

Data Publishing Associated with Graduate Thesis: A Case Study in Geography

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Abstract: The innovative dataset associated with graduate theses represent an important, outcome of graduate research. These datasets are closely linked to the theses and serve as mutually corroborating scientific evidence. In 2025, China had 4.3 million enrolled graduate students, with 1.4 million admissions and 1.2 million graduates. This implies that over one million theses were produced nationwide in 2025. Currently, most institutions in China lack clear regulations on the publication and aggregation of scientific data linked to graduate theses, resulting in dispersal and loss of these valuable datasets. In particular, geography is a dataset-intensive field that contains rich scientific value within its thesis data; however, traditional closed-models limit data publication and sharing. This paper focuses on the current status of publishing original data from geography graduate theses under the framework of open science, analyzes the main challenges, and proposes conceptual, policy, and practical solutions for the field. The paper also outlines future trends in publishing graduate thesis data and calls for the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, to lead pilot initiatives and explore management methods and implementation strategies for publishing original data associated with master's and doctoral theses.

Keywords: graduate theses; original data; data publication; geography; data management

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1 Introduction

As the highest level of higher education in China, graduate education plays a crucial role in both scientific research and talent development. Graduate theses reflect students' research abilities and the quality of their training, often resulting in highly-valuable scientific outputs in the form of peer-reviewed research publications. As a result, the theses and their associated original scientific data hold significant scientific value^[1]. According to the Statistical bulletin on national economic and social development of China, 2025^[2], China had 4.3 million graduate students enrolled in 2025, with 1.438 million admissions and 1.167 million graduates. This suggests that more than one million theses were produced nationwide in 2025, with the ratio of master's to doctoral theses approximately 4:1, implying

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roughly 800,000 master's theses and 200,000 doctoral theses. The data embedded in these theses represent valuable scientific resources that should not be overlooked, whether for the graduate students themselves, the academic community, or national data resource management.

Scientific datasets are essential not only for technological progress and innovation but also for decision-making in socio-economic development^[3]. With advances in information technology, the demand for datasets have grown, and scientific data sharing has become an increasingly important issue. Internationally, the establishment of numerous institutions and the introduction of policies have emphasized the importance of data sharing. Since the International Geophysical Year (IGY) established the World Data Center in 1957^[4,5], subsequent milestones include the establishment of the International DOI Foundation (IDF) and the DOI system by the Association of American Publishers (AAP) in 1998^[6,7]; the OECD's Declaration on open access to research data from public funding in 2004^[8] and OECD Principles and guidelines for access to research data from public funding^[9]; the founding of "Earth System Science Data" in 2009, which centers on published data papers as its core content^[10]; and UNESCO's Policy guidelines for the development and promotion of open access in 2012^[11]. Currently, UNESCO operates the Global Open Access Portal, monitoring open access to scientific information in 158 countries^[12].

Domestically, since Chinese Academy of Sciences academician Sun Shu and colleagues first emphasized the importance of data sharing in 1994^[13], China has spent more than 20 years addressing the issue^[14]. Following the 196th Xiangshan Conference in 2002, China launched a plan for building scientific data sharing platforms in 2003. Key policies include the National science and technology infrastructure construction outline (2004–2010)^[15] and the Measures for the administration of scientific data in 2018^[16], which define that data sharing should follow the principle of "open by default, closed by exception". Article 22 further emphasizes: "Relevant authorities and legal entities should actively promote the publication and dissemination of scientific data, supporting researchers in organizing and publishing data with clear ownership, completeness, accuracy, and high sharing value". The publication of original data associated with graduate theses should be incorporated into the data management system according to these measures.

2 The Nature of Original Data Associated with Graduate Theses

Original data associated with graduate theses refer to data generated by graduate students during thesis preparation through intellectual labor, including collection, organization, computation, and analysis. These datasets represent important academic achievements resulting from graduate research and are valuable scientific resources for the broader research community. A successful thesis generally contains significant scientific findings sufficient to meet the requirements for degree conferral. The original data associated with a thesis typically include both the original datasets supporting the scientific discoveries and data papers that describe and validate these datasets. In other words, a successful thesis outcome comprises 3 components: a unique scientific discovery, an original dataset supporting the discovery, and a data paper demonstrating the dataset's reliability, credibility, and reproducibility.

Since these data constitute a valuable research resource, their publication is essential for ensuring data security, protecting ownership rights, maintaining quality standards, complying with ethical standards, and facilitating data sharing. Furthermore, publishing and sharing original thesis data can enhance the visibility and impact of both the data authors and the affiliated institutions, promoting collaboration and academic exchange in related fields.

This aligns with Article 22 of the Measures for the administration of scientific data^[16].

Effectively managing original data generated in graduate theses and incorporating them into the scientific data sharing system has become an urgent issue in academic governance. However, publishing thesis-related original data is a relatively new concept, and most graduate students have limited understanding of it. To address this, this paper conducted a survey on graduate students' attitudes and preferences regarding data publication. Based on this survey, we analyze the current status and role of original thesis data and propose strategies for its publication, aiming to optimize the allocation and sharing of substantial research resources in universities, accelerate scientific innovation and discovery, and foster a sense of historical responsibility among graduate students in the era of big data.

3 Survey on Graduate Students' Engagement with Data Publication

The main purpose of this survey was to understand graduate students' awareness, attitudes, practices, and recommendation regarding data publication, thereby providing a reference for optimizing data publication strategies. The study employed a mixed-methods approach combining questionnaire surveys, in-depth interviews, and data analysis. Participants were graduate students enrolled in geography-related programs at 26 universities and research institutes with strong disciplinary reputations in geography across China. A total of 138 valid questionnaire responses were collected, including 48 doctoral students (34.78%), 88 master's students (63.77%), and 2 undergraduates from research institutes, Project 985/211 universities and other universities (Figure 1a). The students' majors mainly covered cartography and geographic information systems, human geography, physical geography, ecology and resources and environment sciences. Among them, only 10 students (7.25%) had completed their thesis defense, whereas 92.75% had not yet done (Figure 1b). All participating graduate students used different types of data to varying extents during their thesis research, primarily statistical data, followed by remote sensing data, with field survey, experimental, and site observation data used to a similar degree (Figure 1c).

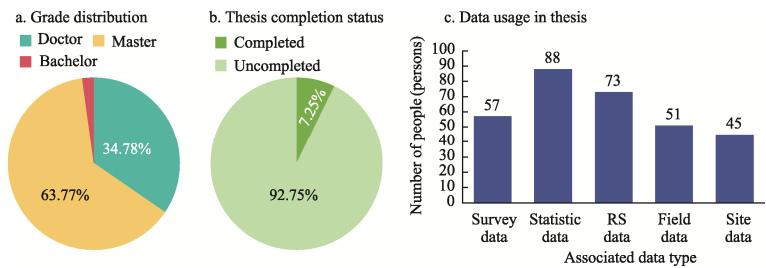


Figure 1 Basic characteristics of the survey sample

3.1 Graduate Students' Awareness and Attitudes Toward Data Publication

Graduate students generally recognize the importance of publishing original thesis data and acknowledge its value for academic dissemination and research (Figures 2a, 2b). However, as Figure 2c shows, due to limited promotion and understanding of this field, students' awareness of thesis-related data publication remains relatively vague. Nevertheless, their overall attitudes toward publication are positive: 48.55% support it, 45.65% remain neutral, and only 5.80% oppose it (Figure 2d).

Regarding willingness to share and publish data, 78.26% and 76.81% of students expressed willingness to share and publish their thesis data, respectively (Figures 2e, 2f), far

exceeding the proportions unwilling to share (21.74%) or publish (23.19%). Table 1 shows that students believe publishing thesis data offers opportunities for further academic interaction and cooperation, avoidance of duplicate work, and expansion of research impact. These benefits are the main motivations for their willingness to share and publish. Analysis of students opposing data publication indicates that their concerns mainly involve doubts about reliability, confidentiality of data, lack of systematic organization of the data, and fear of plagiarism.

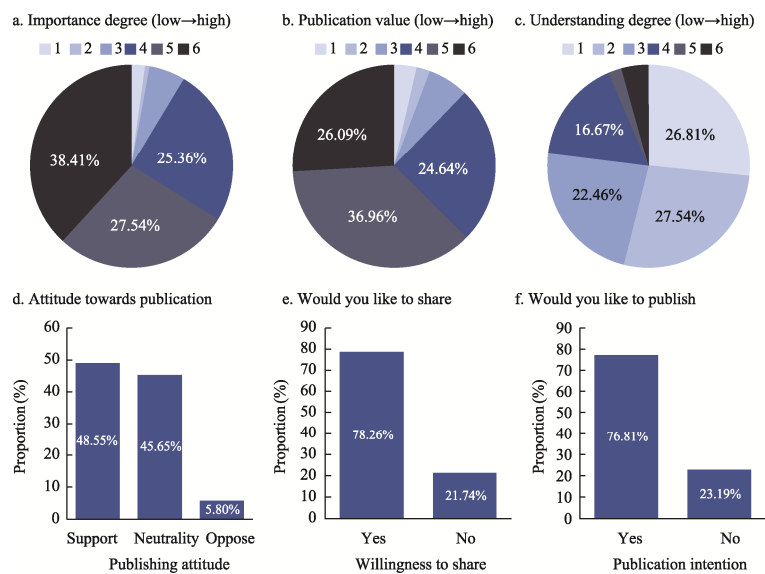


Figure 2 Graduate students' awareness and attitudes toward data publication

Table 1 Expected benefits from publishing original thesis data

Expected benefits	Number of students (persons)	Proportion (%)
Academic interaction and cooperation	108	78.26
Avoidance of duplicate work	105	76.09
Expansion of research impact	85	61.59
Academic reputation enhancement	52	37.68
Financial support	43	31.16
Others	1	0.72

3.2 Current Status of Graduate Students' Data Publication

In contrast to graduate students' generally positive attitudes toward the publication of thesis data, the results show that over 97% of students had never participated in publishing thesis data (Figure 3a), and more than 70% were unfamiliar with existing data sharing policies and platforms (Figure 3b). This indicates that, at present, practical engagement with thesis-related data publication is almost nonexistent. Students identified issues such as copyright, data quality, data privacy, and platform usability (Table 2) as challenges that need urgent resolution. Additionally, academic policy requirements, supervisor's opinion, academic morality, peer pressure, and personal interest (Table 3) are potential factors affecting students' decisions to share and publish data.

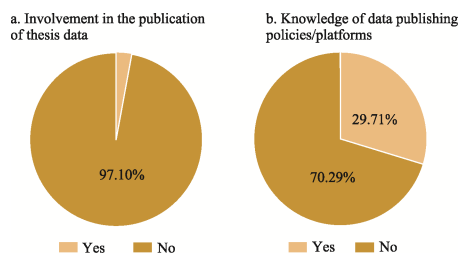


Figure 3 Current status of degree thesis data publication

Table 2 Possible challenges in data publication

Challenges	Number of students (persons)	Proportion (%)
Copyright issues	122	88.41
Data quality control	114	82.61
Privacy and security	110	79.71
Platform usability	75	54.35
Others	1	0.72

Table 3 Factors influencing decisions on data sharing and publication

Factors	Number of students (persons)	Proportion (%)
Academic policy requirements	97	70.29
Supervisor’s opinion	89	64.49
Peer pressure	61	44.20
Academic morality	57	41.30
Personal interest	49	35.51
Others	3	2.17

4 Key Issues Regarding the Publication of Graduate Thesis-Associated Original Data

4.1 Intellectual Property and Data Security

Intellectual property rights and data security are among the primary concerns for graduate students regarding the publication of thesis-associated original data. Currently, universities and research institutions train a large number of graduate students who contribute significantly to China’s scientific development. Compared with other research papers, the data generated in graduate theses possess greater theoretical and practical value and are closely linked to China’s current stage of development. If such data are published without proper management or oversight, copyright disputes or unauthorized use may arise, thereby threatening data security across various research fields.

Most graduate students participate in research projects led or co-led by their supervisors, and their theses often constitute parts of these projects. Although the scientific findings in a thesis are independently produced by the student, data collection and processing are usually conducted under the guidance of supervisors or project leaders, and many datasets are generated collaboratively. Therefore, the handling of intellectual property for datasets produced by individual students versus project teams is a key concern for graduate students when publishing thesis-associated original data.

4.2 Data Publication Platforms

Data publication involves providing datasets with clear ownership, security, reliability, and ethical compliance to society, enabling discoverability, accessibility, verification, evaluation, and reuse^[17,18]. A central concern for students is determining the appropriate platform for data submission. Unlike traditional research papers, data publication includes both the publication of physical datasets and the associated knowledge, often in the form of data papers. The primary issue for authors and users is the availability of digital platforms for publishing datasets.

Currently, datasets can be published through 2 main routes based on the issuing institution. The first is submission to data centers, which assign unique and permanent identifiers (e.g., DOI, CSTR). Data centers include institutional repositories and journal-based repositories. Institutional repositories encompass national government data centers (e.g., data.gov, NASA data centers, China Science and Technology Resource Sharing Network covering 20 national scientific data centers), discipline-specific centers (e.g., World Data System, wwPDB), and some public repositories providing data storage and publication services. Journal-based repositories require authors to submit datasets associated with papers to designated journal-recognized platforms, such as Nature, Science, PLoS, ESSD, GigaScience, and Scientific Data. Publishers such as China Scientific Data require authors to store associated datasets in designated repositories (e.g., Figshare, Dryad) prior to article publication, citing the data in the paper^[19], ensuring linkage between the article and the dataset^[20].

The second route is direct data publication. The *Journal of Global Change Data & Discovery*^[21,22] and the *Digital Journal of Global Change Data Repository*^[23], co-hosted by the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR, CAS), and the Geographical Society of China, treat datasets and data papers as independently published but linked outputs. Unlike supplementary materials, they are independent, peer-reviewed knowledge units, following a formal publication process that includes peer review, ensuring security, ownership, quality, ethics, format, and standard compliance.

Data publication platforms play a critical role in data quality control, which remains a key challenge in the publication of graduate thesis-associated data. Platform construction affects publication workflows, storage efficiency, preservation accuracy, and usability, and is essential for establishing mechanisms and promoting data publication. Data quality control impacts the acceptance and willingness of research communities to use published data. Internationally, numerous repositories have been established to store and share data, including Figshare^[24], Dryad^[25], BMC^[26], Springer-Nature-approved repositories^[27], Elsevier-approved repositories^[28], China Data Bank^[29], National Scientific Data Center of China^[30], World Data Center^[31], and institutional databases. Authors submitting datasets generally follow corresponding data and metadata submission guidelines^[32]. Such repositories can be considered as pre-publication platforms, where stored datasets can serve as supplementary materials for scholarly articles.

According to the 2024 revised Regulations on the administration of publication, electronic publications must be issued by registered publishing entities (Chapter 2, Article 9), which are required to obtain official approval, publishing license, and business registration (Chapter 2, Article 15). Publishing entities are responsible for editorial accountability (Chapter 3, Article 24). Accordingly, data storage and data publication are distinct activities, and datasets stored in centers lacking formal publishing qualifications cannot be considered formally published—they should be considered “pre-publication” data.

With approval from the National Press and Publication Administration, The *Journal of*

Global Change Data & Discovery and the *Digital Journal of Global Change Data Repository* were officially launched in 2017 and 2020, respectively. The two journals are currently the only pair worldwide authorized to publish both datasets and associated data papers with full publication qualifications. Their establishment and operation provide a model for dataset publication. As data publication develops, more qualified journals are expected to emerge, thereby facilitating the publication of graduate thesis-associated original data.

4.3 Impact on the Publication of Research Paper

In the era of big data, graduate degrees are primarily awarded based on theses, which focus on scientific discoveries, technological innovations, and empirical validation. Digital datasets supporting these findings are essential foundations. Graduate students are often concerned whether publishing data might hinder the publication of research papers. To handle this issue, typically, research papers and their associated datasets could be published synchronously (or linked via agreements) in different academic journals. This approach is increasingly advocated and implemented in journals worldwide, such as those published by the American Geophysical Union^[33].

4.4 Evaluation of Degree Achievement and Scientific Contribution

Graduate students generally acknowledge the value of data publication, while also recognizing that it increases research scope and workload. Discovering scientific patterns in data is one step, while preparing datasets for publication requires additional effort and creativity.

Assessing the scientific contribution of graduate students via data publication has become a widespread concern. Citation metrics and publication in high-impact journals incentivize traditional research papers; data publication also requires a separate evaluation framework^[34,35]. The data publication evaluation phase is a necessary component of the complete lifecycle of data publishing^[36]. Common evaluation metrics include accesses, downloads, and citations^[36,37]. Further refinement can assess data quality according to publication level. Liu^[38] proposed a data impact score method, and Scientific Data provides Altmetric indicators to reflect visibility and online discussion^[39]. In China, increasing attention has also been devoted to strengthening data publication through platforms such as official media accounts^[40]. Without innovative policies encouraging and guiding evaluation, graduate students may have limited motivation to publish original thesis data.

4.5 Supervisor Support

Supervisors' attitudes and actions directly influence students' willingness and effectiveness in publishing data. Lack of support is a key barrier. Some supervisors undervalue data publication, regarding traditional research papers as the sole academic output and considering data publication an extra burden rather than a contribution. If supervisors do not recognize the independent publication value of these data, they are unlikely to provide moral support or encouragement. More seriously, concerns about revealing competitive advantages or core technologies may lead supervisors to resist data publication. Moreover, current academic evaluation systems often exclude data publication from supervisor assessment, reducing the incentive to guide students. As a consequence, students may encounter obstacles in seeking supervisor support, hindering data publication efforts.

5 Conclusions and Recommendations

In recent years, several research institutions and universities have begun exploring the publication of original data associated with graduate theses, with pilot initiatives notably undertaken by the IGSNRR, CAS. This paper provides an in-depth examination of the publication practices of geography graduate thesis data under the framework of open science. It not only highlights the critical role of open data in promoting transparency, reproducibility, and collaboration in scientific research but also analyzes the proactive efforts of geography graduate students within this emerging trend, underscoring the necessity and urgency of data publication. Survey and interview results from graduate students confirm the importance of publishing original thesis data and demonstrate strong support within the student community for data sharing. During the survey stage, enrolled graduate students showed a high level of willingness to share their data, indicating promising prospects for initiating nationwide efforts to publish graduate thesis-associated original data.

Looking forward, institutions such as the IGSNRR, CAS may serve as leading pilot programs to gradually standardize, guide, and promote the publication of graduate thesis data. Simultaneously, it is necessary to establish national-level mechanisms to support these efforts^[41]. However, we acknowledge that data publication is neither a simple nor immediate process. In practice, challenges remain, including data security, quality control, limited awareness of data publication, and complex intellectual property issues. To address these challenges, collaborations with open data platforms and the exploration of innovative publishing models are recommended, aiming to overcome traditional publication barriers, facilitate global sharing and utilization of research data, and enhance the academic value and impact of graduate theses.

Based on these considerations, we propose a set of targeted strategies. Firstly, it is necessary to develop reliable and qualified platforms for data publication, storage, and sharing to ensure data quality, accuracy, and proper citation, thereby laying a solid foundation for the long-term planning of graduate thesis data publication. Secondly, practical policies and procedures should also be established, including guidelines on publication methods, application processes, and usage norms, to enable systematic review and archiving of data while safeguarding the rights of students and institutions, thereby maximizing the value of thesis data and promoting deeper research related to graduate thesis-associated original data. Furthermore, strengthening education and outreach is critical. Enhancing awareness among graduate students and supervisors, providing technical guidance, and establishing appropriate incentive mechanisms are essential to support effective participation in data publication.

Looking ahead, as the principles of open science continue to gain traction and technology advances, the publication of data in geography is expected to experience broader development. Data publication should be integrated into research evaluation systems to further encourage graduate students and researchers to actively participate in data sharing. At the same time, continuous improvement of data platforms and processing technologies will significantly enhance the efficiency and quality of data publication. The exploratory and practical efforts led by the IGSNRR, CAS in publishing graduate thesis data may serve as a reference model for promoting openness, transparency, and collaboration in scientific research. We anticipate that more disciplines will join this initiative, collectively advancing the openness, transparency, and collaborative nature of scientific research, and enabling early-career researchers to make creative and historically significant contributions in the field of scientific data.

Author Contributions

Liu, C. required that original data linked to graduate theses be published. Wang, Z. B. solicited experimental cases for graduate training at the Institute of Geographic Sciences and Natural Resources Research, CAS. Chu, M. R., Wang, Z. B., and Liu, C. were responsible for the overall design of the survey questionnaire. Chu, M. R., Luo, L. Z., Gao, K., Li, J. Y., and Wang, S. Y. conducted the survey data collection and investigation. Chu, M. R. completed the first draft of the paper, and Liu, C. revised it.

Conflicts of Interest

The authors declare no conflicts of interest.

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