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Spatial–Temporal Evolution Analysis of the Development of Jingdang and Famen Townships in the Vicinity of the Capital City Site of the Western Zhou Dynasty in China

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Abstract: This study aimed to explore the evolution of Jingdang and Famen towns near the Zhouyuan site, the capital city site of the Western Zhou Dynasty in China, to elucidate the relationship between township development and the essential ancient relics conservation areas. Based on the remote sensing satellite images from 1982 to 2022, combining with historical demographic data, this study used four methods, including land use classification, land use transfer matrix, landscape pattern center of gravity changes, and population count statistics, to study the spatial–temporal evolution of land, population, and ecology in the region over the past 40 years. The results showed that under the strict relic conservation regimen, these two towns are in a declining stage. To improve their decaying status, some potential strategies valuable for township development are proposed to balance the relationship between relic conservation and township development for their mutual benefit and coexistence.

Keywords: township; land use; ancient large city-sites; Zhouyuan site; spatial–temporal evolution; relic conservation

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1. Introduction

Townships in China consist of villages. As the lowest administration organization, townships link cities with rural areas. In the traditional social model, townships were the leading agricultural production areas in China, and arable land is critical to townships [1]. In 1982, the Chinese government encouraged the implementation of "Household Contract Responsibility System with Remuneration Linked to Output" to accelerate the development of townships [2]. In recent decades, with the rapid development of China's economy, townships have gradually formed a development model that focuses on agricultural production, with equal emphasis on industry and services, which has become the driving force for the country's socioeconomic development. As a country with 36.11% rural population [3], the Chinese government pays close attention to the development of townships, and launched several national strategies for rural revitalization and rural industrial development plans in 2017, so as to promote the healthy and rapid development of townships.

With the implementation of the national strategy, many Chinese scholars have devoted themselves to the study of township development. They interpreted China's township development from various perspectives, including township infrastructure development [4], sustainable township development [5], township ecological protection [6], township tourism industry development [7], township economic model innovation [8], and township policy formulation [9]. They concluded that complete infrastructure, excellent ecological environment, multiple industry types, and appropriate policy support are the prerequisites for supporting the sustainable development of townships. In other countries

worldwide, e.g., Iran's Hormozgan Province, economic, social, and environmental factors have promoted the development of local townships [10]. Scholars have attempted to reshape township spaces in West Java, Indonesia, using ecological design methods [11]. In Namibia, sufficient food is the key to ensuring the healthy development of townships [12]. In South Africa, township enterprises provide employment opportunities for residents and contribute to the rapid development of townships [13]. In Moravia, Czechia, grape-themed tourism has served as a new engine for the development of the township [14]. In the Serbian town of Zlote, based on the beautiful natural environment, tourism has become the primary way to promote the development of the townships, balancing the relationship between economic development and ecological protection [15].

However, less research has involved the development of townships near the ancient large city-sites areas with paramount conservation significance. The authors visited many ancient large city-sites areas, such as the Erlitou site and the Yinxu site in Henan Province, and the Zhouyuan site, the Terracotta Warriors and Horses site, and the Han Chang'an City site in Shaanxi Province. Although there are differences in the natural endowments and social and economic conditions of the areas, the townships around the sites are generally developing rather slowly. Therefore, it is possible that the strict heritage protection policy is an important constraint on the rapid development of these townships. Thus, it is valuable to probe the relationship between township development and relics conservation in the ancient large city-sites areas. In this paper, we selected the Jingdang and Famen towns near the Zhouyuan site as the case studies to explore the evolution of township development in the ancient large city-sites areas, which has experienced a long-term strict heritage conservation regime. In contrast to the traditional qualitative studies that rely on empirical and descriptive methods, this paper quantitatively reveals this area's spatial–temporal evolution based on remote sensing data and demographic data using a combination of three methods, including land use classification, land use transfer matrix, and landscape pattern center of gravity changes, to seek a solution for a harmonious development between the townships and heritage conservation in an area rich in ancient cultural relics [16]. Taking the Zhouyuan site as an example, this paper aims to explore the development of the townships around the Zhouyuan site over the past 40 years through quantitative research methods. And based on this, it discusses the conflict between the protection of ancient large city-sites areas and the development of its neighboring townships, and proposes more practical suggestions to reconcile the relationship between township development and heritage conservation.

Jingdang Town of Qishan County and Famen Town of Fufeng County are located in Baoji City, Shaanxi Province. They are located in the vicinity of the Zhouyuan site, where the largest and wealthiest cultural relics have been found in the capital city site of the Western Zhou Dynasty (1046 BC–771 BC), which is of great cultural, scientific, and artistic value (Figure 1). In the past four decades, China's rapid urbanization has significantly impacted the township land structure [17]. Furthermore, the strict heritage protection measures of the large ancient city-site have further escalated the land conflicts [18,19]. Therefore, forced by the dual pressures of urbanization and heritage conservation, land has become a key indicator of the development of Jingdang and Famen townships in the Zhouyuan site region. The evolution of its land use reflects the development process of the townships [20,21]. In addition, the region's agricultural population change is also an important indicator of township development [22,23]. In conclusion, Jingdang and Famen townships are good test areas for analyzing the relationship between townships and cultural relics conservation using various methods such as remote sensing and ArcGIS.

The satellite remote sensing images of Jingdang Town and Famen Town in 1982, 1992, 2002, 2012, and 2022 were interpreted using ArcGIS 10.1 and ENVI 5.1 software. Based on this, this paper explored the spatial and temporal evolution of land, population, and ecology in Jingdang and Famen towns over the past 40 years using three methods, including the land use classification model, land use transfer matrix model, and landscape pattern center of gravity changes model, and combined the changes in population size

and structural composition since 1985 [24]. The study found that under the strict relic conservation regimen, these two towns are in an overall stage of decline, with slow agricultural development, low agricultural modernization, lagging industrial growth, severe loss of agricultural population, and significant ecological damage. In order to improve the decaying status of Jingdang Town and Famen Town, this paper proposes six suggestions, hoping to balance the relationship between relic conservation and township development for their mutual benefit and coexistence.

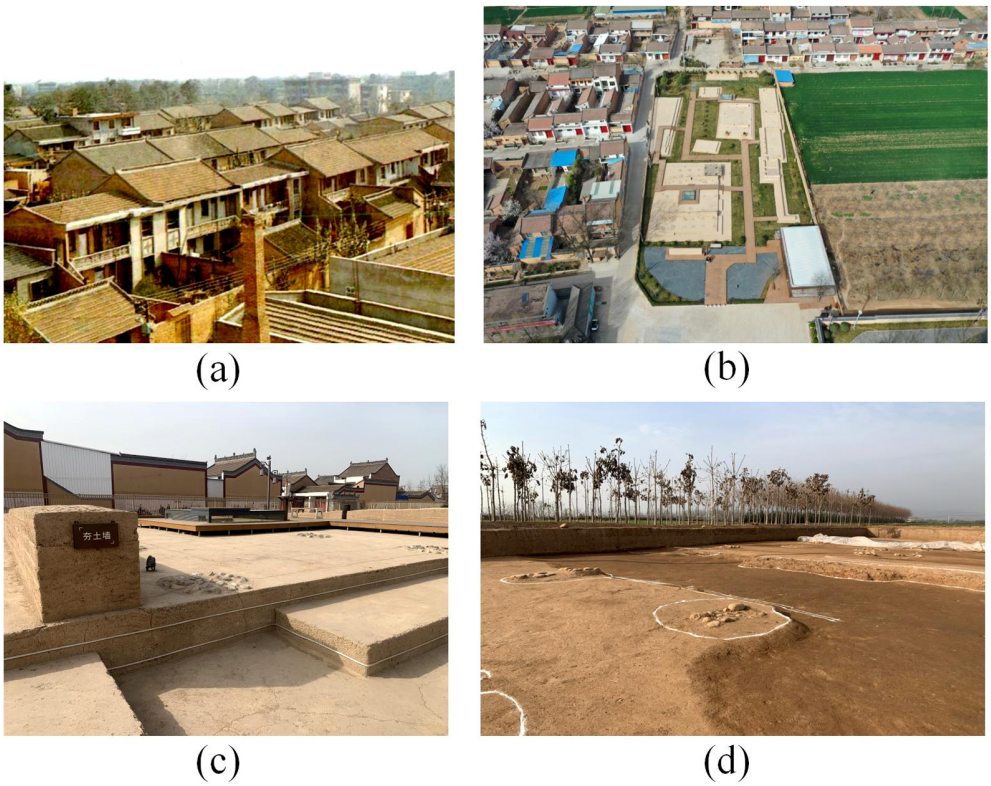

Figure 1. Actual view of the Zhouyuan site. (**a**) Townships near the Zhouyuan site in the mid-1980s. (**b**) Townships near the Zhouyuan site at present. (**c**) Ruins adjacent to the villages at present. (**d**) Archaeological work in progress at the Zhouyuan site.

2. Materials and Methods

2.1. Overview of the Study Area

Jingdang Town and Famen Town belong to Qishan County and Fufeng County of Baoji City, respectively. These two towns border each other and are located in low mountain hills and the Loess Plateau. The terrain is high in the north and low in the south, with an altitude of 599 m to 1594 m. They belong to the warm temperate semihumid continental monsoon climate, with an average annual temperature of about 12 °C, an average annual frost-free period of 210 days, and an average annual precipitation of 628.8 mm. Since 1976, archaeologists have successively discovered large palace sites of the Western Zhou Dynasty (1046 BC–771 BC) in the area, such as the Fengchu site [25], the Shaochen site [26], and the Qizhen-Yuntang site [27], thus confirming that the region was the site of Qizhou, the capital of the early Western Zhou Dynasty [28]. Currently, the region is the largest Western Zhou period site in China in terms of area and the most excavated artifacts, with significant historical, cultural, and scientific value. However, with the acceleration of urbanization, the expansion of site protection, and the increasingly stringent heritage protection policies, the land structure and landscape pattern of Jingdang and Famen towns have undergone significant changes. In fact, under strict heritage protection policies, townships throughout the Zhouyuan site region have declined to varying degrees. Yet, Jingdang and Famen towns are the closest to the Zhouyuan site and have become the core areas where conflicts

are most prominent. In order to more comprehensively study the township development in the area of the large ancient city-site, this paper selected Jingdang Town and Famen Town, which are closely related to the Zhouyuan site, as the research objects. It is roughly located at 107°46′ E–107°58′ E, 34°24′ N–34°35′ N (Figure 2).

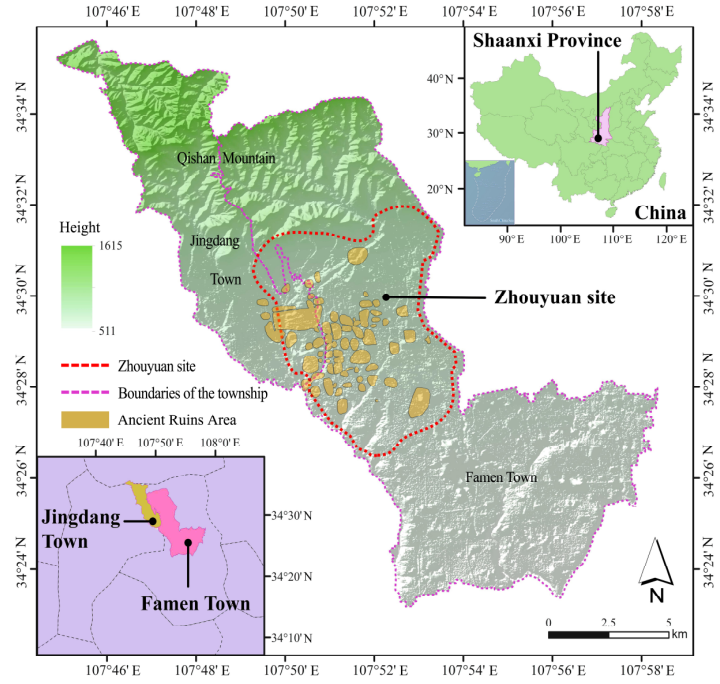

Figure 2. Research scope map.

2.2. Data Sources

In this study, the data resources of Jingdang and Famen towns were derived from the remote sensing images of LandSat3 MSS in 1982, LandSat5 TM in 1992, LandSat7 ETM+ in 2002 and 2012, and LandSat8 OLI and LandSat9 OLI in 2022. These original imageries, spanning nearly 40 years, were obtained from the USGS (http://glovis.usgs.gov/, accessed on 21 December 2022) website, using the US-developed WGS84 Universal Transverse Mercator (WGS84UTM) coordinate system [29]. In these images, the spatial resolution was 60 m in 1982 and 30 m in the rest of the years. The strip number/line were 137/36 and 138/36 in the 1982 images, 127/36 in the 1992–2012 images, and 127/36 and 128/36 in the 2022 images. These images were taken from March to September with less than 2% cloudiness. In the paper, the original images were preprocessed using ArcGIS10.1 and ENVI5.1 software, including geometric correction, image alignment, band fusion, image mosaicking and cropping, study area extraction, image enhancement, supervised classification, etc. Radiometric correction and atmospheric correction were also preprocessed by using the software "FLAASH" function, and the remotely sensed images were enhanced and analyzed in terms of interpretation [30]. The smaller the number of spatial resolutions, the more precise it is for land use classification. The spatial resolution of 30 m or 60 m chosen in this paper can already meet the research needs. Data sources are listed in Table 1.

Table 1. Data sources from 1982 to 2022.

Year	Satellite	Spatial Resolution	Strip Number/Line
1982	LandSat3 MSS	60 m	137/36 & 138/36
1992	LandSat5 TM	30 m	127/36
2002	LandSat7 ETM+	30 m	127/36
2012	LandSat7 ETM+	30 m	127/36
2022	LandSat8 OLI & LandSat9 OLI	30 m	127/36 & 128/36

2.3. Research Methodology

This paper studied the township areas of the large ancient city-site from the perspective of land use evolution and population change. First, based on the interpretation of remote sensing images, the land use and landscape pattern data of Jingdang Town and Famen Town from 1982 to 1992 were obtained through three methods, including land use classification, land use transfer matrix, and landscape pattern center of gravity changes [31]. By analyzing these data, this paper quantitatively studies the structure of cultivated land (CL), forest land (FL), grassland (GL), construction land (COL), unutilized land (UL), and water area (WA) in the region during different periods, clearly showing the transformation amount between different land types and the transfer distance and direction of different landscapes over 40 years, thus revealing the spatiotemporal evolution of the landscape patterns of the townships in the large ancient city-site area. The calculation approaches of land use classification, land use transfer matrix, and landscape pattern center of gravity changes are consistent with the those of Chen et al. [32–34].

Second, this paper consulted the total population, agricultural population, and nonagricultural population of Qishan County, where Jingdang town is located, and Fufeng County, where Famen Town is located, in 1985, 1986, 1992, 1997, 1999, 2002, 2007, 2009, 2012, 2017, 2019, and 2020, as recorded in the Shaanxi Provincial Statistical Yearbook [35]. Since population statistics about each township were unavailable in China until 2014, this paper further consulted the China County Statistical Yearbook Township Volume [36] for the respective populations of Jingdang Town and Famen Town from 2015 to 2020. The above data analysis revealed the changes in population size and demographic structures in this region over the past 40 years, thereby further revealing the township development in the large ancient city-site area.

The research methodology can be divided into four steps (Figure 3): (1) The remote sensing data of different years were classified into six types of land use through the land use classification method. (2) The land use transfer matrix model was established to analyze the spatiotemporal transition process between different land use types [37]. (3) The change model of landscape pattern gravity center was constructed to analyze the transfer distance and direction of various landscapes. (4) Demographic data were used to analyze the population quantity and structural changes in the study area.

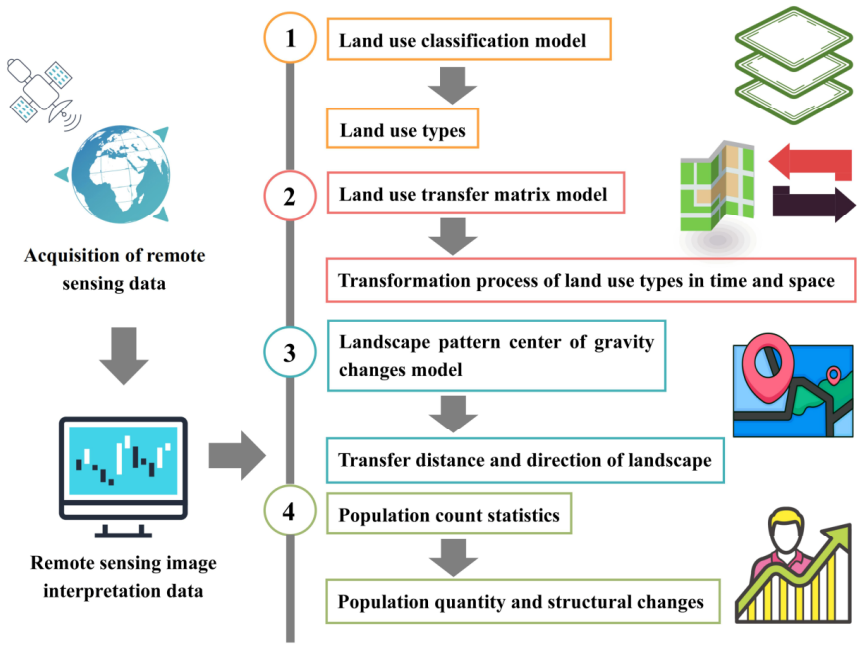

Figure 3. Method flow chart.

3. Results

3.1. Land Use

The area and proportion of land use types in Jingdang and Famen towns in 1982, 1992, 2002, 2012, and 2022 were extracted by interpreting remote sensing images using ENVI 5.1 software. According to the purpose of the study and the research of scholars such as Chen [38,39], through the maximum likelihood classification method with reference to the classification criteria for current land use status in China (GB/T 21010–2017) (https://max.book118.com/html/2018/1106/8024017017001132.shtm, accessed on 17 February 2024), the study area was divided into six categories, including CL, FL, GL, COL, UL, and WA. A confusion matrix was constructed to verify the accuracy. In the confusion matrix, about 100–150 samples were selected from six land use types each year, and about 800 samples were used for validation. The results showed that the kappa coefficients were all above 0.9, meeting the accuracy requirements of medium-resolution remote sensing images. Table 2 and Figure 4 show the six land use changes of CL, FL, GL, COL, UL, and WA in the area from 1982 to 2022. Details of the confusion matrix are given in the paper's Supplementary Materials.

Table 2. Land use structure from 1982 to 2022.

Year	Area Proportion	CL	FL	GL	COL	UL	WA
1982	Area/km^2	98.40	35.14	26.03	8.83	2.38	1.38
	Proportion/%	57.16	20.41	15.12	5.13	1.38	0.80
1992	Area/km^2	97.69	35.68	25.47	9.12	1.65	2.55
	Proportion/%	56.75	20.72	14.79	5.30	0.96	1.48
2002	Area/km^2	94.02	35.60	24.42	13.60	2.67	1.85
	Proportion/%	54.62	20.68	14.18	7.90	1.55	1.07
2012	Area/km^2	95.38	34.00	23.94	14.49	2.15	2.20
	Proportion/%	55.40	19.75	13.91	8.41	1.25	1.28
2022	Area/km^2	91.65	34.27	24.10	18.19	2.52	1.43
	Proportion/%	53.24	19.91	14.00	10.56	1.46	0.83

The results showed that the most noticeable change among the six land use types was in COL, followed by CL. In 40 years, the COL increased from 8.83 km^2 (5.13%) in 1982 to 18.19 km^2 (10.56%) in 2022, an increase of 9.36 km^2 or 106.00% compared with 1982. At the same time, CL decreased from 98.40 km^2 (57.16%) in 1982 to 91.65 km^2 (53.24%) in 2022, a decrease of 6.75 km^2 or 6.86% compared with 1982. Although some changes have taken place in the other four land use types, the fluctuations were relatively small on the whole. The land use change map from 1982 to 2022 further showed that although CL has decreased, it is still the dominant land use type in Jingdang and Famen towns, indicating that the area has been dominated by agriculture for a long time. In addition, the increase in COL over the past 40 years in Figure 4 was mainly reflected in the expansion of villages and the increase in intervillage corridors, which might be caused by the expansion and renovation of houses and the construction of more new roads by local indigenous people with economic development.

3.2. Land Use Transfer Process

Based on the land use transfer matrix, this paper obtained the land use change information of Jingdang Town and Famen Town in five periods, as shown in Table 3. See the Supplementary Materials of the paper for the data of the land transfer matrix from 1982 to 2022.

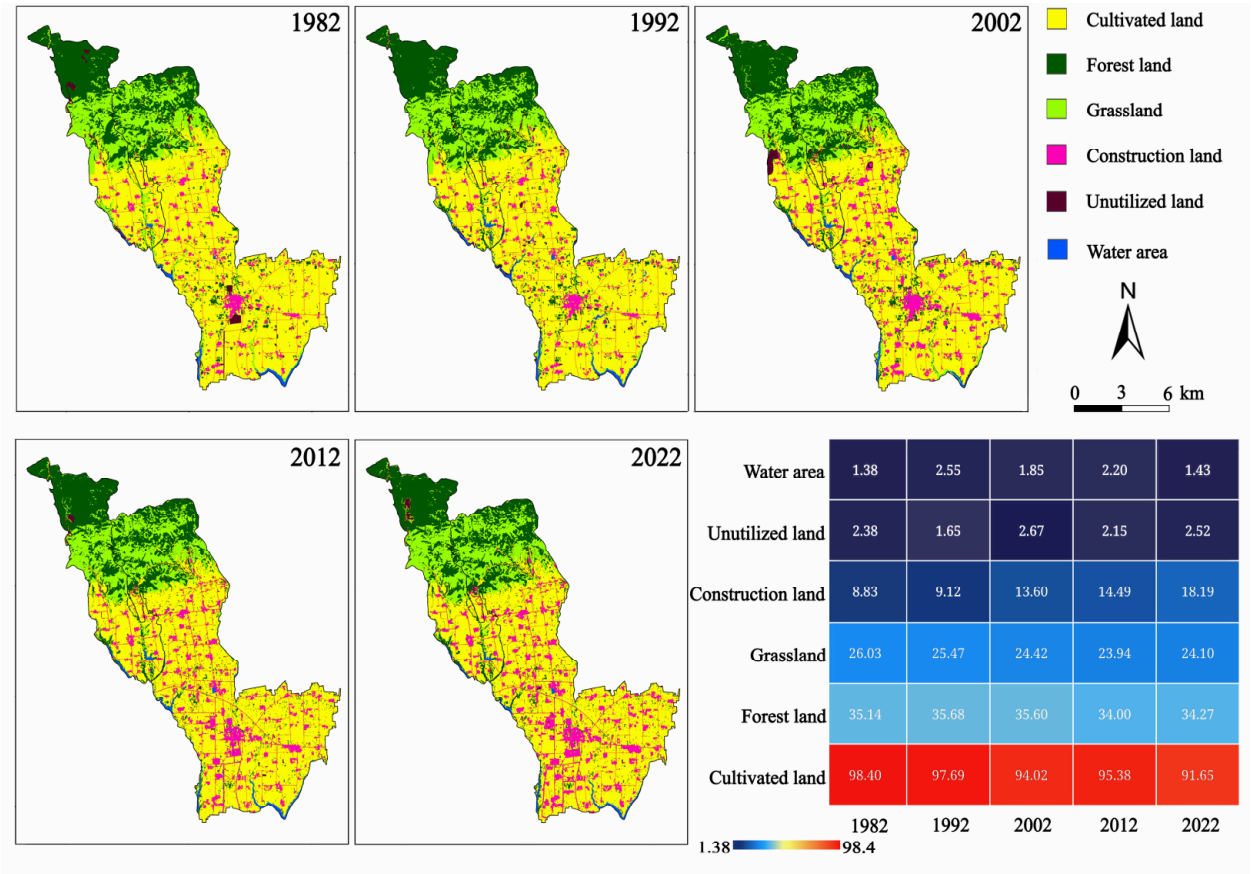

Figure 4. Land use change map from 1982 to 2022.

The results pointed out that CL decreased sharply from 1982 to 2022, while COL increased rapidly. During 1982–1992 and 2002–2012, the exchange change data of CL were 7.18 km^2 and 9.36 km^2, respectively, accounting for 91.00% and 89.14% of the total change data, while the exchange change data of COL were 4.48 km^2 and 2.04 km^2, respectively, accounting for 93.72% and 69.62% of the total change data. In these two stages, the changes of CL and COL were mainly exchange change, with little net change, indicating that their changes were mainly reflected in the change of spatial location. During 1992–2002 and 2012–2022, the net change data of CL were 3.67 km^2 and 3.53 km^2, respectively, accounting for 24.75% and 33.46% of the total change data, while the net change data of COL were 4.48 km^2 and 3.70 km^2, respectively, accounting for 51.49% and 56.40% of the total change data. In these two stages, the net land amount of COL increased sharply, and a large amount of CL might be converted into COL due to the construction needs. It was noteworthy that FL and GL also decreased during 1992–2012, with a cumulative reduction of 1.60 km^2 and 1.42 km^2, respectively, and only slightly improved in the last decade.

3.3. Landscape Pattern Center of Gravity Changes

The coordinates of the landscape pattern gravity center in 1982, 1992, 2002, 2012, and 2022 were calculated using ArcGIS 10.1 software to obtain the distance and direction of the gravity center movement of each landscape type [40]. The calculation results are shown in Table 4 and Figure 5.

Among the six types of land use, the gravity center of CL changed the most frequently in distance, moving 2184.41 m to the northwest from 1992 to 2002 and 1357.09 m to the northwest from 2012 to 2022. The net decrease in CL was the fastest in these two periods. The distance change of the gravity center of COL was the most stable among all land use types over the 40 years, reflecting that the increase in COL may be mainly the continuous expansion centered on the original village, with little large-scale new land for residential

or other construction lands. Meanwhile, the gravity center of FL, GL, and WA has also changed significantly. Over the past 40 years, FL has degraded toward the northeastern mountains, with a cumulative distance of 1,508.68 m. Although the gravity center of GL oscillated from north to south, it also generally degraded to the northern mountains, with a cumulative distance of 780.72 m. The most dramatic phase of the gravity center change in WA occurred in 2012–2022, moving 3560.78 m to the southeast. Among them, the gravity centers of GL and WA have been moving southward in the last decade.

Table 3. Land use change information from 1982 to 2022 (km^2).

Type	Increase	Decrease	The Total Change Data	The Exchange Change Data	The Net Change Data
			1982–1992		
CL	3.59	4.30	7.89	7.18	0.71
FL	1.16	0.63	1.79	1.26	0.53
GL	0.83	1.38	2.21	1.66	0.55
COL	2.54	2.24	4.78	4.48	0.30
UL	1.19	1.93	3.12	2.38	0.74
WA	1.42	0.25	1.67	0.50	1.17
Total	10.73	10.73	10.73	8.73	2.00
			1992–2002		
CL	5.58	9.25	14.83	11.16	3.67
FL	4.69	4.78	9.47	9.38	0.09
GL	3.81	4.85	8.66	7.62	1.04
COL	6.59	2.11	8.70	4.22	4.48
UL	2.10	1.07	3.17	2.14	1.03
WA	0.40	1.11	1.51	0.80	0.71
Total	23.17	23.17	23.17	17.66	5.51
			2002–2012		
CL	5.82	4.68	10.5	9.36	1.14
FL	3.66	5.17	8.83	7.32	1.51
GL	1.40	1.78	3.18	2.80	0.38
COL	1.91	1.02	2.93	2.04	0.89
UL	1.00	1.51	2.51	2.00	0.51
WA	0.65	0.28	0.93	0.56	0.37
Total	14.44	14.44	14.44	12.04	2.40
			2012–2022		
CL	3.51	7.04	10.55	7.02	3.53
FL	2.73	2.57	5.30	5.14	0.16
GL	1.92	1.81	3.73	3.62	0.11
COL	5.13	1.43	6.56	2.86	3.70
UL	1.22	0.85	2.07	1.70	0.37
WA	0.16	0.97	1.13	0.32	0.81
Total	14.67	14.67	14.67	10.33	4.34

Table 4. Landscape type transfer distance and direction.

	1982–1992		1992–2002		2002–2012		2012–2022	
Type	D (m)	DR	D (m)	DR	D (m)	DR	D (m)	DR
CL	109.11	E	2184.41	NW	716.76	SE	1357.09	NW
FL	307.09	NE	88.63	NE	744.35	NE	368.61	NE
GL	309.18	S	1984.71	NW	702.09	SE	192.72	S
COL	108.98	E	44.20	S	615.54	SW	244.52	NE
UL	491.65	SW	573.93	NE	781.84	SE	271.75	S
WA	1808.75	NE	508.93	SE	793.51	NW	3560.78	SE

Note: distance (D); direction (DR); north (N); south (S); east (E); west (W); northeast (NE); northwest (NW); southeast (SE); southwest (SW).

3.4. Population Count Statistics

By reviewing the yearbook data of the study area and related regions, this paper made statistics on the population change of the region in the last 40 years. The results are shown in Tables 5 and 6 and Figure 6.

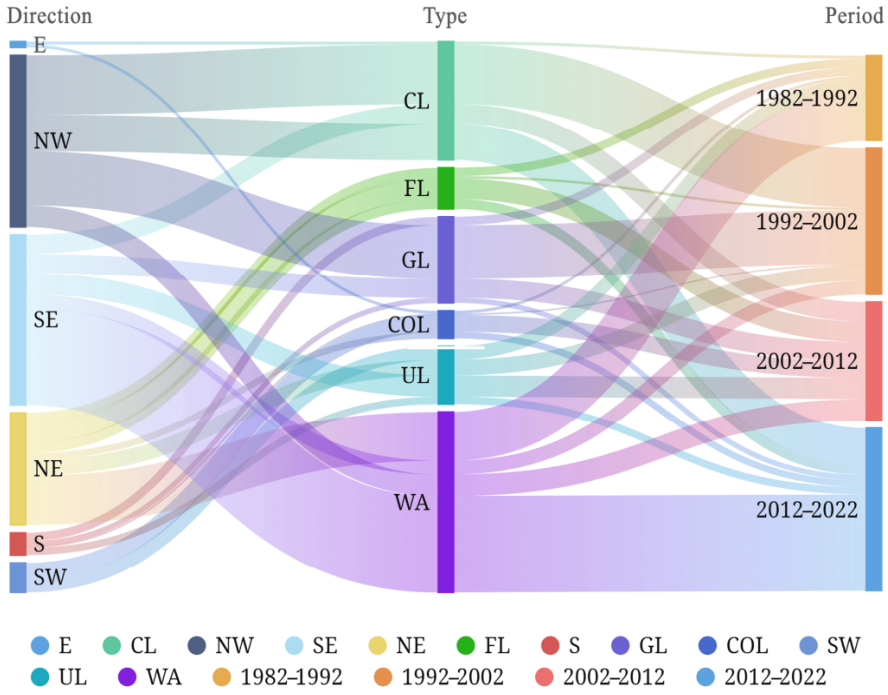

Figure 5. Landscape pattern center of gravity changes from 1982–2022.

From 1985 to 2020, the population of Qishan County, where Jingdang Town is located, and Fufeng County, where Famen Town is located, remained relatively stable at approximately 400,000 to 500,000 people. The population peaks in Qishan and Fufeng counties occurred in 2012 (474,548) and 2007 (468,223), respectively. Since then, the total population of these counties has been on a declining trend. As of the end of 2020, the total population of Qishan County and Fufeng County was 457,003 and 433,791, respectively. From the perspective of population composition, the agricultural populations of Qishan county and Fufeng county declined rapidly over the 40 years, from 374,560 and 402,389 in 1992 to 196,328 and 186,357 in 2020, with a decrease of 47.58% and 53.69%, respectively.

Further combining the population data of Jingdang Town and Famen Town from 2015–2020, it can be seen that the total population of these two towns has fluctuated very little in the last six years. Since 2019, the population of both towns has shown a downward trend. Moreover, by the end of 2020, the populations of Jingdang Town and Famen Town were 31,992 and 69,694, respectively.

Table 5. Population structure of Qishan and Fufeng counties from 1985 to 2020.

Year	County	TP	AP	NAP	County	TP	AP	NAP
1985	Qishan	403,540	/	/	Fufeng	384,746	/	/
1986		408,914	/	/		390,952	/	/
1992		437,829	374,560	63,269		429,326	402,389	26,937
1997		447,691	376,460	71,231		437,868	406,860	31,008
1999		450,826	376,924	73,902		447,704	414,928	32,776
2002		457,892	379,106	78,786		453,071	416,356	36,715
2007		462,329	378,461	83,868		468,223	426,772	41,451
2009		468,833	383,688	85,145		441,433	400,065	41,368

Table 5. *Cont.*

Year	County	TP	AP	NAP	County	TP	AP	NAP
2012		474,548	242,870	231,678		446,179	240,881	205,298
2017		470,897	222,122	248,775		449,161	211,869	237,292
2019		461,834	204,038	257,796		440,309	194,529	245,780
2020		457,003	196,328	260,675		433,791	186,357	247,434

Note: total population (TP); agricultural population (AP); nonagricultural population (NAP).

Table 6. Population of Jingdang Town and Famen Town from 2015 to 2020.

Year	Town	Total Population	Town	Total Population
2015	Jingdang	30,071	Famen	71,410
2016		30,195		69,382
2017		30,806		69,384
2018		32,561		71,550
2019		32,887		71,139
2020		31,992		69,694

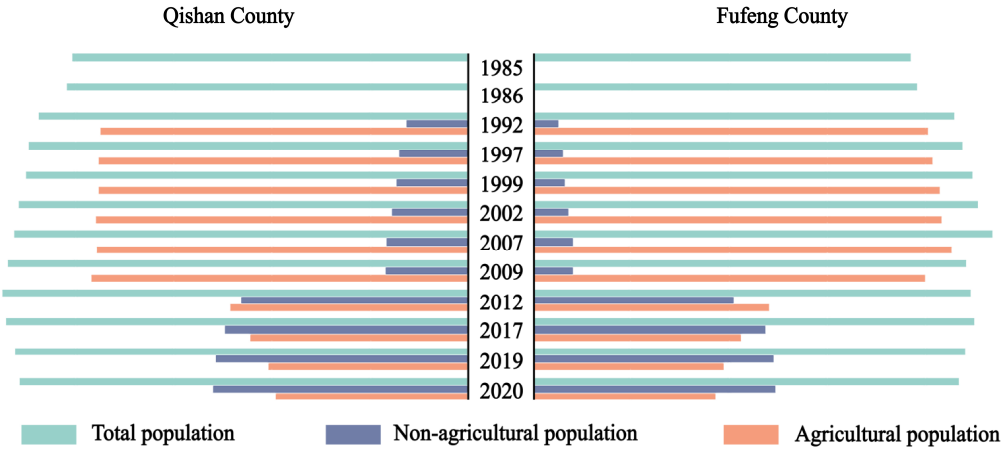

Figure 6. County population change map from 1985–2020.

4. Discussion

This study is the first to analyze the spatial–temporal evolution of townships in the large ancient city-site areas using a combination of remote sensing technology and demographic data domestically and internationally. Using a land use classification model, land use transfer matrix model, and landscape pattern center of gravity changes model from 1982 to 2022, combined with population count statistics since 1985, the paper systematically analyzed the development characteristics of Jingdang Town and Famen Town near the Zhouyuan site over the past 40 years. The combination of these methods improved the efficiency and accuracy of this study.

The results showed that although the cultivated land area declined sharply from 1982 to 2022, it is still the dominant land use type in Jingdang Town and Famen Town. At the same time, construction land has proliferated. However, the landscape gravity center of construction land remained relatively stable, reflecting that most of this growth is a continuous expansion centered on the original villages, with little new residential land or other built-up lands on a large scale. For example, residents expanded their houses on the original sites, and local government renovated some original roads and other infrastructure. In general, the land use type dominated by cultivated land and the more homogeneous form of construction land use in the area indicated that the strict heritage protection policy of Zhouyuan site limited the diversity of land use and development in Jingdang Town and Famen Town.

Based on the data of the landscape pattern center of gravity changes, it can be seen, again, that the forest land and grassland have been degraded to the northern mountainous areas for 40 years. It was only in recent years that the grassland re-expanded southward, reflecting the deterioration of the ecological environment in this area. The demographic data further showed that the population change in this region has been relatively small since 1985, with a declining trend in recent years, while in terms of population composition, the agricultural population in this region has declined dramatically, with a loss rate of about 50%.

According to the results of satellite remote sensing and demographics, two contradictions can be identified: (1) The agricultural population loss rate in Jingdang Town (47.58%) and Famen Town (53.69%) is about 7–8 times that of the cultivated land reduction rate (6.86%), leading to the conflict between a small number of farmers and a large amount of cultivated land in the area today. (2) The populations of Jingdang Town and Famen Town remain stable, even slightly reduced. However, a strange phenomenon has emerged in this region, whereby the indigenous people have expanded many houses.

Using the results of land use classification, land use transfer matrix, landscape pattern center of gravity changes, and population data statistics, this paper researched the spatial–temporal development of Jingdang Town and Famen Town in the Zhouyuan site over the past 40 years from the perspective of land, population, and ecology. Furthermore, this paper attempts to explain the above two contradictions and propose some development suggestions.

4.1. Land

Jingdang Town and Famen Town are located in the vicinity of the Zhouyuan site, which was listed as a national key cultural relics protection site in 1982. Strict protection policies have restricted the diversity of the land use in this area, as well as the development of local industry and agriculture.

Since 2001, China's economy has witnessed snowball growth. To date, the economy has grown by nearly 11 times and has become the second-largest economy in the world [41]. Along with the economic take-off, the urbanization and industrialization of Chinese townships are in full swing, such as Huaxi in Jiangsu [42], Nanjie in Henan [43], and Dongling in Shaanxi [44], which have become important pillars in promoting the economic growth of townships, ensuring the employment of the residents, and promoting the livelihood of local people [45,46]. However, in addition to the expansion of houses by residents and the renovation of roads by the government, the industries in Jingdang Town and Famen Town have not yet developed, which has improved the appearance of the towns to a certain extent. In contrast, Qishan County and Fufeng County, where the towns are located, have witnessed rapid industrial development (http://gxj.weinan.gov.cn/cyfz/wgjs/768853.htm, accessed on 25 April 2023). Hence, the local government abandoned its plans to deploy industries in the area to better protect the Zhouyuan site, which became the most important reason for the single type of land use and lagging industrial development in Jingdang Town and Famen Town.

Agriculture is the major pillar industry in Jingdang Town and Famen Town, but its development may be more optimistic. First, due to the continuous excavation of the Zhouyuan site, a large amount of cultivated land has been occupied for a long time. Although farmers have received some rent or compensation, it has greatly reduced their willingness to continue to invest in agriculture [47–49]. Secondly, strict heritage conservation regulations prevent the construction of facilities such as greenhouses, irrigation canals, and ponds on cultivated land, resulting in a low level of agricultural modernization in the region and seriously affecting agricultural development.

4.2. Population

Inefficient agricultural production and backward industry led to the slow economic development in Jingdang Town and Famen Town. A slew of natives work in the nearby big cities of Xi'an and Baoji for higher income, which is more typical in the rural areas of these two towns. For example, in Hejia Village (Jingdang Town) and Shaochen Village (Famen Town), both within the core area of the Zhouyuan site, the vast majority of young people in the village gave up farming to work in the city, leaving elderly and children village behind. In fact, "Hollow Village" exists in many Chinese rural areas [50], such as Shandong Province [51] and Jiangsu Province [52], but they seem to be more pronounced in the Zhouyuan site region.

In addition, young people who have become rich in big cities have expanded their houses in their hometowns due to the traditional Chinese culture of the "Hometown Complex", improved their living conditions, and showed their success in making a living outside [53,54]. Driven by the power of example, an ever-growing number of young people give up agriculture and leave their homeland to work in big cities. This vicious circle has led to the loss of many young laborers, which has seriously affected the economic development of Jingdang Town and Famen Town. During the survey, the contrast between a large number of ornate buildings and a small number of children and elderly residents strongly reflected the decay of the townships in the Zhouyuan site region, so much so that residents jokingly said, "Our contemporary townships will soon become sites excavated and studied by archaeologists".

4.3. Ecology

The development of townships is closely related to ecology [55]. A positive ecological environment can promote the healthy and rapid development of townships. For instance, in Europe, ecological improvement is an essential factor in accelerating the development of rural areas in the Czech Republic [56]. In Asia, the development of townships in Malaysia has also benefited from the improvements of local ecology [57]. In Africa, ecological improvements have also contributed to South Africa's economic development of townships in recent years [58]. However, in Jingdang Town and Famen Town, quarrying has been carried out for many years due to the rich limestone in the northern mountains. Furthermore, rivers nearby are also illegal sand mining areas. These ecological damages have accelerated local soil erosion, led to continuous degradation of forests and grasslands, and seriously hindered the rapid development of local townships.

The agricultural modernization of Jingdang Town and Famen Town lags behind due to the strict cultural relics protection policy. At the same time, the deterioration of the ecological environment has brought about a decrease in crop yields, a sharp decline in species diversity, and land desertification, further hindering agricultural production activities and bringing more negative impacts to local agricultural development [59,60]. The continuous ecological deterioration has reduced the willingness of residents to engage in agricultural production, forcing many young people to leave their hometowns to earn a living in big cities, which has exacerbated the loss of agricultural population in Jingdang Town and Famen Town.

4.4. Explanation of Two Contradictions

Based on the land use and population changes in Jingdang Town and Famen Town from 1982 to 2022, two apparent contradictions are identified: (1) A large amount of cultivated land relative to a small amount of agricultural population today; (2) a stable or even decreasing total population relative to a significant expansion of housing.

Based on the analysis of the spatial–temporal evolution of land, population, and ecology over the past 40 years in the region, this paper has tentatively found the reasons for the above two contradictions. (1) Jingdang Town and Famen Town are predominantly agricultural production areas, with cultivated land as the primary land use. Although a large amount of cultivated land has been drastically reduced in the past 40 years, a large

amount of cultivated land remains in the area today, accounting for 53.24%. Meanwhile, due to the need to preserve the cultural relics of the Zhouyuan site, the agriculture in this region has not been highly modernized, and the industrial development has lagged behind, resulting in a low willingness of the indigenous people in this region to engage in agricultural production. In addition to the continued destruction of the region's ecology and the lack of employment opportunities beyond agricultural production, young people in mounting numbers are forced to leave their hometowns to work in nearby big cities, leading to a precipitous decline in the region's agricultural population, which has declined by more than 50% cumulatively over 40 years. These factors collectively led to the conflict between a small number of farmers and a large amount of cultivated land in today's Jingdang Town and Famen Town. (2) Many young people have gone to work in big cities, leaving only the elderly and children in the townships, which has led to a long-term downward trend in the population of townships. People who work in big cities and then become rich also choose to expand their houses in their hometowns to improve the living conditions of the elderly and children and to display their success in their hometown, resulting in a contradiction between population decline and large-scale housing expansion in Jingdang Town and Famen Town.

4.5. Suggestion

The Zhouyuan site is the largest and most representative city site of the Western Zhou Dynasty discovered in China so far, with significant cultural, historical, and scientific value. In September 2022, the Chinese government approved the "Master Plan for the Protection of the Zhouyuan Site (2021–2035)" (http://www.shaanxi.gov.cn/zfxxgk/fdzdgknr/zcwj/nszfwj/szh/202212/t20221202_2267370.html, accessed on 9 February 2024), which means that the protection of the Zhouyuan site will be even more stringent. Nevertheless, the protection of large ancient city-sites must balance the healthy development of townships near the protected areas. In order to improve the decay of Jingdang Town and Famen Town, prevent them from falling back into the rut of slow development in the past 40 years, and better protect the Zhouyuan site, a total of six suggestions are proposed in this paper. (1) Based on the overall plan for the protection of the Zhouyuan site, the local government should formulate an overall industrial master development plan of Jingdang town and Famen town, coordinating the relationship between heritage protection and township development. (2) The local government should define the scope of protection of the Zhouyuan site and strictly limit the arbitrary expansion of its protection boundaries by conservation organizations. (3) The local government should encourage the construction of modern agricultural facilities such as greenhouses on cultivated land outside the protected area, and they should also promote the cultivation of economic crops, such as cotton, oil peony, and kiwifruit, so as to stimulate the enthusiasm of residents for agricultural production and improve production efficiency. (4) Conservation agencies should develop tourism through site protection, exhibition, and science popularization, and encourage residents to operate hotels, restaurants, and other service industries to create diversified jobs, improving residents' income and attracting young people to return to the township. (5) Conservation agencies should prioritize the recruitment of residents near the Zhouyuan site for services, such as cleaning, defense, and construction labor, to increase residents' participation in the protection of the Zhouyuan site. (6) The local government, conservation agencies, and other relevant agriculture, forestry, and environmental departments should make great efforts to restore the ecology and create a favorable environment for site protection, agricultural production, tourism services, and residents' livelihood.

Based on land use and population changes, under the strict heritage protection policy of the Zhouyuan site, this paper studied the spatial–temporal evolution of Jingdang Town and Famen Town over the past 40 years. The study of the spatial–temporal evolution based on remote sensing and demographic data is consistent with the actual changes in the towns of Jingdang and Famen, suggesting that the methodology used in this paper can reveal the land, population, and ecological changes in the area. However, among the many

methods of land use, the three selected in the paper do not allow the exploration of the details of the spatiotemporal evolution of land use, such as the degree of fragmentation and connectivity and so on, coupled with the difficulties in the collection of social and other statistical data [61,62]. Therefore, this paper still has some limitations. In the future, the paper will conduct an in-depth study of this area over a five-year or even shorter time span, apply more research methods, and combine information such as household questionnaires and detailed economic statistics, so as to propose more specific and practical suggestions for township development.

5. Conclusions

Large, ancient city-sites fully reflect the development of human civilization with significant social value, leading governments in various countries to formulate strict protection measures. However, the development needs of the townships surrounding the reserve are often simultaneously neglected, affecting the production and livelihood of residents, resulting in the slow development of these townships. By revealing the development of Jingdang and Famen towns in the Zhouyuan site region over the past 40 years, this paper hopes to accommodate the production and living needs of residents when formulating the heritage conservation strategies, and promote the mutually beneficial symbiosis between heritage conservation and township development. In addition, the wide application of this method in archaeology allows for the integration and management of a variety of site information, such as the location of the site and the distribution of artifacts. It is also able to effectively conduct spatial analyses of sites and their surrounding areas in a long time series, thus assisting archaeologists in understanding the spatial relationships, distribution patterns, and potential archaeological phenomena of the sites. And, ultimately, it provides scientific support to the government or heritage department in formulating conservation and development plans for archaeological sites, coordinating heritage conservation with town development, and drawing up master plans for cities.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/land13020263/s1. Tables S1–S5: Confusion matrix for land use classification accuracy verification from 1982 to 2022. Tables S6–S9: Land use transfer matrix data from 1982 to 2022.

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