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Editorial

Plant systematics and biogeography in the Australasian tropics

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It has been recognised for centuries that the majority of species are found in the tropics. The reasons are the subject of much debate, especially regarding the roles of temperature and time (Brown 2014), but whatever the causes, it is undeniable that the tropics teem with species known and unknown.

Of all tropical areas, the Neotropics stands out for its exceptional taxon richness and rates of diversification (Antonelli *et al*. 2015). Whereas the Australasian tropics cannot match the species numbers of the Neotropics except perhaps for trees (Slik *et al*. 2015), it does boast the world's largest tropical island (New Guinea), among the largest and most intact tropical savannahs (Woinarski *et al*. 2007), the greatest concentration of basal angiosperm lineages (Metcalfe and Ford 2009) and the most species-rich mangroves (Daru *et al*. 2013). These landscapes are not just rich in species, but also exhibit high levels of phylogenetic diversity and phylogenetic endemism (Thornhill *et al*. 2016).

The concept of Australasia was first introduced by Charles de Brosses in 1856 to describe the lands south of Asia and west of Polynesia. Since then, numerous geographical circumscriptions of Australasia have entered common usage. All of these circumscriptions include Australia and New Zealand, and many, particularly regionalisations based on biogeography, also include New Guinea, New Caledonia and adjacent islands – it is this definition of the Australasian tropics that has been adopted for this Special Issue. Indeed Australia, New Guinea and New Caledonia have many shared lineages, a consequence of a shared geological history.

Australia and the island of New Guinea comprise the Sahul Shelf, which lies on the Australian Plate. The last major Gondwanan vicariance event rifted this plate from Antarctica *c.* 40 Ma, and northward movement precipitated a collision with the Eurasian Plate bearing the Sunda Shelf from *c.* 25 Ma. Contact between the Sunda and Sahul shelves provided not only opportunities for biotic exchange between the northern and southern hemispheres (Crayn *et al*. 2015), but also stimulated evolutionary radiation through geomorphological change driven by the accretion of exotic terranes to the northern edge of New Guinea, and much orogeny. Zealandia, bearing modern day New Zealand, rifted from the Australian Plate in the late Cretaceous, but New Caledonia probably remained pinned to the north of that plate until the earliest Palaeocene, and islands with a relictual biota may have persisted in the region throughout the drowning and subsequent re-emergence of the New Caledonian landmass in the Oligocene (summarised in Ladiges and Cantrill 2007).

The consequences of the rifting of the Australian Plate included a continental-scale decline in the mesic biome (particularly rain forest), extinction of rain forest lineages and a large-scale radiation of sclerophyll lineages (Hill *et al*. 1999) at least in Australia. There was much climatic and habitat instability through time, but it is likely that pockets of stability persisted and retained a rainforest flora that expanded and radiated during periods of favourable climate.

The prehistoric peopling of Australasia occurred via the tropics, beginning at least 50 000 years ago (Bird *et al*. 2018). The subsequent influence of people on landscapes and biotas is not fully understood but was likely mediated through the imposition of fire management (Bowman 1998), the movement of useful plants (Rangan *et al*. 2015), and possibly hunting pressure on populations of large herbivores. These influences operated not only in savanna but also rainforest landscapes (e.g. Butler *et al*. 2014). More recently, European colonisation of the Australasian tropics has caused ecological change through resource extraction, agriculture, changed fire regimes, and the introduction of exotic species. These impacts have been patchy – for instance, significant areas of New Caledonia have been ecologically degraded by mining operations, whereas northern Australian savannahs are relatively intact. Emerging threats include climate change and land use conversion in areas targeted for future development, and the introduction of new pests and diseases.

To ensure ecological and economic sustainability, it is critically important that land use change and conservation priority-setting is informed by thorough biodiversity knowledge. Yet capability in plant systematics research located in the Australasian tropics is extraordinarily low given the vast areas to cover and their high biodiversity (richness and endemicity). Capacity building is urgently required to address this. As well as improving knowledge of tropical Australasia's unique biodiversity and providing more timely and accurate baseline data for environmental impact assessments, increased research capacity would also support the development of ecologically sustainable enterprises based on native biodiversity, particularly for Indigenous communities, as has been initiated for wild rice (Brozynska *et al*. 2017) and spinifex products (Hosseinmardi *et al*. 2017).

This special issue was conceived in part as a celebration of the tenth anniversary of the Australian Tropical Herbarium. My intent, initially, was to stimulate a small group of authors whom I knew had completed, or nearly completed, bodies of work relevant to plant systematics in the Australasian tropics, to finalise and submit manuscripts. My expectations were modest – a target of perhaps five to six manuscripts. However, it quickly became evident that there was great interest among a much broader range of potential authors in contributing to a themed special issue and within a few months over 40 authors had 'promised' manuscripts. A total of 15 papers have now been accepted for publication (10 appearing in this double issue), and a further 10 are in review.

This double special issue contains papers that contribute original research on a wide range of topics in Australasian plant systematics and evolution, including biogeography, developmental morphology, evolutionary radiation, and taxonomy. These works enhance our knowledge of the Australasian flora by providing new insights into (1) historical biogeographical relationships with Madagascar (Joyce *et al*. 2018), New Guinea (Edwards *et al*. 2018; Nargar *et al*. 2018) and New Caledonia (McLay *et al*. 2018); (2) the location and extent of historical biogeographical barriers along the northern and eastern coasts of Australia (Edwards *et al*. 2018; McLay *et al*. 2018; Nargar *et al*. 2018); (3) the evolution of phenotypic traits such as heavy metal hyperaccumulation (McLay *et al*. 2018) and endosperm rumination (Gagul *et al*. 2018); and (4) the floristics of the region by contributing 12 new taxa from Australia and New Caledonia (Gâteblé *et al*. 2018; Renner and Worboys 2018; Wilson and Forster 2018; Zich and Ford 2018) and a synopsis of a little known and cryptic group in New Guinea (Leach 2018).

I hope readers enjoy this collection of excellent papers, and that they look forward with anticipation to the second of the planned issues on plant systematics and biogeography in the Australasian tropics, to be published in 2019.

Conflicts of interest

The author is co-author of several papers in the special issue.

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