associates include kiokio (*Blechnum* sp. [*B. capense* agg., common sp. with reduced lower pinnae]), *Sticherus cunninghamii*, *Lycopodium scariosum*, and *Coprosma robusta*. On some of the rocky outcrops the usually epiphytic orchids *Dendrobium cunninghamii*, *Earina mucronata*, *E. autumnalis*, and *Bulbophyllum pygmaeum* are a feature. The presence of mountain flax here is an enigma as the species is absent from seemingly suitable sites elsewhere in the park and indeed from the whole of the Egmont ringplain. Mountain flax was cultivated by the Maori (Kirk 1870), so it is possible that it was planted at the pa sites on the peaks of the range and later became naturalised (see Human activity in the park).

Near the lower reaches of Plymouth Track old logging roads and disturbed forest margins support manuka scrub (see logged rimu–rata/kamahi forest p. 27). A little to the west, a different scrub type dominated by narrow-leaved mahoe (*Melicytus lanceolatus*), *Coprosma robusta*, and *Hebe* "egmontiana" [*H. stricta* var. *egmontiana*] has developed where pines (mainly *Pinus radiata*), originally established to control gorse and blackberry, have been felled.

Exotic plantations

Less than 30 ha of exotic plantations now remain on the Kaitake Range (see Human activity in the park). The largest are at Lucys Gully and are mainly of coast redwood (*Sequoia sempervirens*), macrocarpa (*Cupressus macrocarpa*), and *Eucalyptus* spp. Other exotic trees present include maritime pine (*Pinus pinaster*) and Douglas fir (*Pseudotsuga menziesii*). Some of the more open-canopied plantations have a dense understorey and ground cover of native plants, including hangehange, mahoe, kawakawa, and kohekohe. Localised populations of native terrestrial orchids e.g., *Corybas trilobus*, *C. rivularis*, *C. cheesemanii*, *Chiloglottis cornuta*, and *Gastrodia sesamoides*, occur in places where the shrub layer is sparse and a thick leaf litter covers the ground. Terrestrial orchids are known to be associated with mycorrhizal fungi which assist in the uptake of nutrients; such fungi are common in this litter type. Thus, paradoxically, two of the indigenous orchid species known from the exotic plantations, *Corybas cheesemanii* and *Gastrodia sesamoides*, have to date not been found in indigenous vegetation in the park.

There are other smaller plantations of macrocarpa and *Eucalyptus* spp. at the Wairau Road end.

Montane forest

Montane forest occurs between approximately 760 m and 1100 m on Mt Taranaki and Pouakai and covers nearly one third of the park area (11 165 ha). Seven types have been delineated on the map (Fig. 4) but six are of minor extent compared to the main type, kamahi–mountain totara forest. A more detailed survey would probably allow the definition of further types on the upper slopes of Pouakai.

Plate 6 Lowland and montane forest

1 *Weinmannia racemosa* var. *racemosa*. (Kamahi)
a twig from low altitude understorey with trifoliate leaves ×0.6.
b twig from low altitude canopy showing unifoliate leaves and capsules ×0.6.
c twig arising from epicormic bud ×0.8.
d juvenile trifoliate leaves ×0.8.
e stem node and stipules ×4.0.
f young capsules ×5.5.
g twig from high altitude canopy ("goblin forest") with unifoliate leaves ×0.6.


a
b
1
2
a
b

Kamahi–mountain totara forest (including "goblin forest")

At its lower limits this forest is dominated by kamahi (Plate 6) up to 15 m tall with widespread crowns (Appendix 3a). Mountain totara and broadleaf (Plate 8) may contribute a little to the canopy cover and there are some emergent miro. With an increase in altitude mountain totara becomes more common, making the forest a kamahi–mountain totara type. The forest also becomes shorter in stature (< 10 m) and tree crowns merge closely to produce a compact, hedge-like canopy. The kamahi are multi-stemmed, gnarled and irregular in shape with trunks and branches covered in mosses, liverworts, and filmy ferns (*Hymenophyllum multifidum, H. rarum* (Plate 9), *H. sanguinolentum, H. pulcherrimum* (Plate 9)).

This is the forest type which makes the greatest impression on visitors to the park. As Cockayne (1928) noted: "On Mt Egmont the kamahi forest is so striking that it has received the popular and expressive name of 'Goblin forest'." Early explorers were impressed by this forest not only because of its park-like appearance, but also the lack of thick undergrowth and lianes made for easy traversing compared with the lower altitude forest. Typical stands are easily accessible near the Dawson Falls Display Centre (Summit Track, Ridge Track), Stratford Mountain House (Kamahi Walk, Moss Walk, Curtis Falls Track), and North Egmont (Connett Walk), but also occur at equivalent altitudes on the Pouakai Range. Epiphytic establishment of trees and shrubs is a feature of this forest. The gnarled intertwining trunks of most of the kamahi trees indicate that they began life perched on other trees, stumps or logs, and gradually grew to form their present rather grotesque shapes. Many other trees and shrubs such as haumakaroa (*Pseudopanax simplex*, including *P. simplex* var. *sinclairii*) (Plate 11), broadleaf, and mountain five-finger (*P. colensoi* s.s.) (Plate 11), grow perched on the kamahi, thus forming 'compound trees'. Mountain totara, often festooned with a hanging moss, *Weymouthia mollis* (Plate 8), and broadleaf, are the most common canopy associates, although extensive patches of pure kamahi forest exist. The understorey is dominated by mountain horopito and toro, while the tufted lily, *Astelia fragrans*, mountain horopito seedlings, and the ferns *Blechnum procerum* [*Lomaria latifolia*] and *B. fluviatile* are the most common ground cover plants. Several other ferns are prominent in this type including Prince of Wales feather (*Leptopteris superba*), perhaps the most attractive fern in the park, and on stream banks, pendent *Blechnum colensoi* and *B. vulcanicum* (Plate 7).

Characteristic features of goblin forest such as the abundance of filmy ferns and *Weymouthia mollis*, and epiphytic establishment of trees and shrubs are obviously attributable to the cool, humid climate which prevails at these altitudes. However, other features of the forest may also result from less obvious climatic effects. For example, overseas research in tropical goblin forests (or cloud forests as they are sometimes called) shows that frequent cloud, mist, or fog can affect tree transpiration rates and limit nutrient uptake. The resulting nutrient starvation causes the stunted, gnarled, twisted tree growth forms. Similarly, high rainfall (average annual rainfall exceeds 6500 mm at North Egmont and Stratford

Plate 7 Lowland and montane forest

1 *Blechnum colensoi.*
a fertile frond × 0.4.
b sterile fronds; two forms × 0.4.

2 *Blechnum vulcanicum.*
a sterile frond × 0.4.
b fertile frond × 0.4.


1
a
b
c
d
2
a
3
a
b
c
♀
♂
4
b
c

Mountain House) leaches the soils of soluble nutrients also resulting in nutrient starvation. The litter layer is a significant nutrient source and the rate of nutrient cycling a major regulator of plant growth. An added complication on Mt Taranaki is the existence of litter layers and old soils buried by recent eruptions. These may also be significant nutrient sources.

At the upper limits of the "goblin forest", especially at Stratford Mountain House and Dawson Falls, there is still evidence of the forest destruction caused by the Burrell eruption. Some stumps and logs of mountain totara, killed by the ash and lapilli showers, are now hosts to epiphytically established kamahi. There are also a few large, short-boled, multi-leadered kamahi which have trunks beneath the Burrell lapilli and so pre-date the eruption. The ability of kamahi to resprout from epicormic buds after being damaged by ash and lapilli showers is one of the reasons for its overwhelming dominance in these forests today.

Kamahi–mountain totara forest with kanuka (including "goblin forest")

At Dawson Falls, large specimens of kanuka, an early successional and light-demanding species, are found scattered through the kamahi forest. They colonised canopy gaps created when the Burrell eruption killed many of the canopy trees. The abundance of kotukutuku trees on interfluves in this forest is also an indication of well-lit sites having been available for their establishment and continued growth (Druce 1966). A few squat, short-boled kaikawaka (Plate 11) pre-dating the eruption have produced adventitious roots from butts buried by the Burrell lapilli. By counting annual growth rings of both kanuka and kaikawaka Druce (1966) was able to determine the Burrell eruption date at 1655 A.D.

Mountain totara–kaikawaka/broadleaved shrubs forest

The upper altitudinal limit of kamahi on Mt Taranaki (1100 m) is somewhat lower than on Pouakai (1200 m), reflecting the effects of Mt Taranaki's recent volcanicity. As a consequence, the forest near tree line on Mt Taranaki is generally a type in which mountain totara, kaikawaka, and broadleaf overtop tree-sized leatherwood, mountain five-finger, and haumakaroa, and kamahi is absent. There is, however, much variation in the distribution and abundance of mountain totara, kaikawaka, and broadleaf, again relating to the history of volcanic destruction at different sites. Every possible combination from co-dominance of all three species to single dominance of any one can be found.

Mountain totara/broadleaved shrubs forest

Above Dawson Falls, where the effects of the Burrell eruption were the most devastating, kaikawaka is very scarce and mountain totara and broadleaved shrubs prevail. Kaikawaka numbers increase gradually to the north and south until at North Egmont and Lake Dive respectively, there are quite extensive stands (Appendix 3b).

Kaikawaka–mountain totara/kamahi forest

A debris fan which borders the south-east margin of the Ahukawakawa Swamp supports kaikawaka–mountain totara/kamahi forest. Other canopy associates are leatherwood, broadleaf,

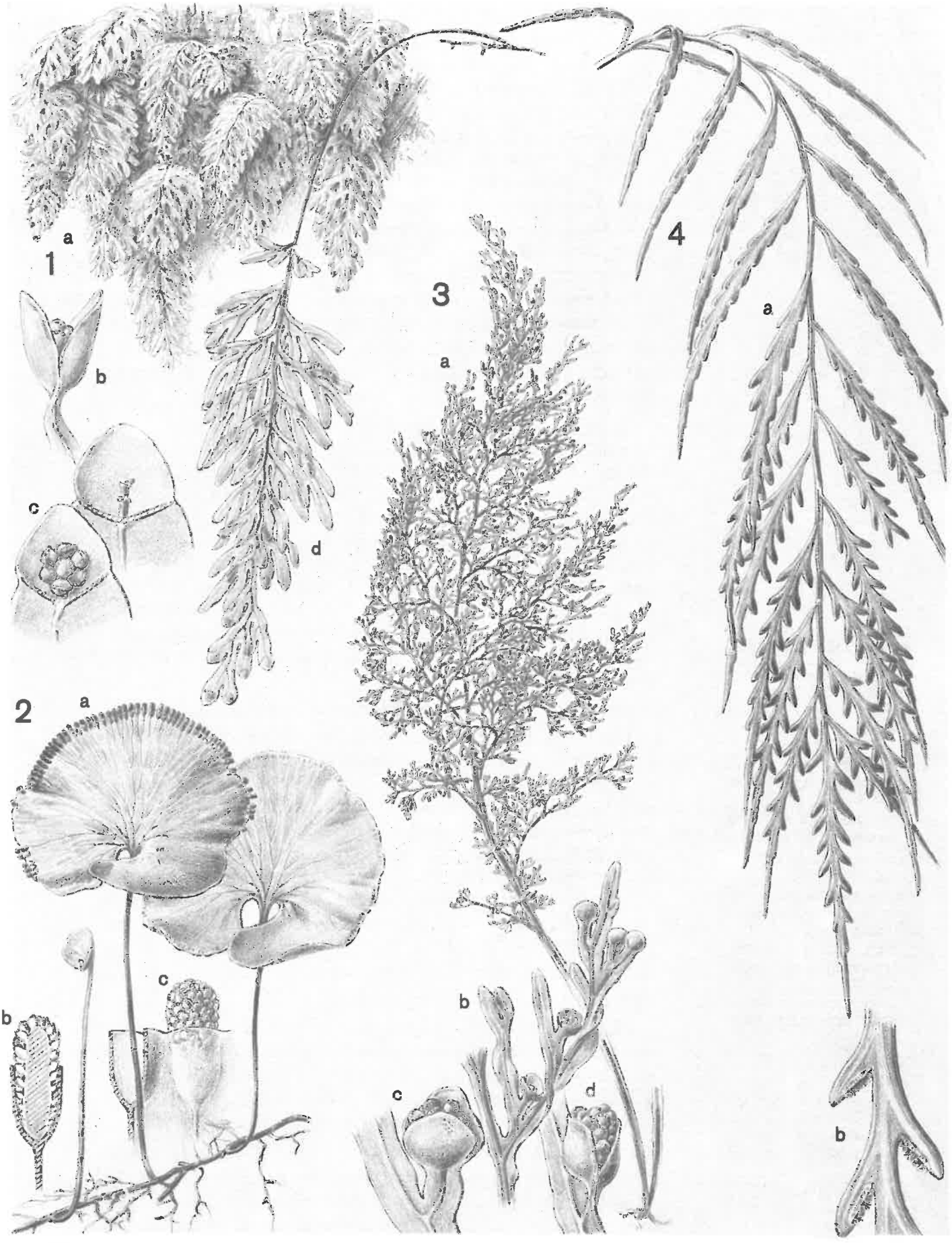
Plate 8 Montane forest

1 *Pseudowintera colorata.* (Mountain horopito)
a branch showing leaves and fruit ×0.6.
b flower ×4.0.
c fruitlets at two different stages on receptacle ×4.0.
d apical shoot showing underside of leaves ×0.6.

2 *Podocarpus cunninghamii.* (Mountain totara)
a branch showing scale leaves ×0.6.
b twig with succulent receptacles and seeds ×1.2.
c succulent receptacle and seed; also cut to show seed ×2.5.

3 *Griselinia littoralis.* (Broadleaf)
a branch showing leaves and fruit ×0.6.
b female flower; also young fruit cut vertically ×4.0.
c male flower ×4.0.

4 *Weymouthia mollis* ×0.6.


1
a
b
c
d
2
a
b
c
3
a
b
c
d
4
a
b

mountain five-finger, and haumakaroa, especially at higher altitude. However, kaikawaka is absent from the recent debris fans on the north-west slopes of Mt Taranaki and montane forest is only barely represented, the upper forest limit being considerably depressed as a result of destruction by recent debris flows.

On Pouakai the pattern is very different, as most of the forests have not been affected by such recent extensive disturbances. Both kamahi and kaikawaka reach higher altitudes than on Mt Taranaki. Kamahi–mountain totara forest gives way almost imperceptibly to leatherwood scrub with kaikawaka occurring in both types. Exceptions to this general pattern are some of the forests at the southern end of the range.

Kaikawaka/kamahi forest + kaikawaka/leatherwood scrub

On the slopes and ridges above the northern margin of Ahukawakawa Swamp is a mosaic of kaikawaka/kamahi forest and kaikawaka/leatherwood scrub, the former mainly on relatively sheltered easterly aspects and the latter exposed to the prevailing westerly winds.

Kamahi forest + leatherwood scrub

The very steep slopes above the northern upper reaches of the Stony River support a mosaic of kamahi forest and leatherwood scrub. This area was blasted by the *c.* 1500–1550 A.D. eruptions and is fully exposed to the westerly winds which are channelled between Pouakai and Mt Taranaki.

Plate 9 Montane forest

1 *Hymenophyllum rarum.* (Filmy fern)
a habit of plant ×0.8.
b indusium containing sporangia ×12.0.
c indusium cut to show sporangia and method of attachment to receptacle ×10.0.
d single frond ×1.5.

2 *Cardiomanes reniforme.* (Kidney fern)
a rhizome with a young frond and two fertile fronds ×0.6.
b indusium cut to show receptacle and sporangia ×8.0.
c sori on frond margin ×8.0.

3 *Hymenophyllum pulcherrimum.* (Filmy fern)
a fertile frond ×0.6.
b part of fertile frond ×5.0.
c top view of indusium with sporangia ×10.0.
d side view of indusium with sporangia ×10.0.

4 *Asplenium flaccidum* subsp. *flaccidum.* (Hanging spleenwort)
a single fertile frond ×0.6.
b part of fertile frond showing sori ×1.5.

Mire vegetation

Although little more than 300 ha (less than 1% of the park area) supports mire vegetation, this class is remarkable for its floristic richness and the diversity it adds to the park landscape. The Ahukawakawa Swamp alone has nearly 260 different species of higher plants (Druce 1976b) and several of these are unknown elsewhere in the park. The most accessible mires are Ahukawakawa Swamp (situated close to the Round The Mountain Track), "Potaema Bog" (near Pembroke Road), and the lakelet, Lake Dive (on the Lake Dive Track). There are, however, many other mires, all small and difficult to reach, but of great botanical interest. These include "Norfolk Road Bog", "Mangawhero Bog", "York Road Bog", "Denbeigh Road Bog", and an extensive network of bogs to the west of Kahui Hut. Altogether there is a range of mires from fertile swamps to infertile acid bogs.

Lowland mires

Potaema Bog at 670 m a.s.l. is the largest of the lowland mires and has the greatest variety of vegetation (Appendix 2). The surrounding forest is mostly rimu–rata/kamahi but a narrow belt in which kahikatea is prominent occurs close to the bog margin. Also present in this belt are some rata of terrestrial origin, mountain totara, pokaka, and a few kaikawaka. Towards the forest margin, kamahi becomes shorter and more shrubby, and a robust lily, *Astelia grandis*, and a large tussocky sedge with harsh cutting


a
b
c
d
e
f
g
1
2
3
4
5