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Evaluation of Development Potentials of the Fuliang County

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Abstract: Chinese rural regions are under dramatic development in the recent years. Development potentials of villages were evaluated to identify different essential conditions and suitability for future development. This study focuses on 157 official villages in the Fuliang County (Jiangxi, China) and evaluates their development potentials based on their physical conditions, which include transportation, population, income of villagers, infrastructure, vegetation, environment and previous land cover changes of developed land within the surrounding areas of each village. The final score is calculated by summing up different weighted scores of different categories for each village. Besides, inverse distance weighting (IDW) images of both the final score of development potentials and each categories' results were made and compared to illustrate the final result. The study found that villages in the southern and northern regions have higher development potentials than villages in the eastern and western regions, mainly because of higher income of villagers, better accessibility and a larger population. Finally, five development zones were identified and analysed based on their location and development potentiality, and potential strategies were put forward individually for future developments.

1. Introduction

The implementation of the rural revitalization strategy was put forward by Chinese government in 2017, which was also a major historic task to build a modern socialism country. Chinese rural development will go into a period of well-around development and rapid transformation in the near future. One of the phenomena of the rapid development in China during the past is the rapid movement of population from rural to cities, which leads to a series of social and environmental issues. Thus, how to revitalize the development of countryside and encourage people to return to their hometowns are the major tasks for Chinese government officials at all levels. Besides, rural planning work in China always lacks scrutinizing real situations of each village because of overloaded work of planners. Strategies were made based on administrative or political boundaries,

which may not be suitable for the real situations. Thus, convenient analysis method is needed for planning reference.

2. Literature Review

Development potentials provide references for policy makers with limited budget but plenty of optional constructions in certain areas. The most common evaluation of development potentials is SWOT analysis which is widely applied in Chinese rural planning. But in most of the planning documents, the SWOT analysis lacks quantitative analysis and relies on official data and subjective judgements of planners, which can be easily misled by politics. Besides, unbalanced infrastructure & resource distributions and various development conditions in Chinese rural areas make it difficult to establish authentic and unified regulation or evaluation nationwide.

The purposes of development potentials in previous studies are varied. Some researches aim to offer guidance to land use, residential consolidation [1,2], land function division [3]. Others hope to support rural industry development [4,5]. The purposes of development potentials for this study, varied from previous researches, in the following aspects: firstly, it offers planners a reasonable method to get to know the real conditions of villages efficiently before planning. Secondly, it helps policy makers to know the macro regional conditions clearly and encourages them to break the political boundary and put forward more efficient strategies based on the real situations of each place.

The differences of evaluation purposes also lead to different research objects and techniques: The previous research objects varied from the regional area to individual villages [6]. The common methods and purposes of evaluation can be categorized as follows: GIS-based geoinformation collection, spatial analysis and evaluation result visualization; weighting system design according to subjective professional judgement; the categorization based on evaluation result [1,5,7,8,9]. The majority of the evaluation systems include factors of nature resources. Other studies, with the purpose of industry development guidance, will consider local attractions in terms of culture, quality of life as well as local suitability that refers to location and transportation [5,10]. While studies with the purpose of settlement consolidation also contain the factors of current physical conditions and economic situations [2].

However, limited accessibility of quantitative data, complicated real-case situation and unconvincing evaluation result bring obstacle for the application of evaluation in Chinese rural area. While, village is the basic unit to implement the Rural Revitalization Strategy. Clarifying the development potential of village and scientifically dividing the development types of village are the basis for the differentiated and accurate implementation of Rural Revitalization Strategy [11]. The current evaluation studies typically include accessible quantitative data as well as some subjective judgement of rural cultural and landscape [12]. Limited study includes the condition of land cover change into the evaluation system.

Thus, this study tries to evaluate the development potentiality of villages in the Fuliang County by its real condition, which includes natural condition, location, transportation, population, income of villagers, infrastructure, vegetation and environment as well as land cover change of developed land in the surrounding area of each village from 2000 to 2018. The final scores of the development potentials are calculated by adding up different weighted scores. IDW analysis was made for both the final scores of development potentials and each category to better illustrate the final result. Finally, regions with similar conditions were identified and were grouped up to five potential regional development zones. Suggestions for future development toward the five development zones were put forward and issues for these studies were clarified for further improvement.

3. Methods

3.1. Studied Area

Jiangxi is a province of China located in the southeast of the country. The southern half of the province is hilly with ranges and valleys interspersed, while the northern part is flatter and lower in altitude. Jingdezhen is a prefecture-level city in northeastern Jiangxi province, and Fuliang county lies in the northern region of the Jingdezhen (Fig. 1). The total area of Fuliang county is 2851 square kilometers with 249 square kilometers of farmland. The population of Fuliang county is over 309,000 people which includes 245,000 villagers living in the rural area. After the opening of Chinese 19th national congress, five research teams were sent to Jiangxi to carry out special investigations about rural development. Local government also hoped to grab the opportunities to start the strategic deployment of rural revitalization. The exploration of the development potentials of rural villages was conducted in this study with the help of technologies of ERDAS and GIS. There are totally 157 official villages in Fuliang County (Fig. 2) and each official village includes several natural villages in the surrounding areas.

Figure 1: The studied area of Fuliang County in Jiangxi province, China

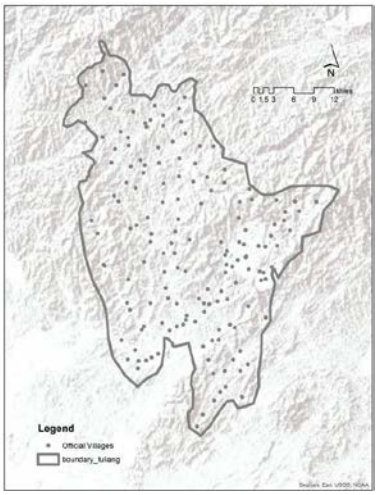

Figure 2: The location of official village in Fuliang County

3.2. Indicator System

In order to evaluate the development potentials of villages reasonably, villages' data of 24 characters were collected and categorized into seven categories: Location, Transportation, Population, Income, Infrastructure, Vegetation & Environment as well as Land cover change of developed land. Table 1 shows all the characters and their parent categories. Location category evaluates geographic characters of each village, including altitude of each village and the distance to waterbody. Transportation category evaluates the accessibility of villages, including the distance to town center, city center and public transit stations, the condition of village cluster (Village cluster refers to the number of surrounding official villages that can be reached within 1000m to 5000m for each village) and the conditions of outside roads. The population category is evaluated by the number of permanent residences, the ratio of permanent residence to household residence as well as the proportion of youth in the permanent residences. Income category evaluates the living conditions of villagers, while the infrastructure category includes the conditions of water supply, garbage collection, sewage processing, road condition, drainage facilities, light and public place. Vegetation category evaluates environmental conditions along the river and road, in the private gardens and public space within each village.

Table 1: Evaluation Categories and characters and the weight assignment.

Categories	Rank of import ance	Weight assigned	Characters	Rank of importance of characters	Weight assigned
Location	3	10%	DEM	2	4.0%
			Distance to waterbody	1	6.0%
Trans-portation	1	20%	Distance to town center	1	6.0%
			Distance to city center	1	6.0%
			Distance to public transits	2	3.0%
			Village cluster evaluation	3	2.0%
			If there is hardened road to each village	2	3.0%
Population	1	20%	Permanent residence	2	4.0%
			Permanent residence / household residence	1	8.0%
			Proportion of youth	1	8.0%
Income	2	15%	Income of villagers	1	15.0%
Infra-structure	2	15%	water supply	1	2.4%
			Garbage collection processing	1	2.4%
			Sewage treatment	1	2.4%
			Road condition inside villages	1	2.4%
			Village drainage facilities	1	2.4%
			Condition of light	2	1.5%
			Existence of public place	2	1.5%
Vegetation & Environment	3	10%	Vegetation along the river	1	2.5%
			Vegetation along the road	1	2.5%

			Vegetation of private place	1	2.5%
			Vegetation in public place	1	2.5%
Land Cover Change of developed area	3	10%	Land Cover Change from 2000-2010	2	6.8%
			Land Cover Change from 2010-2018	1	3.4%

3.3. Data Collection and Evaluation

The data source of the study is shown in Table 2. Location data was extracted from the DEM map of the Fuliang county. And the transportation information is collected from Open Street Map, Google map and onsite survey. The data of population, income, infrastructure and vegetation & environment comes from local official construction bureau. The information of land cover changes of the surrounding area of each village comes from classification maps made by the author. The original data comes from Landsat 7 and Landsat 8 remote sensing images of 30 meters, which were downloaded from the USGS website.

Table 2: Data sources

Date name	Date	Resolution
Dataset of Official villages in Fuliang County	2017	
Open Street Map	March, 2018	
Landsat 7 images	Sep 23rd, 2000 Sep 19th, 2010	Table Cell Size Panchromatic: 15 m Table Cell Size Reflective: 30 m Table Cell Size Thermal: 30 m
Landsat 8 image	April 10th, 2018	

In order to better evaluate the development potentials of each village, original quantitative data was recategorized into different levels. #1 represents the most superior condition, while the last number (#2-#5) represent the most inferior condition. The study takes factors that villages located in flat places, close to waterbody, have shorter distance to other places as contributing factors of good development potentiality. Besides, the study believes that more population especially the youth population, higher average income, better infrastructure condition, better environment will make village more suitable for development.

In addition, this study assumes that a village that has greater increase of developed area will have higher development potentials, since the increase of developed regions indicates construction projects or investments increased in certain rural area. In order to know the changes of developed area, the land cover change was calculated and quantified. More specifically, the classification maps of land cover for the Fuliang County in 2000, 2010 and 2018 were made in the first step and the overall accuracy of three classifications are over 80%. The data used here is Level-one Landsat images of 2000, 2010 and 2018 that were download from USGS website. Supervised classification, unsupervised classification and spatial enhancement techniques were utilized during the process. The land cover classification system is shown in Table 3, which includes seven land cover types.

Table 3: Land Cover classification system

Class Name	Remarks

House	Residence of all different levels of density
Big Architecture	Huge architectures discerned, which are mainly factories
Farmland	Cropland, Vegetable farm, etc
Transportation	Highway, railroad
Vegetation	Forest, shrub, grassland, etc
Waterbody	River and lakes
Bare land	Barren land, bare soil, rock, etc

The Fuliang County has 157 official villages that belong to 17 towns. The 2000-meter buffer is made for each village to identify the surrounding areas of villages. Fig. 2 shows the location of official villages in the Fuliang County and their respective 2000m buffer. Finally, the land cover information for each buffer each year was extracted from the classification map, which contains areas and percentages of different land cover types. In order to better evaluate the level of land cover changes and alleviate the impact of errors, different percentage changes were assigned into five different levels. Level 1 represents dramatic huge change of developed land, while level 5 represents no change in the developed land, as shown in Table 4.

Table 4: Different levels of land cover change

Levels of Land Cover Change (Value assigned)	(a-b)/b
3	>50
2	10-50
1	0.5-10
0	0-0.5
-1	-0.5-0
-2	<-0.5

a: Area of one land cover type in the first year of one period
b: Area of same land cover type in the final year of one period

3.4. Weighting System

After evaluation and categorizing, the weighting system was designed to offer reasonable proportion to each category. The weighted score of each category is identified based on the rank of importance that is evaluated by the discussion of the research team.

The Transportation and Population categories are the most important factors for the development potentials. For one thing, good transportation and commuting system will make villages more accessible and encourage more outside connections. For another, villages with great population, especially youths, have enough labor force for development. Income and infrastructure are ranked as the second most important factors. Income reveals the quality of livelihood of local people, while the infrastructure shows the basic living conditions for each village. The factors of geographic location, vegetation & environment and land cover change are ranked as the least important factors when compared to the others for the following reasons: Firstly, all 157 official villages have similar geographic conditions, since most of them are located in the mountain areas. Secondly, the environmental condition inside villages could be improved by future development, which is not crucial for current development, and the Fuliang county is famous for its good natural environment outside villages, which may offset some bad effects of inferior vegetation condition inside each village. Thirdly, land cover change only shows the previous development of each village, which

cannot fully represent the future trend. More detailed weighting assignments in each category were also designed and final weighting system is shown in Table 1.

3.5. Analysing Method

After the evaluation, IDW analysis map is made for both the final score of each village as well as for the six different factors' categories and comparison was made for the better understanding of the final result. Besides, five zones were identified based on the result of development potentials.

4. Result

4.1. Result of Land Cover Change

Appendix 2 shows the final classification map of Fuliang county in 2000, 2010 and 2018. The developed lands distributed along the road and river which are separated by hill and mountains, especially in the northwestern area of the county. And the eastern part of the county has a huge plat plain, which contains a large area of cropland and residence. From 2000 to 2018, most of development happened in the eastern and southern regions of the county, other developments happened in valleys of low latitude or along the road and river.

Table 5 shows the areas and percentages of different land cover types in different years. It could be identified that the area of farmland increases from 2000 to 2018, while the area of vegetation decreased in this period. Areas of waterbody and house do not have big change in the 18 years. Barren land increases a lot from 2000 to 2010 and remains stable from 2010 to 2018. The area of transportation facilities has small stable increase from 2000 to 2018. Finally, the area of big architecture increases a lot from 2000 to 2010, which indicates some industry development in Fuliang County, since the most of big architectures were discerned as factories from google map.

Table 5: Areas and percentage of different land cover types in different years.

Land Cover Types	2000		2010		2018	
	Area/Hectare	Percentage	Area/Hectare	Percentage	Area/Hectare	Percentage
Farmland	41,047	13.72%	54,326	18.16%	54,134	18.10%
Vegetation	243,883	81.52%	226,702	75.77%	225,850	75.49%
Waterbody	2,746	0.92%	3,313	1.11%	2,977	1.00%
Barren land	80	0.03%	927	0.31%	894	0.30%
House	5,558	1.86%	6,122	2.05%	5,507	1.84%
Transportation	5,585	1.87%	6,119	2.05%	7,057	2.36%
Big Architecture	267	0.09%	1,693	0.57%	2,743	0.92%
Total	299,166	100.00%	299,202	100.00%	299,162	100.00%

Appendix 3 shows the spatial map of land cover changes in the surrounding areas of each village. Vegetation land cover had shrinks from 2000 to 2018. Vegetation area decreased in the southern part of Fuliang from 2000 to 2010, while it decreased in the central north and south from 2010-2018 (Fig. A). The area of barren-land decreased from 2010 to 2018 mainly in the northern area of Fuliang county, while southern part met some expansions in the same period (Fig. B). The area of house land also shrunk in the northeastern area of the county while it increased in southwestern area of the county from 2000 to 2010. House land in the southeastern region of the

county had a little stable decrease from 2000 to 2018 (Fig. C). Transportation infrastructure did not have much change from 2000 to 2018: it decreased a little bit in the northern region from 2000 to 2010, while it increased a little bit in the central part of the county from 2010 to 2018 (Fig. D). The area of farmlands decreased in the northern region. One unique changing pattern happened in the southern part: it increased from 2000 to 2010 but decreased from 2010 to 2018, which may result from inaccurate classification in 2010. Other region remained stable for farmland area in the past 18 years (Fig. E). The land cover changes of big architecture, these architectures are mainly big factories that built in the studied area, which is very distinct during classification process. The major big architectures built in the period of 2000-2010 in the south region of the county. Also, the area of big architecture land cover type increased along a road in the central region of the county from 2010 to 2018 (Fig. F).

4.2. Result of Evaluation of Development Potential

Fig. 3 shows the final result of development potentials in the Fuliang county. The lowest score of development potentiality is 1.737, while the highest score is 3.402. The average score is 2.557. The distribution of final score data is almost normalized with a little bit negative skewness, which indicates that only a small number of villages have higher scores. This study also categories the final score into three levels: 8 villages that have final scores lower than 2 are the villages with greatest development potentials (orange stars in Fig. 4), and 17 villages that get scores higher than 3 (blue spot in Fig. 4) are the villages that have low development potentials. Others are the villages with the medium level of development potentials.

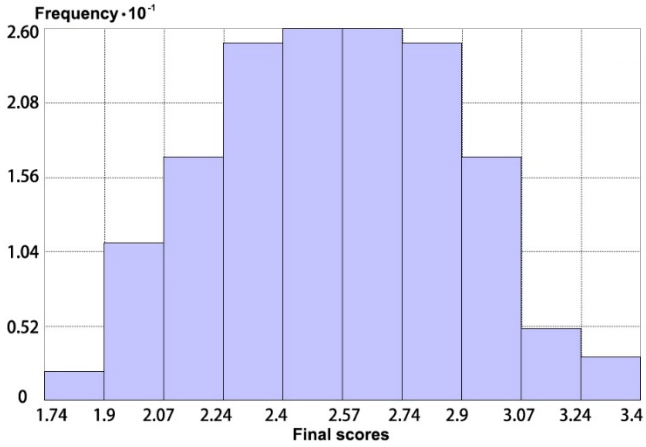

Figure 3: The histogram of final score for each village.

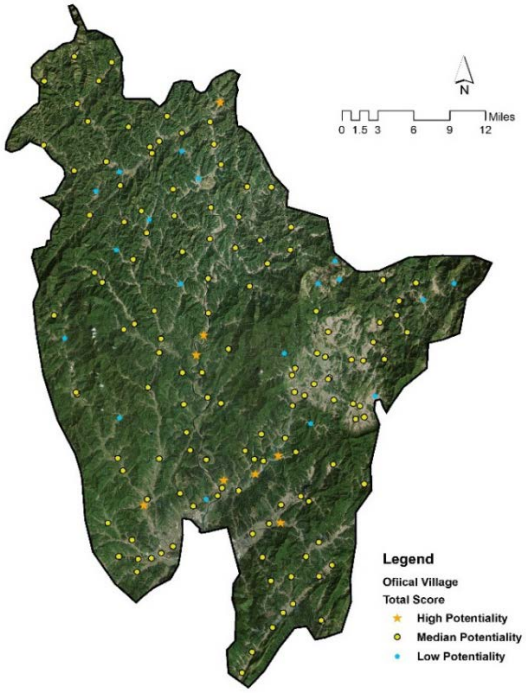

Figure 4: Official villages with different development potentiality in Fuliang county

Fig. 5 shows the overall distribution of development potentials of 157 villages in the Fuliang county. Villages in the central area and part of northern area of the county have the best development potentials, while villages in the southwestern and the eastern regions have the least development potentials.

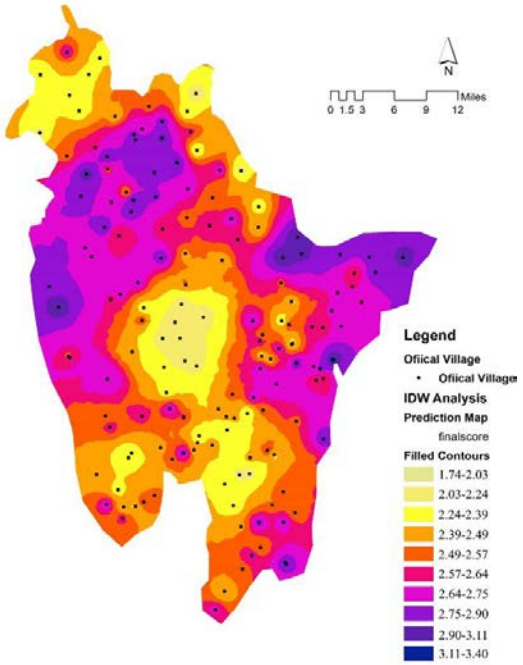

Figure 5: IDW analysis of the final score

Other six IDW images show the overall condition of each category (Fig. 6 to Fig. 11). The IDW income analysis indicates that the average incomes of villagers in the center and northern region are the highest, while the incomes in the western regions are relatively low. The IDW map of Transportation categories (Fig. 7) shows a good accessibility in the southern regions of the county and inferior conditions in the northern regions. Population IDW image (Fig. 8) indicates an overall high population in all villages of the Fuliang county. Some villages in the southern and northern regions have higher populations when compared to the villages in other regions. IDW analysis of vegetation & environment (Fig. 10) reveals almost the same distribution pattern with the development potentiality map, while the infrastructure IDW map (Fig. 11) shows the good infrastructure conditions in only the northern areas of the county. Fig. 9 shows the land cover change of the Fuliang county. Developed land in the central north and southwestern regions of the county has dramatic changes, while the changes in the other regions are low.

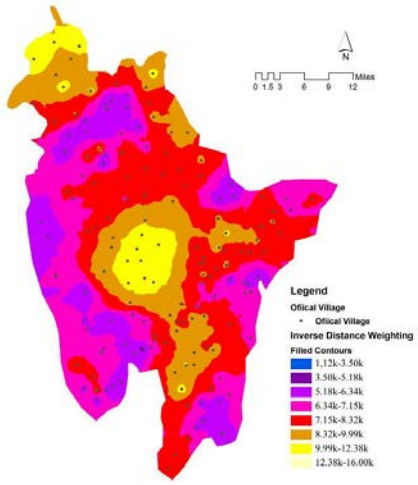

Figure 6: IDW analysis of the average income of each village

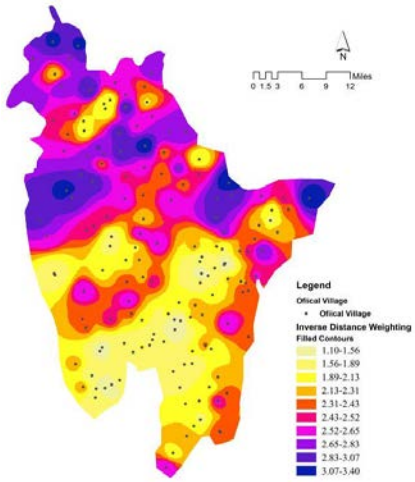

Figure 7: IDW analysis of the transportation categories

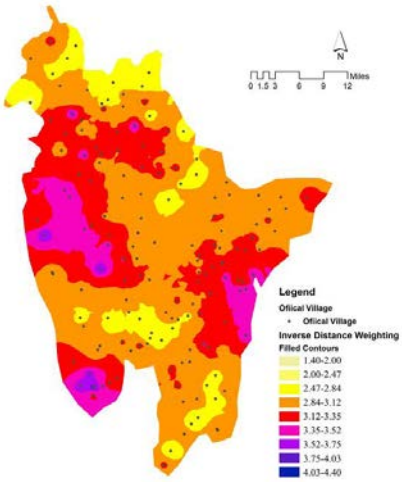

Figure 8: IDW analysis of the population condition

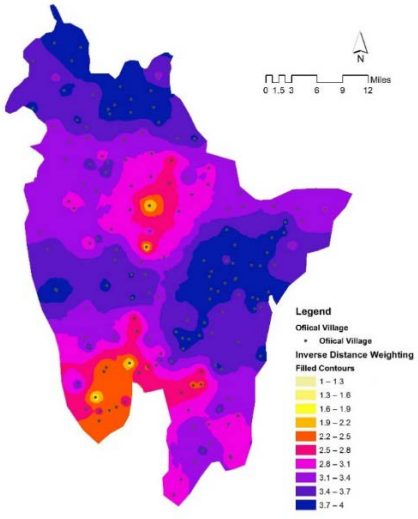

Figure 9: IDW analysis of the land cover change of the developed area

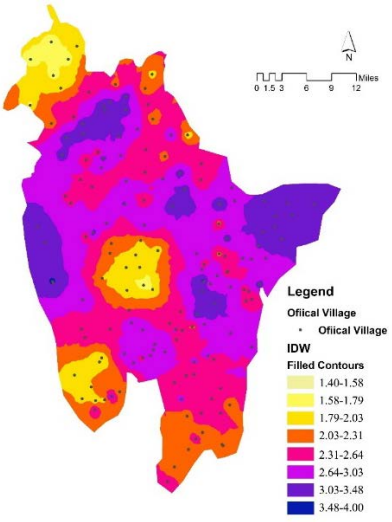

Figure 10: IDW analysis of the vegetation

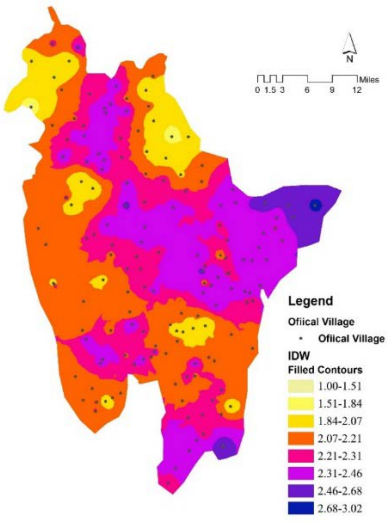

Figure 11: IDW analysis of the infrastructure

5. Conclusion and Discussion

The final result indicates that villages of higher development potentiality are mainly located in the central, southern and parts of northern region of the county. By comparing the map of final score with the maps of IDW analysis of individual categories, it could find out that villages with higher potentiality also have higher average income, better population distributions and better vegetation conditions. However, the transportation IDW map reveals that the southern region of the county has a better accessibility. And land cover change of the developed area indicates that only the central and the southern region of the county had some big change of the developed area. The infrastructure map shows medium level infrastructure condition in the western and southern areas and inferior condition in the eastern region. The villages of low development potentiality are mainly located in the central north and eastern region of the county and their conditions are below average in most of categories' evaluations based on IDW images.

The IDW analysis reveals clear spatial patterns of the development potentiality in the Fuliang County and five development zones were identified based on the final result. More information of conditions of each region was collected from the IDW map of individual categories (Table 6).

Table 6: Conditions of different categories in different regions of the Fuliang County

Regions of Fuliang County	Average Income	Accessi-bility	Popu-lation	Land cover change of developed area	Vege-tation	Infra-structure	Development potentiality
The southern region	Medium	Superior	Medium to Superior	Medium to high	Medium	Inferior to Medium	Medium to Superior
The central region	Superior	Medium to Superior	Medium	Medium to high	Medium to Superior	Inferior	Superior
The northern region	Superior	Inferior	Medium to high	low	High	Medium to High	Superior
The eastern region	Medium	Inferior to Medium	Medium	low	Inferior	Inferior	Inferior
The western region	Inferior to Medium	Inferior to Medium	Inferior to Medium	low	Inferior	Medium	Inferior

Villages in the southern region of the county have overall good development potentiality. The average income of villagers in this zone as well as vegetation conditions increases gradually from south to north. And the transportation condition is inferior when compared to other zones. Developed land did not change much in the past 18 years, while population condition is relatively good. Based on the administration boundary, we could find that the northern region (**Fig. 12**), including Xihu county, parts of Legong county and Jiangcun county, is located in mountain areas and is full of forest. People in this zone grow high-quality tea and also make money from processing forest goods. The northern regions should think highly of environmental protection in

future development and could start tourism development in some suitable locations. The accessibility should be improved to support potential tourism industry.

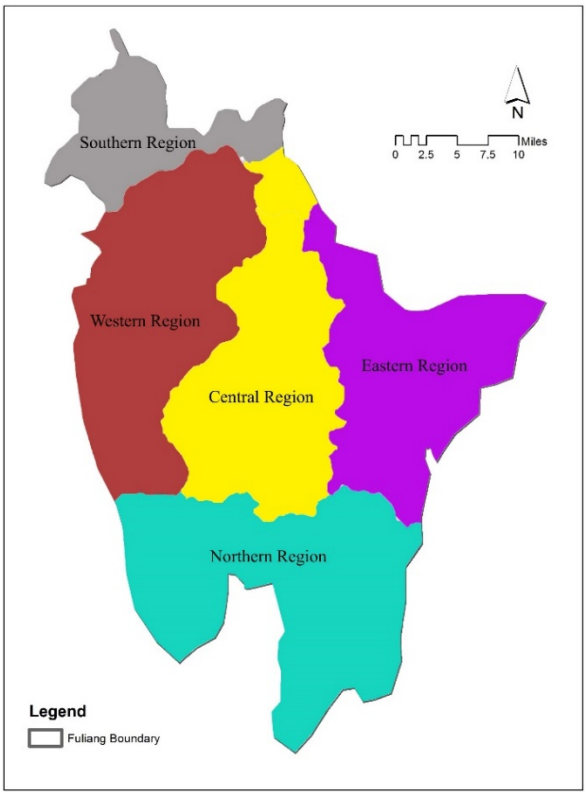

Figure 12: Different regions of Fuliang County

The western region, including parts of Jinggongqiao county, Jiaotan county and Huangtan county, has overall inferior development potentiality. The income and vegetation condition are unsatisfied. Besides, developed area had limited change in the past 18 years. The southern part of the zone has better accessibility, while the northern part has poor transportation condition. Limited residences in local area bring obstacle for industry development. When compared with the northern region, the western region has better industry development, but it did not bring much income to local villagers. For further development, transportation condition should be improved in the northern part and government could put forward strategies to encourage young villagers to come back in order to improve the local labor market. At the same time, special attention should be paid to the environmental protection during the development.

The central region, including parts of Legong county, Jiangcun county, Jinggongqiao county, Xingtan county, Zhitan county, Jiaotan county and Zhuangwan county, has overall good development potentiality, especially in the town of Jiaotan. From the topographic map, the majority part of central zone is located in the flat area. The zone has overall good condition in all aspects except infrastructure, which indicates the overall poor living quality of local residences. Besides, the southern part has better conditions when compared to the northern part. For further development, government could improve the overall infrastructure as well as the accessibility of the northern part of the zone.

The eastern region is also located in mountainous areas. The region, including counties of Yaoli, Ehu and parts of Xingtian and Zhuangwan. Yaoli, is famous for its tourism development. Besides, Ehu has some development in agriculture and industry. But currently, it did not bring much benefits

to local residences, since the average income of villagers and infrastructure condition are not satisfactory. The developed land of the region did not have much land cover change previously and the vegetation condition and transportation condition are unsatisfactory. The region has the medium-level size of population, which indicates the impact of industry developments. Government should pay attention to the environmental protection in future as well as try to improve the transportation and infrastructure here. Nicely-built environments inside village and good accessibility could attract more tourists in future.

The northern region is closed to Jingdezhen city, which has good development potentiality because of its flat terrain, good accessibility and abundant labor force. The region includes Hongyuan, Sanlong, Fuliang, a part of Wanggang, Xianghu and Shou'an. The analysis shows that the developed land has big change surrounding the Jingdezhen city previously. The vegetation and infrastructure conditions vary a lot from place to place. However, good condition here did not bring high income to local villagers. Besides, it seems that labor force gathered in some certain areas inside the region. Unbalanced result for each category indicates the complicated development in this region. Based on our analysis, special attentions should be paid to the built environments inside each village to guarantee the living conditions of workers. The planning of Jingdezhen city should be taken into consideration during strategy making process towards the zone to fully utilize its superior transportation and location condition. Further analysis should be done to offer detail planning strategies for future development.

There are some limitations in the study that need to be clarified for further improvement. Firstly, weighting system needs further discussion: Current weighting system designed by the research team based on working experiences may not be appropriate for the Fuliang County. And different weighted method could be put forward under different planning ideas and the corresponding results could be compared and discussed. Secondly, the location and boundary of each official village need to be investigated to avoid inaccurate analysis. For instance, population density may be more appropriate to evaluate potential labour force in each place than total population. It is possible that some villages are much larger than others, and therefore have a larger population size but low population density. Thirdly, the assignment of levels in each characters and categories may not be appropriate for describing the real situation of the Fuliang County, which may lead to the distortion of the final results. For future study, more detail analysis that considering the suitability of industry development should be done to offer policy maker further reference as well as specific strategies that should be made. And other relevant information, such as culture, history and the condition of soil could be included in the evaluation process. Besides, the study identifies 17 villages that have relatively worse development potentiality. Detail analysis and strategies need to be done to improve the current development condition of these villages.

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Appendix

Evaluation methods and criteria

Categories	Characters	Evaluations of different levels
Location	DEM	1: <400m; 2:>400m
	Distance to waterbody	1: <500m; 2: 500m-2,000m; 3: 2,000m-4,000m; 4: >4,000m
Trans-portation	Distance to town center	1: <3,000m; 2: 3,000m-10,000m; 3: 10,000m-20,000m; 4: >20,000m
	Distance to city center	1: <20,000m; 2: 20,000m-40,000m; 3: 40,000m-70,000m; 4: >70,000m
	Distance to public transits	1: <1,000m; 2: 1,000m-5,000m; 3: 5,000m-10,000m; 4: >10,000m
	Village cluster evaluation	1: >10; 2: 6-10; 3: 3-6; 4: <3 (=33% number of villages can be reached within 1km + 67% number of villages can be reached within 5km)
	If there is hardened road to each village	1: all villages have road with hard surface; 2: more than 50% of villages have hard-surface road; 3: less than 50% of villages have hard-surface road
Population	Permanent residence	1: >3,000; 2: 2,000-3,000; 3: 1,000-2,000; 4: 506-1,000; 5: <506;
	Permanent residence / household residence	1: >2; 2: 1-2; 3: =1; 4: 0.8-1; 5: <0.8;
	Proportion of youth	1: >0.8; 2: 0.6-0.8; 3: 0.4-0.6; 4: 0.2-0.4;
Income	Income of villagers	1: >12,000; 2: 9,000-12,000; 3: 6,000-9,000; 4: 3,000-6,000; 5: <3,000;
Infrastructure	Water supply	1: Town waterworks centralized water supply; 2: Villages have centralized water supply facilities; 3: No centralized water supply, each household solves its own drinking water
	Garbage collection processing	1: Transfer to town processing; 2: The village has centralized treatment facilities; 3: Household construction and processing facilities; 4: No treatment facilities

	Sewage treatment	1: Discharge into the urban sewage pipe network; 2: The village has centralized treatment facilities; 3: Household construction and processing facilities; 4: No treatment facilities
	Road condition inside villages	1: All of villages have harden road; 2: More than 50% of villages have harden roads; 3: Less than 50% of villages have harden roads.
	Village drainage facilities	1: All of natural villages have drainage facilities; 2: More than 50% of natural villages have drainage facilities; 3: Less than 50% of natural villages have drainage facilities
	Condition of light	1: All of natural villages have light; 2: Part of natural villages have light; 3: No light
	Existence of public place	1: Yes; 2: No
Vegetation & Environment	Vegetation along the river	1: Widespread; 2: Good; 3: Less; 4: None
	Vegetation along the road	
	Vegetation of private place	
	Vegetation in public place	
Land Cover Change of developed area	From 2000 to 2010, From 2010 to 2018	1: a>3; 2: 3>a>2; 3: a<2 (a = 30% of developed land change from 2000 to 2010 + 70% of developed land change from 2010 to 2018)

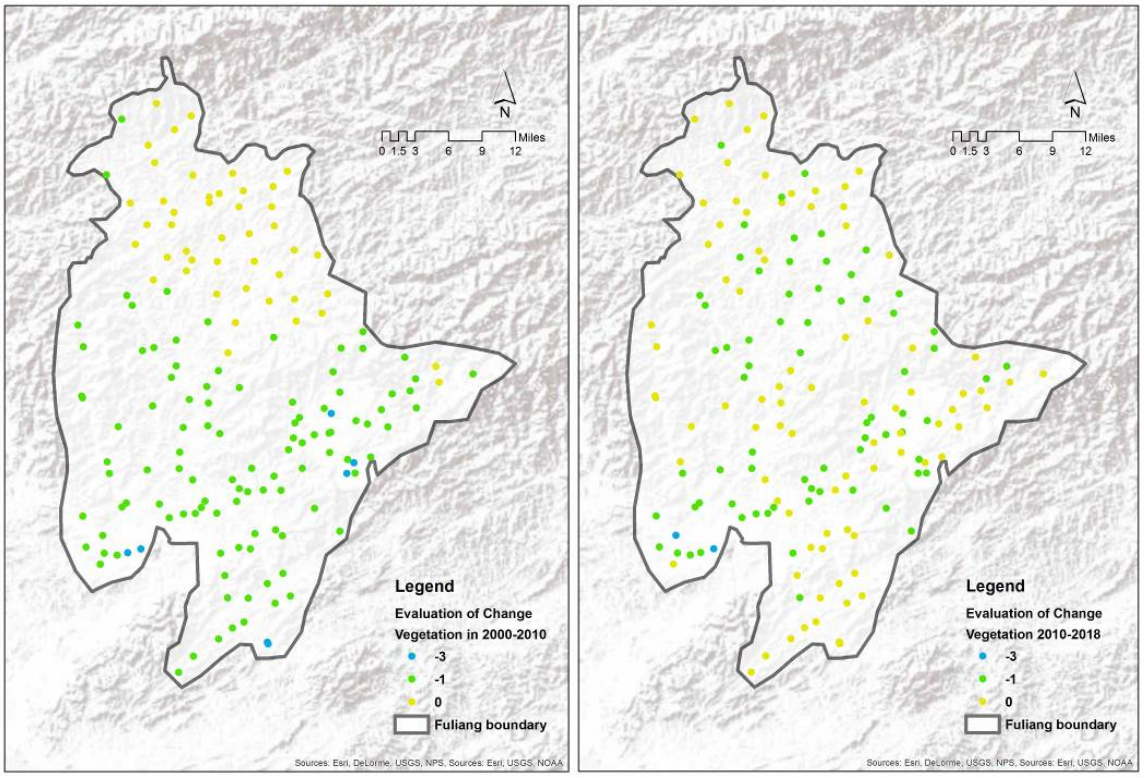

Figure A: Area of vegetation land cover change in 2000-2010 and 2010-2018

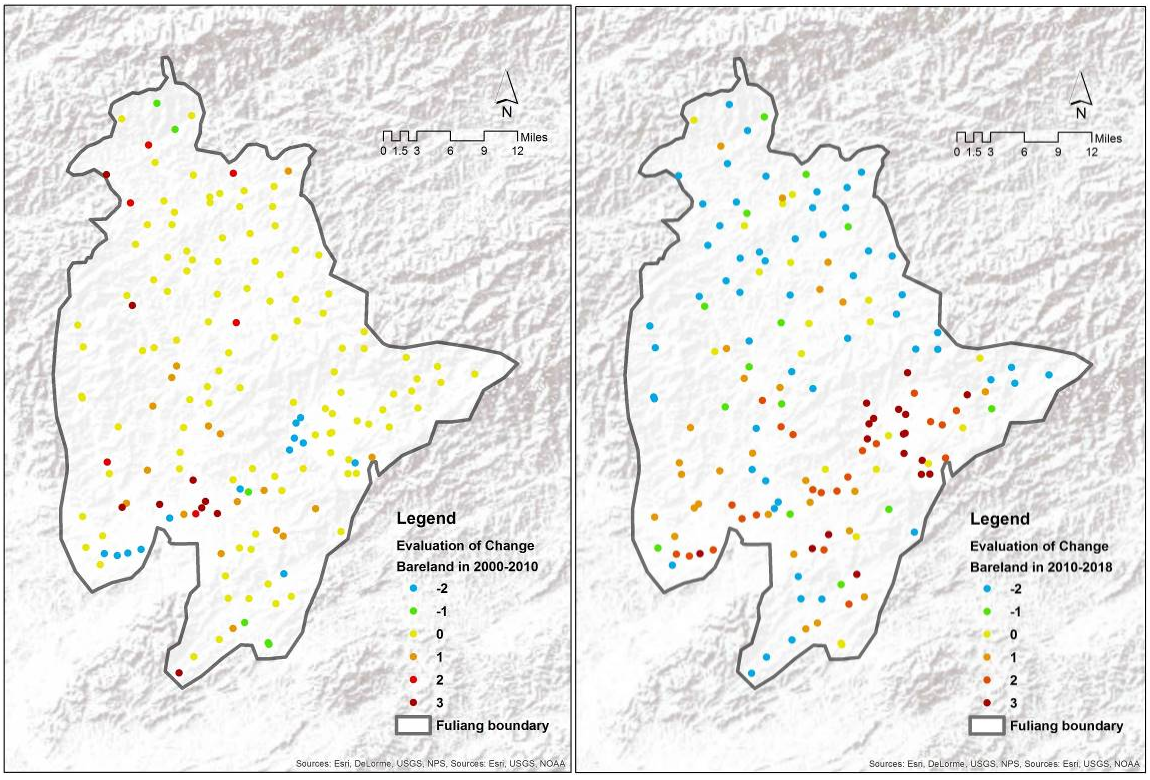

Figure B: Area of barren-land land cover change in 2000-2010 and 2010-2018

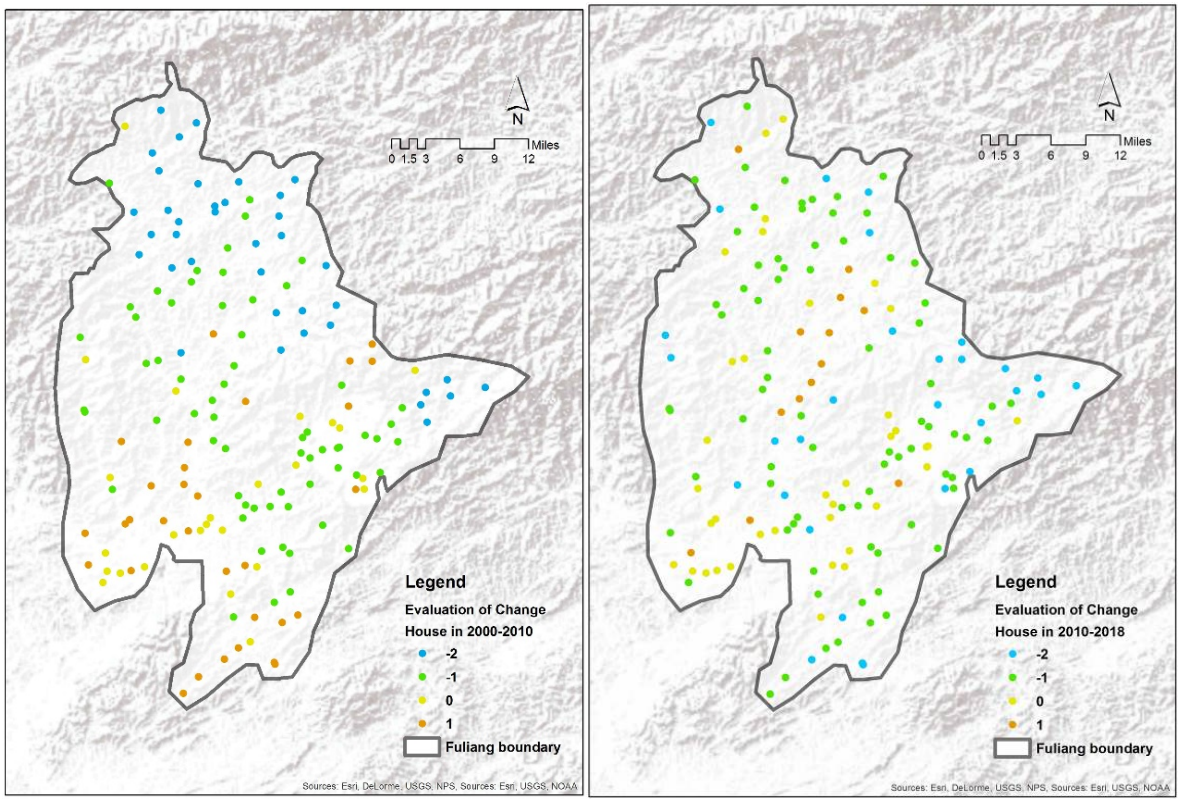

Figure C: Area of house land cover change in 2000-2010 and 2010-2018

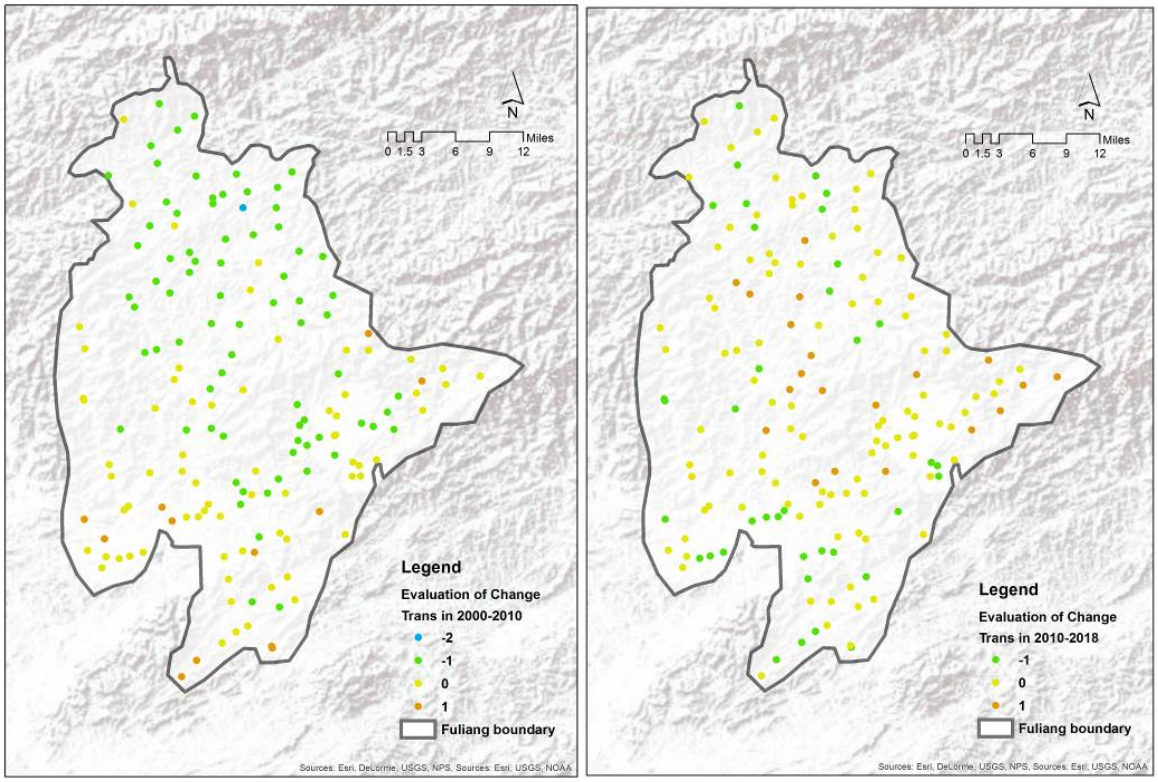

Figure D: Area of transportation land cover change in 2000-2010 and 2010-2018

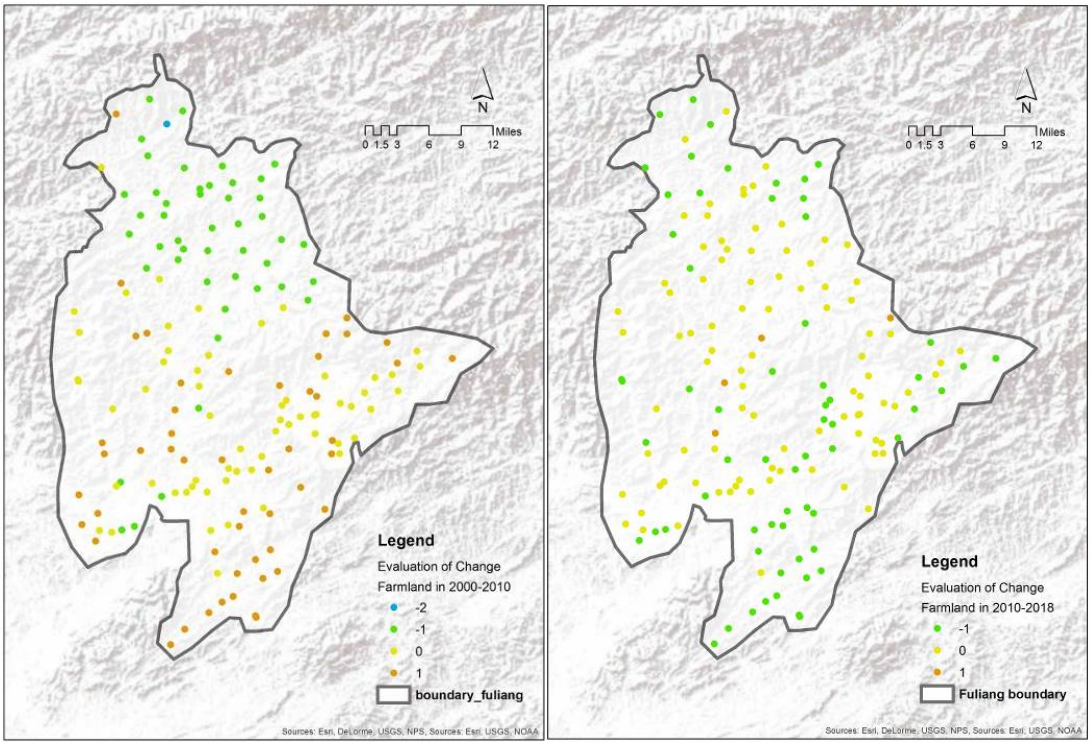

Figure E: Area of farmland land cover change in 2000-2010 and 2010-2018

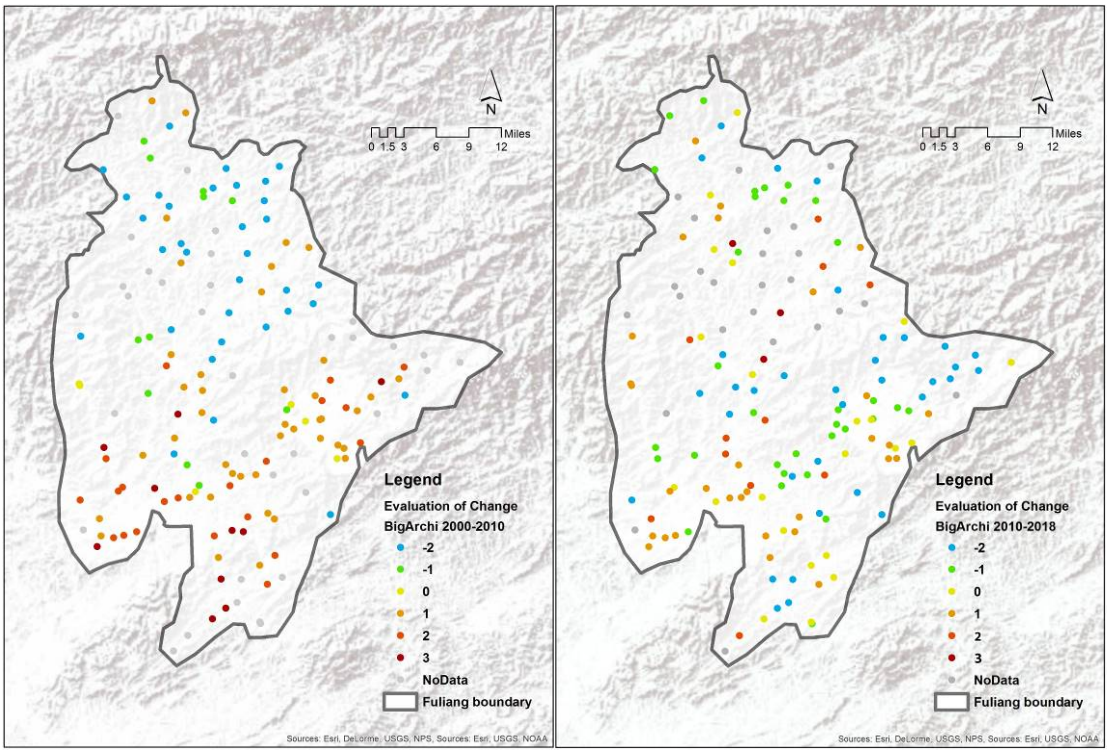

Figure F: Area of big architecture land cover change in 2000-2010 and 2010-2018