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5.3.1 Regeneration of trees on different microsites

Densities of seedlings in Kokatahi were obtained from subplots that were mostly on the ground in permanent plots throughout the catchment (Appendix 2, Table A2.3). In 1982, comparable data were obtained in an area in which most trees of a former tall canopy had died over 30 years previously (Appendix 2, Table A2.4), including subplots on the ground, on logs, and on tree ferns. No southern rata seedlings were found in these plots (Appendix 2, Table A2.4) although they were found elsewhere in the catchment (Appendix 2, Table A2.3). Most species had higher densities of seedlings on the non-terrestrial microsites (e.g. tawheowheo in a lower altitude plot and papaumu at a higher altitude plot), although a few species (e.g. horopito) had higher densities on the ground than on tree fern trunks or logs (numbers of seedlings in each microsite were different for horopito, kamahi, papaumu, tawheowheo at 500 m, and for horopito, papaumu and *Coprosma ciliata* at 700 m, adjusted G tests, all $P<0.001$). However, it should be stressed that it is not known whether there are differences in seedling growth and survivorship among microsites.

5.3.2 Regeneration of former canopy species

In plots where dieback of former canopy trees had occurred, many species that formerly constituted the canopy have not been recruited into the communities that have replaced them. This is especially the case in Pohangina, where kamahi, the former dominant canopy species, is absent as either trees, saplings, or seedlings (Appendix 1, Table A1.1 and Appendix 2, Table A2.1). In Kokatahi, in contrast, regeneration of kamahi was observed in 1982 in plots where the former canopy had died more than 30 years before (Appendix 2, Table A2.4). However, in these same plots in Kokatahi, there was no regeneration of southern rata, a former canopy constituent, and little regeneration of Hall's totara (Appendix 2, Table A2.4). Seedlings of both southern rata and Hall's totara were found elsewhere in Kokatahi, albeit at low densities (Appendix 2, Table A2.3).

5.4 FOREST TYPE DISTINCTIONS BETWEEN STUDY AREAS

A classification of all plots at their earliest and most recent censuses using TWINSPAN showed that each study area had distinct forest types (Fig. 13), so extrapolation of results from single study areas is probably inappropriate. The classification distinguished different forest types along a gradient that reflects increasing altitude, and, to a lesser extent, latitude; this gradient is evident from the top to the bottom of the classification diagram (i.e. low-altitude Orongorongo subplots at the top and high-altitude Copland plots at the bottom). Indicator species at the first TWINSPAN division reflect a low altitude (characterised by porokaiwhiri (*Hedycarya arborea*) and mahoe) versus high altitude (papaumu) distinction. The first division separated nearly all North Island plots from those in Westland.

At the second division, the group of plots characterised by porokaiwhiri and mähoe were separated further, i.e. plots with a high basal area of porokaiwhiri (Orongorongo) from most plots in Pohangina (including all at the most recent

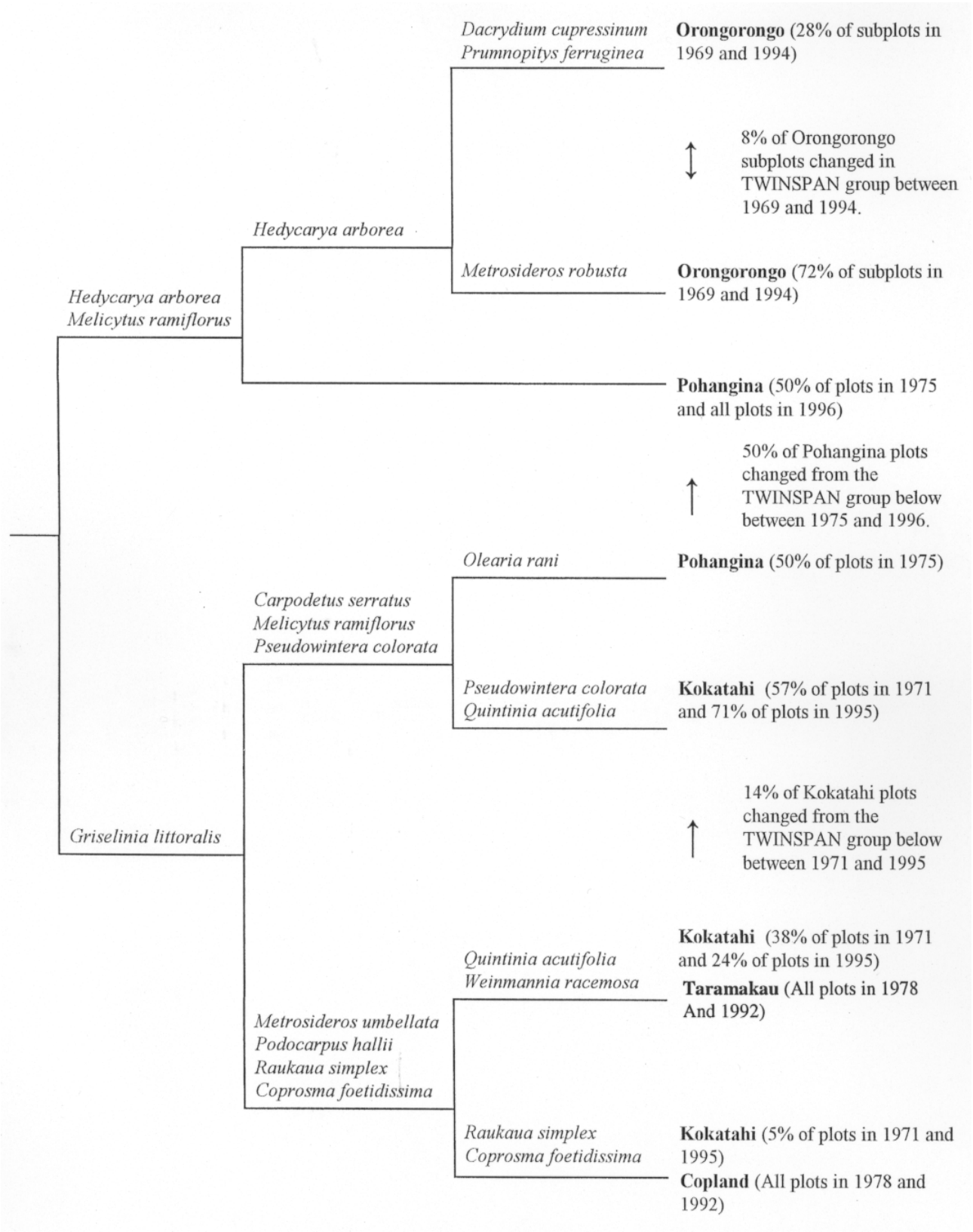

Figure 13. Twinspan classification of plots of the five study areas at the earliest and most recent census for each plot. Indicator species are shown for each division in the classification. Where plots changed classification between the earliest and most recent census, an arrow denotes the direction of change and the percentage of plots that changed classification are noted.

census). Orongorongo subplots were segregated further on the basis of those dominated by a high basal area of podocarps from those with a high basal area of northern rata.

The group of plots distinguished by papaumu were mostly from Westland, although half the Pohangina plots at the earliest census also were included in this group. A further division within this group separated plots characterised by shorter species (mahoe, horopito, and putaputaweta (*Carpodetus serratus*)) from those dominated by taller forest species (southern rata with frequent Hall's totara) with haumakoroa and hupiro (*Coprosma foetidissima*) in the understorey. The group characterised by lower stature species were typical of areas where there had been widespread mortality of former canopy tree species. This group was in turn separated into a group in which heketara (*Olearia rani*) was the indicator species (the Pohangina plots at the earliest census) and a second group in which horopito and tawheowheo were indicator species (most Kokatahi plots). Among the plots in which southern rata was dominant, further divisions separated those characterised by the presence of kamahi and tawheowheo (all Taramakau plots and some Kokatahi plots) from those characterised by high basal areas of haumakoroa and hupiro (all Copland plots and one Kokatahi plot).

Forest of most study areas, especially Taramakau and Copland, and to a lesser extent Orongorongo and Pohangina, was rather homogeneous, i.e. one or at most two forest types were recognised at the third level of TWINSPAN division. In contrast, vegetation in Kokatahi was more heterogeneous; three forest types were recognised. Some forests in Kokatahi were similar to those in Taramakau, others were similar to that in Copland, and a third forest type was unique to Kokatahi.

5.5 CHANGES IN FOREST COMMUNITIES OVER TIME

Most forest types showed no change between the earliest and most recent censuses; no plots in Taramakau and Copland changed in classification, and only 2 of 25 subplots within the Orongorongo plot changed classification during a 25-year census period (Fig. 13). Three of the six Pohangina plots changed in classification between 1975 and 1996; this was because papaumu, which distinguished these plots from others at the earliest census, became extinct on those plots in the intervening period (Fig. 13, Appendix 1, Table A1.1). Otherwise, the forest change between the censuses in Pohangina was not substantial (Appendix 1, Table A1.1). Plots in Kokatahi showed the greatest changes in classification between the earliest (1972) and the most recent (1995) censuses. Three of 21 plots showed a change in classification from tall forests characterised by dominance of southern rata, Hall's totara, kamahi, and tawheowheo to short forests dominated by horopito, tawheowheo, and putaputaweta, the most common forest type in the Kokatahi plots in 1995. These post-dieback communities were distinct from those in other study areas.

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