BOTANICAL GARDENS GROWING ROLE IN CONSERVATION

China's botanical gardens provide vital support for the country's implementation of the Convention on Biological Diversity.

Bamboo is synonymous with China and holds important cultural and commercial values. Its ecological value lies in the ecosystems it supports as well as high potential for carbon sequestration of some bamboo species. Yet, given the wide distribution and significance of bamboo to China, it is surprising that so much about the plant remains unknown. This year, the South China Botanical Gardens, of the Chinese Academy of Sciences (CAS) identified a previously unknown species of bamboo, *Gelidocalamus fengkaiensis*, found in Qixingding Nature Reserve, Guangdong Province.

This discovery highlights the importance of botanical gardens for conservation of biodiversity. Flora conservation has often focussed on protection of plants in the wild but increasingly, there is recognition of the conservation value of growing plants outside their natural habitat in a controlled environment such as a botanical garden. Greater ecological benefits come from gardens that form an organised network.

China now has an extensive and coordinated network of 162 botanical gardens. The network has conserved more than 23,000 species, accounting for about 60% of China's native plants. More than 52 million tourists visit botanical gardens every year.

These gardens cover the main climatic areas with 32 gardens in marginal tropical areas, 68 in subtropical areas, and 62 in temperate areas. They contribute to biodiversity preservation through innovation in protecting Chinese native plants and through supporting China to implement the Convention on Biological Diversity.

The Chinese Union of Botanical Gardens (CUBG), was launched in 2013 by CAS, the National Forestry and Grassland Administration and the Ministry of Ecology and Environment. In its first decade, CUBG implemented an initiative known as the 'Full-Coverage Conservation Plan for Native Plants', which includes the evaluation, inventory and protection of native plants in 15 representative areas that cover 3.59 million km^2 or about 37.4% of the land area.

The Botanical Gardens of CAS are the pillar of the nation's botanical gardens and hold its most impressive relocation and conservation facilities, including vast facilities for tissue culture and micropropagation and seed banking. They promote their commitment to the investigation of plant resources, introduction and domestication, scientific research and resource application, environmental education and gardening. ■

Kwanchai Khammuean/EyeEm/Getty

UNDERSTANDING BIODIVERSITY IN FORESTS

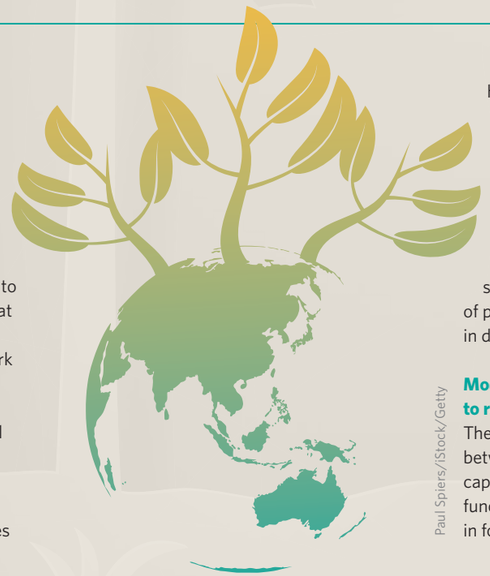
Asking big questions led to planting the world's largest experimental subtropical forest.

The Chinese Academy of Sciences' Institute of Botany has led pioneering work on forests biodiversity and the associated nature-based services that support societies.

The good, the bad and the fungi

How different species coexist still puzzles ecologists. A forest typically comprises just a few common plant species and many rare species. The accepted wisdom — that natural predators stop the forest becoming dominated by a single species — is undermined too often. The research team from CAS looked at soil fungi and their complex plant relationships, ranging from co-dependency as symbionts, to pathogens or decomposers that support nutrient recycling.

Establishing a broad network of observation data of large forest dynamics plots, the researchers compared survival rates of rare and common tree species to show that the interaction of different functional soil fungi determines how trees coexist. Published in *Science* in 2019, the research showed beneficial symbiotic fungi around soil roots reduced disease-causing fungi to improve tree survival, particularly around trees of the same species. Trees with high levels of pathogenic fungi fared worse in dense patches.



Paul Spiers/iStock/Getty

Model forest confirms potential to reduce climate change

The complex relationship between biodiversity, and its capacity to support ecosystem functions, is difficult to observe in forests: trees grow so slowly that research conclusions build slowly too. Collaborating with German and Swiss colleagues, the CAS research team created the world's largest experimental subtropical forest of 300,000 trees in plots from 1-32 species to test the relationship between biodiversity and ecosystem functions.

A decade of monitoring led to the landmark finding that forests with mixed tree species had twice the biomass of forests with single species—demonstrating that forests with greater diversity have higher productivity. Published in *Science* in 2018, the study identified that more diverse forests also had a higher capacity to store carbon and a faster carbon cycle rate, confirming that conservation of forests can slow global warming.

Drawing a line under human impacts on species diversity

Understanding links between human activities and large-scale patterns of species diversity can help determine priority areas and strategies for protection. In collaboration with colleagues from Tsinghua University, the CAS team prepared a global biodiversity priority protection area distribution map of high-efficiency and low-cost protection areas, published in *Science Advances* in 2020. This map, together with a map of the potential distribution of protected areas, provides the scientific basis for deliberations by the United Nations Convention on Biological Diversity's Post-2020 Global Biodiversity Framework. ■

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

CONNECTING THE DOTS TO PROTECT BIODIVERSITY IN CHINA

Policy innovation to ensure the right areas are protected.

Aurelija Diliute/iStock/Getty

Mapping areas of high biodiversity is helping China's decision-makers to protect natural resources for the future. The research of the ecosystem services and conservation team, led by ecologist, Zhiyun Ouyang, professor of the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, underpins an overhaul of China's system of ecological protection, and pursues mainstreaming in biodiversity and ecosystem services in policy making.

China has rich biodiversity and expansive landscape resources. The team's research team considered spatial distribution of more than 1,500 threatened species to show that the current protected areas are poorly positioned. Many act as 'islands' and are too small for wildlife and ecosystem processes to occur.

This finding led to a proposal for a new system of protected areas as well as the spatial layout of national parks, providing robust scientific and legal foundations for extensive institutional reforms.

The team evaluated seven types of ecosystem service provided by the natural environment to society: food supply, carbon sequestration, soil retention, sandstorm prevention, water resource conservation, flood regulation and storage, and biodiversity protection. This revealed important gaps: for example, the priority protection area that occupies 37% of the country, provides 83% of its carbon sequestration services and 78% of soil conservation services. This research underpins innovation in China's ecological protection policies, including ecological function areas and protection red line planning: it is also helping to scope ecological transfer payments (ETPs) that incentivise protection of nature.

Through research collaborations, the team has raised the concept of Gross Ecosystem Product (GEP) to balance entrenched concepts of Gross Domestic Product (GDP). While GDP considers a nation's economic performance, GEP measures its conservation performance.

The GEP accounting framework helped China adopt a system that incorporates valuing ecological products, improving evaluation ecological protection effectiveness, and promoting the continuous supply of ecological products. In 2021, the United Nations Statistical Commission adopted GEP as an accounting indicator for the economic value of ecosystem services and ecological assets. ■

igmgaibmhbmm/iStock/Getty