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Biodiversity–ecosystem functioning research in Chinese subtropical forests

Keping Ma[1], *Jin-Sheng He*[2], *Helge Bruelheide*[3,4], *Alexandra-Maria Klein*[5], *Xiaojuan Liu*[1,6] *and Bernhard Schmid*[6,*]

[1] *State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, Beijing 100093, China*
[2] *Department of Ecology, College of Environmental Sciences, Peking University, Beijing 100871, China*
[3] *Institute of Biology/Geobotany and Botanical Garden, Martin Luther University Halle-Wittenberg, Am Kirchtor 1, 06120 Halle, Germany*
[4] *German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, DeutscherPlatz 5e, 04103 Leipzig, Germany*
[5] *Chair of Nature Conservation and Landscape Ecology, Faculty of Environment and Natural Resources, University of Freiburg, Tennenbacher Straße 4, 79106 Freiburg, Germany*
[6] *Department of Evolutionary Biology and Environmental Studies and Zürich–Basel Plant Science Center, University of Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland*
*Correspondence address. Department of Evolutionary Biology and Environmental Studies, University of Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland. Tel: +41-44-635-5205; Fax: +41-44-635-5711; E-mail: bernhard.schmid@ieu.uzh.ch

Worldwide, forests provide habitat for a large diversity of plants, animals and microbes. At the same time, forest ecosystems are essential providers of multiple ecosystem services important for human well-being. However, the relationship between biodiversity and ecosystem functioning has only been little researched in forests and therefore its role for the functioning of forest ecosystems and their services is not yet understood. If results from comparable studies in other ecosystems are considered (e.g. Balvanera *et al.* 2006), it is conceivable that diverse forests would, for example, grow faster, produce more biomass, store more carbon and better maintain soil fertility and plant–insect interactions and functional stability than less diverse forests or monoculture tree plantations. The hypothesis that biodiversity increases and stabilizes interactions and functions is the common theme of the papers in the present issue of the *Journal of Plant Ecology*.

The first 4 of the 24 papers (Brezzi *et al.* 2017; Chi *et al.* 2017; Huang *et al.* 2017; Wang *et al.* 2017) use a unique comparative study design in which forest plots at a site in Southeast China have been selected according to different levels of tree species richness and stand age (Bruelheide *et al.* 2011). Tree diversity increases the amount of leaf litter (Huang *et al.* 2017) and plant resources for herbivorous insects (Brezzi *et al.* 2017). Differences among tree species in seasonal growth patterns were detected as one possible reason for complementary resource use in diverse plots (Chi *et al.* 2017). Other aspects of ecosystem functioning were more strongly influenced by stand age; this was the case for soil respiration, which declined with stand age (Wang *et al.* 2017). The following four papers (Guo *et al.* 2017; Shi *et al.* 2017; Tong *et al.* 2017; Zhang *et al.* 2017) expand the geographical range of the previous ones and demonstrate that species interactions within and between trophic levels are important drivers of population and community structure and thus affect biodiversity–ecosystem functioning relationships.

This special issue includes two papers that focus on methodological questions, which are pertinent to biodiversity–ecosystem functioning research. Weißbecker *et al.* (2017) provide sampling designs and guidelines for subsequent treatment of soil samples for later analysis of RNA and DNA of microbial communities. Schmid *et al.* (2017) show how linear- and mixed-model statistical approaches can be combined to analyze complex hierarchical data that typically arise in biodiversity–ecosystem functioning research.

The following nine articles (Bu *et al.* 2017; Eichenberg *et al.* 2017; Germany *et al.* 2017; Li *et al.* 2017a; Peng *et al.* 2017; Scholten *et al.* 2017; Staab *et al.* 2017; Sun *et al.* 2017; Yang *et al.* 2017) report first results from a large forest biodiversity experiment in Southeast China where more than 500 plots of 400 tree individuals each and ranging in biodiversity from monocultures to 2-, 4-, 8-, 16- and 24-species mixtures have been established according to nested extinction-scenario designs (Bruelheide *et al.* 2014). A most striking commonality among these papers is that already a few years after establishment

In this Special Issue Chinese author names are abbreviated in reference lists with a capital letter for every syllable (e.g. Liu XJ), even though full names are written as single words in author lists after the titles of papers (Xiaojuan Liu). This policy should always be followed when citing Chinese authors.

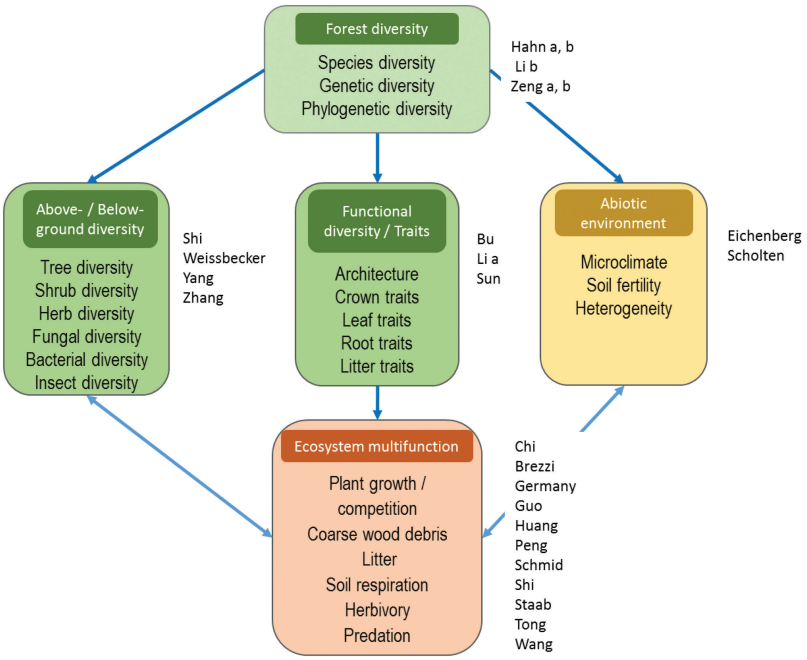

Figure 1: an overview over the topics covered in this special issue. First-author names refer to the papers in the special issue (cited with the extension '*et al.* 2017') and are located near one of the topics to which they contribute. Note, however, that most papers integrate several topics.

there are strong and significant effects of planted tree diversity on multiple ecosystem functions including increased total leaf area (Peng *et al.* 2017), increased fine-root production (Sun *et al.* 2017), between-species belowground complementarity (Bu *et al.* 2017) and reduced insect visits to trees with extrafloral nectaries (Staab *et al.* 2017). Other functions such as herb-layer variables are only beginning to show a biodiversity signal (Germany *et al.* 2017) or are more influenced by edaphic or microclimatic variation across the experimental site (Scholten *et al.* 2017), e.g. shrub survival (Yang *et al.* 2017) and wood decomposition (Eichenberg *et al.* 2017).

The last five papers (Hahn *et al.* 2017a, 2017b; Li *et al.* 2017b; Zeng *et al.* 2017a, 2017b) of this special issue extend the biodiversity theme beyond species richness to genetic diversity. Whereas the first two papers show how genetic diversity of woody species is affected by stand age and other environmental conditions but not by species diversity, the following three papers report significant effects of genetic diversity on ecosystem functions, e.g. increased litter decomposition (Li *et al.* 2017b). Interactive effects between species and genetic diversity are also addressed in these three papers.

The aim of this special issue is to present an integrative view on different aspects of a common theme, biodiversity–ecosystem functioning research. The complexity of this theme requires the collaboration of many research groups, ideally on shared field sites and experiments such as in the present case in Southeast China. Obviously, forest experiments require long-term study and the mentioned experiment was only planted 7 years ago. Nevertheless, already within this short time biodiversity effects emerged. While the experimental study is being continued, differently aged natural forest plots could already shed some light on biodiversity effects in more mature forest ecosystems. This special feature shows that positive biodiversity–ecosystem functioning relationships have already developed at a very early stage of forest establishment. This finding is not only of basic interest for ecological research but also of relevance for reforestation and afforestation management. At the same time, the papers in this special issue provide a baseline against which future findings from biodiversity–ecosystem functioning research in forests can be compared.

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