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Dataset of Cultivated Land in Vietnam Reconstructed from Historical Documents for the Period 1500–2000 A.D.

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Abstract: The effective reconstruction of historical land use datasets is of great importance for analyzing the process of long-term land cover changes, diagnosing the mechanism of climate change, and evaluating the impact of human activities. Aimed at Vietnam, which has lacked reconstructed results for historical cultivated land area in the past, this paper takes The Atlas of World Population History, The World Economy: Volume 1: A Millennial Perspective and Volume 2: Historical Statistics and International Historical Statistics: Africa, Asia & Oceania, 1750–1988 as the basic population information, and obtains the total population at 16 key time points between 1500 and 2000 A.D. by interpolation and fusion of historical documents. Further, combined with data for paddy field area, the ratio of paddy field area to cultivated land area, the grain ration standard, land tax systems, paddy field yields, and ripening system, the process of change in cultivated land area was deduced using two indicators of cultivated land area per capita and grain possession per capita. The results showed that the cultivated land area of Vietnam has shown an almost exponential upward trend over the past 500 years, with a slow increase before 1850 A.D. and a rapid increase after 1850 A.D. Compared with global datasets such as the History Database of the Global Environment (HYDE) 3.2 and SAGE, the results of this paper not only have a certain consistency but they also have greater temporal resolution (50 years), and are more in line with the fluctuations in the natural environment and of the social economy over historical periods.

Keywords: land use/cover change; reconstruction of cultivated land area; historical documents; Vietnam

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[2] Liu, H. L., Liu, X., He, F. M. Cultivated land dataset in Vietnam based on historical documentation (1500–2000) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2022. https://doi.org/10.3974/ geodb.2022.03.07.V1. https://cstr.escience.org.cn/CSTR:20146.11.2022.03.07.V1.

1 Introduction

Land use and cover change (LUCC) is considered to be one of the significant drivers of global environmental change[1–3], among which changes in cropland area is an important part of the study of past global changes. Such changes profoundly affect the global and regional environment through changes in the physical conditions of the land surface (i.e., surface albedo, radiative forcing, evapotranspiration, and soil erosion) and the biogeochemical cycle[4,5]. At present, LUCC research, using reconstructed cultivated land data as its basis, has made remarkable progress, forming the various global land use datasets represented by HYDE, KK10, SAGE, etc.[6–10]. However, as the SAGE publisher has stated, the global dataset is only applicable to global-scale studies, while its application to the regional scale is subject to large uncertainties[9]. Further assessment of the reliability of global historical LUCC datasets demonstrates that the historical cropland data for Germany and China in the SAGE and HYDE datasets cannot objectively reflect the total amount of land reclamation and the spatial distribution characteristics of the two countries during specific time periods[11–13], which greatly deviate from their "true values" in the historical past. Therefore, fully excavating regional historical documents and natural records in order to reconstruct the LUCC process on a regional scale is not only vital for the study of regional historical geography but also an urgent need to improve global LUCC datasets.

At present, due to the long history of agricultural and pastoral civilization and the relatively detailed and continuous historical records, the eastern and southern regions of Asia, the Americas, and parts of Africa have good conditions for regional land cover reconstruction research[14], thus producing a large number of regional reconstruction results over a long timescale[15–16]. However, the Indochina Peninsula, which also has a long agricultural history, lacks accurate statistics for historical population and cultivated land area due to its complicated political evolution, frequent internal wars, and poor preservation of historical archives in the region[17]. Therefore, the reconstruction of cultivated land area in the Indochina Peninsula has not been carried out systematically and thoroughly. This paper collects information on population, land use, agriculture, and taxes from Vietnamese historical records, and constructs a quantitative relationship between cultivated land area and population in different historical periods, so as to reconstruct the changes of cultivated land area during the past 500 years.

2 Metadata of the Dataset

Table 1 lists the metadata information relating to the cultivated land area dataset in Vietnam based on historical documentation (1500–2000) [18].

3 Methods

3.1 Data Sources

The source data used in the construction of this dataset included basic information on four aspects, namely, population; paddy field (cultivated land) area and ratio of paddy field area to cultivated land area; expenditure on grain, including grain ration, public grain, and surplus grain; paddy yield and farming system. Of these data sources, population data used The Atlas of World Population History[20], The World Economy: Volume 1: A Millennial Perspective and Volume 2: Historical Statistics[21] (hereafter referred to as The World Economy), and International Historical Statistics: Africa, Asia & Oceania, 1750–1988[22] (hereafter referred to as International Historical Statistics) as the main data sources for different historical periods.

Table1 Metadata summary of the Cultivated land dataset in Vietnam based on historical documentation (1500–2000)

Items	Description
Dataset full name	Cultivated land dataset in Vietnam based on historical documentation (1500–2000)
Dataset short name	CultivatedLandVietnam_1500-2000
Authors	Liu, H. L. HHM-8300-2022, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, liuhl@igsnrr.ac.cn Liu, X. GMW-7633-2022, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, liuxian211@mails.ucas.ac.cn He, F. N. https://orcid.org/0000-0001-7743-6484, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, hefn@igsnrr.ac.cn
Geographical region	Vietnam
Data time period	1500–2000 A.D.
Temporal resolution	50 years for 1500–1800 A.D., 20–30 years for 1800–1900 A.D., 10 years for 1900–2000 A.D.
Data Formats	.xlsx
Data size	12.5 KB
Dataset components	Year, population, and national cultivated land valuation
Foundation	Ministry of Science and Technology of P. R. Chin (2017YFA0603304)
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	***Data*** from the Global Change Research Data Publishing & Repository includes metadata, datasets (in the *Digital Journal of Global Change Data Repository*), and publications (in the *Journal of Global Change Data & Discovery*). ***Data*** sharing policy includes: (1) ***Data*** are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use ***Data*** subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute ***Data*** subject to written permission from the GCdataPR Editorial Office and the issuance of a ***Data*** redistribution license; and (4) If ***Data*** are used to compile new datasets, the 'ten per cent principal' should be followed such that ***Data*** 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

The paddy field (cultivated land) area and ratio of paddy field area to cultivated land area in Vietnam in different time periods took the official land census data for the feudal dynasty period (1500–1885 A.D.), the French colonial period (1885–1954 A.D.), and the independence period (since 1954 A.D.) directly recorded or reproduced from Da Nan Unified History[23], International Historical Statistics, The World Bank: World Development Indicators[24] (hereafter referred to as The World Bank), Current Situation of Vietnam under French Rule[25], Vietnamese Village Community [26], and other documents as the main data sources.

In order to determine the data needed for the calculation of grain possession per capita in the feudal period of Vietnam, this paper used the amount of grain payment and the corresponding populations of twelve provinces in Vietnam during the Jialong period (1802–1819 A.D.) recorded in Da Nan Unified History to obtain the amount of public grain payment per capita. However, the expenditure standard of grain rations and surplus grain in the same period could not be obtained directly because of the current condition of Vietnamese historical records. It was therefore determined by referring to the relevant data for Chinese society[27], in view of the fact that the Vietnamese ethnic group is relatively similar to that in the area south of the Yangtze River in China, with similar physiques, food preferences, and modes of agriculture.

As for the paddy yield in different historical periods, the yield of paddy fields in 1930 A.D. during the French colonial period[25] was taken to be the same as that in the feudal dynasty period, given that the traditional small-scale farming mode continued to be used

during the colonial period in Cochin-China[28], and agricultural technology did not greatly improve during the latter period. In addition, the crop cultivation system used in Vietnam during the feudal dynasty period can be classified as biannual, based on the common situation in densely populated areas of Southeast Asia in the 16th century, as recorded in relevant research monographs[29].

Of the abovementioned basic data sources, The Atlas of World Population History records the population growth, deaths, and migrations in each country in each historical period, as well as an estimated result for total population, which has been applied to the transformation of the agricultural population growth pattern in early modern Britain[30]. The International Historical Statistics has collected and summarized the statistical data for population, land, economy, trade, and other aspects of most regions of the world since the latter half of the 19th century, which is one of the few modern socioeconomic datasets in the world with a complete time series by country. Prof. Angus Maddison, the author of The World Economy, is recognized as the most authoritative expert on economic history data analysis in the world. In his book, the results for economic analysis of historical data and materials unearthed by scholars from various countries have been applied to a historical comparison of the economic gap between China and the West[31] and the history of low-carbon transition in Germany[32]. In addition, the local gazetteer of Vietnam-Da Nan Unified History-is a precious ancient source for the study of Vietnamese history and geography. This gazetteer is well structured, top-to-bottom, and contains detailed information on boundaries, divisions, establishment and evolution, division of jurisdiction, climate, cities, household registration, land tax, and other information, and is known as "the most important historical material in the general gazetteers of the Nguyen dynasty of Vietnam."[33].

3.2 Technical Route

The construction of our dataset involved a two-part process: the data for cultivated land area after 1950 A.D. were adopted directly from The World Bank, while the data from 1500–1950 A.D. were reconstructed using the technical route shown below in Figure 1, which is divided into four key technical links, including the construction of population sequence, the calculation of paddy field area or grain possession per capita, the accounting of the total area of cultivated land, and the comparison and verification of the results.

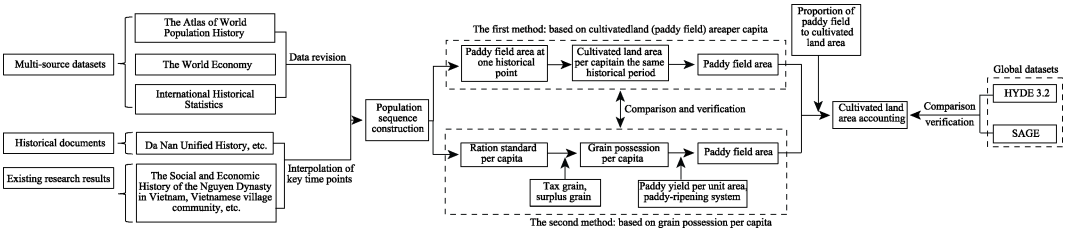

Figure 1 Technical route for reconstructing cultivated land area in Vietnam between 1500 and 1950 A.D.

When constructing the population sequence for Vietnam, the population data since 1500 A.D. in the three population datasets mentioned above were first drawn as a graph (Figure 2). Through comparative analysis, it was found that the degree of convergence and superposition for each set of data in different periods was good, and was also in line with the population wave dynamics under the influence of natural and socioeconomic factors in specific time periods, which are described in The Social and Economic History of the Nguyen Dynasty in Vietnam[17] (hereafter referred to as The Social and Economic History of the Nguyen Dynasty). Therefore, the time-segment selection and interpolated results for each population dataset are shown as follows: (1) the population from 1500 to 1800 A.D.

adopts the data with centennial resolution in the same period from The Atlas of World Population History. However, as the temporal resolution of this population data is low, this paper also interpolates the population values at two key time points, 1550 and 1750 A.D., with the help of the population declines caused by natural disasters and wars during the Nguyen Dynasty described in The Social and Economic History of the Nguyen Dynasty. Based on the average annual growth rate, the population in 1650 A.D. was estimated from those in 1600 and 1700 A.D.; (2) the population from 1800 to 1921 A.D. is based on the data for different time points in The Atlas of World Population History and The World Economy; (3) the population from 1921 to 1950 A.D. is based on the data for each time point in the same period contained in International Historical Statistics and The World Economy.

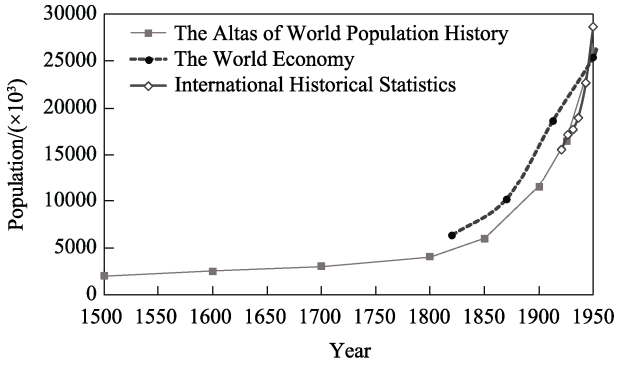

Figure 2 Comparison of historical population datasets from three sources in Vietnam for the period 1500 to 1950 A.D.

After constructing the historical population sequence, the two reconstruction algorithms for cultivated land area used in different periods were defined as follows:

(1) The first algorithm is based on the cultivated land (paddy field) area per capita, aimed at the reconstructed time points from 1500 A.D. to 1950 A.D. The algorithm is given by Equation (1):

$$C_k = \frac{H_k \times P_k}{G_k} \tag{1}$$

where C_k is the total area of cultivated land in the region, H_k is the population of the region, P_k is the paddy field area per capita in the region, and G_k is the ratio of paddy field area to cultivated land area in the region.

(2) The second algorithm is based on the method of grain possession per capita, aimed at the reconstructed time points from 1500 A.D. to 1885 A.D. The algorithm is given by Equation (2).

$$C_k = \frac{H_k \times F_k}{U_k \times G_k \times O_k} \tag{2}$$

where C_k, H_k, and G_k are the same variables as defined in Equation (1), F_k is the level of grain possession per capita in the region, U_k is the paddy yield per unit area in the region, and O_k is paddy-ripening system in the region.

4 Data Results and Validation

4.1 Data Composition

Dataset of cultivated land in Vietnam reconstructed from historical documents (1500–2000 A.D.) is composed of a table, and the result is shown in Table 2.

4.2 Reconstructed Results and Validation of Population Data

As can be seen from the reconstructed results (Figure 3), the population of Vietnam has shown a fluctuating upward trend over the past 500 years: (1) during the century from 1500 to 1600 A.D., the population first increased and then decreased, with an average annual growth rate of 2.14‰; (2) during the century from 1600 to 1700 A.D., the population showed a slow growth trend, with an average annual growth rate of 1.92‰; (3) during the century from 1700 to 1800 A.D., the population first decreased and then increased, with an average annual growth rate of 2.88‰; (4) during the 50 years from 1800 to 1850 A.D., the population again showed a trend of first increasing and then decreasing, with an average annual growth rate of 8.14‰; (5) during the century from 1850 to 1950 A.D., the population showed an exponential growth trend, with an average annual growth rate of 14.51‰.

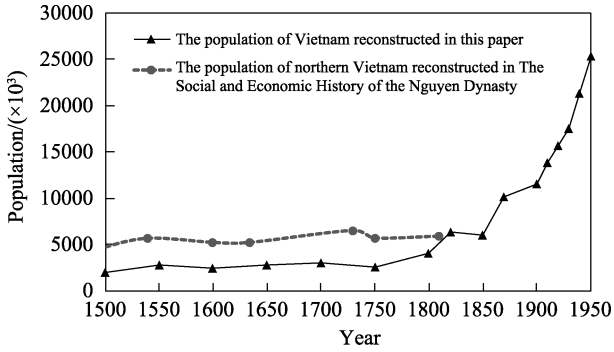

Figure 3 Comparison of reconstructed population results between those for the whole of Vietnam and the north of the country from 1500 to 1950 A.D.

Table 2 Reconstructed dataset of cultivated land area in Vietnam (1500–2000 A.D.)

Historical period	Year	Population ($\times10^3$)	Cultivated land area (10^3 hm^2)		
			Reconstructed results based on cultivated land (paddy field) area per capita	Reconstructed results based on grain possession per capita	Statistical data[24]
Feudal dynasty	1500	2,000[20]	350.69	365.27	–
	1550	2,724	477.64	497.50	–
	1600	2,476[20]	434.16	452.21	–
	1650	2,725	477.89	497.76	–
	1700	3,000[20]	526.04	547.91	–
	1750	2,550	447.13	465.72	–
	1800	4,000[20]	701.38	730.54	–
	1820	6,313[21]	1,106.95	1,152.98	–
	1850	6,000[20]	1,052.07	1,095.81	–
	1870	10,146[21]	1,779.05	1,853.01	–
Colonial period	1900	11,500[20]	2,827.87	–	–
	1910	13,780[20]	3,388.52	–	–
	1920	15,615[20]	3,839.75	–	–
	1930	17,477[22]	4,297.62	–	–
	1940	21,270[22]	4,576.54	–	–
	1950	25,348[21]	5,453.98	–	–
Independent period	1960	–	–	–	5,550.00
	1970	–	–	–	5,630.00
	1980	–	–	–	5,940.00
	1990	–	–	–	5,339.00
	2000	–	–	–	6,200.00

In order to verify the rationality of the reconstructed results obtained in this paper, we also compared them with the population change trend in northern Vietnam from 1500 to 1800 A.D., estimated from The Social and Economic History of the Nguyen Dynasty, which is based on the number of historical villages and communities (Figure 3). The result of the comparison shows that the fluctuations in the two curves are consistent, and both show the "two ups and two downs" in the population development during the past 300 years. It should be pointed out that the population of northern Vietnam at each time point estimated in The Social and Economic History of the Nguyen Dynasty is much higher than the population of the whole country calculated in this paper. In this regard, we believe that the estimated results contained in this book remain to be discussed. This book also notes that the population of northern Vietnam accounted for 55% of the total population of the country[17], so it can then be calculated that the total population of Vietnam in 1730 A.D. was 11,766,000, which exceeded that of 1900 A.D., which was 11,500,000. A lack of knowledge of the differences in the sizes of villages and communities may be the reason for the incorrect estimated results obtained in The Social and Economic History of the Nguyen Dynasty.

4.3 Reconstructed Results and Comparison of Cultivated Land

4.3.1 Reconstructed Results

The reconstructed results for cultivated land in Vietnam during the past 500 years based on cultivated land area per capita are shown in Figure 4, from which we can discern three characteristics: (1) the cultivated land area of the country shows a generally fluctuating upward trend, with three "bottoms," in 1600, 1750, and 1850 A.D.; (2) before 1850 A.D., the growth rate of cultivated land was relatively slow, with an average annual growth rate of 3.14‰; (3) after 1850 A.D., the cultivated land increased at a high rate in an approximate straight line, with an average annual growth rate of 11.90‰. It should also be noted that there is not much difference between the value of cultivated land based on grain possession per capita and the value based on cultivated land area per capita, with a relative deviation of only 4.07%, in general, which shows that the two estimated results are relatively consistent.

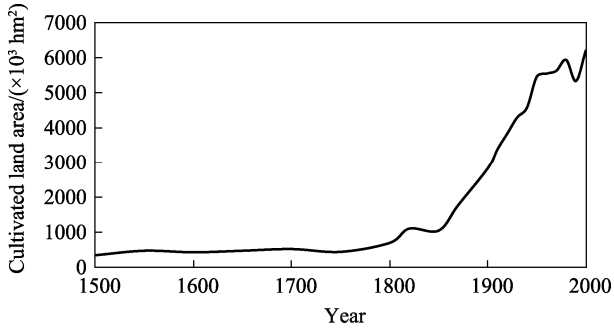

Figure 4 Reconstructed results for cultivated land in Vietnam from 1500 to 2000 A.D.

4.3.2 Comparison with Results for Vietnam in Other Global Datasets

The reconstructed results for cultivated land in Vietnam in this paper were compared with those in the HYDE 3.2, SAGE, and other global datasets (Figure 5), which showed that: (1) the trends of the latter two datasets before 1800 A.D. were close to the results obtained in this paper, with a minimum relative deviation of 3.20% in value, and that the consistency among the three datasets was good; (2) although the temporal resolution of the latter two datasets since 1800 A.D. has been improved to 10 years and 1 year, respectively, the details of the change process are quite different from the results in this paper, and the deviations at most time points are higher than those before 1800 A.D.

Because the temporal resolution of the HYDE 3.2 dataset before 1700 A.D. is only 100 years and the SAGE dataset lacks data before 1700 A.D., it is difficult to reflect the fluctuations in land reclamation rates caused by natural or social events lasting only a few years or decades in Vietnam before 1700 A.D. Moreover, the idea for reconstruction of the global datasets is based on backward extrapolation of modern cropland area, and lacks the support of population and land statistics for the historical period, which leads to an overly smooth curve for the reconstructed results. Based on the above analysis, we believe that the results in this paper better depict the changes in cultivated land area in Vietnam during the past 500 years.

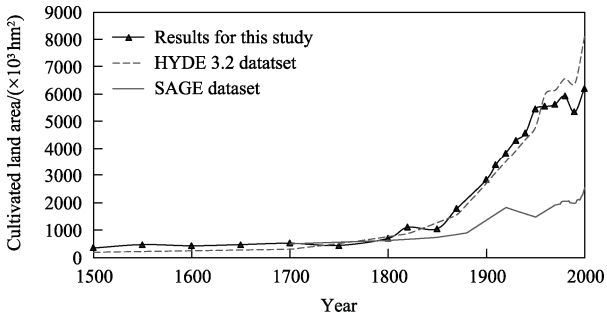

Figure 5 Comparison of different reconstructed results for cultivated land in Vietnam for the period 1500–2000 A.D.

5 Discussion and Conclusion

The method behind the idea for reconstructing population and land data developed in this paper was to first revise and interpolate the population sequence of Vietnam over the past 500 years, and then to reconstruct the national cultivated land at multiple time points based on cultivated land per capita and grain possession per capita. The reconstructed results include a data file stored in Microsoft Excel format, consisting of reconstruction years, population, cultivated land calculated based on cultivated land area per capita and grain possession per capita. The size of this data file is 12.5 KB, and the time resolution of this dataset is 50 years for 1500–1800 A.D., 20–30 years for 1800–1900 A.D., and 10 years for 1900–2000 A.D.

The cultivated land reconstructed for Vietnam over the past 500 years shows an almost exponentially increasing trend, with a slow increase before 1850 A.D. and then a rapid increase after 1850 A.D. This result lays a data foundation for determining the spatial distribution of cultivated land in Vietnam in different historical time periods. Due to the long history of mutual aggression between the countries of the Indochina Peninsula, the territories of these countries have changed greatly over time. Therefore, the next step in this study is to select appropriate spatial distribution factors for grid distribution of cultivated land in Vietnam based on the definitions of national territorial boundaries in different historical time periods.

Author Contributions

Liu, H. L. designed the overall plan of dataset; Liu X. collected and processed population and other data; Liu, H. L. and He, F. N. designed the model and algorithms; Liu, X. verified the data results; Liu, H. L. and Liu, X. wrote the data paper.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Skole, D. L., Meyer, W. B., Turner, II., *et al.* Global land-use/land-cover change: towards an integrated study [J]. *AMBIO—A Journal of the Human Environment*, 1994, 23(1): 91.

[2] Ramankutty, N., Delire, C., Snyder, P. Feedbacks between agriculture and climate: an illustration of the potential unintended consequences of human land use activities [J]. *Global & Planetary Change*, 2006, 54(1/2): 79–93.
[3] Mahmood, R., Pielke, R. A., Hubbard, K. G., *et al*. Land cover changes and their biogeophysical effects on climate [J]. *International Journal of* Climatology, 2014, 34(4): 929–953.
[4] Ruddiman, W. F. The anthropogenic greenhouse era began thousands of years ago [J]. *Climatic Change*, 2003, 61(3): 261–293.
[5] Goldewijk, K. K., Drecht, G. V., Bouwman, A. F. Mapping contemporary global cropland and grassland distributions on a 5×5 minute resolution [J]. *Journal of Land Use* Science, 2007, 2(3): 167–190.
[6] Goldewijk, K. K. Estimating global land use change over the past 300 years: the HYDE database [J]. *Global Biogeochemical Cycles*, 2001, 15(2): 417–433.
[7] Goldewijk, K. K., Beusen, A., Doelman, J., *et al*. Anthropogenic land use estimates for the Holocene-HYDE 3.2 [J]. *Earth System Science Data*, 2017, 9(2): 927–953.
[8] Kaplan, J. O., Krumhardt, K. M., Ellis, E. C., *et al*. Holocene carbon emissions as a result of anthropogenic land cover change [J]. *Holocene*, 2011, 21(5): 775–791.
[9] Ramankutty, N., Foley, J. A. Estimating historical changes in global land cover: croplands from 1700 to 1992 [J]. *Global Biogeochemical Cycles*, 1999, 13(4): 997–1027.
[10] Ramankutty, N. Global cropland and pasture data from 1700–2007. Available online at [http://www.geog.mcgill.ca/nramankutty/Data-sets/Datasets.html] from the LUGE (Land Use and the Global Environment) Laboratory, Department of Geography, McGill University, Montreal, Quebec, Canada. 2012.
[11] Li, B. B., Fang, X. Q., Ye, Y., *et al*. Regional assessment of the accuracy of global land use datasets: the case of Northeast China [J]. *Science of China*: *Earth Sciences*, 2010, 40(8): 1048–1059.
[12] He, F. N., Li, S. C., Zhang, X. Z., *et al.* A comparative analysis of the results of arable land reconstruction in traditional farming areas in China over the past 300 years [J]. *Acta Geographica Sinica*, 2012, 67(9): 1190–1200.
[13] Fang, X. Q., Zhao, W. Y., Zhang, C. P., *et al*. Assessment methods and evaluation cases of data reliability of global historical LUCC datasets [J]. *China Science*: *Earth Science*, 2020, 50(7): 1009–1020.
[14] Thompson, R. S. BIOME 300: understanding the impacts of human activities on land cover over the past 300 years [J]. *IGBP Newsletter*, 2000, 43: 2–3.
[15] Li, M. J., He, F. N., Xiao, R. A comparative study of spatial and temporal changes in arable land in China, the United States, Pakistan and India over the past 300 years [J]. *Advances in Geographical Sciences*, 2015, 34(1): 64–72.
[16] Etter, A., McAlpine, C., Possingham, H. Historical patterns and drivers of landscape change in Colombia since 1500: a regionalized spatial approach [J]. *Annals of the Association of American Geographers*, 2008, 98(1): 2–23.
[17] Li, T. N. The Social and Economic History of the Nguyen Dynasty in Vietnam [M]. Beijing: Wenjin Press, 2000.
[18] Liu, H. L., Liu, X., He, F. N. Cultivated land dataset in Vietnam based on historical documentation (1500–2000) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2022. https://doi.org/10.3974/geodb.2022.03.07.V1. https://cstr.escience.org.cn/CSTR:20146.11.2022.03.07.V1.
[19] GCdataPR Editorial Office. GCdataPR data sharing policy [OL]. https://doi.org/10.3974/dp.policy.2014.05 (Updated 2017).
[20] McEvedy, C., Jones, R. Atlas of World Population History [M]. Puffin Books, 1978.
[21] Maddison, A. The World Economy: Volume 1: A Millennial Perspective and Volume 2: Historical Statistics [M]. OECD Publishing, 2006.
[22] Mitchell, B. R. International Historical Statistics: Africa, Asia & Oceania, 1750–1988 [M]. Stockton Press, 1995.
[23] The Nguyen Dynasty Museum of Vietnam. Da Nan Unified History [M]. Chongqing: Southwest Normal University Press, 2015.
[24] The World Bank. World Development Indicators [Z]. http://datacatalog.worldbank.org.
[25] Ma, Z. H. The current situation of Vietnam under French rule [J]. *New China Magazine*, 1933, 1(16).
[26] Ruan, H. F. Vietnamese Village Community [M]. Southeast Asia Research Institute in Yunnan province of P. R. China, 1983.
[27] Wu, H. Grain yield, grain possession per capita and labor productivity in the early Qing dynasty [J]. *Studies in Chinese Economic History*, 1993(1): 43–48.
[28] Qu, W. A study of Vietnamese economy during the French colonial rule [D]. Guiyang: Guizhou Normal University, 2015.
[29] Reid, A. Southeast Asia in the Age of Commerce, 1450–1680 (Volume 1: The Lands below the Winds) [M]. New Haven, CT: Yale University Press, 1988.
[30] Lu, Y. M. A study of the changing pattern of agricultural population growth in early modern Britain [J]. *Theorists*, 2008(8): 110–112.
[31] Xie, F. Z. When did the economic gap between China and the West open up? —Angus Maddison's "Millennium Statistics" [J]. *Journal of Historical Theory*, 2012(4): 40–48, 158–159.
[32] Gao, X. Progress and experience of low-carbon transition in Germany [J]. *German Studies*, 2014, 29(2): 32–44, 125.
[33] Han, Z. J. A study of issues related to the compilation of the Da Nan Unified History [J]. *Chinese Historical Geography Series*, 2018, 33(3): 105–114.