

A case for conservation

China urgently needs to take action to preserve its wealth of biodiversity, say Chung-I Wu, Suhua Shi and Ya-ping Zhang.

China is home to roughly 10% of the world's biodiversity. It has at least 30,000 species of vascular plants and the *Fauna Sinica* catalogue now stretches to 150 volumes. But this diversity is being destroyed by farming and industrial developments at an alarming rate. Conservation is therefore a matter of urgency, but to be taken seriously it needs a scientific basis and must attract the brightest scientists.

Remarkable achievements over the past five decades have been made in documenting flora and fauna in China. But it is now time to place an emphasis on understanding the general ecological and evolutionary principles behind the country's diversity. To achieve this, we believe that a national centre for ecological and evolutionary studies should be created.

Biodiversity basics

Before we examine this proposal, we need to understand the scientific basis of biodiversity research. The field divides readily into three areas: surveying and recording the flora and fauna; discovering how the species are related and distributed; and looking for patterns that help us to interpret this biodiversity.

Obviously, the third stage hinges on having sufficient information from the first two areas. After all, Darwin could deduce the general principles of evolution only after extensive studies had been carried out.

Scientists in China have made excellent progress in tackling the first two stages, and there are several ongoing mega-projects dealing with biogeography. For example, a team led by Deyuan Hong, a botanist based at the Chinese Academy of Sciences (CAS),



Mangrove trees are perfectly adapted to the harsh brackish environment in which they live.

Beijing, is examining the biodiversity in the Yangtze Basin, and ecologists Keping Ma and Ruyong Sun at CAS and Beijing Normal University, respectively, are studying bio-diversity conservation at key sites across China.

But what about the scientific principles underlying such studies? Biodiversity covers every aspect of ecology and evolution, from community stability to speciation (the duplication of species). Examples of the research areas it includes are: ecology and evolution; community and ecosystem; species competition and extinction; genetic diversity; formation of

species; and adaptation.

These areas highlight the variety of research in this field. Ecological and evolutionary principles are most easily discerned from simple systems. For example, grassland is usually a simpler ecological system than a tropical forest, and zebrafish are certainly easier to handle than tilapia (an African freshwater fish). The choice of a suitable system should take into account the ease with which general principles can be deduced. In China, complex systems were often chosen for economic rather than scientific reasons.

Basic research is also important for social

and cultural reasons. General scientific principles are extremely relevant to the urgent crisis in conservation biology. Looking at efforts outside the developed countries, it is clear that conservation has not been completely successful. The reason is not necessarily poverty alone, as this would imply that conservation ethics naturally follow the accumulation of wealth. China's wealth has grown extraordinarily, for example, but its conservation ethics have failed to keep pace. To close this gap, it is imperative that the country assembles a core group of biologists who are devoted to ecology, evolution and systematics.

Conservation biology therefore needs to be seen as a stimulating and prestigious scientific endeavour, otherwise few bright young people will enter the field. If the desired social status can be achieved, it will attract strong candidates to become college professors, school teachers and professional biologists. At the same time, these new recruits will be conservation-minded — as there are few ecologists, evolutionists and systematists who are not strong proponents of conservation biology at heart. From these professionals will spring the motivation for conservation.

A proposal for a national centre

More importantly, a national centre for ecology and evolution would help the drive towards a broader scientific understanding of biodiversity. Greater attention to fundamental science would encourage deeper and broader analysis and synthesis of biodiversity research. Ultimately, policy decisions will rest on such understanding.

At present, there are only a handful of institutes or departments in China where the emphasis is on the conceptual issues relating to ecological and evolutionary principles. Most noticeable is the lack of theoretical development. The stability of community structure, the population ecology of predator–prey (or host–parasite) interactions, the consequence of sexual rather than natural selection, the theory of speciation and the impact of population structure on adaptation are just a few examples of concepts that need to be developed.

To address this imbalance, we urge China's scientific community to adopt

strategies that will promote integrative research activities aimed at revealing general principles in ecology and evolution. At the local level, the formation of research and training programmes across traditional taxonomy-based departments (such as zoology and botany) should be strongly encouraged. But creating a new structure without imposing a cumbersome bureaucracy will be a major challenge.

A possible solution is to create an interdisciplinary training and research programme. This will allow scientists from existing departments to establish a new programme in, say, ecology and evolution, without creating a new physical entity. A more traditional approach is to realign existing departments to suit the new demand. Fudan University in Shanghai is likely to be the first in China to take the initiative and reorganize some departments to form a new department of ecology and evolution. This will probably be followed up by Sun Yat-Sen University in southern China.

At the national level, we propose the establishment of a national centre for ecological and evolutionary studies. This would promote the synthesis of the diverse array of biodiversity research results. The centre would not need permanent research staff, as its function would be to integrate data that already exist, rather than to create more. As a virtual institution, it would be administratively flexible and inexpensive to operate. We envision two main missions for the centre.

First, it would run workshops where ecologists, evolutionary biologists and systematists could gather. This would promote collaboration on joint analysis of results. The workshops would be significantly different from conventional academic meetings, where the role of the participants is to present and absorb. Instead, they would seek active participation in the analysis of all research results, wherever they are generated. The goal would be to integrate efforts across disciplines.

As part of this mission, the centre should also assume an international character by attracting participants from abroad. For example, in certain areas of evolutionary biology, particularly molecular evolution and population genetics, there is a strong contingent of Chinese expatriates who have

substantial commitments inside China.

In parallel with the workshops, a series of summer courses should be given. These would help to expose final-year undergraduates and postgraduate students to biodiversity research.

The second mission would be to train the next generation of ecologists, evolutionary biologists and systematists. The centre should act as a magnet for the brightest researchers in China. A number of PhD students would be sent by the national centre for sponsored research in the best institutions worldwide. The duration of training is likely to be about three years — roughly equivalent to doing a PhD.

Similar models

In many respects, the proposed centre would resemble the National Center for Ecological Analysis and Synthesis in Santa Barbara, California, and the planned US National Science Foundation Center for Synthesis in Biological Evolution. The scope and structure would be different, but the spirit of synthesizing existing observations into general principles would be the same. In fact, a prototype of the effort suggested here already exists in China in the form of the International Center for the Study of Evolution of Biodiversity, Kunming¹, which is at present partially supported by the Shanghai Institute of Advanced Studies, directed by Uli Schwarz. This institute is jointly sponsored by the Chinese Academy of Sciences and Max Planck Society, Germany.

The establishment of ecological and evolutionary research in China should prove beneficial for areas far beyond conservation biology. Many fields of biology in China will undoubtedly gain from enhanced efforts in ecology and evolution. These fields should be part of an increasingly integrative approach. After all, as Theodosius Dobzhansky said: “Nothing in biology makes sense except in the light of evolution.” ■

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