0.975	1.037	0.994	1.005	1.001
Hebei	1.002	1.005	1.001	1.000	1.004	1.009	1.004	1.008	1.005	1.007	1.004	1.006	1.009	1.007	1.008	1.014	1.042	1.097	1.034	1.032	1.047
Heilongjiang	1.003	1.003	1.005	1.009	0.995	1.015	0.983	1.003	0.999	0.994	0.994	0.997	0.996	1.166	1.003	1.002	1.007	1.006	1.006	1.411	1.060
Henan	1.006	1.004	0.997	1.018	1.007	1.009	1.001	1.008	1.003	1.006	1.004	1.008	1.011	1.010	1.010	1.011	1.020	1.030	1.037	1.026	1.065
Hubei	1.006	1.006	0.994	1.020	1.011	1.009	1.003	0.997	1.008	1.005	1.004	1.007	0.996	1.006	1.008	1.017	1.010	1.012	1.013	0.996	1.043
Hunan	1.004	0.999	1.003	1.004	1.010	1.005	1.005	1.009	1.009	1.007	1.008	1.004	0.983	1.010	1.007	1.007	1.009	1.009	1.011	1.014	1.037
Inner Mongolia	0.989	0.999	1.013	1.020	0.989	1.010	0.995	0.999	0.977	1.001	1.015	1.113	1.009	1.012	0.990	1.013	0.986	1.054	1.027	1.039	0.993
Jiangsu	1.007	1.006	1.003	1.017	1.006	1.010	1.002	1.008	1.004	1.007	1.007	1.007	1.016	1.016	1.024	1.008	1.022	1.017	1.013	1.019	1.039
Jiangxi	1.001	0.999	1.008	1.002	1.009	1.018	1.013	1.004	1.006	1.006	1.003	1.004	1.002	1.008	1.007	1.012	1.011	1.016	1.013	1.011	1.104
Jilin	1.002	1.005	1.004	1.007	1.020	1.008	0.998	1.015	1.006	1.003	0.999	1.009	1.042	0.998	0.993	1.005	1.000	1.016	1.012	1.010	1.044
Liaoning	1.005	1.011	1.010	1.013	1.013	1.013	1.013	1.014	1.005	1.009	1.006	0.996	1.060	0.994	1.002	0.984	1.002	1.007	1.033	1.084	1.053
Ningxia	1.006	1.012	1.018	1.012	1.018	0.999	0.996	1.006	1.020	0.986	1.011	1.027	1.014	1.025	1.011	1.014	1.022	1.163	1.009	1.012	1.301
Qinghai	1.256	0.983	0.984	1.056	0.947	1.019	1.195	1.052	0.974	0.957	0.986	1.038	1.048	1.042	0.984	1.021	1.025	1.027	1.158	1.074	1.079
Shaanxi	1.008	1.033	1.032	1.028	1.025	1.025	1.013	1.027	0.973	1.043	1.027	1.011	1.034	1.026	1.017	1.016	1.020	1.028	1.028	1.013	1.046
Shandong	1.004	1.002	1.007	1.007	1.005	1.008	1.003	1.007	1.005	1.004	1.005	1.005	1.018	1.001	1.005	1.001	1.006	1.004	1.014	1.032	1.470
Shanghai	1.048	1.039	1.037	1.000	0.986	0.983	1.032	1.000	1.000	0.977	1.006	1.018	1.000	0.990	0.952	1.061	0.994	1.006	1.000	1.000	1.000
Shanxi	0.995	1.011	1.004	1.006	0.992	1.011	0.989	1.008	1.003	1.004	1.002	1.005	1.000	1.002	0.998	1.001	1.001	1.002	1.002	1.006	1.011
Sichuan	1.000	1.014	1.007	1.011	1.011	1.003	1.006	1.004	1.005	1.006	1.011	1.018	1.023	1.023	1.018	1.023	1.036	1.052	1.048	1.063	1.055
Tianjin	1.086	1.045	1.027	0.978	0.999	1.007	1.007	0.995	1.018	1.005	1.025	1.031	1.055	1.016	1.024	1.038	1.096	1.039	0.995	1.064	1.000
Xinjiang	1.015	1.021	1.006	1.009	0.988	1.009	0.996	0.998	1.010	1.010	1.004	1.007	0.990	1.310	1.036	1.508	1.021	1.039	1.013	1.023	1.036
Yunnan	1.002	1.004	1.006	1.007	1.006	1.013	1.005	1.010	1.006	1.005	1.005	1.007	1.014	1.006	1.006	1.006	1.007	1.008	1.051	1.052	1.098
Zhejiang	1.000	0.992	1.004	1.009	1.002	1.005	1.002	1.008	1.001	1.009	1.003	0.995	1.004	1.001	1.001	1.014	1.047	1.099	1.115	1.118	1.059

Figure 2. Analysis of the evolution of the spatial and temporal characteristics of green total factor productivity.

In order to more intuitively reflect the spatial evolution characteristics of green development of agriculture and the number of agricultural heritage sites and explore the relationship between the two in space and time, three typical years were selected for visual analysis with the help of the Arcgis 10.8 tool: 2001, 2011 and 2021. The results are shown in Figure 3. The results demonstrate that regions exhibiting high green total factor productivity in agriculture and a considerable number of agricultural heritage sites are concentrated in the resource-rich southwest, northwest, and northeast. These regions exhibit a notable degree of spatial correlation between the two variables.



(**a**) (**b**)

(**c**) (**d**)

(**e**) (**f**)

Figure 3. Visualisation of green total factor productivity in agriculture and the amount of important agricultural heritage sites identified. (**a**) Green total factor productivity in agriculture in 2001. (**b**) The number of agricultural heritage sites in 2001. (**c**) Green total factor productivity in agriculture in 2011. (**d**) The number of agricultural heritage sites in 2011. (**e**) Green total factor productivity in agriculture in 2021. (**f**) The number of agricultural heritage sites in 2021.

However, when viewed in a time series context, the growth of green total factor productivity in agriculture has been markedly constrained, while the quantity of agricultural heritage sites has continued to expand considerably. This demonstrates that the effective utilisation of agricultural heritage sites to enhance the green development of agriculture has become a prevalent challenge faced by all provinces in China.

4.2. Benchmark Regression

The results of this paper's test of the relationship between agricultural heritage site preservation and green development of agriculture using a two-way fixed effects model are shown in Table 3.

Table 3. Analysis of baseline regression results.

VARIABLES	**(1)** *Greening*	**(2)** *Greening*	**(3)** *Greening*	**(4)** *Greening*
Heritage sites	0.0061 *** (0.0009)	0.0035 *** (0.0012)	0.0034 *** (0.0012)	0.0025 ** (0.0012)
Facility		0.0733 (0.0456)	0.0640 (0.0468)	0.0374 (0.0476)
Leisure		−0.0027 (0.0039)	−0.0030 (0.0036)	−0.0034 (0.0040)
Disasters		−0.0000 (0.0000)	−0.0000 (0.0000)	−0.0002 (0.0001)
Reserves			−0.0000 (0.0000)	−0.0000 (0.0000)
Investment			−0.0003 (0.0002)	−0.0004 (0.0002)
Precipitation				7.9029 (5.9465)
Temperature				0.0160 ** (0.0064)
Constant	1.0120 *** (0.0025)	1.0115 *** (0.0061)	1.0433 *** (0.0359)	0.8339 *** (0.0880)
Province fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
R-squared	0.145	0.147	0.153	0.169

Note: * means $p < 0.1$, ** means $p < 0.05$, *** means $p < 0.01$, and the standard errors in parentheses are the same below.

Model 1 is the result of the consequence of the absence of control variables. Model 2 is the result of the introduction of control variables exclusively at the agricultural level. Model 3 incorporates control variables at the environmental level in addition to those present in Model 2. Finally, Model 4 incorporates control variables at the natural environment level in addition to those present in Model 3. The results demonstrate that the protection of agricultural heritage sites exerts a positive influence on the green development of agriculture, reaching statistical significance at the 1% level in Model 1, Model 2 and Model 3 and at the 5% level in Model 4.

Based on this, research hypothesis H1 is established.

4.3. Endogenous Treatment

To address the issue of endogeneity, which may arise due to omitted variables and mutual causation, we employ the two-stage panel instrumental variable (IV) method to conduct the regression analysis. The selected instrumental variable is the number of agricultural heritage site recognitions in each province in the lagged period. This is because the number of agricultural heritage site recognitions is as follows: In the lagged period, the number of agricultural heritage site recognitions is correlated with the number of recognitions in the current period. Additionally, the number of recognitions belongs to the predetermined variables and will not directly affect the current period of green development of agriculture. To meet the correlation and exclusivity assumptions of instrumental variables, the regression results are presented in Table 4. Model 5 illustrates the regression results of the initial stage, indicating that the number of agricultural heritage site recognitions in the lagged period (*L. Heritage sites*) has a positive effect on the number of agricultural heritage site recognitions in the current period at the 1% level of significance. The significance level is also demonstrated by Model 6, which illustrates the regression results of the second stage. It is evident that, even after the endogeneity has been mitigated through the instrumental variable approach, the protection of agricultural heritage sites still exerts a positive influence on the green development of agriculture, with a significance level of 1%.

Table 4. Analysis of endogenous treatment results (Two-Stage Least Squares Estimation).

VARIABLES	**(5)** **First** ***Heritage sites***	**(6)** **Second** ***Greening***
Heritage sites		0.0084 *** (0.0028)
L.Heritage sites	0.4891 *** (0.0536)	
Facility	−0.0337 ** (0.0139)	0.0004 (0.0003)
Leisure	4.1680 ** (1.6959)	−0.0107 (0.0312)
Reserves	−0.0102 (0.0371)	−0.0008 (0.0006)
Disasters	−0.0002 (0.0001)	−0.0000 (0.0000)
Investment	−0.0021 (0.0068)	−0.0000 (0.0001)
Precipitation	−89.1473 (147.0148)	−0.3604 (3.1809)
Temperature	−0.0085 (0.0523)	−0.0015 ** (0.0007)
Constant	1.1787 (0.7530)	1.0378 *** (0.0162)
Province fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
LM statistic	73.643 ***	
Wald F statistic	74.825 ***	
R-squared	0.280	0.028

Note: * means $p < 0.1$, ** means $p < 0.05$, *** means $p < 0.01$, and the standard errors in parentheses are the same below.

4.4. Robustness Test

In order to test the robustness of the empirical results, we use the following three methods: First, we replace the calculation method of the explained variable. We replaced the super-efficient SBM-ML (SBM-Malmquist–Luenberger) method index used to calculate the green total factor productivity in agriculture, which is used to measure the explained variable green development, with the super-efficient SBM-ML method. The results are presented in Model 7 of Table 5, showing the impact of agricultural heritage site protection on green total factor productivity in agriculture. It can still show a positive effect at the 5% significance level. Secondly, the sample period is shortened. Considering the impact of the length of the sample selection period, we shortened the sample period to 2010–2021 as a robustness check. The results are presented in Model 8 of Table 5. During 2010–2021, the impact of agricultural heritage site protection on super-efficient SBM-ML concluded that green total factor productivity in agriculture can still have a positive effect at the 1% significance level. Third, we replaced the regression model. Considering that green total factor productivity in agriculture is limited data, we changed the empirical model to the panel Tobit model, which is used for regression, and the results are shown in Model 9 of Table 5, which shows that in the panel Tobit model, agricultural heritage sites protection can still have a positive effect on green total factor productivity in agriculture at the 1% significance level.

Table 5. Analysis of robustness test results.

VARIABLES	**(7)** **Change the Calculation Method of the Explained Variable to Super-Efficient SBM-ML Index Calculation** *Greening′*	**(8)** **Change the Sample Period to 2010–2021** *Greening*	**(9)** **Change the Measurement Method to Panel Tobit** *Greening*
Heritage sites	0.0049 ** (0.0021)	0.0039 *** (0.0011)	0.0041 *** (0.0011)
Facility	0.0002 (0.0005)	−0.0002 (0.0001)	−0.0001 (0.0001)
Leisure	0.0206 (0.0822)	0.0161 (0.0306)	0.0178 (0.0302)
Reserves	0.0058 (0.0068)	−0.0010 (0.0009)	−0.0008 (0.0008)
Disasters	−0.0000 (0.0000)	−0.0000 (0.0000)	−0.0000 (0.0000)
Investment	−0.0000 (0.0004)	−0.0000 (0.0002)	−0.0000 (0.0002)
Precipitation	8.1979 (10.2607)	−1.3631 (3.5064)	−1.3299 (3.3313)
Temperature	0.0090 (0.0111)	−0.0017 (0.0011)	−0.0013 (0.0011)
Constant	0.8490 *** (0.1519)	1.0557 *** (0.0201)	1.0478 *** (0.0188)
Province fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
R-squared	0.330	0.062	-

Note: * means $p < 0.1$, ** means $p < 0.05$, *** means $p < 0.01$, and the standard errors in parentheses are the same below.

All of the above indicates that the research results have good robustness.

5. Further Discussion

5.1. Mechanism Analysis

For the mechanism analysis, we adopt a path test by capturing the effects of the core explanatory variables on the mediating variables in order to avoid the problem of causal identification bias that may be caused by the traditional stepwise method of testing mediation effects. Therefore, we take land transfer rate (*Land*), the ratio of the agricultural tertiary industry (service industry) to the total agricultural output value (*Industry*), the ratio of the number of agricultural cooperatives to the total rural population (*Cooperation*), the amount of agriculture-related financial expenditure (*Finance*), and the amount of green patent authorisations (*Technology*), in each province as the explanatory variables, respectively, and still regress the number of agricultural heritage recognition in each province as the core explanatory variables. The results are shown in Model 10-Model 14 in Table 6. The results show that the protection of agricultural heritage sites can promote the improvement of agricultural green total factor productivity by significantly promoting the land circulation rate, upgrading the agricultural industry structure, establishing new agricultural management organisations, the amount of financial support to agriculture, and green technology innovation. They are positively significant at the confidence intervals of 1%, 5%, 1%, 1% and 1%, respectively. The results demonstrate that these five paths have demonstrated a mediation effect.

Table 6. Analysis of mechanism analysis results.

VARIABLES	**(10)** ***Land***	**(11)** ***Industry***	**(12)** ***Cooperation***	**(13)** ***Finance***	**(14)** ***Technology***
Heritage sites	0.5287 *** (0.1493)	0.0020 ** (0.0008)	2.5771 *** (0.3042)	77.7120 *** (9.8917)	233.6452 *** (76.0997)
Facility	0.1024 *** (0.0375)	−0.0000 (0.0001)	−0.0588 (0.0765)	1.4586 (2.4867)	39.4462 *** (10.1320)
Leisure	45.1731 *** (5.8725)	−0.0676 *** (0.0200)	46.4240 *** (11.9676)	1216.0387 *** (389.1329)	9808.0192 *** (2089.4956)
Reserves	1.8882 *** (0.4890)	0.0021 *** (0.0004)	7.1894 *** (0.9964)	98.8325 *** (32.4000)	−25.1801 (57.6149)
Disasters	−0.0026 *** (0.0007)	−0.0000 ** (0.0000)	−0.0025 * (0.0014)	−0.3111 *** (0.0453)	−0.9045 *** (0.2814)
Investment	0.0792 *** (0.0289)	0.0002 *** (0.0001)	−0.1280 ** (0.0589)	−0.1503 (1.9156)	88.5231 *** (11.1391)
Precipitation	1500.9286 ** (733.1549)	0.3479 (1.6333)	2957.8031 ** (1494.1073)	123,760.1303 ** (48,581.5112)	503,082.0421 ** (232,773.3118)
Temperature	7.8348 *** (0.7945)	0.0003 (0.0005)	18.1892 *** (1.6191)	271.2188 *** (52.6461)	63.0221 (73.6549)
Constant	−95.6653 *** (10.8522)	0.0165 * (0.0095)	−273.7822 *** (22.1158)	−2816.5939 *** (719.1031)	−1920.2153 (1299.6186)
Province fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
R-squared	0.878	0.290	0.747	0.847	0.401

Note: * means $p < 0.1$, ** means $p < 0.05$, *** means $p < 0.01$, and the standard errors in parentheses are the same below.

Based on this, research hypothesis H2-H5 is established.

5.2. Heterogeneity Analysis

5.2.1. Geographical Heterogeneity

Given that the heterogeneity of regional infrastructure construction and regional economic levels may affect the impact of agricultural heritage sites on green development of agriculture [50], we divided the provinces into eastern, central, western and northeastern regions for group regression (The eastern region includes Beijing, Tianjin, Shanghai, Hebei Province, Shandong Province, Jiangsu Province, Zhejiang Province, Fujian Province, Guangdong Province, and Hainan Province; the central region includes Shanxi Province, Henan Province, Hubei Province, Anhui Province, Hunan Province, and Jiangxi Province; the western region includes Inner Mongolia Autonomous Region, Xinjiang Uygur Autonomous Region, Ningxia Hui Autonomous Region, Shaanxi Province, Gansu Province, Qinghai Province, Chongqing, Sichuan Province, Guangxi Zhuang Autonomous Region, Guizhou Province, and Yunnan Province; the northeastern region includes Heilongjiang Province, Jilin Province, and Liaoning Province. (Due to data limitations, this does not include the Hong Kong, Macao, Tibet and Taiwan regions)). The results are shown in Model 15 to Model 18 in Table 7. The findings indicate that the conservation of agricultural heritage sites exerts a favourable influence on green development of agriculture at the 1% confidence interval in the eastern region and central region. However, this effect is not statistically significant in the western region and northeastern region.

Table 7. Analysis of geographical heterogeneity analysis results.

VARIABLES	**(15)** **Eastern** ***Greening***	**(16)** **Central** ***Greening***	**(17)** **Western** ***Greening***	**(18)** **Northeastern** ***Greening***
Heritage sites	0.0057 *** (0.0019)	0.0027 *** (0.0009)	−0.0004 (0.0009)	−0.0054 (0.0068)
Facility	−0.0011 (0.0007)	−0.0001 (0.0003)	−0.0005 (0.0009)	0.0001 (0.0011)
Leisure	0.0295 (0.0531)	0.0371 * (0.0201)	−0.0001 (0.0402)	−1.6513 (1.0404)
Reserves	−0.0022 (0.0019)	−0.0014 (0.0010)	0.0032 (0.0057)	0.0082 (0.0114)
Disasters	−0.0000 (0.0000)	−0.0000 * (0.0000)	−0.0000 * (0.0000)	−0.0000 (0.0000)
Investment	−0.0001 (0.0006)	−0.0000 (0.0002)	−0.0004 *** (0.0002)	−0.0019 (0.0024)
Precipitation	−8.6872 (7.7041)	3.2867 (3.0263)	1.3613 (3.0458)	93.8090 ** (41.5834)
Temperature	−0.0018	−0.0025 *	0.0190 ***	0.0736 ***
	(0.0030)	(0.0014)	(0.0055)	(0.0249)
Constant	1.0986 *** (0.0458)	1.0484 *** (0.0289)	0.7188 *** (0.0882)	0.4850 ** (0.2038)
Province fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
R-squared	0.125	0.240	0.391	0.329

Note: * means $p < 0.1$, ** means $p < 0.05$, *** means $p < 0.01$, and the standard errors in parentheses are the same below.

One potential explanation is that, in comparison to the western and northeastern regions, the eastern and central regions may possess superior infrastructure, more advanced economic development, more sophisticated agricultural policies, and more comprehensive public services within the designated areas for the protection of agricultural and cultural heritage. Additionally, the supporting policies that have been formulated are also more systematic. To illustrate, coastal provinces and cities in China, such as Zhejiang and Guangdong, have established provincial financial institutions to allocate dedicated funds annually to facilitate agricultural green construction in agricultural heritage site regions. Such discrepancies may have resulted in disparate degrees of efficacy in the implementation of measures for the safeguarding of agricultural heritage and the promotion of green development of agriculture.

5.2.2. Artificial Intelligence (AI) Level Heterogeneity

In the context of the rapid development of the digital economy and information technology, there has been a notable increase in the integration of AI technology with agriculture [51]. This integration has also extended to digital forestry and green forestry, particularly in the protection and promotion of agricultural heritage sites. Examples of this integration include the use of drones for spraying and harvesting, the implementation of smart irrigation and supervision facilities, and the establishment of a sharing platform for big data agricultural information. Concurrently, when the value of agricultural heritage sites is recognised, local governments frequently collaborate with enterprises to construct online platforms for operation and utilise new media and other channels to stimulate heritage. Consequently, the number of local AI companies will influence the efficacy of agricultural heritage site protection in the context of green development of agriculture. In consideration of the aforementioned factors, the number of AI companies in each province on an annual basis is employed to reflect the AI level of the province in question for that specific year. Subsequently, the data are dichotomised into two categories, with the median serving as the demarcation point. Provinces exhibiting a lower number of AI companies than the median are classified as having a lower amount of AI companies, while those with a median or higher number of AI companies are categorised as having a higher amount of AI companies. The results of the group regression are presented in Table 8. The findings of Model 19 indicate that in provinces with low levels of agricultural heritage sites, the positive impact of its protection on the advancement of green development of agriculture is not statistically significant. Conversely, Model 20 indicates that for provinces exhibiting elevated AI levels, the implementation of agricultural heritage site protection does not yield a discernible positive impact on the green development of agriculture, and the positive effect of development is statistically significant within a 1% confidence interval. Meanwhile, the results passed Fisher's combination test, indicating that there was a difference between the two groups at the 1% significance level.

Table 8. Analysis of AI level heterogeneity analysis results.

VARIABLES	**(19)** **Lower Amount of AI Companies** ***Greening***	**(20)** **Higher Amount of AI Companies** ***Greening***
Heritage sites	−0.0003 (0.0015)	0.0211 *** (0.0027)
Facility	−0.0003 (0.0004)	−0.0004 (0.0005)
Leisure	0.0172 (0.0627)	0.0256 (0.1475)
Reserves	−0.0029 (0.0105)	−0.0025 (0.0043)
Disasters	−0.0000 (0.0000)	0.0000 (0.0000)
Investment	−0.0006 * (0.0003)	0.0005 (0.0003)
Precipitation	13.5038 * (7.3569)	−3.1711 (7.8030)
Temperature	0.0360 *** (0.0100)	−0.0215 *** (0.0072)
Constant	0.5370 *** (0.1626)	1.2389 *** (0.0911)
Province fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
R-squared	0.255	0.534
Difference between groups (p-value)	0.0214 ***	

Note: * means $p < 0.1$, ** means $p < 0.05$, *** means $p < 0.01$, and the standard errors in parentheses are the same below.

One potential explanation is that provinces with higher levels of AI development are better equipped to utilise advanced technologies and more efficient methods in the promotion of green agricultural practices within cultural heritage protection areas. This enables them to play a more effective and efficient role in this regard. To illustrate, the Miyun Origin in Beijing deploys intelligent agricultural monitoring systems, drone spraying and intelligent irrigation to facilitate the protection of agricultural heritage sites, thereby promoting the green and sustainable development of local agriculture.

5.2.3. Urban–Rural Integration Heterogeneity

One of the most significant processes in the protection of agricultural heritage sites is the integration of urban and rural areas [52]. The level of urban–rural integration will influence the complexity of protecting agricultural heritage sites, which in turn will impact the role of agricultural heritage site protection in promoting the green development of agriculture. Accordingly, the urbanisation rate is employed as a proxy variable for urban–rural integration, with a division according to the median value of the urbanisation rate. Those values below the median are defined as representing a lower degree of urbanisation, while those values equal to or above the median are defined as representing a higher degree of urbanisation. The group regression results are shown in Table 9. The findings of Model 21 indicate that for provinces with a lower degree of urbanisation, the protection of agricultural heritage sites exerts a positive influence on the green development of agriculture, reaching statistical significance at the 1% level. Conversely, for provinces with a higher degree of urbanisation, the positive impact of agricultural heritage site protection on the green development of agriculture is not statistically significant. Meanwhile, the results passed Fisher's combination test, indicating that there was a difference between the two groups at the 1% significance level.

Table 9. Analysis of urban–rural integration heterogeneity analysis results.

VARIABLES	**(21)** **Lower Degree of Urbanisation** ***Greening***	**(22)** **Higher Degree of Urbanisation** ***Greening***
Heritage sites	0.0109 *** (0.0025)	0.0006 (0.0015)
Facility	−0.0002 (0.0012)	−0.0002 (0.0003)
Leisure	−0.0823 (0.1308)	0.0292 (0.0598)
Reserves	−0.0063 (0.0060)	0.0022 (0.0066)
Disasters	0.0000 (0.0000)	−0.0000 (0.0000)
Investment	0.0004 (0.0004)	−0.0007 ** (0.0003)
Precipitation	−3.2197 (10.8886)	13.2230 * (7.2999)
Temperature	−0.0040 (0.0115)	0.0215 *** (0.0081)
Constant	1.1127 *** (0.1542)	0.7229 *** (0.1146)
Province fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
R-squared	0.321	0.205
Difference between groups (p-value)	−0.0103 ***	

Note: * means $p < 0.1$, ** means $p < 0.05$, *** means $p < 0.01$, and the standard errors in parentheses are the same below.

One potential explanation for this phenomenon is that the rapid expansion of construction land in areas with a high degree of urbanisation may intensify the conflict between land development and the protection of agricultural heritage, thereby weakening the positive impact of heritage protection on the green development of agriculture. In comparison to provinces with a high level of urbanisation, the protection of agricultural heritage sites may have a more direct impact on local green development of agriculture. To illustrate, despite the relatively slow pace of urbanisation in Guangxi Province, the farmland terraces in Guilin and the traditional agricultural heritage of ethnic minorities in Nanning exemplify an interactive and harmonious relationship between land, people and nature, which directly promotes local green development of agriculture.

6. Research Conclusions and Prospects

6.1. Research Conclusions

First, the protection of agricultural heritage sites can significantly promote the green development of agriculture, which is still significant after mitigating endogeneity and passing various robustness tests. Second, the protection of agricultural heritage sites can promote the advanced agricultural industrial structure, increase the land transfer rate, promote the construction of new agricultural management organisations, strengthen financial investment in supporting agriculture, and promote green inventions and innovations to promote the green development of agriculture, and the five ways of action have all passed the intermediate effect test. Last, protecting agricultural heritage sites can promote green development of agriculture: there is heterogeneity, which is more pronounced in the eastern and central regions, regions with higher levels of AI development and regions with lower levels of urbanisation.

6.2. Research Implications

At present, many agricultural heritage sites are even "endangered", hindering the green transformation of agriculture, and it is urgent to solve this problem. For example, agricultural heritage sites in some developing countries, such as the Cordillera Rice Terraces in the Philippines, are facing problems such as uncontrolled tourism development, endangered farming cultures and loss of traditional awareness, which make it difficult to realise the positive effects of agricultural heritage sites on the green development of agriculture. Evidence from China can inform the resolution of these issues. In light of the research findings, this paper presents the following findings and recommendations. Firstly, the positive role of agricultural heritage in agricultural development, particularly in developing countries, may not yet be fully realised. Consequently, efforts could be made to maximise its potential. Once a consensus has been reached on the protection of agricultural heritage, it would be prudent to consider measures that both conserve this heritage and facilitate its appropriate development and use. Secondly, the potential of the five identified channels—land, industry, labour organisation, financial capital, and green technology—could be explored in the protection and promotion of agricultural heritage sites, thereby promoting green agricultural practices through a multi-faceted approach. Thirdly, it may be beneficial to develop differentiated strategies, with a particular focus on the construction of agricultural infrastructure in the agricultural resource-rich areas, and on the enhancement of public services in areas with agricultural heritage. Furthermore, the potential of AI in facilitating the conservation and green development of agricultural heritage sites warrants further investigation. In the context of urban–rural integration, it would be beneficial to give due consideration to the protection of agricultural heritage and the promotion of innovative thinking.

6.3. Research Shortcomings and Prospects

While this paper employs a relatively scientific methodology to examine the relationship and mechanism between agricultural heritage protection and green development of agriculture, it is not without limitations. Firstly, the research data are limited and the data granularity is relatively coarse. In order to strengthen the argument, it would be beneficial to include data at the prefecture, city and county levels. At the same time, due to the limitation of data availability, only China can be selected as a representative country, and in the future, the data can be supplemented to make a horizontal comparison with the cases of other countries, so as to obtain more generalised conclusions. Secondly, the research perspective is relatively macro. In order to gain a deeper understanding of the subject matter, future research could employ empirical surveys and in-depth interviews to supplement the individual perspectives on agricultural heritage protection and green development of agriculture.

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