A New Land Use Classification System Dataset Based on the Ecological-populated Residential-industrial Uses of China (2008)

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Abstract: The dataset presented in this paper is based on land functions and encompasses a classification of the spatial distribution of national ecological-populated residential-industrial land within China, including ecological, ecological-industrial, industrial-ecological, and populated residential-industrial land. The second level recognized based on dominant land use function and is subdivided into 15 categories, including ecological conservation, riparian zone protection, soil and water conservation, flood regulation, wind-breaking and sand-fixing, biodiversity conservation, and common ecological regulation in ecological lands, while pasture, timber, and aquaculture land use types are recognized in ecological-industrial lands, arable and orchard land use types are recognized in industrial-ecological lands, and urban built-up areas, populated residential in rural, and industrial land use types are recognized in populated residential-industrial lands. The third level recognized is based on land cover types. The dataset is archived in .tif data format with data size of 19.5 MB

Keywords: ecological-populated residential-industrial land; land classification; land function; ecological land

1 Introduction

The massive size of the Chinese population combined with a shortage of land resources, rapid industrialization, urbanization, and economic development have increasingly aggravated conflicts between various land use types of China[1–3]. Land use changes have led to a range of conflicts between arable land and forests and grassland[4–5], serve to highlight the multiple functions of land use within China, as well as the competition and conflicts between them; understanding these relationships is key to balancing the disparate functions and objectives of a particular land use type[6–7].

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The current land use classification published by the Chinese Ministry of Land and Resources is on the basis of their utilization purpose. At the same time, the "People's Republic of China Land Management Law" utilized three LAND USE categories, agricultural, construction, and unused land, as a basis for control and management. It is noteworthy that more emphasis is placed on the industrial and populated residential function of lands within the current LAND USE classification system, while insufficient attention is afforded to ecological roles[9–10]. This means that a considerable number of LAND USE types with important ecological functions are classified as unused resulting in the random adjustment of this category to others[12–13]. It is therefore urgent to develop a new land use classification system based on the role of ecological function and separately classify ecological land to co-ordinate the identification and development of industrial, populated residential, and ecological spaces.

2 Metadata of Dataset

The metadata of ecological-populated residential-industrial land classification in China dataset (EcoResInd_Landuse_China_1km_2008) are summarized in Table 1.

Table 1   Metadata summary of ecological-populated residential-industrial land classification dataset of China (2008)

Items	Description
Dataset full name	Dataset of a new land use classification system of China (2008), ecological-populated residential-industrial land use classification
Dataset short name	EcoResInd_Landuse_China_1km_2008
Authors	Zhang, H. Q. U-9331-2017, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, zhanghq@igsnrr.ac.cn Xu, E. Q. U-9329-2017, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, xueq@igsnrr.ac.cn Zhu, H. Y. U-9334-2017, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, zhuhy@igsnrr.ac.cn
Geographical region	China
Year	2008
Spatial resolution	1 km × 1 km
Data format	.tif
Data size	19.5 MB
Data files	The spatial distribution of ecological-populated residential-industrial land classification across China, as .tif files
Foundation(s)	National Natural Science Foundation of China (41601095, 41671097)
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 (data products), and publications (in this case, 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[5]

3 Methods

As the aim of this research is to document the multiple functions and main purpose of LAND USE, differences in socioeconomic development and productiveness, as well as in populated residential and ecological functions across different regions of China were synthesized. This enabled the identification and classification of land use functional areas in accordance with regional differences and the identification of national-scale ecological-populated residential-industrial lands. The main classification principles utilized were to initially highlight main land use function based on multi-functional considerations before emphasizing the importance of ecological land. This enabled focus to be placed on the spatially explicit locations of ecological-populated residential-industrial land.

3.1 Land Use Classification System

The ecological-populated residential-industrial land classification system is consisted of three levels[16] (Table 2).

Table 2   Table of the ecological-populated residential-industrial land classification system

First-level	Second-level		Third-level
Ecological land	Major ecological regulation land	Water conservation land	Forests, grasslands, wetlands, and glaciers
		Soil conservation land	Forests, grasslands, and wetlands
		Wind-breaking and sand-fixing land	Forests, grasslands, and wetlands
		Flood regulation land	Forests, grasslands, and wetlands
		Riparian zone protection land	Forests, grasslands, and wetlands
		Biodiversity conservation land	Forests, grasslands, wetlands, and glaciers
	Common ecological regulation land		Forests, grasslands, wetlands, and glaciers
	Ecological conservation land		Sandy, alkaline, barren, and desert land
			Alpine desert and tundra
Ecological-industrial land	Pasture land		Grassland
	Timber production land		Forest
	Aquaculture land		Water bodies
Industrial-ecological land	Arable land		Arable land
	Orchards		Forests
Populated residential-industrial land	Urban built-up areas		Urban built-up areas
	Land used for rural occupation		Land used for rural occupation
	Industrial land		Mining and industrial land

3.2 Data Collection and Processing

On the basis of classification principles and the system developed for this study, the strategy of first partition and second classification was applied to determine the spatial distribution of ecological-populated residential-industrial lands (Table 3).

Table 3   Proposed strategy for the re-zoning and re-classification of Chinese
ecological-populated residential-industrial land[16]

Land use type	Definition	Data sources
Water conservation land	Sources of major rivers and important areas of water	Ecological function zoning①, China's Natural Reserve Areas[17], Land use map
Soil conservation land	Key protection and administration of water and soil conservation	Ecological function zoning①, National Water and Soil Conservation Planning[18], Land use map
Wind-breaking and sand-fixing land	Sandstorm sources and key control regions	Ecological function zoning①, control project for the sandstorm source of Beijing and Tianjin②, Land use map
Flood regulation land	Lakes and wetland areas with the delinquent flood and peak adjustment function	Ecological function zoning①, Land use map
Riparian zone protection land	Riparian zone of major rivers within two kilometers	China's river distributions③, National Public Forest Division delineation④, Land use map
Biodiversity conservation land	Major national and provincial nature reserves	Ecological function zoning①, China's Natural Reserve Areas[17], WCMC Natural Reserve Areas⑤
Common ecological regulation land	Areas with ecological regulation as their major function with the exception of major ecological regulation lands	Land use map
Ecological conservation land	Unused lands except for the swamp in the conventional land classification system	Land use map
Pasture land	Scope of the semi-pasturing and pasturing counties (cities) except for the pasture forbidden regions	Chinese Livestock Yearbook 2012[19], ecological functional zones, LAND USE map
Timber land	Key development regions of the fast-growing and high-yield timber forest	Fast-growing and high-yield timber forest project[20], Land use map
Aquaculture land	Water bodies in key fisheries counties (cities) except of the wetlands	China Fishery Yearbook 2012[21], Land use map
Arable land	Arable land in the Land use map	Land use map
Orchards	Orchards of fruit, tea, and mulberry	Vegetation Map of People's Republic of China[22], Land use map
Industrial land	Factories, industrial zones, oil, salt, quarries and other LAND USE types, as well as traffic, airports, and the special distribution of Land use	Land use map
Urban built-up area	Urban built-up area in the Land use map	Land use map
Rural populated residential land	Rural populated residential land in the Land use map	Land use map

(1) The production of major ecological regulation land. The spatial distribution of six land

① Ministry of Environmental Protection of P. R. China, Chinese Academy of Sciences. National Ecological Function Zone. 2008.
② State Forestry Administration of P. R. China. National Sandification Control Program (2011-2020). 2013.
③ Vector map of river system at scale of one: four million in China provided by Data Center for Resources and Environmental Sciences, Chinese Academy of Sciences.
④ State Forestry Administration of P. R. China, Ministry of Finance of P. R. China. National Public Forest Division delineation. 2009.
⑤ WCMC Natural Reserve Areas (http: //protectedplanet.net/).

classes was based on the distribution of key functional areas as defined by Ecological Function Zoning, the divided area of the National Forest Zoning, the distribution of control projects for the sandstorm source of Beijing and Tianjin, the distribution of Chinese Nature Reserve Zones, and nature reserves within the WCMC Reserve system.

(2) The production of land used for pasture, timber, aquaculture, and orchards. The relative extent of land used for pastures was extracted based on the distribution of grasslands within semi-pastured and pastured counties (cities), while timber production land coverage was based on the extent of forests within the context of fast-growing and high-yield timber forestry project developed by the base construction program (Chinese Academy of Forestry, Chinese Academy of Surveying and Mapping 2005). Similarly, the extent of land used for aquaculture was extracted based on the distribution of water bodies in key fisheries counties (cities), while coverage of orchards was delineated based on the distribution of this land use type in the 1∶1 million vegetation map of China. Areas extracted using these approaches were then overlaid with major ecological land regulations; these overlaid areas were then classified as different kinds of ecological land according to functional conservation priorities.

(3) The extent of forests, grasslands, wetlands, and glaciers were extracted using LAND USE maps. Thus, as lands were subtracted from (1) and (2), remaining areas comprised common ecological regulation land; land use, including sandy, alkaline, barren, desert, alpine desert lands and tundra, were therefore extracted from maps and classified within the ecological conservation category.

(4) Arable, industrial, urban built-up, and rural populated residential land were extracted directly from LAND USE maps for use in this study. On the basis of the corresponding relationship between the ecological-populated residential-industrial land classification system (Table 2) and LAND USE maps, these areas were re-classified in terms of their functions.

A Land use map therefore forms the basis of the ecological-populated residential-industrial land classification presented in this report, including six first-level classes and 25 second-level classes[23–24]. The first-level classes used within this classification include arable, forested, and grassland, as well as water bodies, urban, rural, industrial and mining, and unused land. Swamps were included in this study within the unused land and water body category as a form of wetland based on their ecological function.

4 Results

4.1 Data Products

A visualized map based on the ecological-populated residential-industrial land classification dataset for China at a spatial resolution of one kilometer (EcoResInd_Landuse _China_1km_2008.rar, 1,762.18 KB) is shown in Figure 1. This map demonstrates that the areas of ecological, ecological-industrial, industrial-ecological, and populated residential-industrial land comprise 603.70 thousand km^2, 13,538,000 km^2, 20,019,000 km^2, and 2,073,000 km^2, respectively, accounting for 62.89%, 14.10%, 20.85%, and 2.16% of the total national area, respectively. The largest proportion of ecological land area performs support and regulation functions, while the proportion of populated residential-industrial land,

the most important kind for human space activities, is the smallest. At the same time, the area of ecological conservation land is the largest from the perspective of second-level classification and accounts for 20.17% of the total national area, while the proportions of arable and common ecological regulation land ranked second and third, comprising 18.76% and 17.87% of the total national area, respectively. Finally, the visualized map shows that areas of flood regulation, aquaculture, and industrial land are the smallest, comprising just 0.25%.

The ecological-populated residential-industrial land map of China (Figure 1) shows that large areas of industrial-populated residential lands are concentrated in eastern China, traditional industrial and agricultural production regions with the highly dense human activities. These areas include dominant production and populated residential functions within China.

5 Discussion and Conclusion

The dataset emphasizes land use functions and was used as a basis for the construction of an ecological-populated residential-industrial land classification system, the development of a strategy to extract various land use types, and the spatial distribution of ecological-populated residential-industrial lands across China. The results of this analysis show that the areas of ecological, ecological-industrial, industrial-ecological, and populated residential-industrial land encompass 6,037,000 km^2, 1,353,800 km^2, 2,001,900 km^2 and 207,300 km^2, respectively, accounting for 62.89%, 14.10%, 20.85%, and 2.16% of the total area of the country, respectively. The ecological-populated residential-industrial land classification system and map presented in this report provide basic data and support underlying land use planning and will stimulate additional studies in this area in the future.
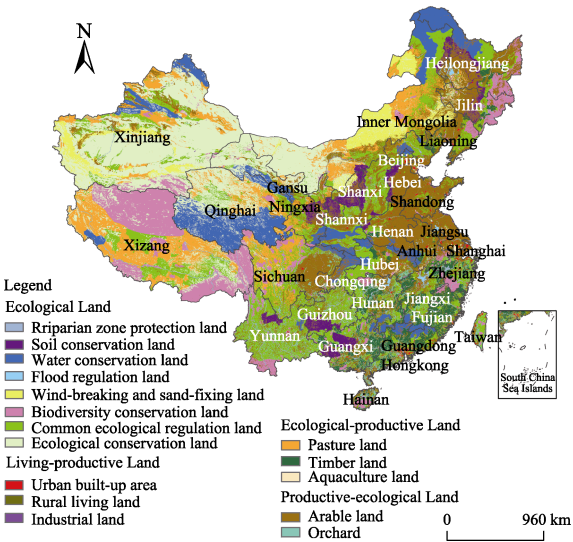

Figure 1   The ecological-populated residential-industrial land map of China[16]

Author contributions

Zhang, H. Q., Xu, E. Q., and Zhu, H. Y. designed the dataset algorithms, while Xu, E. Q. contributed to data processing and analysis, Zhu, H. Y. performed data validation, and Zhang, H. Q. wrote this paper.

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