

Remote Sensing Image Based Wenshan *Panax notoginseng* (GI) Distribution Dataset (2022)

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Abstract: *Panax notoginseng* is a commonly used and precious Chinese medicinal herb in China, It is also a geographical indication product of Yunnan. High spatial resolution remote sensing satellite data are used for the rapid monitoring of planting position and scope of *Panax notoginseng*, and the scientific and rational utilization of cultivated land resources, adjustment of diversified agricultural structure, and the sustainable development of *Panax notoginseng* industry are of great importance. The *Panax notoginseng* planting dataset in Wenshan Zhuang and Miao Autonomous Prefecture, Yunnan (2022), was developed using multisource satellite images, including Pleiades, Gaofen series, ZY series and Beijing-2, and a comprehensive mapping method, combined with arable land and garden information in land survey data, field survey data, and historical data from the “Land Survey Cloud” platform. Results show that the planting area of Wenshan *Panax notoginseng* in 2022 was approximately 8,295.75 ha. Spatially, the planting area decreased from southwest to northeast. The dataset was archived in shapefile format and consisted of eight data files with a total size of 8.25 MB (compressed to one 4.54 MB file).

Keywords: Wenshan,Yunnan; remote sensing image; *Panax notoginseng*; geographical indication,2022

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Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: <https://doi.org/10.3974/geodb.2024.05.02.V1> or <https://cstr.escience.org.cn/CSTR:20146.11.2024.05.02.V1>.

1 Introduction

Panax notoginseng is a plant of the *Panax* genus in the Araliaceae family. It is a rare Chinese medicinal material in China^[1]. The growth of *Panax notoginseng* has specific climate and altitude requirements, it also has higher requirements to the environmental, it likes cool. In the first three years of *Panax notoginseng*'s growth, 8%–12%, 12%–15%, and

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15%–20% of light transmittance are needed^[2-3]. Wenshan Zhuang and Miao Autonomous Prefecture (hereinafter referred to as “Wenshan Prefecture”) of Yunnan Province is the origin and main production area of *Panax Notoginseng* planting in China^[4]; it has the reputation of being “the hometown of *Panax notoginseng* in China”. *Panax notoginseng* is not only a local characteristic biological resource but also a pillar industry. However, *Panax notoginseng* has strict land requirements and cannot be continuously cultivated, and soil for planting *Panax notoginseng* generally requires more than 10 years for replanting^[5]. In recent years, the *Panax notoginseng* industrial cluster has developed quickly in Wenshan Prefecture, *Panax notoginseng* planting occupies a large amount of cropland, cropland for *Panax notoginseng* cultivation are gradually decreasing. The “nongrain” tendency caused by the cultivation of *Panax notoginseng* in Wenshan Prefecture has intensified, and the grain production and demand remains tight balance. The Central Committee of the Communist Party of China attaches great importance to food security. In November 2020, the No. 44 (2020) of the General Office of the State Council of the People’s Republic of China^[6] clearly stressed the need for the scientific and rational use of cultivated land resources, studies on the relationship between food production and economic benefits, and strict implementation of cultivated land protection systems. Therefore, the monitoring of planting location and scope of *Panax notoginseng* is of great practical importance for the protection of cultivated lands, scientific and rational utilization of cultivated land resources, food security, and supervision of functional areas for food production.

The traditional monitoring of *Panax notoginseng* cultivation mainly relies on census statistics and on-site visits, which are time-consuming, laborious, and inefficient and hardly objectively and truthfully reflect the actual planting situation in a region on a macroscale. *Panax notoginseng* has strict light transmittance requirements. Yunnan has good sunshine and solar radiation conditions, in order to create an ideal growing environment, light transmittance is often reduced by laying black sunshade nets^[7,8]. Therefore, the spectral characteristics of the plot planted in *Panax notoginseng* are obviously different from those of other surrounding ground objects, and this is the basis for monitoring *Panax notoginseng* planting through remote sensing^[9-13]. Chinese remote sensing satellites enter the “era of high resolution”, and domestic meter-level satellite images have surged, image quality has considerably improved, and satellites have the advantages, such as large coverage areas and short revisit periods and so on; thus, remote sensing has become essential to crop planting distribution and farmland rapid monitoring^[14-17]. To date, the extraction of planting information of *Panax notoginseng* mainly relies on data sources, such as 16m Gaofen-1^[11], 10m Sentinel-2^[4], 30m Landsat series, and TM/OLI^[10], and accurate monitoring studies and remote sensing images with spatial resolution at the meter and submeter levels are lacking. The Ministry of Natural Resources has deployed the Third National Land Survey, land change investigations, and daily change investigations which is independently conducted by local governments. These work have basically achieved survey and monitoring at the meter and submeter levels in most areas of the country. However, the monitoring of cultivated and garden land at the national scale is only segmented to secondary classification, and no clear requirements have been made for planting crops. From the protection of cultivated land and prevention of the “nongrain” phenomenon, high-precision *Panax notoginseng* planting information is needed as a important decision-making basis for the formulation of agricultural production structure adjustment, making optimization policies, and supervision measures for functional grain production areas. Remote sensing monitoring of *Panax notoginseng* planting provides a reference for the advanced exploration of detailed monitoring of agricultural lands, such as cultivated and garden lands.

This study is mainly based on multisource domestic meter-level satellite images combined with the location and scope of cultivated land and gardens in the land survey data.

Visual interpretation was used for the development of the 2022 *Panax notoginseng* planting dataset in Wenshan Prefecture, Yunnan Province, and the data were verified using ground survey and based the “Land Survey Cloud” platform internet + survey means. The aim is to provide accurate samples and verification data for the intelligent remote sensing monitoring of *Panax notoginseng* and basic data for food security assessment, locate *Panax notoginseng* planting areas, and contribute to relevant policy formulation in the Wenshan area of Yunnan Province.

2 Metadata of the Dataset

The metadata of the dataset^[18] is summarized in Table 1.

Table 1 Metadata summary of the dataset for comprehensive mapping of geographical indication product planting area in cloudy and rainy areas of Southern China using multisource satellite images: a case study of *Panax notoginseng* planting in Wenshan, Yunnan (2022)

Items	Description
Dataset full name	Dataset for comprehensive mapping of geographical indication product planting area in cloudy and rainy areas of Southern China using multisource satellite images: a case study of <i>Panax notoginseng</i> planting in Wenshan, Yunnan (2022)
Dataset short name	Wenshan_SanQi_2022
Authors	Shen, J. P., China Land Surveying and Planning Institute, shenjp2023@163.com Li , Q., China Land Surveying and Planning Institute, 24640953@qq.com Wang, Y. Q., China Land Surveying and Planning Institute, wangyq.14b@igsnr.ac.cn Liu, C., Institute of Geographic Sciences and Natural Resources Research, lchuang@igsnr.ac.cn Yu, B. H., Institute of Geographic Sciences and Natural Resources Research, yubh@igsnr.ac.cn
Geographical region	Wenshan Zhuang and Miao Autonomous Prefecture, Yunnan Province: 22°40′N–24°48′N, 103°35′E–106°12′E
Year	2022
Data format	.shp
Data size	8.25 MB
Data files	8 data files, named in wenshan_sanqi_202.shp format
Foundation	Ministry of Science and Technology of P. R. China (2021YFE0117300-4)
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(1) <i>Data</i> are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use <i>Data</i> subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute <i>Data</i> subject to written permission from the GCdataPR Editorial Office and the issuance of a <i>Data</i> redistribution license; and (4) If <i>Data</i> are used to compile new datasets, the ‘ten per cent principal’ should be followed such that <i>Data</i> records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset ^[19]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS

3 Data Processing Methods

3.1 Study Area

Wenshan Prefecture is located southeast of Yunnan–Guizhou Plateau (22°40′N–24°48′N, 103°35′E–106°12′E). Its east-west transverse distance is 255 km², its north-south longitudinal distance is 190 km², and its total area is 31,500 km². Wenshan Prefecture has jurisdiction over one city and seven counties, namely Wenshan City and Yanshan, Xichou, Malipo, Maguan, Qiubei, Guangnan, and Funing Counties. In Wenshan Prefecture, the terrain is mainly mountainous and decreases from northwest to southeast, and the altitude is 1,000–1,800 m. It has a subtropical climate, and precipitation is higher than 1,000 mm but

with an uneven distribution. Precipitation is more frequent in the southwest than in the northeast, central, and western regions. The average annual temperature is approximately 17.8°C, showing the characteristics of high temperatures in winter and weak high temperatures in summer^[20]. Owing to the large relief of the terrain, the local microclimate characteristics are obvious. According to the classification of land use status in 2022, the total area of cultivated lands in Wenshan Prefecture is approximately 610,206 ha, and the total area of garden lands is approximately 104,957 ha^[21].

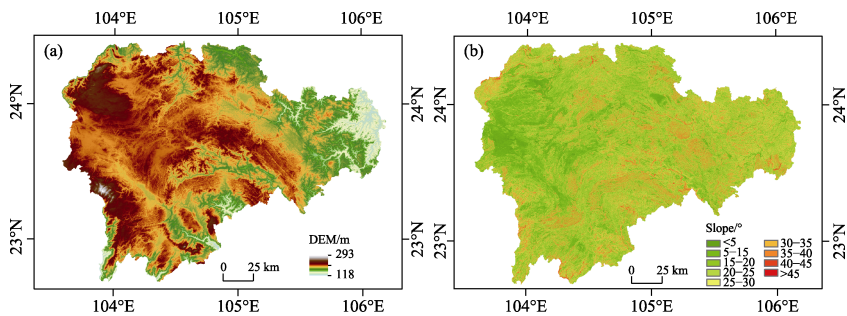


Figure 1 Topography (a) and landform (b) maps of Wenshan Prefecture

3.2 Data Source and Pre-processing

All the data used in this dataset are domestic remote sensing satellite images with high spatial resolutions within 2 m, the image collection period is from September to November 2022. The sensor types mainly include the French Pleiades, domestic Jilin-1, Gaofen-7, ZY-3, ZY-1, Beijing-2, Gaofen-1, Gaofen-2, and Gaofen-6 (Figure 2 and Table 2). More than 70% of the area had 0.5 m resolution image data; 29.4%, 1-m resolution; and 0.14%, 2-m resolution, which are mainly used to fill the cloud coverage area, the specific situation is shown in Table 2. The acquired remote sensing images have geometric distortions because of the sensors, surface topography, and other factors. The original images must be pre-processed mainly through geometric precision correction, image enhancement fusion, and image registration. In addition, land-type statistical data on land use status classification

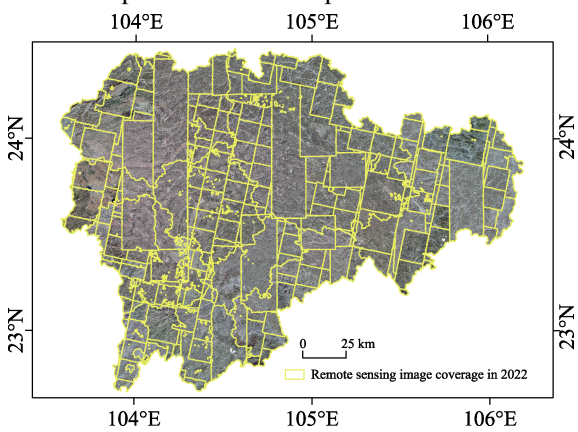


Figure 2 Remote sensing image base map of Wenshan Prefecture in 2022

Table 2 Data source of satellite images























No.	Data source	Original image resolution captured	Image resolution after fusion	Area (km ²)
1	Jilin-1	Panchromatic: 0.5 m; Multispectral: 2 m	0.5 m	10,742.25
2	Jilin-1	Panchromatic: 0.75 m; Multispectral: 3 m	1 m	7,671.72
3	Pleiades	Panchromatic: 0.5 m; Multispectral: 2 m	0.5 m	11,400.56
4	Gaofen-7	Panchromatic: 0.8 m; Multispectral: 3.2 m	1 m	1350.04
5	Gaofen-2	Panchromatic: 0.8 m; Multispectral: 3.2 m	1 m	165.94
6	Beijing-2	Panchromatic: 0.8 m; Multispectral: 3.2 m	1 m	37.85
7	Gaofen-1	Panchromatic: 2 m; Multispectral: 8 m	2 m	38.23
8	ZY-3	Panchromatic: 2.1 m; Multispectral: 5.8 m	2 m	4.07
9	ZY-1	Panchromatic: 2.5 m; Multispectral: 10 m	2 m	0.69
10	Gaofen-6	Panchromatic: 2 m; Multispectral: 8 m	2 m	0.31

in Wenshan Prefecture and counties (cities) of Yunnan Province in 2022 were collected, including garden plots, cultivated lands, and dry lands and so on^[21], and auxiliary information, including terrain and geomorphology data, was used as reference for interpreting *Panax notoginseng* planting area.

3.3 Interpretive Flag Establishment

Remote sensing interpretation is based on information, such as spectral feature difference, size, shape, and texture of ground objects. *Panax notoginseng* is a shade-loving plant and needs to be covered by a shade shed during its growing period. Shade sheds used to control light transmittance are mainly black plastic sunshade nets, which are the physical basis for extracting the planting area of *Panax notoginseng* through remote sensing. For large-scale remote sensing, information about target ground objects is obtained through comprehensive mapping. This study is based on field data and experience obtained from field investigations, and field evidence photos provided by the “Land Survey Cloud” platform, using multisource high-resolution remote sensing data for the analysis of the color, texture, and other features of the planting area of *Panax notoginseng*. Ultimately, the remote sensing interpretation markers of *Panax notoginseng* planting were established (Table 3).

Table 3 Interpretive signs of *Panax notoginseng* in Wenshan Prefecture

Region	Longitude (E)	Latitude (N)	Image	Photo	Region	Longitude (E)	Latitude (N)	Image	Photo
Wenshan City	103.938,5°	23.651,3°			Maguan County	104.361,6°	22.933,0°		
	103.866,3°	23.562,7°			Qiubei County	103.861,1°	24.102,2°		
Yanshan County	104.176,2°	23.838,3°				103.853,4°	23.893,2°		
	104.176,2°	23.864,8°			Guangnan County	104.736,0°	24.018,8°		
Xichou County	104.795,3°	23.583,0°			Funing County	105.380,6°	23.382,7°		
Malipo County	104.575,6°	23.150,8°							

3.4 Indoor Interpretation

Compared with machine learning, manual visual interpretation has the advantages of high flexibility, strong interpretation, and wide applicability. To prevent the influences of water bodies and mountain shadows on the remote sensing monitoring of *Panax notoginseng* planting, this study adopts the comprehensive mapping method to accurately interpret the planting situation of *Panax notoginseng* in Wenshan Prefecture. First, this study created a spatial location consistency database to initially define the planting area of *Panax notoginseng*, integrating multisource remote sensing image data, cultivated land and garden information of land change survey, digital elevation models, and climatic data. Then, the color features, texture structure, and shape features of the remote sensing images were used in the extraction of the suspected planting plots of *Panax notoginseng* through manual visual interpretation in the ArcGIS platform. According to the interpretation results, the actual planting situation of *Panax notoginseng* was verified using field investigation data, and the preliminary interpretation results were adjusted and optimized for the accurate delineation of the specific boundaries of *Panax notoginseng* planting areas.

4 Data Results and Validation

4.1 Data Composition

The Dataset consists of one shapefile. The dataset is the planting data of *Panax notoginseng* in Wenshan Prefecture in 2022 and stored in .shp format, including eight data files with a total size of 8.25 MB (compressed into 4.54 MB, named Wenshan_SanQi_2022 form).

4.2 Data Results

In 2022, the planting data of *Panax notoginseng* in Wenshan Prefecture were collected using a total of 15,405 planting plots with a planting area of about 8,295.75 ha (Table 4), which is extremely close to the planting area announced by Wenshan Prefecture in 2022 (125,400 mu=8,360 ha)¹. As shown in Table 4, the *Panax notoginseng* planting among these counties, Wenshan City is the largest and has the largest planting area, accounting for nearly one-third of the whole prefecture, followed by Yanshan, Qiubei, and Maguan Counties, which all have a planting area of more than 1,000 ha. The above counties accounted for more than 85% of the planting area of *Panax notoginseng* in Wenshan Prefecture. By contrast, Xichou, Malipo, Guangnan, and Funing Counties had small *Panax notoginseng* planting areas, accounting for less than 15%. From the perspective of spatial distribution, the planting area of *Panax notoginseng* in Wenshan Prefecture is mainly distributed in the southwest, decreasing from southwest to northeast (Figure 3). In terms of topography and geomorphology, *Panax notoginseng* planting areas are mostly distributed in areas above 1,000 m, and a few plots in Xichou, Malipo, Machan, Guangnan, and Funing Counties are distributed below 1,000 m. The slope of *Panax notoginseng* is mainly distributed between 10° and 15° (Table 5). From the perspective of concentration, the planting center of *Panax notoginseng* in Wenshan Prefecture was located in an oval area of approximately 12 km × 10 km in the southeast, and the hot spots are mainly located in Wenshan City, Qiubei County, and Yanshan County.

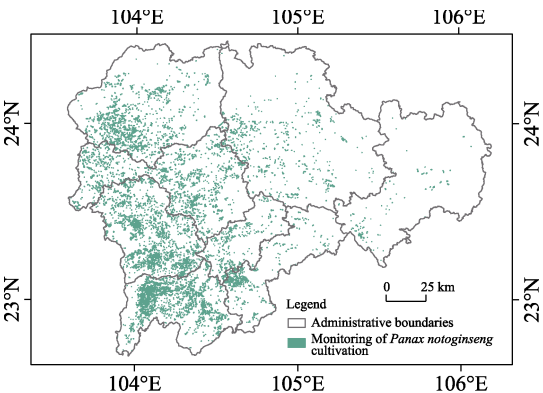


Figure 3 Spatial distribution of *Panax notoginseng* plants in Wenshan Prefecture in 2022

Table 4 Remote sensing monitoring statistics of *Panax notoginseng* planting in each county (city) of Wenshan Prefecture

Administrative division code	Administrative division name	Number of planting plots (piece)	Planting area (ha)	Ratio (%)
532601	Wenshan City	3,384	2,552.99	30.77%
532622	Yanshan County	2,159	1,561.52	18.82%
532623	Xichou County	646	281.92	3.40%
532624	Malipo County	832	336.97	4.06%
532625	Maguan County	4,837	1,437.83	17.33%
532626	Qiubei County	2,205	1,517.89	18.30%
532627	Guangnan County	1,043	478.96	5.77%
532628	Funing County	299	127.67	1.54%
Total	Wenshan Prefecture	15,405	8,295.75	100%

According to the classification data of land use status in 2022, the cultivated land in Wenshan prefecture is 610,206 ha, of which dry land cover 504,604 ha, accounting for

¹ Wenshan prefecture *Panax notoginseng* and traditional Chinese medicine industry development center. Reply to Proposal No. 13010234 of the Second Session of the 13th Wenshan Prefecture of the Political Consultative Conference [EB/OL]. <https://www.ynws.gov.cn/info/1303/311111.htm>. 2023-05-29.

82.69%; the garden land area in Wenshan prefecture is 104,957 ha, of which other gardens land cover 55,840 ha, accounting for 53.20%. According to the work classification of the Third National Land Survey, the fields where perennial crops, such as medicinal materials, are planted are included in the “other garden land” category. Therefore, approximately 14.86% of the “other garden land” areas in the state are *Panax notoginseng* planting areas. More than half of the “other garden land” areas in Wenshan City cultivate *Panax notoginseng*, accounting for 56.23%; nearly one-third of the “other garden land” area in Qiubei, Yanshan, Malipo, and Maguan Counties cultivate *Panax notoginseng*. From the perspective of the proportion of *Panax notoginseng* planting area in the dry land area, that is, the proportion of cultivated “nongrain” land caused by the cultivation of *Panax notoginseng*, the results show that Wenshan City and Maguan County accounted for a relatively high proportion (3.22% and 3.34%, respectively); Yanshan, Xichou, and Qiubei Counties accounted for 1.41%, 1.38%, and 1.34% respectively, and Guangnan and Funing Counties accounted for 0.62% and 0.41% respectively (Table 6).

Table 5 Topography and landform of *Panax notoginseng* planting in each county (city) of Wenshan Prefecture

Administrative division name	Altitude (m)			Slope (°)		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Wenshan City	1,131	2,228	1,696	0.0	52.3	12.2
Yanshan County	1,216	2,183	1,560	0.0	49.2	11.1
Xichou County	865	1,723	1,462	0.0	44.9	14.7
Malipo County	375	1,858	1,262	0.0	45.8	14.6
Maguan County	195	2,043	1,614	0.0	54.3	13.9
Qiubei County	1,217	2,408	1,771	0.0	42.6	10.8
Guangnan County	782	1,819	1,452	0.0	42.1	12.4
Funing County	229	1,614	925	0.3	32.8	7.9

Table 6 Proportion of *Panax notoginseng* planting in cultivated land and garden land in each county (city) of Wenshan Prefecture

Administrative division name	The proportion of occupied garden land (%)	The proportion of occupied other garden land (%)	The proportion of occupied arable land (%)	The proportion of occupied dry land (%)
Wenshan City	32.99	56.23	2.85	3.22
Yanshan County	19.80	32.06	1.21	1.41
Xichou County	6.64	10.88	1.09	1.38
Malipo County	5.33	33.07	0.97	1.13
Maguan County	12.94	30.09	2.65	3.34
Qiubei County	20.34	28.14	1.23	1.34
Guangnan County	1.40	5.38	0.45	0.62
Funing County	0.49	0.54	0.29	0.41
Wenshan Prefecture	7.90	14.86	1.36	1.64

5 Discussion and Conclusion

5.1 Discussion

Panax notoginseng planting monitoring information in Wenshan Prefecture, Yunnan Province, was obtained using multisource meter-level remote sensing satellite images and topographic and geomorphic information in 2022. At a high spatial resolution, the comprehensive mapping method was used for the identification of surface crop types, exhibiting high reliability and effectiveness. According to the obtained dataset, the spatial layout characteristics of *Panax notoginseng* planting in Wenshan Prefecture were discussed,

and the agglomeration rules and differences in *Panax notoginseng* planting in terms of geographical distribution, landform, and other factors were revealed. Combined with the main data results of the classification of land use status in 2022, through the comparative analysis of planting land of *Panax notoginseng* and grain planting land, the influence of planting *Panax notoginseng* in Wenshan Prefecture on the “nongrain” local cultivated land was estimated. The results can provide data for the formulation of policies balancing economic development and cultivated land protection, implementation of agricultural structure adjustment, and sustainable development of characteristic medicinal materials.

5.2 Conclusion

On the basis of remote sensing satellite images with high spatial resolution (mainly 0.5 and 1 m) in 2022, this study developed a dataset of *Panax notoginseng* sample points in Wenshan Zhuang and Miao Autonomous Prefecture of Yunnan Province (2022) through comprehensive mapping and field investigation. The results are highly consistent with the planting area data published on the official website of Wenshan Prefecture. The spatial distribution of *Panax notoginseng* planting areas in Wenshan Prefecture was analyzed, and the contribution of *Panax notoginseng* planting to the “nongrain” cultivated land in Wenshan Prefecture was preliminarily estimated using main data results of land use classification in 2022. The main conclusions are as follows:

(1) Based on multisource high spatial resolution remote sensing data, such as Jilin-1, Gaofen Series, ZY series, Beijing-2, and French Pleiades, the location and scope of *Panax notoginseng* planting plots were accurately identified by visual interpretation and multivariate features, such as spectral information and texture information, provided strong data support for the spatial distribution monitoring of *Panax notoginseng* planting areas.

(2) The planting area of *Panax notoginseng* in Wenshan Prefecture is approximately 8295.75 ha. Wenshan City is the largest producing area, accounting for nearly one-third of the whole prefecture, followed by Yanshan, Qiubei, and Maguan Counties. They accounted for more than 85% of the planting area of *Panax notoginseng* in the whole prefecture. The planting area is mostly distributed in the area of more than 1,000 m, and the slope is mainly concentrated between 10° and 15°.

(3) *Panax notoginseng* planting is an important factor in the “nongrain” cultivated land in Wenshan Prefecture. In terms of “nongrain” conversion caused by garden lands, the contribution rate of *Panax notoginseng* planting in Wenshan Prefecture is 7.9%. From the perspective of cultivated land occupation, the “nongrain” contribution rate caused by the cultivation of *Panax notoginseng* planting in Wenshan City and Maguan County is relatively high, accounting for approximately 3%.

Author Contributions

Wang, Y. Q. gave general guidance to the research and development of the dataset and revised the data paper; Shen, J. P. sorted out the remote sensing image dataset and auxiliary data, interpreted *Panax notoginseng* planting data, analyzed the related results, and wrote the data paper; Li, Q. inspected the planting plots of *Panax notoginseng* and verified relevant datasets; Liu, C. and Yu, B. H. revised the paper.

Conflicts of Interest

The authors declare no conflicts of interest.

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