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ORIGINAL ARTICLE

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Restoration of mangrove plantations and colonisation by native species in Leizhou bay, South China

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Abstract To examine the natural colonisation of native mangrove species into remediated exotic mangrove stands in Leizhou Bay, South China, we compared soil physical–chemical properties, community structure and recruitments of barren mangrove areas, native mangrove species plantations, and exotic mangrove species—*Sonneratia apetala* Buch.Ham—between plantations and natural forest. We found that severely degraded mangrove stands could not regenerate naturally without human intervention due to severely altered local environments, whereas some native species had been recruited into the 4–10 year *S. apetala* plantations. In the first 10 years, the exotic species *S. apetala* grew better than native species such as *Rhizophora stylosa* Griff and *Kandelia candel* (Linn.) Druce. The mangrove plantation gradually affected soil physical and chemical properties during its recovery. The exotic *S. apetala* was more competitive than native species and its plantation was able to restore soil organic matter in about 14 years. Thus, *S. apetala* can be considered as a pioneer species to improve degraded habitats to facilitate recolonisation by native mangrove species. However, removal to control proliferation may be needed at late stages to facilitate growth of native species. To ensure sustainability of mangroves in South China, the existing mangrove wetlands must be managed as an ecosystem, with long-term scientific monitoring program in place.

Keywords Competitive exclusion · Mangrove · Ecosystem restoration · Invasive species · *Sonneratia apetala*

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Introduction

Woody mangrove plants are well known for their well-developed morphological and physiological adaptations to their environmental conditions. Mangrove species grow at the interface between land and sea in tropical and sub-tropical regions with high salinity, brackish waters, and muddy, anaerobic soils, and play a very important role in the ecosystem processes of coastal areas. Mangroves create unique ecological environments that host rich assemblages of species, and also protect and stabilise coastlines, enrich coastal waters, yield commercial forest products, and support coastal fisheries (Snedaker 1984). However, accumulating evidence shows that mangrove species are particularly sensitive to human disturbances (Kovacs 1999; Lugo 1999; Zedler 2000; Kathiresan and Bingham 2001; Macintosh et al. 2002). In the past several decades, habitat destruction through human encroachment has been the primary cause of mangrove loss. Diversion of freshwater for irrigation and land reclamation have destroyed extensive mangrove forests, and heavy historical and continuing exploitation has severely damaged the remaining mangrove habitats. Early mangrove management has focussed on timber production and fuel wood, and mangroves have been managed for cultivation of fish, shrimp, and ecotourism. Because of this, conservation of remaining mangrove, and restoration of the most extensively degraded mangrove, has become a growing concern for ecologists, policy makers, and the general public (FAO 1994; Field 1999; Ellison 2000).