

Mangrove invasion of salt marsh in temperate Australia: predicting patterns of seedling recruitment under fluctuating environmental conditions

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Abstract

Surveys in estuaries of southeast Australia have revealed a decline in salt marsh habitat and a concurrent landward “invasion” of these marshes by the native mangrove *Avicennia marina*. A leading explanation for this invasion is that environmental change, particularly increased run-off of nutrients and freshwater due to human modification of the coastal landscape, has reduced stressful abiotic conditions of salt marshes and facilitated the recruitment of *A. marina*, allowing competitive displacement of the species of plants that characteristically dominate the marsh. To examine this explanation, in a series of field experiments over four years I manipulated salt marsh vegetation and nutrients along tidal elevation gradients with varying abiotic stresses and species of plants, supplied mangrove propagules to these areas, and monitored the establishment, stress response and growth of seedlings. Seedling establishment was universally poor in areas without marsh vegetation. Marsh vegetation facilitated seedling establishment at low tidal elevations, but largely precluded recruitment at high tidal elevations. Nutrients did not influence seedling establishment, but reduced physiological stress (as determined by chlorophyll fluorescence) and promoted early growth of established seedlings, catalyzing the demographic transition from seedling to sapling, with some individuals producing fruit after only two years. Marsh vegetation and nutrients thus ameliorate harsh abiotic conditions and facilitate landward recruitment and spread of mangroves into low tidal elevations of adjacent salt marshes. Importantly, mangrove recruitment was temporally variable, and years with heavy rainfall had substantially greater recruitment than years of drought. Given that the southeast coast of Australia is predicted to be one of the regions most influenced by environmental change over the next century, due to a combination of population growth and increased warming and rainfall under climate change, understanding the ecological processes responsible for mangrove invasion will help to predict distributional shifts from seaward to landward and with increasing latitude.

Keywords

El Niño, eutrophication, disturbance regime, non-indigenous species, woody encroachment