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Linking Restoration and Ecological Succession

Springer

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Cover Illustration: The photo shows several stages in the restoration of areas mined for phosphate on Christmas Island situated in the Indian Ocean.

1. The rainforest type in the background is complex mesophyll vine forest and the canopy height is about 35m.

2. The closed canopy vegetation in the middle distance is natural regrowth (i.e., a secondary succession) after about 25 years on areas cleared for phosphate mining—the canopy is dominated by 15 to 20m tall *Macaranga tanarius* (Euphorbiaceae), a common early successional tree on disturbed sites in the SE Asia/Pacific region.

3. The vegetation in the foreground was planted onto the mined area and is one year old. *Macaranga tanarius* (the large-leafed plant) is a major component of the rehabilitation and is used to mimic the early stages of natural succession. Photo by Paul Reddell.

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Preface

This book was conceived over dinner at the Cooloola Dunes near Brisbane, Australia, as we pondered how to reconcile 700,000 years of soil development with typical successional studies of <200 years and restoration concerns that normally cover <20 years. Restoration ecology is deeply rooted in ecological succession yet seems, as a fast-emerging discipline, to be largely unaware of the potential benefits a closer examination of succession can provide. These benefits address both how to restore ecosystem function and structure as quickly as possible and the longer-term consequences of current restoration activities. Successfully restored ecosystems can be more or less sustainable without constant care. This state is only achievable within a framework that recognizes, implicitly or explicitly, the temporal dynamics that constitute successional processes. While the current goals of restoration do not address change over thousands of years, certainly 2–200 year dynamics, the most common temporal scale for successional studies, are essential to consider. Restoration tactics will also differ depending on the age of the ecosystem being restored. Succession offers insights into processes of change in ecosystems of all ages, from very young, recently disturbed sites to very old systems such as the Cooloola Dunes.

Restoration ecology incorporates many areas of knowledge both within and outside traditional ecology. Succession often complements or reinforces these ties. Disturbance ecology is central to defining the physical limits for both succession and restoration. Landscape ecology, like restoration, operates within a spatial context and incorporates many ecosystems while succession offers more ecosystem-specific lessons. Studies of ecological assembly seek generalizations similar to succession and critical to the initiation of restoration. Invasion biology studies emerging ecosystems that both restoration and succession must address in a rapidly changing world. Studies of ecosystem health help define appropriate restoration goals but are rarely addressed in a successional context. Historical ecology provides proper land-use context for both restoration and succession. We argue that restoration within a successional framework will best utilize the lessons from each of these areas. Restoration, unlike successional studies, must cross disciplines and address societal needs, including politics, economics, human health issues, sustainability, and land-use planning.

Restoration also has much unfilled potential to elucidate fundamental unknowns within successional studies. When restoration is conducted within a

scientific framework of replicated studies and peer-reviewed publication, it can clarify much about species change. Restoration is the acid test of our ability to understand not only how ecosystems are assembled and held together but also how they change over time. Proper documentation of both the failures and the successes of restoration activities will advance our understanding of many of the aforementioned subdisciplines of ecology, including succession, particularly within landscape gradients and novel, emergent ecosystems.

We assembled this book in order to examine and strengthen both the theoretical and practical ties between succession and restoration. We are not constrained by occasional differences in temporal or spatial scales between the two disciplines or the relative focus on natural versus human-managed ecosystems because restoration is fundamentally the management of succession. Restoration must ultimately succeed if disturbed landscapes are to be recovered and we argue that success will improve where successional principles are employed.

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Writing and editing books inevitably takes us away from many urgent family matters. The editors express their appreciation for the patience and support given by our wives Elizabeth, Janet, and Gillian, and the Hobbs' children Katie and Hamish during the long course of working on this book.

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