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DATA PAPER

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Biodiversity dataset of vascular plants and birds in Chinese urban greenspace

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Abstract

Urban greenspace plays an important role in buffering the threat of urbanization to biodiversity. Biodiversity research in urban greenspace is essential for understanding the impacts of human activities on biodiversity and the associated ecosystem functioning and services in urban ecosystems. However, we lack large-scale biodiversity datasets in urban greenspace for macroecological studies. In this paper, we provided a comprehensive biodiversity dataset of vascular plant and bird species in 286 university campuses and 118 urban parks in 143 cities in China, covering a wide range with different levels of urbanization (20–50°N in latitude and 81–130°E in longitude). Plant species were classified into different growth forms, and bird species were identified as resident or migrant. In total, the dataset contains 46,558 occurrence records for 5,915 plant species (about 18% of all Chinese vascular plant species) and 6,423 records for 546 bird species (around 40% of all recorded bird species in China). This dataset provides an important data source for evaluating the anthropogenic effects of biodiversity changes and advancing urban ecology. The complete data set for this abstract published in the Data Paper section of the journal is available in electronic format in MetaCat in JaLTER at http://db.cger.nies.go.jp/JaLTER/metacat/metacat/ERDP-2021-02.1/jalter-en.

KEYWORDS
biodiversity conservation, biotic homogenization, human activities, urban biodiversity, urban greenspace

1 | INTRODUCTION

Biodiversity and its associated ecosystem functioning and services are experiencing unprecedented threat by the significant increasing urbanization through habitat destruction, degradation, and fragmentation (Nilon et al., 2017). As urbanization continues to expand, the efforts directed toward the trade-offs between loss of wildlife habitats and human activities for economic development should be critical (Filazzola et al., 2019). Urban greenspace includes all natural, semi-natural, and artificial ecosystems within and around urban areas (Cilliers et al., 2013), and supports high concentrations of plant and bird species. Thus, urban greenspace plays an important role to offset the threat of urbanization in

biodiversity, and provides a range of benefits to humans and biodiversity conservation (Aronson et al., 2017).

Biodiversity data in urban greenspace is essential to improve our knowledge of species resources, anthropogenic impacts on biodiversity, and the importance of urban ecosystems for biodiversity conservation. As one of the mega-diverse countries in the world, China harbors over 35,000 higher plant species and 1,300 bird species (Wang et al., 2015; Zheng et al., 2011). In recent decades, increasing efforts and financial investment have enabled the development of several national-level biodiversity databasing platforms, such as the Chinese National Specimen Information Infrastructure (NSII, 2021) and Chinese Field Herbarium (CFH, 2021). Although these biodiversity data cover a large extent of China's land surface, we lack a comprehensive dataset in urban biodiversity in China. Furthermore, since biodiversity-related data in urban greenspace in China were mainly documented in Chinese, there is an urgent need to break language barriers by sharing the data worldwide, which could serve as the base data for comparative studies across regions (Amano et al., 2016; Konno et al., 2020).

This data paper aims to provide a wide range of biodiversity data in urban greenspace in China. Plants and birds, as the most studied taxa in urban ecosystems, are included in our dataset. Overall, 5,915 plant species, accounting for more than 18% of all Chinese vascular plant species, were documented in 254 campuses, and 546 bird species, containing more than 40% of all Chinese bird species, were recorded in 53 campuses and 118 urban parks. These data could shed insights into the anthropogenic effects on biodiversity distributions,

TABLE 1 Dataset owners and contact persons

Owners and contact individuals (contact individuals are marked with *)	Affiliation	Contact	
		Address	Email address
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biotic homogenization effect on species composition, the influences of nonnative species to local biodiversity, species' adaptation and evolution across space and time (Qian et al., 2016; van Kleunen et al., 2018; Wang et al., 2021; Zorzal et al., 2020).

2 | DATA DESCRIPTION

2.1 | Identifier

ERDP-2021-02.

2.2 | Contributor

Dataset owners and contact persons are shown in Table 1.

2.3 | Project

2.3.1 | Title

Zijiang Excellent Scholar Award Program.

2.3.2 | Personnel

Jian Zhang.

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2.3.3 | Funding

East China Normal University.

2.4 | Geographic coverage

81.29°E–129.63°E

19.99°N–49.61°N

Geographic coordinate system is WGS84.

2.5 | Taxonomic coverage

The dataset includes 5,915 vascular plant species and 546 bird species (see Plant_List.csv and Bird_List.csv for details).

2.6 | Methods

2.6.1 | Biodiversity data collection

For plant data, the literature search was conducted using China National Knowledge Infrastructure (CNKI, 2021) with the following search terms in Chinese: "University" or "Campus" or "College" and "plant" ("大学" or "校园" or "学院" and "植物"). We also collected data from published books, online databases, and research reports which contain campus plant list. Finally, 120 papers, 34 published books, 3 eBooks, 37 online databases, and 18 research reports were screened out, including plant list data in 254 university campuses. For bird occurrence data, we used Baidu Xueshu (Baidu, 2021) to search for papers published about bird diversity in university campuses and urban parks, and 59 published papers were selected. Our own bird survey data in 15 parks within three cities in Inner Mongolia (Hohhot, Baotou, and Ordos) were also included. Finally, bird list data covered 53 university campuses and 118 urban parks.

2.6.2 | Environmental variables collection

The geographic coordinates, area and established years of university campuses and urban parks were extracted from the relevant primary data sources. If the geographic coordinates were missing in some literature, we extracted them from Google Earth (Google, 2021) by using the names of university campuses and urban parks. We also searched the area and established year from official homepages of university campuses and urban parks as a supplement of the primary data source. The rest missing area information was calculated based on urban park and campus area boundaries on Google Earth. Elevations were extracted from EarthEnv-DEM90 at 90-m spatial resolution (Robinson et al., 2014). Mean annual temperature and mean annual precipitation were extracted from WorldClim version 2 at l-km spatial resolution (Fick & Hijmans, 2017). The established year information for several parks was missing, and it was represented by "NA" in the dataset.

2.6.3 | Taxonomy

To standardize the taxonomic names of plants, we followed The Plant List v1.1 (TPL, 2013) to search for the currently accepted names and synonyms. iPlant's The Taxonomic Name Resolution Service (http://tnrs.iplantcollaborative.org/) and Flora Reipublicae Popularis Sinicae (http://frps.iplant.cn/) were also used to validate

when species cannot be found in The Plant List. Data were collected at specie-level and records with genus- or family-level were excluded. As a result, 46,558 occurrences records of plant were compiled. To validate the taxonomic names of birds, we referred to the data from *a checklist on the classification and distribution of the birds of China* (Zheng et al., 2011) and from a paper about global diversity of birds (Jetz et al., 2012). In total, we compiled 6,423 occurrences records for birds. The growth forms of plant species were classified into trees, shrubs, and herbs based on the descriptions in the Flora of China and relevant literature. Bryophytes and aquatic plants were excluded in this dataset. Among them, 19,017 records contained 1,819 tree species, 9,236 records included 1,156 shrub species, and 18,305 records were about 2,941 herb species.

To group the plant species into native and non-native species at regional level, we divided China into seven geographic regions, including eastern, southern, northern, central, northeastern, southwestern, and northwestern China. These regions represent different climatic zones in China to a certain extent (Zhu et al., 2019). If species occurred in a region naturally, they were defined as native species in this region. Likewise, species that occurred beyond their native distribution ranges were classified as non-native species in this region (Avolio et al., 2020; Padullés Cubino et al., 2019). The nativeness status of plant species in a region was identified according to the Flora of China (http://foc.iplant.cn/), the Database of Invasive Alien Species in China (http://www.chinaias.cn), and the catalogue of cultivate plants in China (Lin 2018). Finally, 26,267 records of native plants and 20,291 records of non-native plants were aggregated.

Migrant status of birds was grouped into "resident" (documented as "R" in the dataset) or "migrant" (documented as "M" in the dataset) according to the descriptions of published papers. If the migrant status of a species cannot be classified, we reported it as "NA" in the dataset. Lastly, 1,036 resident bird records in campuses and 2,030 resident bird records in urban parks were documented. Bird survey time of university campuses and urban parks were extracted from the relevant primary data sources, and a total of 145 university campuses and urban parks cover the whole-year bird survey.

2.6.4 | Data verification procedures

Data quality control

All data were digitized by extracting biodiversity information from original sources into the Excel spreadsheet. Before adding into the dataset, the survey methods of original literature were evaluated. Specifically, we excluded literature with sample surveys, only the literature with survey area covering the whole campus or parks was considered. To ensure the integrity of compiled data, we calculated species richness of each locality from compiled data, and compared it with the reported richness of the original literature. All species scientific names were carefully checked for typing errors and misspellings.

Taxonomic and status validation

The species names were standardized as described in the Methods section to ensure the identification validity based on the consistent standard. After having validated the taxonomic names, the species list was checked to avoid that synonym representing the same species appearing one locality.

Geographic location and variables validation

In order to improve the accuracy of the location, we deduced the descriptive position backward from longitude and latitude and compared it with the location name given in the original literature. In case of mismatch, the coordinates were double-checked. For the variables, we sorted the spreadsheet to identify extreme values of each variable, and double-checked them.

TABLE 2 File name and description of the data

Data file name	Description
Plant_List.csv	Species information table of plants, containing the species scientific names, the names of university campuses where are located, taxon rank, plant growth forms ("tree," "shrub," and "herb"), nativeness status ("native" or "non-native"), and data sources
Bird_List.csv	Species information table of birds, including species scientific names, names of campuses or parks where are located, taxon rank, bird migrant status ("resident" or 'migrant'), bird survey time, and data sources
Locality_Infor.csv	Locality information table of all campuses and parks, including the numeric identity, province and city where the locality is located, geographic coordinates, elevation, mean annual temperature, mean annual precipitation, area and established year
Source_List.csv	The primary data sources for plant list and bird list data, including paper, book, eBook, research report, online database, and survey data

TABLE 3 The variable definition of each data file

Data file name	Variable name	Variable definition
Locality_Infor	LocationID	Numeric identity of each campus or urban park
	Region	The geographic region of the campuses or urban parks located
	Province	The province of the campuses or urban parks located
	City	The city of the campuses or urban parks located
	Locality	The name of university campuses or urban parks
	Locality_Type	The type of locality: University campuses or urban parks
	Elevation (m)	The elevation of the campuses or urban parks
	decimalLatitude	The latitude of the campuses or urban parks
	decimalLongitude	The longitude of the campuses or urban parks
	MAT (°C)	Mean annual temperature
	MAP (mm)	Mean annual precipitation
	Area (ha)	The area of campuses or urban parks
	EstablishedYear	The established year of campuses or urban parks
Plant_List	LocationID	Numeric identity of each campus
	Locality	The name of the campuses
	ScientificName	Species scientific name
	Family	The family to which the plant species belongs
	Genus	The genus to which the plant species belongs
	SpecificEpithet	Epithet of the plant species
	TaxonRank	Taxon rank of plant species, including species, subspecies, varietas, cultival, forma, and hybridized
	GrowthForm	Plant growth forms, including trees, shrubs, and herbs
	Plant_NativenessStatus	The nativeness status of one species in a region, including native and non-native
	SourceID	Numeric identify of primary data sources
Bird_List	LocationID	Numeric identifier of each campus or urban park
	Locality	The name of the campuses or urban parks
	ScientificName	Species scientific name
	Family	The family to which the bird species belongs
	Genus	The genus to which the bird species belongs
	SpecificEpithet	Epithet of the bird species
	TaxonRank	Taxon rank of bird species
	Bird_MigrantStatus	The migrant attribute, including resident, migrant, and NA. NA means missing information
	Bird_SurveyTime	The survey time, including the whole year, one or several seasons
	SourceID	Numeric identify of primary data sources
Source_List	SourceID	Numeric identifier of primary data sources
	Source	Primary data sources for plant and bird list data
	SourceType	Types of primary data sources, including paper, book, eBook, research reports, online database, and survey data
	Source_CN	Primary data sources for plant and bird list data in Chinese

2.7 | Data structure

2.7.1 | Data files

Data files are shown in Table 2.

2.7.2 | File format

The data were comma-delimited in UTF-8 encoding.

2.7.3 | Header information

Headers corresponding to variable names (see next section) are included as first row in the data files.

2.7.4 | Variable definitions

The variables are listed in the order they appear in each data file (Table 3). Variable names are headers included

as first row in the data files (13 columns for campus and urban park information, 10 columns for plant list file, 10 columns for bird list file, and 4 columns for source list file). "NA" is the code for missing values for all variables.

2.8 | Accessibility

2.8.1 | License

2.8.2 | Location of storage

http://db.cger.nies.go.jp/JaLTER/metacat/metacat/ERDP-2021-02.1/jalter-en

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REFERENCES

Amano, T., Gonzalez-Varo, J. P., & Sutherland, W. J. (2016). Languages are still a major barrier to global science. *PLoS Biology*, *14*, e2000933. https://doi.org/10.1371/journal.pbio.2000933

Aronson, M. F., Lepczyk, C. A., Evans, K. L., Goddard, M. A., Lerman, S. B., MacIvor, J. S., & Vargo, T. (2017). Biodiversity in the city: Key challenges for urban green space management. *Frontiers in Ecology & the Environment*, *15*, 189–196. https://doi.org/10.1002/fee.1480

Avolio, M., Pataki, D. E., Jenerette, G. D., Pincetl, S., Clarke, L. W., Cavender-Bares, J., & Trammell, T. L. (2020). Urban plant diversity in Los Angeles, California: Species and functional type turnover in cultivated landscapes. *Plants People Planet*, *2*, 144–156. https://doi.org/10.1002/ppp3.10067

Baidu (2021). Baidu Xueshu. https://xueshu.baidu.com/

CFH. (2021). Chinese field herbarium. Retrieved from https://www.cfh.ac.cn

CNKI. (2021). China national knowledge infrastructure. http://cnki.net

Cilliers, S., Cilliers, J., Lubbe, R., & Siebert, S. (2013). Ecosystem services of urban green spaces in African countries-perspectives and challenges. *Urban Ecosystem*, *16*, 681–702. https://doi.org/10.1007/s11252-012-0254-3

Fick, S. E., & Hijmans, R. J. (2017). WorldClim 2: New 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology*, *37*, 4302–4315. https://doi.org/10.1002/joc.5086

Filazzola, A., Shrestha, N., & MacIvor, J. S. (2019). The contribution of constructed green infrastructure to urban biodiversity: A synthesis and meta-analysis. *Journal of Applied Ecology*, *56*, 2131–2214. https://doi.org/10.1111/1365-2664.13475

Google. (2021). Google Earth. https://www.google.com/earth

Jetz, W., Thomas, G. H., Joy, J. B., Hartmann, K., & Mooers, A. O. (2012). The global diversity of birds in space and time. *Nature*, *491*, 444–448. https://doi.org/10.1038/nature11631

Konno, K., Akasaka, M., Koshida, C., Katayama, N., Osada, N., Spake, R., & Amano, T. (2020). Ignoring non-English-language studies may bias ecological meta-analyses. *Ecology and Evolution*, *10*, 6373–6384. https://doi.org/10.1002/ece3.6368

Lin, Q. W. (2018). *Catalogue of cultivate plants in China*. Science Press (in Chinese).

NSII. (2021). China National Specimen Information Infrastructure. http://www.nsii.org.cn

Nilon, C. H., Aronson, M. F. J., Cilliers, S. S., Cynnamon, D., Frazee, L. J., & Goddard, M. A. (2017). Planning for the future of urban biodiversity: A global review of city-scale initiatives. *Bioscience*, *67*, 332–342. https://doi.org/10.1093/biosci/bix012

Padullés Cubino, J., Cavender-Bares, J., Hobbie, S. E., Hall, S. J., Trammell, T. L., Neill, C., & Groffman, P. M. (2019). Contribution of non-native plants to the phylogenetic homogenization of US yard floras. *Ecosphere*, *10*, e02638. https://doi.org/10.1002/ecs2.2638

Qian, S., Qi, M., Huang, L., Zhao, L., Lin, D., & Yang, Y. (2016). Biotic homogenization of China's urban greening: A meta-analysis on woody species. *Urban Forestry & Urban Greening*, *18*, 25–33. https://doi.org/10.1016/j.ufug.2016.05.002

Robinson, N., Regetz, J., & Guralnick, R. P. (2014). EarthEnv-DEM90: A nearly-global, void-free, multi-scale smoothed, 90m digital elevation model from fused ASTER and SRTM data. *ISPRS Journal of Photogrammetry and Remote Sensing*, *87*, 57–67. https://doi.org/10.1016/j.isprsjprs.2013.11.002

TPL. (2013). The plant list version 1.1. http://www.theplantlist.org

van Kleunen, M., Bossdorf, O., & Dawson, W. (2018). The ecology and evolution of alien plants. *Annual Review of Ecology, Evolution, and Systematics*, *49*, 25–47. https://doi.org/10.1146/annurev-ecolsys-110617-062654

Wang, L. S., Jia, Y., Zhang, X. C., & Qin, H. (2015). Overview of higher plant diversity in China. *Biodiversity Science*, *23*, 217–224 (In Chinese).

Wang, X., Svenning, J. C., Liu, J. J., Zhao, Z. C., Zhang, Z. C., Feng, G., Si, X. F., & Zhang, J. (2021). Regional effects of plant diversity and biotic homogenization in urban greenspace – The case of university campuses across China. *Urban Forestry & Urban Greening*, *62*, 127170.

Zheng, G. M., Zhang, Z. W., Ding, P., Ding, C. Q., Lu, X., & Zhang, Y. Y. (2011). *A checklist on the classification and distribution of the birds of China* (2nd ed.). Science Press (in Chinese).

Zhu, Z. X., Roeder, M., Xie, J., Nizamani, M. M., Ross Friedman, C., & Wang, H. F. (2019). Plant taxonomic richness and phylogenetic diversity across different cities in China. *Urban Forestry & Urban Greening*, *39*, 55–66. https://doi.org/10.1016/j.ufug.2019.02.004

Zorzal, R. R., Diniz, P., de Oliveira, R., & Duca, C. (2020). Drivers of avian diversity in urban greenspaces in the Atlantic Forest. *Urban Forestry & Urban Greening*, *126908*, 126908. https://doi.org/10.1016/j.ufug.2020.126908

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