



4C



4D

4A



4B



Plates 4A–4D Present-day woody associations: high-elevation shrub and subshrub associations.

Plate 4A Highly modified subalpine association (H) on the Griffel Range (1300 m a.s.l.), in the alpine tussock-shrubland pre-settlement woody vegetation zone (X). Woody species include *Dracophyllum prunum*, *Gaultheria depressa* var. *depressa*, *Pimelea oreophila*, and, occasionally, *Hebe buchananii*.

Plate 4B *Ozothamnus* low alpine association (L) on the Griffel Range (1100 m a.s.l.), in the snow totara-mountain toatoa pre-settlement woody vegetation zone (VIII). Dieback in the *Ozothamnus leptophyllum* shrubland may be due to recent fire. The herbaceous vegetation is dominated by the exotic forb *Hieracium lepidulum*.

Plate 4C *Hebe odora*-mountain toatoa association (K) at 1050 m a.s.l. on the Rock and Pillar Range, in the bog pine-snow totara-mountain toatoa pre-settlement woody vegetation zone (IX). The present vegetation comprises *Chionochloa rigida* with relatively fire-tolerant *Hebe odora*, *H. propinqua* and *Dracophyllum uniflorum*.

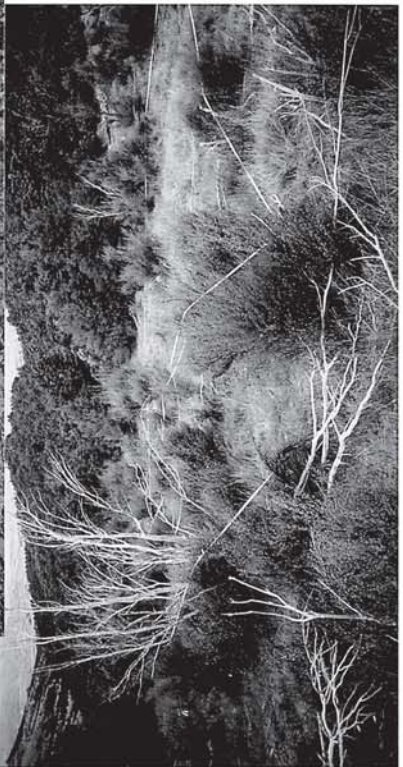
Plate 4D *Dracophyllum* high alpine association (M) on the Pisa Range (approx. 1500 m a.s.l.), in the alpine tussock-shrubland pre-settlement woody vegetation zone (X). Taller shrubs may have co-dominated with tall tussocks on the broad summits of schist ranges such as these in prehuman times, while dwarf and mat-forming shrubs were restricted to the highest, most exposed positions. Frequent fires in the early pastoral era probably removed the fire-sensitive upland woody flora as well as tall tussocks, and led to truncated soil profiles or loss of the entire regolith.



5A



5B



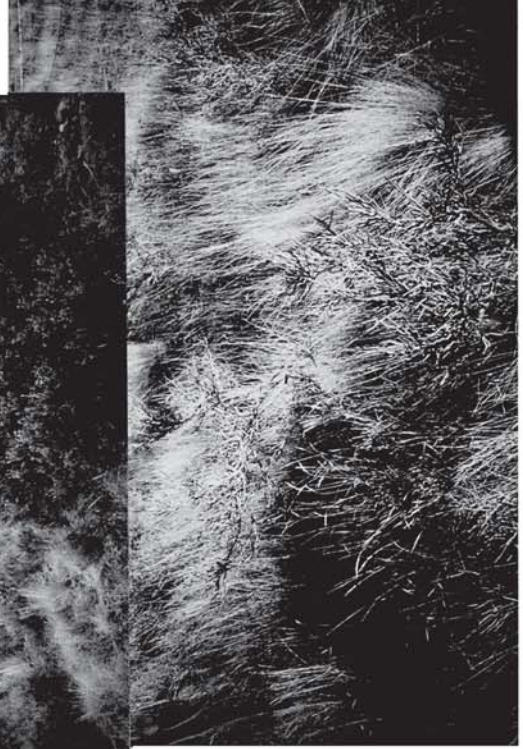
5C



5D



5E



5F

Plates 5A-5F Secondary woody successions in Central Otago.

- Plate 5A Secondary *Kunzea ericooides* (kanuka) woodland with occasional wilding pines on north-facing slopes at 350 m a.s.l. on the true right of the Luggate Creek in the kanuka-kowhai woodland pre-settlement woody vegetation zone (I). Other shrubs include *Coprosma crassifolia*, *Corokia cotoneaster*, *Helichrysum lanceolata*, and *Meliclytus alpinus*. A mature tree of *Olearia lineata* stands on a frequently flooded terrace on the true left creek bank, with dense shrubland of broom and gorse (woody plant association C) directly behind it.
- Plate 5B A *Podocarpus hallii* (Hall's totara) sapling at the base of a *Kunzea ericooides* shrub, in Locharburn Scientific Reserve at 600 m a.s.l. in the kanuka-kowhai-Hall's totara pre-settlement woody vegetation zone (IV). We counted 222 *P. hallii* seedlings and saplings in a 10 × 10 m quadrat in this community, suggesting rapid recruitment.
- Plate 5C *Kunzea ericooides* recovering from recent fire in Locharburn Scientific Reserve, adjacent to the fenced and less recently burned area of *K. ericooides* and *Podocarpus hallii* (Plate 5E, above).
- Plate 5D Shrubs of *Hebe propinqua* in the *Hebe odorata*-mountain toatoa subalpine association (K) on the eastern slopes of the Hector Mountains at approx. 1100 m a.s.l. The site falls within the bog pine-snow totara-mountain toatoa pre-settlement woody vegetation zone (IX).
- Plate 5E Regeneration of *Ozobannus leptophyllus* at 400 m a.s.l. on Flat Top Hill, in the kowhai-kanuka woodland (II) and kowhai woodland (III) pre-settlement woody vegetation zones. The young plants have established from the seed of three larger, adult plants in the 9 years following rabbit control and the exclusion of stock, apparently unimpeded by the short *Thymus vulgaris* (thyme) subshrub canopy.
- Plate 5F *Carmichaelia petriei* growth in stock-and-rabbit exclosures at 300 m a.s.l. on outwash terraces near Luggate, in the kanuka-kowhai woodland pre-settlement woody vegetation zone (I). A shrubland physiognomy has developed over 10 years where fertiliser has been applied annually. In the grazed vegetation, shrubs are reduced to coppiced stumps.