Journal of Global Change Data & Discovery. 2025, 9(3): 316-322
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Dataset Development of Plant Species in the Lower Reaches of the Tarim River

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Abstract: The lower reaches of the Tarim River Basin serve as a crucial ecological barrier in China's extreme arid region, with its plant diversity playing a key role in maintaining regional ecological balance and addressing global climate change. This study combines field survey data with literature data to systematically construct a plant species inventory dataset for the lower reaches of the Tarim River. The field survey was conducted from July 30 to August 19, 2024, utilizing remote sensing and GIS technologies. A 10 m × 10 m plot was established in the lower reaches of the Tarim River Basin (39°25′12″N–40°40′12″N, 87°35′24″E–88°30′0″E). To ensure data quality and accuracy, the research team invited plant experts to identify plant information during the collection process. The authors meticulously documented information on 24 families, 65 genera, and 81 species of plants, compiling them into the Dataset of plant species of the lower reaches of the Tarim River (2024). The dataset includes: (1) geo-locations of the sample sites; (2) plant list and statistics of families and life forms. The plan list is composed of family, genus, species, classification, life form, national protection status, common names, and collection locations; (3) plants' photos. The dataset is archived in .shp, .xlsx, and .jpg formats, and consists of 87 data files with data size of 1.63 GB (compressed into 4 files with 1.62 GB).

Keywords: lower Tarim River Basin; plant diversity; dataset; field survey; extreme arid zone

DOI: https://doi.org/10.3974/geodp.2025.03.07

Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2025.02.09.V1.

Received: 02-03-2024; **Accepted:** 14-08-2025; **Published:** 25-09-2025

Foundations: National Natural Science Foundation of China (42171042, 42361144792); Xinjiang Uygur Autonomous Region (2023TSYCLJ0049)

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Data Citation: [1] Chen, X. N., Gui, D. W., Yue, J., *et al*. Dataset development of plant species in the lower reaches of the Tarim River [J]. *Journal of Global Change Data* & *Discovery*, 2025, 9(3): 316–322. https://doi.org/10.3974/geodp.2025.03.07.

[2] Chen, X. N., Gui, D. W., Yue, J., *et al*. Dataset of plant species of the lower reaches of Tarim River (2024) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2025. https://doi.org/10.3974/geodb.2025.02.09.V1.

1 Introduction

The lower reaches of the Tarim River are located at the northern edge of the Taklamakan Desert in southern Xinjiang, one of the driest ecological regions in the world[1]. The climate here is extremely arid, with an annual average precipitation of less than 50 mm and evaporation exceeding 3,000 mm, forming a unique desert ecosystem primarily composed of desert vegetation and riparian forests[2]. Despite the harsh natural environment, the ecosystem of the lower reaches of the Tarim River continues to perform important ecological functions, such as regulating regional climate, maintaining biodiversity, and conserving soil moisture[3]. Its rich plant communities are not only a key component in maintaining the stability of the desert ecosystem but also provide valuable ecological services to the local society[1].

In recent years, the combined impacts of global climate change and human activities have led to a continuous degradation of the ecological environment in the lower reaches of the Tarim River[4]. Rising temperatures, changes in precipitation, and activities such as excessive water use and land expansion have severely threatened the stability of riparian forests and wetland ecosystems. Issues such as reduced river flow, declining groundwater levels, and vegetation degradation have further increased ecological vulnerability, posing a severe challenges to the sustainability of regional ecological functions[4,5]. Notably, since the launch of ecological water diversion in the lower reaches of the Tarim River in 2000, there have been significant changes in vegetation structure and species composition in the region. However, due to the lack of long-term, systematic monitoring data, detailed records of species changes remain relatively scarce. Given the ecological importance of the lower Tarim River to both the regional environment and local livelihoods, it is particularly necessary to gain a deeper understanding of its vegetation diversity and dynamic change patterns. This not only helps reveal the driving factors of ecological degradation but also provides a theoretical foundation for developing scientifically sound ecological conservation and restoration strategies.

Although some scholars have conducted plant diversity studies in the Tarim River Basin[6–8], revealing the basic composition and distribution characteristics of the regional vegetation, systematic datasets of plant species images are still lacking, making it difficult to meet the urgent needs of ecological protection and resource management. Existing studies primarily rely on scattered data with limited coverage and long update cycles, making it difficult to accurately reflect the dynamic changes in vegetation and its complex interactions with environmental factors. More importantly, these datasets are insufficient to support data-driven ecological decision-making and management measures[9,10]. In recent years, media reports have generally stated that there are approximately 46 plant species in the lower reaches of the Tarim River, however, in reality, a complete and detailed species list has long been absent. Therefore, this study integrated field survey results with literature analysis to construct a plant diversity dataset for the lower reaches of the Tarim River. This dataset contains rich species distribution information, covering different vegetation types and environmental gradients, and can provide robust data support for in-depth ecological research.

2 Metadata of the Dataset

The metadata of the Dataset of plant species of the lower reaches of the Tarim River (2024)[11] is summarized in Table 1. It includes the dataset full name, short name, authors, year of the dataset, data format, data size, etc.

Table 1 Metadata summary of the Dataset of plant species of the lower reaches of the Tarim River (2024)

Item	Description
Dataset full name	Dataset of plant species of the lower reaches of the Tarim River (2024)
Dataset short name	PlantsList&Sites_LR_TarimRiver
Authors	Chen, X. N., Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, chenxiaonan231@mails.ucas.ac.cn Gui, D. W., Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, guidwei@ms.xjb.ac.cn Yue, J., Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, yuejian@ms.xjb.ac.cn Wei, G. H., Tarim River Basin Management Bureau, 530748965@qq.com
Geographical region	Lower Tarim River (39°25′12″ N–40°40′12″N，87°35′24″ E–88°30′0″E)
Year	2024
Data format	.xlsx, .jpg, .shp
Data size	1.63 GB
Data files	Geographic location of survey sites, plant list and statistics on their families, genera, and life forms, plant photographs
Foundations	National Natural Science Foundation of China (42171042); Xinjiang Uygur Autonomous Region (2023TSYCLJ0049)
Data publisher	Global Change Research Data Publishing & Repository, htttp://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(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 percent 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[12]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS, GEOSS, PubScholar, CKRSC

3 Methods

3.1 Data Sources

3.1.1 Field Survey Data

Based on the research objectives, vegetation type diversity, and community distribution characteristics in the study area, 3 vegetation sampling methods were adopted: systematic sampling (A), transect sampling (S), and representative plot sampling (T). Sampling plots were established in typical ecological types including riparian zones, saline-alkali lands, wetlands, and deserts to comprehensively cover the major vegetation communities in the lower Tarim River, with a total of 90 sampling plots (10 m × 10 m each) being deployed (Figure 1). GPS coordinates were recorded for each plot, while vegetation parameters including species composition, coverage, individual counts, and growth status were systematically documented. Selected plots were designated as long-term monitoring sites with periodic observations to ensure data timeliness and representativeness. The entire sampling process was supported by remote sensing image interpretation, GIS spatial positioning, and mapping technologies to facilitate plot selection and spatial data annotation.

3.1.2 Literature Data

The authors systematically reviewed recent research literature on vegetation diversity in the lower Tarim River and typical plant communities in Xinjiang, including academic papers[3,6–8], datasets[9], and monographs[13,14], with a focus on species inventories, community structure, and succession characteristics. These references were cross-referenced, supplemented, and validated against field survey results to enhance the comprehensiveness and scientific rigor of the data.

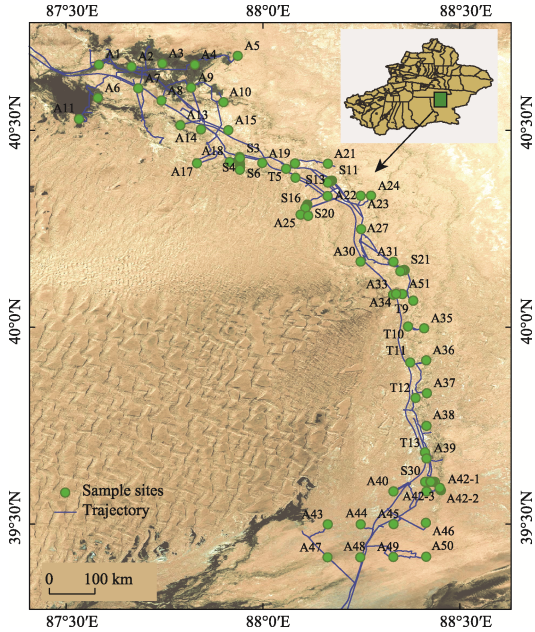

Figure 1 Distribution map of vegetation survey sample sites in the lower Tarim River

3.2 Data Processing

The data processing workflow consists of 3 stages: plant identification, taxonomic correction, and data organization.

Plant identification: Initial identification is conducted in the field using identification software such as Xingse and Shihuajun, accompanied by photography. Subsequent confirmation is performed using authoritative references such as the Xinjiang Flora[13] and the Flora of China[14].

Taxonomic correction: Verify the Latin scientific names of plants to ensure accurate taxonomic classification, and reference the latest revisions in plant systematics.

Data organization: Organize survey data, remove duplicate records, and classify and label plants based on characteristics such as their life forms.

4 Data Results

4.1 Dataset Composition

The dataset includes the following content: (1) the geographical locations of sampling sites; (2) a list of plant names and related information, recording taxonomic, protection status, and life form information, including family name, genus name, species name, taxonomic rank, life form, national protection level, synonyms, and photography locations; (3) plant photographs for identification and citation across disciplines. The dataset is archived in .shp, .xlsx, and .jpg formats.

4.2 Data Results

The vegetation survey of the lower reaches of the Tarim River was conducted from July 30 to August 19, 2024, lasting 21 days (Figure 2), with the aim of systematically collecting and analyzing foundational data on plant diversity in the region. This survey employed standardized plot design and data collection methods to comprehensively obtain key

information such as species richness, abundance, and life forms, laying a solid foundation for subsequent data analysis.

Figure 2 Photos of vegetation survey work in the lower Tarim River

A total of 81 plant species were recorded during the survey, spanning 24 families and 65 genera. Statistical analysis of these plant families revealed that Amaranthaceae had the highest number of species, with 15 species, accounting for 18.5% of all plant species. Next were Fabaceae, Poaceae, and Asteraceae, each with 9 species, accounting for 11.1% of all plant species (Figure 3). This result indicates that Amaranthaceae plants dominate the vegetation composition in this region, while Fabaceae, Poaceae, and Asteraceae also play a key role in vegetation diversity.

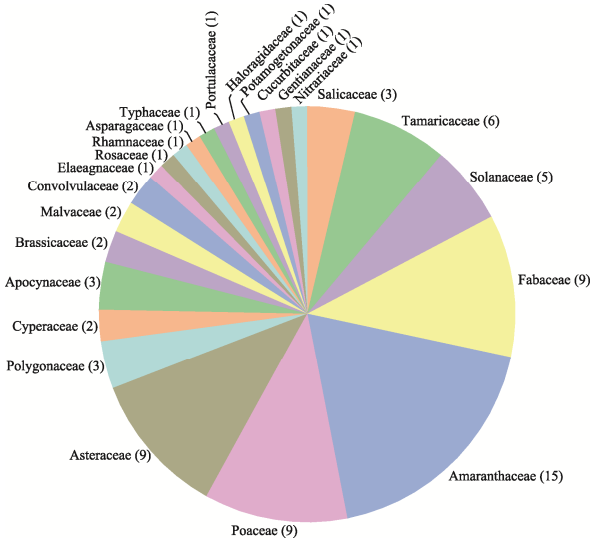

Figure 3 Classification of plant species in the lower Tarim River

Further analysis revealed that the plant communities in the lower reaches of the Tarim River are relatively rich and diverse. Specifically, there are 7 species of tree plants, primarily distributed near the riverbed and in areas with good water supply, such as the poplar (*Populus euphratica*) forest belt; there are 19 species of shrub plants, which are relatively widely distributed and mainly concentrated along the riverbanks and in ecologically fragile areas surrounding them, playing a role in sand fixation and water conservation; herbaceous plants are the most abundant, with 54 species, accounting for the majority of the surveyed plant species. They are primarily distributed in arid surfaces and river floodplains, forming

an indispensable component of the local ecosystem. Additionally, one species of perennial vine was recorded, though in small numbers, it plays a certain connecting role within the complex vegetation structure (Figure 4).

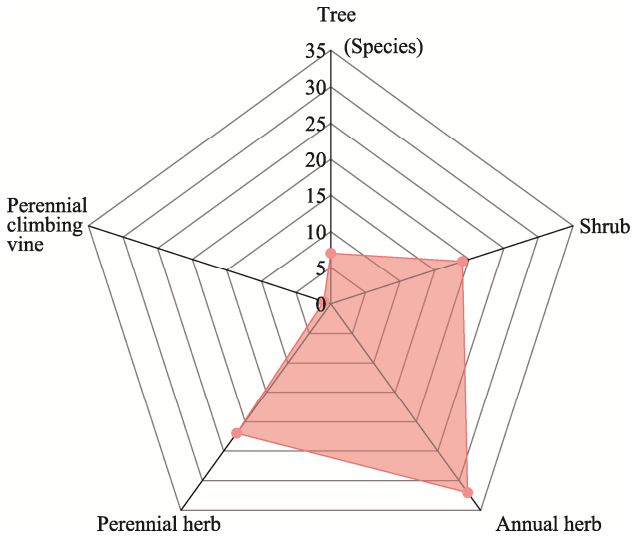

Figure 4 Classification of plant life forms in the lower Tarim River

This diversity reflects the unique ecological environment and complex vegetation structure of the lower reaches of the Tarim River, demonstrating the region's adaptability and stability in the context of long-term natural succession and ecological changes. Additionally, the survey identified 4 plant species under national key protection: *Populus euphratica* (Poplar), *Haloxylon ammodendron* (Saxaul), *Glycyrrhiza inflata* (Inflated Licorice), and *Lycium ruthenicum* (Black Goji Berry). These protected species possess significant ecological functions and economic value. Poplar and Saxual play important ecological barrier roles locally, while Inflated Licorice and Black Goji Berry, as medicinal and ecological plants, are equally significant for the restoration and protection of the local ecosystem. Artificially cultivated Saxaul and Black Goji Berry exhibit good growth, not only helping to improve soil structure and prevent wind erosion, but also providing economic income for local residents. Overall, the presence of these protected and artificially cultivated plants further highlights the importance of ecological conservation and regional sustainable development, demonstrating the potential and challenges of achieving balance between nature and human activities.

5 Conclusion

This study systematically analyzed the structure and frequency of 81 plant species during the vegetation growth season in the lower reaches of the Tarim River, covering 24 families and 65 genera, through literature review and field surveys. The plant community composition was rich, with Amaranthaceae being the most abundant, accounting for 18.5%, followed by Fabaceae, Poaceae, and Asteraceae, each accounting for 11.1%. The distribution of trees, shrubs, herbs, and vines reflects the ecological characteristics of the region. The study identified 4 nationally protected plant species, including artificially cultivated Saxaul and Black Goji Berry, which contribute to both ecological conservation and economic development. These findings provide scientific basis for ecological conservation and restoration and aid in evaluating the effectiveness of ecological restoration efforts. The

constructed vegetation dataset holds significant value for ecological diversity research, climate change assessment, educational outreach, and policy formulation. The dataset reveals species distribution and community structure, offering new insights into vegetation evolution and ecological functions. Future work will focus on updating and expanding the dataset to comprehensively reflect vegetation diversity and ecological functions, thereby advancing ecological conservation and sustainable development.

Author Contributions

Gui, D. W. proposed the theme and topic, and was responsible for the overall design and implementation plan; Chen, X. N. completed the field research, data analysis, and data paper; Yue, J. compiled relevant materials on the lower Tarim River and designed the sampling route; Liu, Q. provided guidance and made revisions to the paper; Wei, G. H. and Chen, C. Q. were responsible for content supervision.

Acknowledgements

The authors would like to express their special thanks to Xu, X. L. and Chen, Z. X. for their assistance in sampling and data collection.

Conflicts of Interest

The authors declare no conflicts of interest.

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