

Gorse and wilding pine management,
proposed additions, Maungatua S.R.

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SUMMARY

Land in a proposed addition to the Maungatua suite of reserves supports vegetation with high biological and landscape values. Acquisition would substantially increase these values of the present reserve. The addition of kanuka forest to the south of the proposed acquisition would complete protection of all significant natural features of the area.

Gorse is a prominent and sometimes dominant plant of vegetation in the proposed addition, and is spreading from here into the tussock grassland of the present reserve. Acquisition would enable integrated management of gorse under a single tenure. Restoration of native vegetation is feasible within several decades.

Wilding pines are establishing in tussock grassland in the reserve. from plantations to the west. Acquisition of the proposed addition would allow prevention of the establishment of a conifer seed source closer to the existing reserve. Conifer control requires restoration of native vegetation stature and density, and regular removal of conifer seedlings.

INTRODUCTION

Mr Brian Patrick, CAS, Department of Conservation, Dunedin, requested advice on the risk of increased gorse and wildling pine infestation of the Maungatua Scientific Reserve from a proposed addition of land on the eastern faces of the Maungatua Range (Duncan property). Other comments on gorse and pine dynamics in the area were also requested.

Conservation officer Dave Wilkins provided a map of the proposed addition. The area was inspected on 23 November 1992.

This report also utilises information from an earlier description of the vegetation of the east face of the Maungatua Range (Allen 1985; appended).

GORSE

The vegetation map of the 1985 report shows that much of the proposed addition to the reserve contains vegetation either dominated by, or with a substantial component of, gorse (Figure 1)

Patches of gorse ranging in size from single plants to infestations of several hundred square metres are scattered throughout depleted snow tussock grassland along most of the upper boundary of the proposed addition. In the absence of management, these will continue to spread into the grassland to at least 600m altitude (Lee *et al.* 1986).

Stands of continuous gorse occupy a zone between developed pasture and adjacent more or less natural vegetation on most of

the main spurs. Gorse is rapidly invading pasture here, and will displace it within a few years in the absence of management. In these situations, gorse is likely to persist for several decades before being displaced by native woody vegetation (Lee *et al.* 1986).

Patches of gorse occur within bracken fernland on many spurs. If the vegetation remains undisturbed, and in particular is not burned, gorse spread should be constrained by the height and density of the bracken until displaced by the establishment of native woody vegetation over a period of decades.

Where gorse is interspersed with native small tree species, especially kanuka and manuka, these will overtop and kill it within a couple of decades. This process can be seen well underway on spurs below the most southerly part of the proposed addition.

As well as displacing native grassland vegetation, gorse probably represents a greater fire risk than native vegetation in this area, because it accumulates a deep dry litter layer. It also disrupts the naturalness of the landscape with conspicuous and intrusive blotches of bright yellow flowers against the subdued browns and greens of native vegetation during spring and early summer.

The addition of the Duncan property to the Maungatua suite of reserves would allow protection of important natural values described in the earlier report (Allen 1985). Equally importantly, it would allow integrated management of gorse under a single land tenure, reducing the risk of fire and substantially increasing the potential for control of spread and eventual eradication.

PINES

The plantations to the west of the existing Waipori and Maungatua reserves are the only significant source of wildling pines in the area. Seedlings from these establish continually in the tussock grasslands on the western flank of the Maungatua Range, and pose a risk of infestation to the reserves. The proposed addition of the Duncan property will not add to this risk, but would allow prevention of the establishment of a source of seed closer to the existing reserve. It would also facilitate better integration of control in the tussock grassland of the upper Mill Creek catchment by rationalising land tenure.

Control of wildling pines requires regular removal of seedlings as they establish and before they become reproductively mature. Management of tussock grassland to maintain a continuous canopy of tall tussock will reduce the availability of microsites suitable for conifer establishment (Allen and Lee 1989), and thus reduce the effort, although not the frequency, required for control operations.

CONSERVATION SCOPE OF PROPOSED ADDITIONS

Almost all currently unprotected land with biological conservation and landscape values on the eastern faces of the Maungatua Range is included in the proposed addition. The only significant omission is the extensive kanuka forest to the south. Its inclusion would be a substantial improvement to the proposal.

MANAGEMENT IMPLICATIONS

Gorse

Gorse should be managed both to eradicate some existing stands and to prevent its further spread.

1. Stands at present surrounded by tall native scrub or forest require no intervention if reversion to native vegetation is the long-term aim of management.

2. Gorse will not spread through a barrier of taller shrubs or trees, so containment can be assisted by encouraging establishment of kanuka, manuka and silver beech at the edges of gorse stands.

3. Where gorse is invading pasture, establishment of kanuka and manuka will accelerate its eventual demise through overtopping. Planting of scattered kanuka and manuka shrubs to act as centres for dispersal for these species in pasture will help achieve this result.

4. Establishment of gorse in tussock grassland can be slowed by eradication of existing isolated stands, by establishment of dense intertussock vegetation, and by recovery of tussock height and density. Over a period of decades, native woody species, particularly manuka, should displace tussock grassland up to the altitudinal limit of gorse, thus eliminating the problem. In the very long term, silver beech forest should cover the slopes of the range up to local timberline.

Pines

Removal of the source of wilding pine seedlings is unlikely to be a viable option, so control of pines should concentrate on regular removal of seedlings from tussock grassland. This must take place at intervals not longer than the period required to reach reproductive age, varying from about five years for *Pinus contorta* to ten years for radiata pine, 12 years for Douglas fir and European larch, and 18 years for Corsican pine.

CONCLUSION

Gorse on the proposed addition to the Maungatua reserve is a source of infestation of snow tussock grassland and pasture, irrespective of the tenure of the land. Under DoC tenure, gorse

management could be integrated over almost all land with biological and landscape values on the eastern faces of Maungatua.

The source of wildling pine infestation of the Maungatua reserves is plantations to the west. The proposed addition will have no effect on this problem, but would allow better integration of control under a single land tenure. Pine control requires regular destruction of seedlings before they reach reproductive age.

The inclusion of kanuka forest adjacent to the southern boundary of the proposed addition would result in protection of virtually all the significant biological and landscape values of the eastern faces of the Maungatua Range.

REFERENCES

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Lee, W.G., Allen, R.B., Johnson, P.N. 1986: Succession and dynamics of gorse (*Ulex europaeus* L.) communities in the Dunedin Ecological District, South Island, New Zealand. *New Zealand Journal of Botany* 24: 279-292.

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MAUNGATUA RANGE, EAST FACE VEGETATION MAP

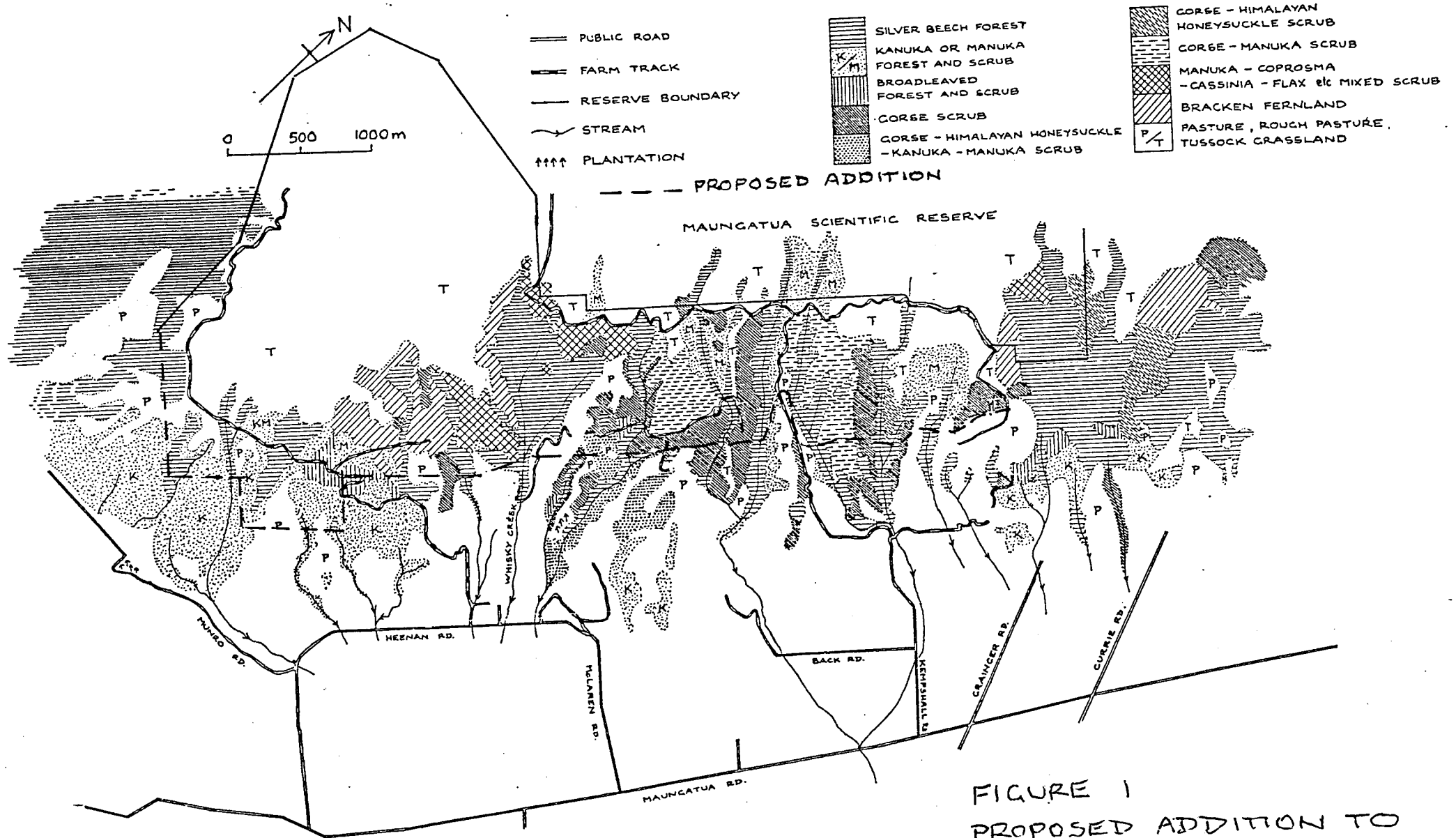


FIGURE 1
PROPOSED ADDITION TO
MAUNGATUA RESERVE

APPENDIX

Vegetation of the east face of the Maungatua Range, east Otago.

Unpublished report, Botany Division, DSIR

VEGETATION OF THE EAST FACE OF THE MAUNGATUA RANGE,
EAST OTAGO.

R.B.Allen, Botany Divn, DSIR. Private Bag, Dunedin. 8/3/85

SUMMARY

Vegetation on the eastern face of the Maungatua Range was surveyed to assess its biological and landscape values. Ten vegetation types were recognised:

1. Silver beech forest
2. Kanuka forest and scrub, manuka scrub
3. Broadleaved forest and scrub
4. Gorse scrub
5. Gorse - Himalayan honeysuckle - kanuka - manuka scrub
6. Gorse - Himalayan honeysuckle scrub
7. Gorse - manuka scrub
8. Manuka - Coprosma - Cassinia - flax etc. mixed scrub
9. Bracken fernland
10. Pasture, rough pasture, tussock grassland

Logging, clearing, fire and grazing have markedly modified native vegetation and encouraged the establishment and spread of exotic scrub weeds. Nevertheless, remaining native forest, scrub and snow tussock communities are in healthy condition, and regenerate well in the absence of disturbance.

With continuation of present management practices, the condition of native vegetation will deteriorate, and exotic scrub will replace many scrub and forest communities as well as further invade grassland. In the absence of clearance, fire and stock, native vegetation would recover and native forest would eventually re-establish over most of the area.

It is recommended that all land at present not in developed pasture should be protected to maintain and enhance the considerable biological and landscape values of the eastern face of the Maungatua Range.

KEYWORDS

Maungatua Range, silver beech, kanuka, manuka, scrub weeds, reserve proposal, Tokomairiro Ecological District, Otago Coast Ecological Region.

INTRODUCTION

Predominantly native vegetation on the east face of the Maungatua Range, mainly on the property of Mr M. Duncan, McLaren Road, RD 1, Outram, was surveyed on 7 February and 6 March 1985. Information on vegetation and flora was collected for assessment of biological and landscape values, and as part of a general survey of remnants of indigenous vegetation of the Taieri Plains area.

SITE DESCRIPTION

Located between NZMS 1 S 163 310650 and 362720, a mosaic of silver beech forest, kanuka, manuka, gorse and Himalayan honeysuckle scrub, bracken fernland, tussock grassland and pasture occupies a series of south-easterly aspect ridges and gullies above rolling foothills in developed pasture. Slope ranges from 10 to 40°, mostly above 20°, and altitude is from 120 to 650 m.

The soil type is mapped as Tuapeka steepeland silt loam, a lowland yellow-brown earth (N.Z. Soil Bureau 1963). It overlies strongly foliated quartzo-feldspathic schist mapped as Chlorite Subzone IV of the Haast Schist Group (McKellar 1966). Annual rainfall is approximately 750 mm (N.Z. Meteorological Service 1982).

The Maungatua Scientific Reserve is situated immediately upslope of the area surveyed, protecting mainly tussock grassland, subalpine scrub and bog vegetation types. Silver beech forest is reserved in the Mill Creek catchment of the Waipori Falls Scenic Reserve, draining the south-western slope of the Maungatua Range, and in the Maungatua Scenic Reserve at the northern end of the range. Most of the other native vegetation types recorded on the east face of the range are also protected to some extent in the existing reserves.

The east face of the Maungatua Range is located in the Tokomairiro Ecological District of the Otago Coast Ecological Region.

VEGETATION

1. Silver beech forest

A detailed survey of silver beech forest was undertaken in the catchment locally known as Whisky Creek or Black Gully, the major stand (c. 30 ha) of this vegetation type in the area examined.

(a) Main gullies.

Silver beech trees up to about 25 m tall and 100 cm diameter at breast height (dbh) occupy the main gullies, particularly in the central and western parts of the area. Here the tall subcanopy contains mahoe, lemonwood, broadleaf, marbleleaf, lancewood and other broadleaved tree species. Tree ferns - *Dicksonia squarrosa* and *Alsophila smithii* - dominate the understorey, but small trees such as peppertree and mapou, and small plants of the subcanopy broadleaved tree species, occur wherever tree ferns are sparse.

Small shrubs, mostly *Coprosma rhamnoides*, are infrequent, and ground cover is patchy, with crown fern dominant where the cover of tree ferns is least dense. Stream sides carry a variety of ferns, predominantly *Blechnum chambersii*, *B. fluviatile* and, particularly on fallen logs, the filmy fern *Hymenophyllum sanguinolentum*. Patches of *Leptolepia novae-zelandiae* and *Leptopteris hymenophylloides* are less common, and *Blechnum colensoi* is restricted to the most

shady habitats. Regeneration of broadleaved tree and shrub species is adequate, but beech seedlings and saplings are infrequent.

(b) Broad central ridges.

These carry fairly open forest of tall, straight silver beech trees of apparently similar age, most falling within the diameter range of 20 to 40 cm. Occasional much larger trees, low-branched and up to about 30 cm dbh, are scattered throughout these stands. No subcanopy layer is evident, and the understorey is restricted to scattered small shrubs of *Coprosma rhamnoides* and a few small tree ferns. Ground cover is provided by dense crown fern except on the gently-sloping broad ridge crests, where there is a carpet of very low *Blechnum latifolium* and the creeping herb *Nertera dichondraefolia*. Few seedlings of beech or other trees or shrubs were noted.

(c) Logged forest.

Logging in the lower gully has resulted in open forest of widely-spaced large beech trees, usually of unmerchantable form, with occasional more slender trees of similar height. A vigorous subcanopy of broadleaved trees, particularly pepper tree, mahoe, marbleleaf, mapou and broadleaf, is present, with a moderately dense understorey of *Coprosma rhamnoides* and young plants of subcanopy species. Crown fern provides much of the ground cover, but small *Alsophila smithii* tree ferns are common, and damp areas carry ferns such as *Blechnum chambersii* and *B. colensoi*, with clumps of hooked sedge, occasional bush rice grass, and patches of mosses. Regeneration of broadleaved tree and shrub species is good, but beech seedlings and saplings are sparse.

(d) Pole stands.

Areas of dense pole stands of beech near the upper northern and eastern edges of the beech forest area attest to relatively recent clearance of the original forest. Trees 5 to 20 cm dbh, straight and relatively unbranched, form thickets which exclude most other-plants. *Coprosma rhamnoides* is present at low density as small shrubs, and scattered ferns, mainly *Hypolepis millefolium* and bracken, provide about 10% ground cover.

Silver beech forest with a similar range of variation occurs in most of the major gullies of the east face of the Maungatua Range, as denoted on the accompanying vegetation map. Large trees are usually confined to the immediate stream-sides, often as long narrow stands no more than a few trees wide. These situations contain the most diverse subcanopy, understorey and ground vegetation strata. Pole stands, varying between perhaps ten and a hundred metres in width, are established on the upper gully sides along the edges of the more mature forest. Here the understorey and ground strata are sparse and species-poor.

2. Kanuka forest and scrub, manuka scrub.

Kanuka stands of a range of ages are extensive on the broad face at the southern extremity of the area surveyed, and are scattered in lower gullies elsewhere. In the youngest stands, mostly established in rough exotic grassland around

the upper edges of gullies above mid-slope, manuka, Coprosma, and other shrub species may contribute a small proportion of the dense vegetation. With increasing age, kanuka dominance increases. On dry sites such as ridge crests, where kanuka is commonly 6 - 8 m tall and up to 20 cm dbh, virtually the only other component of the vegetation is a sparse ground cover of Blechnum latifolium, Poa imbecilla and Lagenifera strangulata.

The largest stems of kanuka, up to 15 m tall and 30 cm dbh, occur in gullies, associated with broadleaved trees such as kohuhu, lancewood, three finger, broadleaf, wineberry and peppertree. The understorey here comprises Coprosma species and small broadleaved trees, frequently containing entanglements of lawyer vines. Ground cover of up to 70% is provided by prickly shield fern, with some crown fern in damper gullies, where other ferns and some herbaceous species may also occur.

Manuka is common upslope of kanuka stands and beech forest, forming a fringe or sometimes extensive stands of shrubs seldom more than 1.5 m tall between these and snow tussock grassland. It extends to higher altitude on northern faces of upper gullies, and also occurs on exposed or cold faces at lower altitude, often associated with bracken, gorse, Himalayan honeysuckle and poor-quality pasture. At all but the highest altitudes kanuka may occur with manuka, and in many places manuka-dominant vegetation grades into a mixed scrub of indigenous shrub species.

Silver beech is frequently associated with kanuka and manuka. Scattered small beech saplings occur in dense young stands of both species, and grow up within them to result in occasional poles up to 8 or 10 m tall in mature stands. Establishment of beech continues within tall kanuka, particularly on drier sites where the understorey and ground cover are relatively sparse, so a range of sizes of beech stem from seedling to small tree is usually present.

3. Broadleaved forest and scrub.

Small patches of low (8 - 10 m tall) forest dominated by broadleaf, kohuhu, marbleleaf, wineberry, plus at lower altitude mahoe, mapou and lemonwood, occur within or adjacent to silver beech stands. Where stock access is limited, a dense understorey of peppertree, Coprosma species, small broadleaved trees and lawyer is established over patchy ground cover of crown fern, hound's tongue fern, hooked sedges and a variety of other ferns and herbs. Where stock are present, such as in forest adjacent to the farm track south of Whisky Creek, browsing has removed all understorey and ground cover vegetation except for scattered peppertree and infrequent crown fern. The only podocarp recorded during this survey was a mature rimu noted in broadleaved forest adjacent to the main farm track south of Whisky Creek.

Most of the tree and shrub species of broadleaved forest are also found in a lower-statured scrub adjacent to taller vegetation on shady, damp sites, especially in the lower parts of the main gullies. Frequently this vegetation exists only as a band a few metres wide, such as on the north side of lower Whisky Creek, beside beech forest. However, more extensive stands establish where competition from exotic scrub weeds and pressure from agricultural activities and stock are sufficiently low.

Gorse scrub.

Dense gorse to 2 m tall occupies large areas of the north faces of gullies north of Whisky Creek, and gorse is vigorously invading adjacent rough pasture and snow tussock grassland. Few species are found in gorse stands other than occasional manuka, kanuka and Himalayan honeysuckle, where these have established at the same time as the gorse.

5. Gorse - Himalayan honeysuckle- kanuka - manuka scrub

Predominantly confined to the two gullies north of Whisky Creek, this vegetation type varies from a heterogeneous mixture of these species to a mosaic of small, almost monospecific stands. Scattered standing charred tall stems of kanuka and occasional cabbage trees suggest derivation from kanuka forest, such as still exists nearby, as a result of sporadic fires.

6. Gorse - Himalayan honeysuckle scrub.

Mainly occupying broad ridges adjacent to beech forest in the north of the area surveyed, dense gorse and Himalayan honeysuckle about 2 m tall form a mosaic of monospecific stands, with the two species seldom mixed.

7. Gorse - manuka scrub.

mixture of gorse and manuka, with less kanuka, is the predominant vegetation of the southern faces of major ridges in the central part of the area surveyed. Remaining patches of indigenous or exotic grassland in these areas are being invaded and replaced by the scrub species.

8. Manuka - Coprosma - Cassinia - flax etc. mixed scrub.

Scattered along the upper limit of woody vegetation, but concentrated above and to the south of Whisky Creek, is low (1 -2 m tall) scrub of varying proportions of manuka, *Coprosma rugosa*, *C. propinqua*, mountain tauhinu and, on damper sites, mountain flax. Snow tussock, inanga and *Hebe odora* are prominent in places, and *Blechnum latifolium* may form patches of dense ground cover. Numerous species of sub-shrub, grass, herb and fern completely cover the ground, and mosses are abundant on damp and shady sites.

9. Bracken fernland.

Dense bracken to 1.5 m tall covers dry north-aspect slopes south of Whisky Creek and in the north of the area surveyed. Scattered dead small stems of manuka attest to the past burning of this vegetation, and at present manuka, mountain tauhinu, gorse, Spanish heath and Himalayan honeysuckle are establishing sporadically within the bracken. Seepages and small gullies support toetoe, mountain flax, *Juncus gregiflorus*, rautahi, niggerhead and a variety of native and introduced herbs and grasses.

10. Pasture, rough pasture, tussock grassland.

Most of the rolling foothill country of the range carries well-established pasture of introduced grasses and legumes. With increasing altitude, pasture on the lower slopes of the main ridges deteriorates in condition to become dominated by low-producing sward grasses such as browntop and sweet vernal, with a high proportion of introduced weed species. Here repeated clearing of regenerating scrub has failed to eradicate gorse, seedlings of which are evident on any recently-cultivated ground. Rushes dominate on seepage areas.

Short tussock grassland (hard and silver tussock) occupies a clearing within beech and kanuka forest at the northern end of the area surveyed, but introduced grasses and weeds provide the majority of ground cover here too.

Snow tussock grassland is the dominant vegetation type on the upper slopes of the range above most woody vegetation. With a ground cover seldom exceeding 50%, snow tussock is interspersed mainly with browntop and sweet vernal at lower altitude, with native intertussock species becoming predominant nearer the summit. The transition between tussock and scrub is gradual, and a mixture of grassland and scrub species may occupy a band up to a few hundred metres wide. Vegetation dominated by snow tussock extends down a few ridges almost to mid-slope, surrounded by scrub or pasture, but here is being invaded and displaced by shrub species.

DISCUSSION

The vegetation patterns of the east face of the Maungatua Range are largely induced by human influence, and demonstrate successional trends which reflect this factor as well as the natural relationships of plants to soil and climatic conditions (diagram attached).

Silver beech forest would have occupied almost the entire range in pre-Polynesian times, with cushion herb-moor and inanga scrub restricted to the permanently wet, exposed summit plateau (Mark, 1955). Maori fires removed much of the forest, inducing a cover of snow tussock grassland into which beech would periodically spread until driven back into the main gullies by subsequent fires. Since European settlement, grazing following burning has weakened the snow tussock and in many places resulted in its replacement by browse-tolerant shrubland and bracken fernland. Early

European demands for timber and agricultural land also resulted in destruction of almost all of the podocarp-rich forests of the footslopes of the range, now clothed in exotic pasture. Tiny and impoverished remnants survive only near Woodside, beyond the northern end of the area surveyed for this report.

The catchment of Whisky Creek contains a typical example of beech forest which has been subjected to several phases of modification. The large trees and well-developed subcanopy and understorey occupying the western and lower main gullies probably represent forest which has escaped human influence. However, deer and stock have had some effect on the vegetation: palatable species such as stinkwood, three finger and broadleaf are rare in the lower understorey, and tracking is evident throughout, often baring substantial areas of ground.

Polynesian fires are most likely to be the reason for the large areas of even-aged forest on the main ridges. Extensive windthrow is a further possibility for their establishment, but the mounds and hollows typically present as evidence of such events were not noted here. The scattered low-branched massive beech trees indicate establishment of a first generation on a site previously cleared of forest, with subsequent regeneration resulting in a second generation of straight, relatively unbranched trees all of similar size. Beech diameters here suggest establishment before the advent of European settlement. The open understorey of these stands reflects both the drier nature of their situation, and its attractiveness to animals, which prevent much regeneration of palatable plants.

Logging of the lower gully dates from early European times, reportedly about 100 years ago (Mr M.Duncan, pers. comm.). This is supported by the absence of stumps or slash, which would decay relatively quickly in this damp situation, and by the diameter of the youngest trees in the stand, which would have established in canopy gaps caused by the logging. Clearing of the upper areas was more recent and more thorough, probably accomplished or assisted by fire. No mature trees remain, and the diameter range of poles suggests destruction of the original vegetation between 40 and 80 years ago. The charred remains of stumps within pole beech stands in catchments immediately south of Whisky Creek are further evidence for this. In places clearance has evidently occurred even more recently, perhaps resulting from burning of the forest margin during fires in adjacent bracken, tussock and scrub vegetation.

Forest at Whisky Creek differs from that protected at Mill Creek to the west and the Maungatua Scenic Reserve to the north-east, both in the range of ages of beech stands present, and in species composition. The existence of extensive even-aged stands is not recorded from either reserve area except as occasional dense secondary growth

sometimes present at the forest edge in Mill Creek (Ward 1983). However, such stands are reported to occur in the upper catchment of Mill Creek, with evidence of former extensive windthrow as their origin (Dr.A.F.Mark, pers. comm.). Podocarps, mainly Hall's totara, are present in both reserves (Allen 1978, Ward 1983) but were not recorded in beech forest at Whisky Creek. The dense understorey reported at lower altitude at Mill Creek, often with podocarp seedlings and dense mingirningi, is absent from Whisky Creek.

Broadleaved forest described in this report differs from that reported in the Waipori Falls and Maungatua Scenic Reserves (Allen 1978) and in the lower Mill Creek catchment (Ward 1983) in the lack of several shrub or small tree species and in a general absence of podocarps. The former probably reflects the higher altitude of forest surveyed for this report (adjacent to the main farm track south of Whisky Creek), the comparatively small size of the stands surveyed, and the effects of stock which have free access to them. Both Scenic Reserves have been protected from logging since around the turn of the century, so the absence of podocarps from nearby unprotected beech and broadleaved forest on the east face of the range is probably largely due to continual logging since then, especially on the lower slopes.

While the establishment of kanuka scrub and forest at lower altitudes has resulted from destruction of former forest by clearing and fire, and that of indigenous scrub at higher altitudes largely through burning and grazing, gorse stands owe their origin mainly to the establishment of farm tracks. Gorse seed is ill-adapted to dispersal by stock or wind, and is usually carried to a site in mud stuck to machinery or in transported gravel. Once established by a track, gorse plants rapidly mature to produce seed which is dispersed a few metres laterally by explosive pod opening. Once established, gorse forms a dense cover within which few indigenous plants can establish, and may persist on a site for several generations until taller plants are present at sufficient density to suppress it (Lee et al in press). Himalayan honeysuckle produces a succulent fruit suited to dispersal by birds, but will not establish in existing closed vegetation or persist for long when overtopped. While not as aggressive as gorse, it often forms dense stands which discourage invasion by indigenous tree species, frequently preferring shady faces where gorse is not particularly successful.

Bracken fernland, perpetuated by burning, is invaded by manuka and other scrub species if left undisturbed, as seen south of Whisky Creek. A similar succession is evident in snow tussock grassland, for at least 150 m altitude above the present upper limit of forest.

In the absence of further burning or clearing, indigenous scrub types, predominantly kanuka at lower altitude and

manuka at higher, will continue to displace exotic and indigenous grassland up to about 750 m altitude. Gorse and Himalayan honeysuckle will compete with the indigenous species on relatively open ground at low to mid altitude, but will not enter or displace established native scrub vegetation. Eventually, perhaps after half a century, exotic scrub will be replaced by indigenous forest, including kanuka and broadleaved species. Beech forest will continue to expand from its present locations to displace adjacent grassland and scrub, and to establish in mature kanuka stands which it will replace in a matter of a couple of generations.

With the paucity of nearby seed sources, podocarp re-establishment on the east faces of the range will be slow, extending from north and south where mature trees still exist. Several centuries would elapse before anything approaching a natural density of podocarps was present within forest now in existence, and in the very unlikely event of discontinuation of agricultural use of the lower slopes it would be equally long before their original podocarp-rich forest returned.

CONCLUSION

The biological continuum of forest, scrub and tussock grassland communities of the Maungatua Range reflects gradients in altitude and aspect, and demonstrates vegetation development in response to disturbance by human and other factors over a period of more than a thousand years. As these patterns are increasingly disrupted by agricultural activities and clearance for timber and firewood, each remnant of indigenous vegetation increases in biological and scientific value. Farmland now extends far up most of the major ridges of the eastern flank of the range, and large expanses of bracken, gorse and Himalayan honeysuckle attest to the extensive removal of native scrub and forest from soils unsuited to agriculture. Further losses of indigenous vegetation will deny the opportunity for protection of anything like a representative range of vegetation types, and destroy much of the historical and biological interest of the Maungatua Range.

The landscape of the eastern flank of the Maungatua Range, up until the last decade largely one of native forest, scrub and tussock grassland, is rapidly fragmenting into a mosaic of rough farmland, gorse and bracken, interspersed with diminishing patches of native vegetation and dissected by the scars of farm tracks. As the major feature of the landscape of the southern approach to the town of Mosgiel and the city of Dunedin, and as the immediate backdrop to Dunedin's airport at Morriona, the Maungatua Range is of immense scenic importance. The only stands of tall forest remaining on the east flank of the range, the areas of beech described in this report are visually prominent from most parts of the Taieri Plain, and from State Highway 1 between Mosgiel and Waihola. The green of well-developed

pasture on the gentle lower slopes helps to emphasise the more sombre olive and tawny tones of the native forest and tussock grassland on the more rugged slopes above, and the transition between cultural and natural landscape here correlates well with topographical change. In comparison, the sudden diagonal and vertical lines of tracks and boundaries of felled or burnt vegetation on the mid-slopes relate very badly to the contours of the landscape, and detract from the scenic quality of the range.

With careful management, including the protection of native scrub and forest remnants from clearing, the prevention of fire in bracken and tussock grassland, and efficient use of exotic pastoral land, the landscape and biological values of the eastern faces of the range would recover. Natural succession from rough pasture or bracken to manuka, kanuka and broadleaved scrub and low forest, and expansion of beech stands into adjacent vegetation, would relatively quickly soften the harsh lines of fire scars and felled scrub edges. Eventually, over a period of perhaps two or three hundred years, forest should re-establish over much of the area.

Understanding of the values of natural landscapes is increasing rapidly, as is evident in the upsurge of recreational use of the countryside around Dunedin, and the popularity of natural history programmes in the area. Existing reserves on the Maungatua Range, encompassing the area from the Waipori Gorge, up the Mill Creek catchment, across the summit and, apart from a gap of a few hundred metres of tussock grassland, to Woodside Glen, are already very popular for recreation, and of considerable importance for study and education. Unfortunately, the most conspicuous part of the entire range, the eastern face, is largely unprotected.

Constraints are imposed on efficient agricultural development of this area by the the topography, slope, soil fertility, costs of clearing and fertiliser, and unavailability of development finance. Burning of bracken and gorse to produce useful pasture is pointless, resulting in perpetuation of these vegetation types unless accompanied by topdressing, oversowing and subsequent regrowth control. Clearfelling of kanuka and beech for firewood and timber is an unsustainable resource use, almost inevitably resulting in establishment of gorse or other types of scrub unless followed by intensive management.

Deterioration of the natural values of the eastern face of Maungatua will continue unless remaining indigenous vegetation is protected and farming is confined largely to the more productive and manageable lower slopes.

RECOMMENDATION

Property on the eastern face of the Maungatua Range,

including all that land at present not in developed pasture or exotic plantation, should be acquired by the Crown or otherwise managed to protect and enhance its biological, scenic and recreational values. The areas of silver beech forest occupying Whisky Creek and other major gullies described in this report are central to these values, and should be a priority for protection.

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SPECIES LIST

<i>Acaena novae-zelandiae</i>	bidibidi
<i>Agrostis capillaris</i> *	browntop
<i>A. stolonifera</i> *	creeping bent
<i>Alsophila smithii</i>	tree fern
<i>Anthoxanthum odoratum</i> *	sweet vernal
<i>Aphanes arvensis</i> *	parsley piert
<i>Aristotelia serrata</i>	wineberry
<i>Asplenium bulbiferum</i>	hen and chickens fern
<i>A. flaccidum</i>	
<i>A. hookerianum</i>	
<i>Astelia fragrans</i>	bush flax
<i>Blechnum colensoi</i>	
<i>B. discolor</i>	crown fern
<i>B. fluviatile</i>	
<i>B. chambersii</i>	
<i>B. latifolium</i>	
<i>B. minus</i>	
<i>B. penna-marina</i>	
<i>Bromus mollis</i> *	soft brome
<i>Bulbinella angustifolia</i>	Maori onion
<i>Carex coriacea</i>	rautahi
<i>C. recta</i>	niggerhead

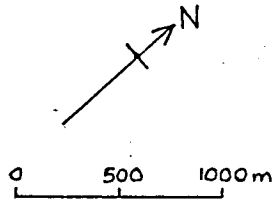
<i>Carpodetus serratus</i>	marbleleaf
<i>Cassinia vauvilliersii</i>	mountain tauhinu
<i>Cerastium fontanum</i> *	mouse-ear chickweed
<i>Chionochloa rigida</i>	snow tussock
<i>Cirsium vulgare</i> *	Scotch thistle
<i>Clematis paniculata</i>	clematis
<i>Coprosma ciliates</i>	
<i>C. foetidissima</i>	stinkwood
<i>C. linariifolia</i>	
<i>C. parviflora</i>	
<i>C. propinqua</i>	
<i>C. pseudocuneata</i>	
<i>C. rhamnoides</i>	
<i>C. rotundifolia</i>	
<i>C. rugosa</i>	
<i>Cordyline australis</i>	cabbage tree
<i>Cortaderia richardii</i>	toetoe
<i>Cyathodes fraseri</i>	patotara
<i>C. juniperina</i>	prickly heath
<i>Dacrydium cupressinum</i>	rimu
<i>Dichelacne crinita</i>	long-hair plume grass
<i>Dicksonia squarrosa</i>	tree fern
<i>Digitalis purpurea</i> *	foxglove
<i>Dracophyllum longifolium</i>	inanga
<i>Epilobium</i> sp.	willow herb
<i>Erica lusitanica</i> *	Spanish heath
<i>Festuca novae-zelandiae</i>	hard tussock
<i>Fuchsia excorticata</i>	tree fuchsia
<i>Gaultheria antipoda</i>	fool's beech
<i>Geranium microphyllum</i>	
<i>Gnaphalium audax</i>	creeping cudweed
<i>G. luteo-album</i>	Jersey cudweed
<i>Gonocarpus aggregatus</i>	
<i>G. montanus</i>	
<i>Griselinia littoralis</i>	broadleaf
<i>Gunnera monoica</i>	
<i>Hebe odora</i>	
<i>H. salicifolia</i>	koromiko
<i>Helichrysum bellidioides</i>	everlasting daisy
<i>H. filicaule</i>	creeping everlasting
<i>Holcus lanatus</i> *	Yorkshire fog
<i>Hordeum murinum</i> *	barley grass
<i>Hydrocotyle americana</i>	waxweed
<i>H. moschata</i>	hydrocotyle
<i>Hymenophyllum sanguinolentum</i>	filmy fern
<i>Hypochoeris radicata</i> *	catsear
<i>Hypolepis millefolium</i>	
<i>Juncus bufonius</i>	toad rush
<i>J. effusus</i> *	soft rush
<i>J. gregiflorus</i>	leafless rush
<i>J. novae-zelandiae</i>	
<i>J. planifolius</i>	grass-leaved rush
<i>Lagenifera strangulate</i>	
<i>Leptopteris hynenophylloides</i>	
<i>Leptospermum ericoides</i>	kanuka
<i>L. scoparium</i>	manuka
<i>Leycesteria formosa</i>	Himalayan honeysuckle
<i>Lolium perenne</i>	perennial ryegrass
<i>Luzula rufa</i>	
<i>Lycopodium fastigiatum</i>	clubmoss

Melicytuss ramiflorus	mahoe
Metrosideros diffusa	climbing rata
Microlaena avenacea	bush rice grass
Mycelis muralis *	wall lettuce
Myrsine australis	mapou
Nertera dichondraefolia	
Nothofagus menziesii	silver beech
Parsonsia heterophylla	NZ jasmine
Pernettya macrostigma	
Phormium cookianum	mountain flax,
Phyrriatosorus diversifolius	hounds tongue fern
Pittosporum eugenioides	lemonwood
P. tenuifolium	kohuhu
Poa colensoi	blue tussock
P. imbecilla	
P. laevis	silver tussock
Polystichurn vestitum	prickly shield fern
Pseudopanax colensoi	three finger
P. crassifolius	lancewood
P. simple;	
Pseudowintera colorata	peppertree
Pteridium esculentum	bracken
Ranunculus hirtus	
R. foliosus	grassland buttercup
Rubus cissoides	lawyer
Rurnex acetosella *	sheep's sorrel
Rytidosperma gracile	danthonia
Scirpus aucklandicus	
Senecio glorneratus	fireweed
S. minimus	fireweed
Taraxacum officinale *	dandelion
Trifolium repens *	white clover
Ulex europaeus *	gorse
Uncinia clavata	hooked sedge
U. uncinata	hooked sedge
Urtica incisa	native nettle

* introduced species

MAUNGATUA RANGE, EAST FACE

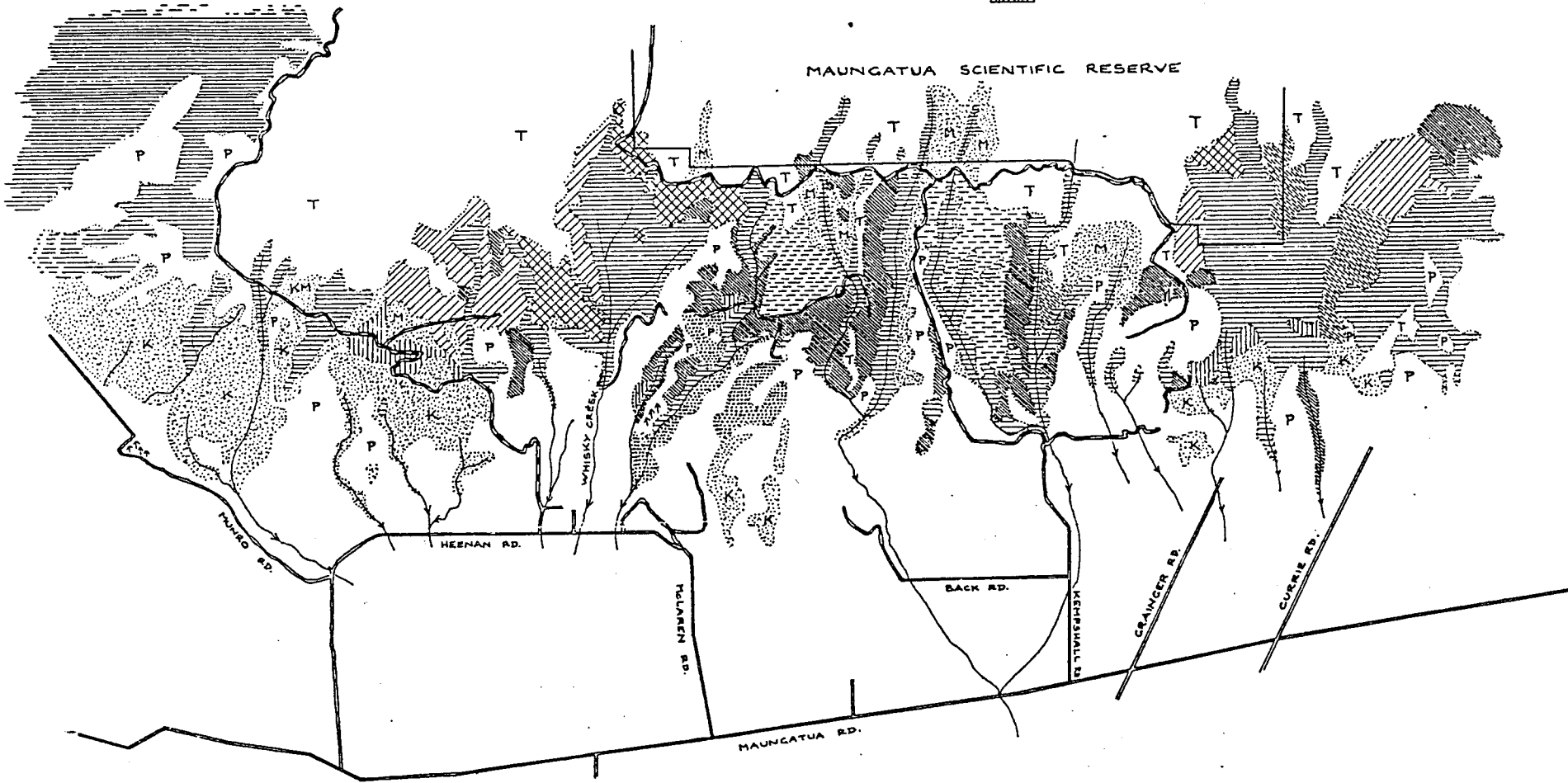
VEGETATION MAP

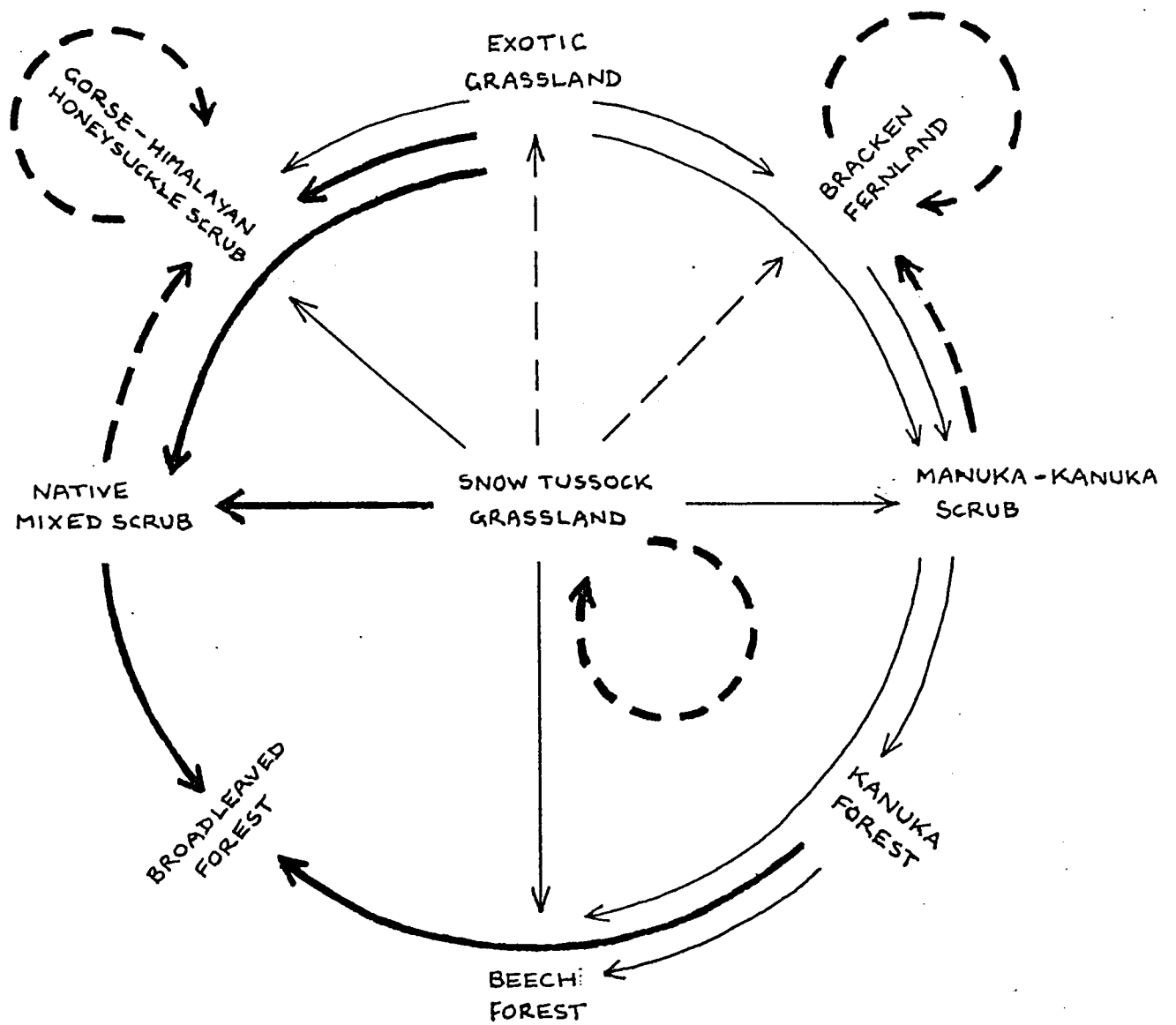


- == PUBLIC ROAD
- FARM TRACK
- RESERVE BOUNDARY
- ~ STREAM
- ↑↑↑ PLANTATION

- [Horizontal lines] SILVER BEECH FOREST
- [Diagonal lines /] KANUKA OR MANUKA FOREST AND SCRUB
- [Diagonal lines \] BROADLEAVED FOREST AND SCRUB
- [Dotted pattern] GORSE SCRUB
- [Cross-hatch pattern] GORSE - HIMALAYAN HONEYSUCKLE - KANUKA - MANUKA SCRUB

- [Vertical lines] GORSE - HIMALAYAN HONEYSUCKLE SCRUB
- [Horizontal lines] GORSE - MANUKA SCRUB
- [Diagonal lines /] MANUKA - COPROSMA - CASSINIA - FLAX etc MIXED SCRUB
- [Diagonal lines \] BRACKEN FERNLAND
- [Stippled pattern] PASTURE, ROUGH PASTURE, TUSSOCK GRASSLAND





NATURAL SUCCESSION

DRY / SUNNY SITES →

MOIST / SHADY SITES →

INDUCED SUCCESSION

FIRE AND GRAZING →

FIRE →

VEGETATION OF THE EAST FACE OF THE MAUNGATUA RANGE : MAIN SUCCESSIONAL TRENDS.