

## Current status and challenges of Chinese plant taxonomy

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### Abstract

With a consideration of the history of plant systematics in China, a detailed analysis of the current status of plant taxonomy in China was undertaken, with particular focus on the literature, specimen accumulation, research personnel, and compilation and quality of published floras, in relation to the Convention on Biological Diversity Protection Strategy, the China Plant Protection Strategy and Cataloging Chinese Native Species requirements. The analysis demonstrated that a large gap exists between the taxonomic knowledge of China and that of western countries. A critical factor underlying this is the knowledge gap in the evaluation and guidance of basic research. The lack of basic data on Chinese plant species has seriously affected the quality of efforts to catalogue all plant species, as well as establishment of both Red and Black Lists based on species classifications. Consideration of the future developments and direction of plant taxonomy in China suggests that China's advantages in geography and resources should be fully utilized in order to participate in international collaborations and to produce high-quality research that conforms to the country's overall image and national strategy requirements. Additional objectives should be to provide a sound foundation for providing consultation to officials on the conservation of national biodiversity, an inventory of species, the assessment of academic research, resource protection, scientific and technological development, policy determination, and the management of species.

### Key Words

Plant taxonomy, status, challenges, China

### Introduction

The Tenth Meeting of the CBD (Convention on Biological Diversity) held in October 2010 in Nagoya, Japan, set a target (Target 1) for the completion by 2020 of a global online flora (CBD, 2015). The XVIII International Botanical Congress held in July 2011 at Melbourne identified this goal as the common task of global botanists (Science in Public, 2011). In April 2012 the Missouri, New York, Edinburgh and Kew botanic gardens released a guideline document about the implementation of GSPC Target 1 by 2020 (Missouri Botanical Garden, New York Botanical Garden, RBG Edinburgh and RBG Kew, 2012). In 1992 China became a Party to the Convention on Biological Diversity. At the sixth Conference of the CBD Parties in 2002 the Global Strategy for Plant Conservation was unanimously adopted. China has actively participated in the work of the Global Strategy for Plant Conservation. The China Wildlife Conservation Management Department of the State Forestry Administration has organized experts to compile the Chinese Wild Plant Conservation Action Plan. It has cooperated with the Chinese Academy of Sciences and other organisations, on the basis of GSPC Target 16, to further the preparation of the China Plant Protection plan.

*China's Strategy for Plant Conservation* (China's Strategy for Plant Conservation Editorial Committee, 2008) is the authoritative contemporary Chinese statement of policy in the field of biodiversity conservation. Current problems in the surveying and cataloging of native plant species in China are summarized as follows:

- The cataloguing of plant collections has been in process for a relatively short time; many recently discovered species are not included in existing lists; the naming of many plants is inconsistent.

- There are few digital herbarium records, and the network for sharing data is imperfect.
- There is a serious shortage of researchers engaged in taxonomy and the study of plant diversity. There is also a shortage of professional training and of funds for the construction of facilities.

Since *Species Plantarum* was published, plant taxonomy has continued to develop. From 1959 to 2013 an inventory of China's flora has been completed in two versions: *Flora Reipublicae Popularis Sinicae* (FRPS), a Chinese-language version compiled between 1959 to 2004, and *Flora of China* (FOC), an English-language version developed between 1994 to 2013. So to what extent are China's plant species now clearly catalogued? Are plant protection lists (Red Lists) and invasive alien plants lists (black lists) complete? What is the state of plant taxonomy in China? What are the problems? This article attempts to conduct a comprehensive analysis, to address academic research scholars, government policymakers, to catalogue biodiversity basic reference data about rare and endangered species, in order to assess the protection that these species need.

## The Basic Data

China is known as "the mother of gardens", with more than 30,000 species of vascular plants, about the total for Europe and North America combined (North America about 20,000, and Europe only about 12,000). China is recognized as the country with the world's richest plant biodiversity in northern temperate zones. In 1916, a plant taxonomy article by Chien Chong Shu marked when the Chinese people began to describe their own plants using a non-traditional taxonomy. Since then, botanists have overcome many difficulties to continue this work. Over the past half-century four generations of Chinese organizations have, despite gaps in the literature, inadequate specimens, lack of experience, and the Cultural Revolution period, finally completed 80 volumes of the projected 126 volumes of the *Flora of China* (FRPS, 1959–2004). This needed the training of several generations of staff.

In specialized areas of plant taxa, Chinese scholars have done a lot of good work and results achieved quite an influence in the world: the discovery of the Dawn Redwood and some silver firs have not only greatly enriched Chinese plant diversity and the world flora; but have been recognized as major achievements in plant taxonomy. Ching's study of ferns in 1993 was awarded a National Natural Science First Award. Many floras and academic works have been produced, including *Northeast Woody Illustration* (1955), *Northeast Herb Flora* (1958–2005), and *Hainan Flora* (1964). China has completed floras for dozens of provinces, municipalities, autonomous regions and natural geographic regions. These works include the second edition of the *Inner Mongolia Flora*, *Beijing Flora*, *Flora of Taiwan* (in English), and the first versions of *Flora of Tibet*, *Yunnan Flora* and *Guangdong Flora*. The publication of the *Flora of China* played a positive role in promoting and complementing the publication of local floras and promoting local plant resource utilization and protection.

In parallel with the completion of local floras, the *Flora of China* has been completed (Flora of China 1994–2013). It comprises 25 volumes of text and 24 volumes of illustrations (available at <http://flora.huh.harvard.edu/china/>). This is an important work in the history of contemporary Chinese plant taxonomy and a landmark, in particular in the description of taxa, in the research involved, and other aspects of the revisions and changes from the original Chinese-language version. These changes have resulted in a lot of progress, the protection and utilization of plant resources in China; these changes have been of epoch-making significance to the world of botany. Recently, the English-language version of the *Flora of Pan-Himalayas*, completed by a team led by Prof. Hong Deyuan of Peking, has marked a new chapter of the history in the preparation of overseas floras by Chinese botanists. This work involved training teams, cultivating talents and accumulating experience. More importantly, it is a sign of the rising recognition of the importance of plants to the world.

The 21st century ushered in an age of 'information taxonomy', offering both unlimited potential applications but bringing more severe challenges. In China, more than 20 national main botanical digital sites have been set up, including the National Specimen Information Infrastructure (<http://www.nsii.org.cn/>), the Species 2000 China Node (<http://www.sp2000.cn/joaen/index.php>), the Biodiversity Heritage Library China node (BHL-China, <http://www.bhl-china.org/cms/-page=page-1>), the China Digital Herbarium (CVH, <http://www.cvh.org.cn/>), and the Chinese Field Herbarium (CFH, <http://www.nature-museum.net/>). These facilities not only provide a very modern way to manage the protection, use and management of natural resources, but more importantly, they provide a solid foundation for Chinese botany research. Contemporary developments of digitalisation and networking in the development of taxonomy undoubtedly offer a golden opportunity to provide more complete background information to help in the urgent task of recording China's plant species. . But to see current achievements in context, we must also face the following realities:

- Many historical data collections have a serious shortage of corresponding literature, and a lack of systematic collation. There is limited amount of specimen collection, and their management is seriously lagging behind.
- There is a worrying shortage of young classical taxonomists. Much descriptive work is of poor quality and difficult to follow up. There are poor evaluation systems and insurmountable competitive mechanisms.
- There is a big dichotomy between the size and variety of the country's plant communities and the manpower available to research them.

## Conclusion

A world online flora is due for completion in six year's time (2020). China has one tenth of the plant resources of the world, and to record it is clearly an extremely difficult task for the Chinese people. At the same time, the popularization of science and education for the more than 1.3 billion population of China will improve the quality of people's appreciation of the academic community, including various types of experts and scholars as well as all levels of managers and policy makers. Classical plant taxonomy at the national level must be forward-thinking and strategic decision-making, especially top-level design and overall layout. China does not lack talent, and there is also no shortage of botany enthusiasts, so the key is how to promote and guide, how to attract talent and cohesion to the task. To this end, the following recommendations are made:

- An emphasis on infrastructure, the speeding-up of plant rescue and storing background information. Completing taxonomic literature and its digitisation, networking the results and improving the efficiency of its use. To finish reviewing the historical data on Chinese plants collections as soon as possible, including not only China's domestic collection cases, but also including foreign collections made over the past 300 years; also collections not only of the less surveyed areas of China but also of neighbouring countries; better management of existing collected specimens and digitalization of records of specimens collected from overseas.
- Increasing classical taxonomy expertise and numbers to ensure that the needs of the country are met..
- On this basis, to find out as much detail as possible about Chinese plant resources, and lay a solid foundation for the country's overall science and the popularization of science. To implement further revisions of the *Flora of China* and the local floras and related types of directories and manuals, not only to provide an academic reference base for research, but also help in the popularization of science, public education and improving the quality of taxonomic data, which is China's core mission of plant taxonomy.

- To establish China's geopolitical and resource influence in East Asia, so that China, as a country with an enormous variety of plant life, can full advantage of its geography and resources. To accelerate specialist dedicated research work to East Asia as a main aim, while developing investigation and research resources in neighboring countries and regions (especially South Asia, Southeast Asia and Central Asia and West Asia). This is also to lay a firm foundations for the development and use of national strategic resources.
- To speed up the construction of information networks, make full use of various resources sharing platform integration, enhance taxonomic infrastructure (specimens, images and documents) and other digital networks' speed and level with a variety of resources, not only for the overall scientific and comprehensive production out , in order to improve the efficiency of scientific research and lay the foundation level of resource utilization, while providing the basic data for the Conservation and Utilization of plant resources, and to provide authoritative information to the strategic decision-making core national interests.

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