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Rainforest-restoration success as judged by assemblages of soil- and litter-dwelling mites (Arachnida: Acari)*

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Abstract

Decline in rainforest cover in many areas of Australia is being countered by various methods of forest reestablishment, including ecological restoration plantings, timber plantations, and unmanaged regrowth. We used assemblages of soil- and litter-dwelling mites to determine which style most closely recaptures the assemblage structure of mites associated with intact rainforest at 84 tropical and subtropical sites in eastern Australia. The six habitat types surveyed were pasture (the typical 'pre-restoration' state), unmanaged regrowth, monoculture forestry, multi-species forestry, ecological restoration and intact rainforest (the 'target' state). Forestry and ecological restoration sites were 5–20 years old. Mites were extracted from soil/litter samples and (excluding Oribatida) identified to family or to finer levels. For two diverse but taxonomically difficult superfamilies characteristic of rainforest, Uropodoidea and Trombidioidea, identification was to morphotaxon. Presence/absence data were analyzed in several ways. First, we used our data to create a list of 'indicator taxa' for pasture and rainforest, and determined the abundance of these indicators in each of the four reforestation methods. We also calculated morphotaxon richness for uropodoids and trombidioids and compared these values among habitat types. In both of these analyses, ecological restoration was most similar to rainforest. We used ordination and ANOSIM to compare mite assemblages among habitat-types. Although mite assemblages clearly distinguished between rainforest and pasture sites, they did not identify any of the four reforestation methods as being consistently similar to rainforest. They did, however, indicate that monoculture forestry and multi-species forestry plantations were often not readily distinguishable from pasture. This may have as much to do with silvicultural methods common to these plantations (e.g., pruning, herbicide application, and maintenance of a relatively open canopy) as to the low diversity of trees present in plantations. We conclude with a brief discussion of the utility of mites in rapid bioassessment programs in Australia, and suggest that the most pragmatic approach involves focusing on a few easily recognized indicators rather than on entire assemblages.

Key words: Astigmata, Australia, bioindicators, Endeostigmata, forest, Mesostigmata, pasture, Prostigmata.

Introduction

Over the past century, vast tracts of tropical and subtropical rainforest have been cleared for lumber and to make way for agriculture (Whitmore, 1997; Lamb *et al*., 2005). Remaining areas of rainforest have lost much of their biodiversity due to fragmentation and reduction in habitat area (Terborgh, 1992; Adam, 1994; Turner, 1996; Laurance & Bierregaard, 1997; Brooks *et al*., 1999). Although the conservation of remaining fragments is of primary importance, there is also the hope that revegetation of cleared areas may reverse some damage by buffering remnants from surrounding land uses, increasing the habitat available to rainforest plants and animals, and facilitating dispersal of biota among remnants (Lugo, 1997; Parrotta *et al*., 1997a; Lamb, 1998; Herbohn *et al*., 2000; Tucker, 2000; Bonham *et al*., 2002; Hartley, 2002; Kanowski *et al*., 2003; 2005a, b; Lamb *et al*., 2005; Wright & Muller-Landau, 2006; Edwards *et al*., 2010).

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