Floristics and Microclimate of Hammond Bush, a Hamilton Basin Forest Remnant

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SUMMARY

Hammond Bush (c. 30 m a.s.l.) is a 1 ha indigenous forest remnant situated above the Waikato River on the outskirts of Hamilton city, within the Hamilton Basin. The remnant has developed on the poorly drained lower terrace of the river and consists of two forest types now scarce in the Hamilton Basin: pukatea/swamp maire and tawa/titoki forest. A total of 234 vascular plants has been recorded from Hammond Bush which is also a refuge for several regionally threatened species within the Hamilton Basin. A comparison is made between Hammond Bush and the floristically similar and larger Koromatua Bush. It is shown that Hammond Bush, although much smaller, has the greater floral diversity because the forest structure is less damaged and its location close to the Waikato River allows for a more equable climate. Hammond Bush is threatened through a combination of public ignorance, vandalism and pressures from weed species. It is urged that as habitat of regional significance, the forest should be formally protected as a public reserve within the existing parks and reserves network of Hamilton city.

INTRODUCTION

During December 1991 I examined a forest remnant containing pukatea (*Laurelia novae-zelandiae*)/swamp maire (*Syzygium maire*), and tawa (*Beilschmiedia tawa*)/titoki (*Alectryon excelsus* var. *excelsus*) forest types on the outskirts of Hamilton at Hammond Park, near Malcolm Street, in the suburb of Riverlea (Fig.1A). Previously the only known example of this vegetation type within the Hamilton Basin (as defined by McCraw 1967) was Koromatua Bush (see inset Fig. 1B) near Rukuhia (de Lange 1989a).

The forest, hereafter referred to as "Hammond Bush"[2], has a vascular flora of 234 species, of which several indigenous species are now regionally threatened within the Hamilton Basin. Unfortunately, the close proximity of the remnant to the city threatens its long-term security. Encroachment by weed species, plantings of garden ornamentals, acts of vandalism and, more recently, deliberate clearance

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[2] Not an approved New Zealand Geographic Board name.

of the forest margin have damaged much of the forest structure.

In this paper I describe the vegetation and flora of the remnant within the regional context of the Hamilton Basin. It is concluded that Hammond Bush is an important remnant of a vegetation type close to extinction within the basin.

HAMMOND BUSH

Location

Hammond Bush is a small 1 ha forest located 0.5 km east of Hammond Park, on the southern edge of Riverlea, Hamilton (see inset Fig. 1C). It is an example of a vegetation type once widespread throughout the Hamilton Basin, a mixed broadleaved forest (More 1976). The land on which Hammond Bush is situated adjoins a public park administered by the Hamilton City Council. However, it would seem that much of the bush is under private multiple ownership, although exact boundaries remain uncertain.

Physiography

Hammond Bush has developed on the lower river terraces some 3–15 m above the Waikato River. These terraces have formed as a consequence of the aggradation of the river into its present course over the last 12 000 years B.P. (McCraw 1967) and are composed of a heterogeneous assemblage of Pleistocene-aged volcaniclastic sands and silts known as the Hinuera Formation (Kear 1960; McCraw 1967; Crowcroft 1992; de Lange and Champion 1994). The alluvial sediments comprise alternating sequences of pumiceous and rhyolitic gravels, sands, and silts (McCraw 1967, Kear and Schofield 1978). At Hammond Bush, the Hinuera Formation is exposed as a series of cliffs 3–10 m in height which effectively form the riverside margin of the bush.

Along the lower terraces of the Waikato River the Hinuera Formation is often partially reworked and overlain by Taupo Pumice Alluvium (McCraw 1967). The surface of the lower terrace is therefore covered in an undulating deposit of varying thickness and composition, derived from reworked Hinuera sediments and Taupo Pumice, supplemented by regular additions of colluvium from the adjacent terrace levels.

The drainage of this surface is poor as a consequence of several thick (1–2 m) underlying silt sheets. These are slowly permeable so ground water remains perched above them (McCraw 1967; Schofield 1972; Petch and Marshall 1988; Crowcroft 1992).

Soils

Due to poor drainage of the lower terrace, the soils of Hammond Bush are heavily gleyed with a well developed organic or even peaty A horizon up to 1 m in depth. These soils correspond to the Tamahana Soils complex of Bruce (1979). Those of the adjacent terrace slope and associated colluvial apron are more variable, often with a weakly developed organic A horizon and less gleying of the lower

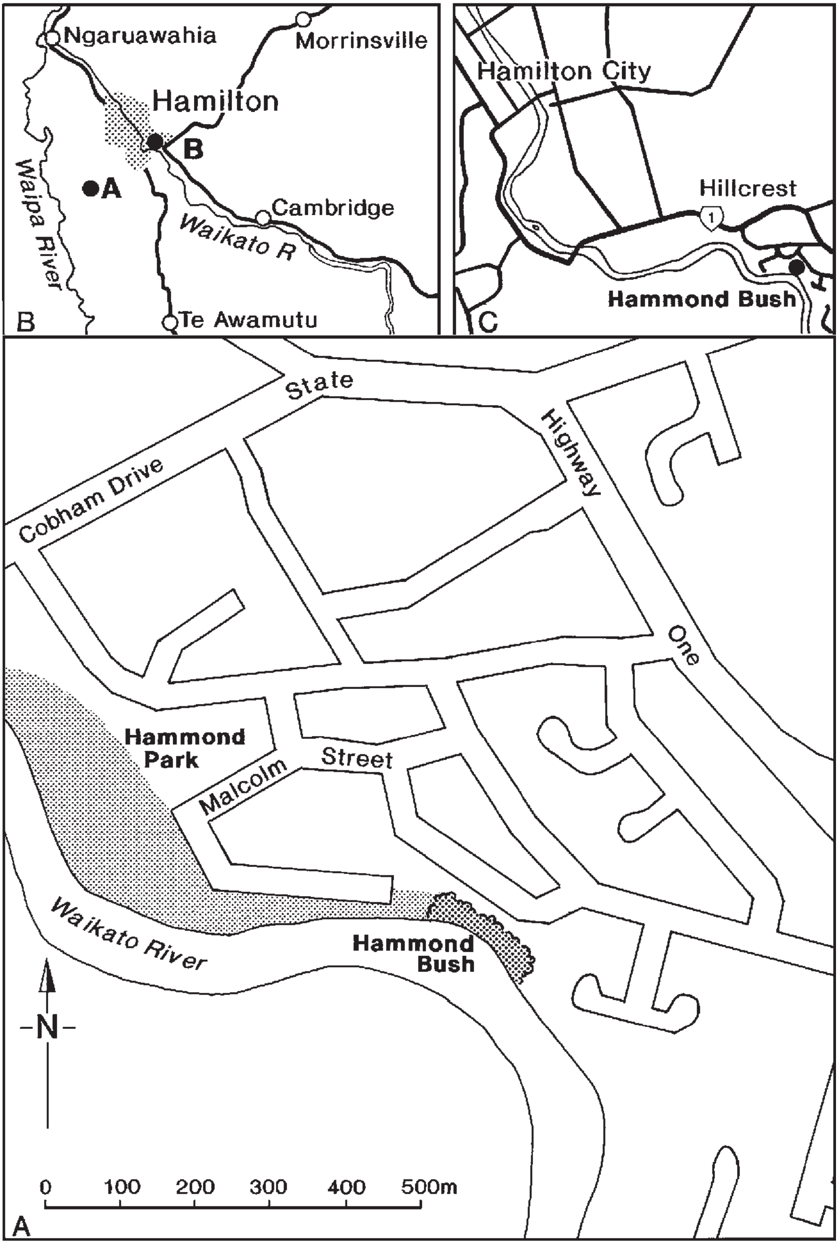

Fig. 1. **1A.** Hammond Bush; showing spatial relationship between the forest remnant, Hammond Park, the Waikato River and adjacent suburb. **1B.** Geographic setting of Koromatua Bush (A) and Hammond Bush (B) within the Hamilton Basin. **1C.** Location of Hammond Bush within urban Hamilton.

soil horizons. These soils are in a continual state of flux as additions of fresh material from slumping and outwash cover them. Such soils form a complex mosaic and are best described as part of the Kirikiriroa and Rotokauri Soils complex as defined by Bruce (1979).

VEGETATION OF HAMMOND BUSH

Vegetation Types

Vegetation types were defined using a simplified version of Atkinson (1985). Four main vegetation types dominated by indigenous species were distinguished, each in a complex mosaic reflecting the subsurface drainage conditions. No attempt was made to distinguish adventive vegetation types, mainly because these were limited in extent and often formed a continuum within a clearly defined indigenous type. However, adventive species prominent within the vegetation types were recorded and are included within the following descriptions.

1. Tawa / Titoki Forest

Restricted to the upper terrace, terrace slope, and better drained colluvial apron of the lower terrace surface, occasional trees of either species were also present on the cliffs above the river (see vegetation type 3). This forest type is dominated by tawa, with varying proportions of titoki as the secondary dominant. Both species were often heavily festooned with white rata (*Metrosideros perforata*) and kiekie (*Freycinetia banksii*). Associated with the forest dominants are rare emergent rewarewa (*Knightia excelsa*), kamahi (*Weinmannia racemosa s.s.*), and porokaiwhiri (*Hedycarya arborea*).

The understorey of this vegetation type is rather dense and is typically dominated by kotukutuku (*Fuchsia excorticata*), hangehange (*Geniostoma rupestre*), and pate (*Schefflera digitata*) in the damper sites, while the drier ground is dominated by thickets of taurepo (*Rhabdothamnus solandri*) and saplings of mahoe (*Melicytus ramiflorus*). The ferns *Doodia media, Blechnum filiforme* and *Asplenium gracillimum* are common components of the understorey.

Near the western margin of the remnant this vegetation type is partially replaced by dense thickets of kotukutuku (*Fuchsia excorticata*), makomako (*Aristotelia serrata*), ponga (*Cyathea dealbata*), alder (*Alnus glutinosa*), and privet (*Ligustrum sinense*).

2. Pukatea / Swamp Maire Forest

Confined to those sites with very poor drainage, pukatea/swamp maire forest has an open canopy of pukatea with dense cohorts of swamp maire as the co-dominant. Rare associated tree species included rewarewa, horoeka (*Pseudopanax crassifolius*) and ti kouka (*Cordyline australis*). The understorey is dominated by mapou (*Myrsine australis*), kotukutuku, pate and hangehange. Nearer the river, shrubs of karamu (*Coprosma robusta*), kanokano (*Coprosma grandifolia*) and mingimingi (*Leucopogon fasciculatus*) are frequent.

Associated with pukatea are dense, almost impenetrable vinelands of kiekie, supplejack (*Ripogonum scandens*) and red rata (*Metrosideros fulgens*). These vinelands probably originate through the collapse of overburdened, liane-festooned, canopy branches of pukatea.

The forest floor, which is predominantly covered in thick leaf litter and numerous pukatea and swamp maire seedlings, supports a diverse herb cover where light is sufficient. The most prominent species in these sites are the sedges *Isolepis reticularis* and *Schoenus maschalinus*. Associated with these are bog stitchwort (*Stellaria alsine*), *Callitriche muelleri*, bitter cress (*Cardamine hirsuta*), along with its native equivalent *C. debilis* "long style" and, infrequently, bush-nettle (*Urtica incisa*). Unusual adventives gathered from this vegetation included the attractive yellow-flowered *Calceolaria tripartita* and pink-flowered garden primula (*Primula malacoides*).

In the poorest drained soils nearer Malcolm Street, pukatea/swamp maire forest gives way to a peripheral margin of alder, grey willow (*Salix cinerea*), and blackberry (*Rubus fruticosus* agg.). Associated with this is a small area of dense wheki (*Dicksonia squarrosa*) tree fern-land, the understorey of which contains numerous seedlings of pukatea and, less frequently, swamp maire. The dense trunks of wheki are home to small populations of *Tmesipteris elongata*, and the trunk of a single prominent mamaku (*Cyathea medullaris*) was covered in *T. lanceolata*.

3. Mahoe/Kanuka Forest with Kamahi

A variable vegetation type confined to the dry cliff faces of the lower terrace immediately above the river. Mahoe is usually the dominant species, with kanuka becoming dominant in drier sites. Occasional specimens of kamahi may be found as emergents within this vegetation, increasing in dominance towards Hammond Park, where the cliffs give way to more gentle slopes composed almost entirely of Taupo Pumice Alluvium (see McCraw 1967).

The understorey of this vegetation type is dominated by small shrubby species, especially taurepo, mapou, and mingimingi. In the damper areas, small trees such as kotukutuku, pate, and kawakawa are prominent. The ferns *Blechnum chambersii*, *Phymatosorus pustulatus*, *Doodia media* and *Polystichum richardii* are ubiquitous, often extending right to the floodline of the river. At the base of the cliffs, where a partially submerged silt sheet extends out into the river, small thickets of alder and crack willow (*Salix fragilis*) have established. The trunks and branches of these trees are usually covered in the orchid *Earina mucronata*.

4. *Machaerina/Phormium* Sedge/flax-land.

A distinctive vegetation type almost entirely dominated by the sedge *Machaerina sinclairii*. This vegetation type is confined to open sites within the wet seepages of the lower terrace cliff face and slips associated with small waterfalls draining the adjacent terrace surface. Aside from *Machaerina*, small amounts of wharariki

(*Phormium cookianum* subsp. *hookerii*) are locally dominant, especially near the river margin. Infrequent woody associates include heketara (*Olearia rani* var. *colorata*), koromiko (*Hebe stricta* var. *stricta*), rangiora (*Brachyglottis repanda*), shining karamu (*Coprosma lucida*) and a single large specimen of the giant herb *Gunnera tinctoria*. In one site, kiekie/red rata vinelands extend down from the lower terrace level, entirely replacing the *Machaerina* sedgeland.

THE FLORA

A vascular flora of 234 taxa was recorded during a three hour visit to the remnant (Appendix 1). Of those species recorded, 85 are adventive and two indigenous species not native to the Hamilton Basin – houhere (*Hoheria populnea*) and a cultivar of houpara (*Pseudopanax lessonii*), have become naturalised. A further two indigenous species exist as isolated plantings, i.e., karaka (*Corynocarpus laevigatus*) and kauri (*Agathis australis*).

Adventive Flora

The adventive flora of the remnant comprises 36 % of the total recorded flora. Although smaller than the indigenous component, several adventives have already significantly altered the lowest tier of the remnant. In particular, wandering Jew (*Tradescantia fluminensis*) and *Selaginella kraussiana* have invaded over half of the remnant area eliminating much of the forest ground cover by their overwhelming growth. This behaviour has been widely reported for wandering Jew within forest remnants throughout New Zealand (Healy and Edgar 1980, Kelly and Skipworth 1984a).

That *Selaginella* can also eliminate cryptogamic floras (J.E. Braggins *pers. comm.* 1993) seems less well known, perhaps reflecting a bias in New Zealand botany toward vascular plants. Removal of wandering Jew is often labour intensive and difficult without the assistance of chemical sprays (Kelly and Skipworth 1984b). Removal of *Selaginella* is, in the author's experience at least, extremely difficult and often impractical where infestations are large. In Hammond Bush successful eradication of these weed species now seems unlikely without concentrated effort and it is anticipated that they will continue to spread throughout the remnant, to the detriment of the remaining forest floor communities. Aside from these troublesome species, small areas of Kahili ginger (*Hedychium gardnerianum*), stinking iris (*Iris foetidissima*) and arum lily (*Zantedeschia aethiopica*) have established from garden plantings and already pose a significant threat to forest regeneration in several sites.

Several of the adventive species recorded from Hammond Bush are first records for the Waikato or for the New Zealand Flora, e.g., *Calceolaria tripartita*, *Gunnera tinctoria*, *Primula malacoides* and *Reynoutria japonica* (see distributions cited in Webb *et al.* 1988). These garden escapes almost certainly originated through the close proximity of the bush to residential areas and it would seem quite probable that other introductions of ornamental species, along with the less desired aggressive weed species, will continue.

Indigenous Flora

An indigenous flora of 145 species was noted within the bush (Appendix 1). This figure is larger than that for the otherwise floristically similar Koromatua Bush (Fig. 1) which, at 2.2 ha, has 114 species (de Lange 1989a). Table 1 shows the distribution, by life form, of taxa within both forest remnants. While Hammond Bush has marginally more ferns and fern allies, trees and shrubs, lianes, rushes and sedges, it has notably more (18 spp.) dicotyledonous herbs. The greater floristic diversity of Hammond Bush is easily explained, for although smaller in extent (1 ha), Hammond Bush occurs within a sheltered river valley, is not accessible to stock and is considerably wetter. Therefore, it is less prone to the effects of summer drought and, as the understorey is well preserved, the forest microclimate is likely to be more stable (see below). Koromatua Bush on the other hand, is accessible to cattle and other browsing animals, has an extremely exposed peripheral margin, and a very open understorey (de Lange 1989a). Therefore, it is much drier, so suffers from drought damage, the effects of wind throw and associated canopy collapse.

The relief of both remnants also differs: Koromatua Bush is located on the lee of an east-facing low lying hill,within two shallow gullies, whereas Hammond Bush is situated immediately above the Waikato River on a series of terraces abruptly truncated by a riverside cliff. The cliffs of Hammond Bush are an important habitat not found at Koromatua Bush and provide the only suitable site for such species as *Lachnagrostis striata*, *Phormium cookianum* subsp.

Life Form	**Hammond Bush**	**Koromatua Bush**
Ferns and fern allies	43	38
Trees and shrubs	40	39
Lianes	12	8
Grasses	4	3
Rushes and sedges	17	12
Orchids	3	5
Monocotyledonous herbs	4	5
Dicotyledonous herbs	22	4
Total	**145**	**114**

Table 1. Comparison of indigenous vascular flora of Hammond and Koromatua Bush according to life form.

hookerii, ti ngahere (*Cordyline banksii*), gully tree fern (*Cyathea cunninghamii*) and *Machaerina sinclairii*. In the Hamilton Basin, many of these species are only known from the cliff sides above the Waikato River (de Lange and Champion 1994).

However, the major influence on the indigenous diversity of both remnants is probably that of local climate. Koromatua Bush is situated within a series of low-lying hills (c.< 50 m a.s.l.); these exert a moderating effect on the severity of frosts through the creation of a boundary layer (Oke 1987). Hence the local prominence of such frost sensitive species as karaka (*Corynocarpus laevigatus*) within the remnant, a feature of this forest first noted by Gudex (1963). Such boundary layers, however, are easily disrupted by the passage of wind (Oke 1987). In the past, however, with continuous forest cover, the effect of wind on the inner forest climate would have been minimal. Today the damaged forest margin of Koromatua Bush is subject to frequent winds which pass over the hills and through the forest (de Lange 1989A). Such winds not only cause tree falls but also carry frost into the forest thereby damaging frost-sensitive species such as kawakawa (*Macropiper excelsum* subsp. *excelsum*).

In comparison, Hammond Bush enjoys a more stable microclimate, not only because the forest tiers are more intact but also because of the geographic setting of the forest within a sheltered arm of the Waikato River. The close proximity to such a large body of slowly moving water, as well as the sheltered aspect, means that the local severity of advective and radiation frosts is reduced. This happens through the formation and ponding of warm water fog above the river, which protects adjacent low-lying ground from radiation frosts as well as affording additional resistance to the influence of advective heat transfer (Oke 1987).

This moderating influence of the river on the associated riparian vegetation partly explains the abundance of kawakawa and taurepo within Hammond Bush, as well as other more usually coastal species such as the rush *Juncus caespiticius*. It may also explain other anomalous basin occurrences of usually coastal species near the remnant, such as *Leptinella dioica* subsp. *dioica* (AK 185280), *Zoysia planifolia* (CHR 466143) and whau (*Entelea arborescens*)[3].

Regionally Threatened Species

Although no nationally threatened species were recorded from the remnant, several species now uncommon within the Basin were recorded from Hammond Bush. The most significant of these species is swamp maire. At Hammond Bush, a thriving population comprising 17 trees, 30 saplings (1.2–2 m height) and >100 seedlings was recorded. The remains of a further four trees (recently felled) and one large ring-barked specimen were also noted. As the bush occupies

[3] Whau (*Entelea arborescens*) is known from a number of sites along the Waikato River bank. It may not be truly native to the basin however, as it is widely grown in several riverside "frost-free" gardens and in such conditions it naturalises freely.

a site difficult to drain, with little land area to gain from such an exercise, it is vandalism such as this, together with the encroachment of shade tolerant weeds, which most threatens the remaining swamp maire.

The presence of such a large population of swamp maire at Hammond Bush is noteworthy because it is only the second viable remnant of this species to be recorded from the Hamilton Basin. The present scarcity of swamp maire within the basin can be largely attributed to a deliberate policy of indigenous forest clearance initiated 115 years ago by European settlers (More 1976; Edmonds and Henshaw 1984). Today it is virtually impossible to determine the historic extent of swamp maire or its associated vegetation type, as much of the Hamilton Basin was already in scrub prior to European settlement (Edmonds and Henshaw 1984), probably as a consequence of Polynesian deforestation (Newnham et al. 1989). Nevertheless the net result of this deforestation has been an almost complete loss of forest containing swamp maire from the basin. Currently, with the exclusion of Hammond Bush, swamp maire has been recorded from only four sites in the Hamilton Basin over the last 46 years: McWhannels Farm, near Ngahinapouri (WAIK 3888, *M.Gudex*, 15 January 1948), a stand of five trees at the source of the Mangawhara Stream (AK 210985, *P.J. de Lange*, 20 September 1992), a single tree at Pukemokemoke near Tauhei (WAIK 11371, *P.J. de Lange*, 25 June 1989)[4], and Koromatua Bush (AK 178394, *P.J. de Lange*, 4 October 1987), where a total of 37 trees was recorded (de Lange 1989b). Of these, the Gudex record is probably historical as there have been no recent confirmations of swamp maire in this area.

Three other species recorded from Hammond Bush: *Dendrobium cunninghamii*, *Fuchsia perscandens*, and bush nettle *Urtica incisa*, also have restricted distributions within the Hamilton Basin. That the latter two taxa are now uncommon in the basin is not surprising, as both are characteristic components of lowland alluvial forest within the greater Waikato (Bartlett 1984, de Lange 1986, 1987 and *pers. obs.*). Field work by the author within the Hamilton Basin suggests that bush nettle and *Fuchsia* may now be confined to Hammond Bush, as they have recently (mid 1980s) become extinct at their previously recorded localities (see de Lange 1987, p. 58). Within Hammond Bush the nettle is probably the most vulnerable, as it is especially prone to being overwhelmed by aggressive ground cover weeds and eradicated as a "nuisance species" by the public. The single specimen of *Fuchsia perscandens*, a female, and therefore reproductively extinct, is less likely to be eliminated because it is able to maintain itself vegetatively and, unlike bush nettle, is able to scramble through competing vegetation.

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[4] This tree discovered in 1989 was destroyed some time later through dumping quarry overburden over it and the regenerating kahikatea forest it was associated with.

The remaining species, *Dendrobium cunninghamii*, has been recorded twice before from within the basin: at Pukemokemoke (de Lange 1989b), where it is uncommon and, until quite recently (August 1988), from within a kahikatea forest near Puketaha (subsequently felled). The scarcity of *Dendrobium* from the lowland remnants of the basin is not easily explained, as there are still areas of apparently suitable habitat left and, unlike *Fuchsia* or *Urtica*, this epiphyte is less vulnerable to structural changes in the lower forest tiers. Of those other epiphytic orchids recorded from the basin, the distribution of *Dendrobium* is most similar to that of *Earina autumnalis* which is known from only three basin records (de Lange 1987, 1989b). Recent research suggests that both these species are less tolerant of frost than our other epiphytic orchids (B.P.J. Molloy *pers. comm.* 1992). Possibly then, the orchid's occurrence at Hammond Bush is another example of the moderating influence the river has on the forest microclimate.

DISCUSSION

That such a diverse and regionally significant forest remnant has survived, undetected by the local botanical community, on the outskirts of Hamilton city, is in itself quite remarkable.

Hammond Bush is clearly an important remnant of the past indigenous flora of the Hamilton Basin. Specifically, it is one of only two surviving examples of a mixed Tawa/Titoki - Pukatea/Swamp Maire forest type known from the Basin. At present there are no protected examples of either vegetation type within the Basin, and with only two examples known, immediate action is needed to prevent their extinction. While Koromatua Bush is the more extensive of the two, it is completely in private ownership, Hammond Bush is only partially so, and being located within the suburbs of Hamilton, would be a valued inclusion to the existing inner city park and reserves network. Furthermore, as Hammond Bush is situated close to the University of Waikato and three schools, there is tremendous value in protecting the forest for educational purposes.

Unfortunately, the forest is being threatened through a combination of vandalism, public ignorance and aggressive weed species. Resolution of these problems is urgently needed if Hammond Bush is to retain present species values and an intact forest structure. On a visit to the remnant during October 1994, I was disturbed to see recent evidence of forest clearance along the grassed verge of the park. Although mainly privet (*Ligustrum sinense*) and alder were being felled, the subsequent exposure was drying out parts of the inner forest. Clearly this action must stop if we are to preserve the botanical features of Hammond Bush intact.

Hammond Bush should be a valued asset within the parks network of Hamilton city, providing the citizens of Hamilton with a much needed link to the primaeval vegetation of the Hamilton Basin. With respect to this, Hamiltonians would be advised to remember that the public desire for such a link with the past was the prime motivation in securing and preserving the last vestige of a formerly extensive kahikatea (*Dacrycarpus dacrydioides*) forest at the Claudelands showgrounds, within Hamilton city (Gudex 1955; More 1976; Champion 1988). The historical importance of this particular forest was specifically commemorated in 1978 with the changing of the remnant's name from Claudelands Bush to Jubilee Park during the Hamilton centenary celebrations. One would hope that with suitable advocacy a similar desire will prevent Hammond Bush from undergoing further destruction.

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APPENDIX 1: VASCULAR FLORA OF HAMMOND BUSH, NEAR HAMMOND PARK, RIVERLEA, HAMILTON CITY.

Abbreviations

A = Adventive (85 spp.)

Ab = Abundant (>50 individuals seen)[1]

O = Occasional (10–20 individuals seen)

juv = juveniles only seen (8 spp.)

N = Naturalised indigenous species (2 spp.)

I = Indigenous (145 spp.)

C = Common (20–50 individuals seen)

R = Rare (< 10 ten individuals seen)

P = Presumed planted (4 spp.)

* = Denotes adventive species

The Herbarium acronyms follow those suggested by Holmgren *et* a*l.* (1990).

[1] For rhizomatous species, ground cover abundance was estimated by coverage.

Lycopods and Psilopods (4) (A:1 I:3)

Lycopodium varium (incl. *L. billardierei*)	R	
**Selaginella kraussiana*	C	
Tmesipteris elongata	O	
T. lanceolata	R	

Ferns (341 (A:1 I:39)

Adiantum cunninghamii	Ab	
A. hispidulum	R	
Asplenium bulbiferum	Ab	
A. flaccidum	C	
A. gracillimum	C	
A. oblongifolium	C	
A. polyodon	O	
Blechnum chambersii	Ab	
B. discolor	R	
B. filiforme	Ab	
B. membranaceum	C	
B. minus	O	
B. sp. “black spot” (*B. capense sensu* Allan 1961)	Ab	
B. chambersii × *B. membranaceum*	O	
Cyathea cunninghamii	O	
C. dealbata	C	
C. medullaris	C	
C. smithii	R	
Deparia petersenii subsp. *congrua* (incl. *D. tenuifolia)*	Ab	
Dicksonia fibrosa	juv., R	
D. squarrosa	Ab	
Diplazium australe	Ab	
Doodia media subsp. *australis*	Ab	
Hymenophyllum ferrugineum	R	
H. flabellatum	R	
Hypolepis ambigua	C	
Lastreopsis glabella	C	
L. hispida	O	
**Nephrolepis cordifolia*	R	WELT P17590
Paesia scaberula	O	
Pellaea rotundifolia	O	
Phymatosorus pustulatus subsp. *pustulatus*	Ab	
P. scandens	Ab	
Polystichum richardii	C	
Pneumatopteris pennigera	Ab	
Pteridium esculentum	C	
Pteris pendula	C	
P. tremula	O	

Pyrrosia eleagnifolia	Ab	
Trichomanes venosum	R	
Gymnosperms (5) (A:0 I:2)		
Agathis australis	juv, p, R	
Dacrycarpus dacrydioides	C	
Dacrydium cupressinum	juv, p, R	
Phyllocladus trichomanoides	juv, p, R	
Prumnopitys taxifolia	juv, R	
Monocotyledonous Trees & Shrubs (4) (A:0 I:4)		
Cordyline australis	O	
C. banksii	R	
C. australis × *C. banksii*	R	
Rhopalostylis sapida	R	
Monocotyledonous Lianes (2) (A:0 I:2)		
Freycinetia banksii	Ab	
Ripogonum scandens	Ab	
Dicotyledonous Trees and Shrubs (48) (A:13 I:34)		
Alectryon excelsus var. *excelsus*	O	
**Alnus glutinosa*	C	
Aristotelia serrata	C	
Beilschmiedia tawa	Ab	AK 208568
**Berberis glaucophylla*	R	
Brachyglottis repanda	R	
Carpodetus serratus	R	
Corynocarpus laevigatus	p, R	
Coprosma areolata	R	
C. grandifolia	C	CHR
C. lucida	R	
C. robusta	C	
C. propinqua × *C. robusta*	R	
**Crataegus monogyna*	R	
Elaeocarpus dentatus	R	
**Euonymus japonicus*	R	
**Fatsia japonica*	R	
Fuchsia excorticata	O	
Geniostoma rupestre var. *ligustrifolium*	Ab	CHR
Hedycarya arborea	O	
Hoheria populnea var. *populnea*	N, O	
**Hydrangea macrophylla*	R	
Knightia excelsa	R	
Kunzea ericoides s.l.	O	
Laurelia novae-zelandiae	C	

Leucopogon fasciculatus	R	
**Leycesteria formosa*	C	
**Ligustrum lucidum*	R	
**L. sinense*	C	
Macropiper excelsum subsp. *excelsum*	C	
Melicytus ramiflorus subsp. *ramiflorus*	Ab	
Myrsine australis	Ab	
Olearia rani var. *colorata*	R	CHR
Pseudopanax arboreus	R	
P. crassifolius	R	
P. arboreus × *P. crassfolius*	juv, R	CHR
P. lessonii c.v.	juv, N, R	
**Prunus serrulata*	juv, R	
Rhabdothamnus solandri	Ab	CHR
**Salix cinerea*	O	
**S. fragilis*	C	
Schefflera digitata	C	
Solanum aviculare	O	
Sophora microphylla	R	
Streblus heterophyllus	R	
Syzygium maire	C	AK 208574
**Ulex europaeus*	O	
Weinmannia racemosa s.s.	O	AK 208572

Dicotyledonous Lianes and Scrambling Plants (13) (A:3 I:10)

Calystegia sepium agg.	O	
**C. sylvatica*	R	
C. tuguriorum	R	
Fuchsia perscandens	R	AK 208564
**Lonicera japonica*	C	
Metrosideros diffusa	C	
M. colensoi	R	
M. fulgens	C	AK 208562
M. perforata	C	
Muehlenbeckia australis	C	
Passiflora tetrandra	O	
Rubus australis	R	
**R. fruticosus* agg.	C	

Grasses (13) (A:9 I:4)

**Anthoxanthum odoratum*	C	
**Bromus willdenowii*	O	
**Dactylis glomerata*	C	
Echinopogon ovatus	R	
**Hordeum murinum*	R	

**Festuca arundinacea*	C	
**Glyceria fluitans*	O	
**Holcus lanatus*	Ab	
Lachnagrostis striata	O	
Microlaena stipoides	C	
Poa anceps subsp. *anceps*	C	
**P. annua*	C	
**P. trivalis*	C	
Orchids (3) (A:0 I:3)		
Dendrobium cunninghamii	R	AK 208563
Drymoanthus adversus	R	
Earina mucronata	Ab	
Rushes (7) (A:3 I:4)		
Juncus australis	R	
**J. bufonius* var. *bufonius*	O	
J. caespiticius	R	AK
**J. effusus* var. *effusus*	Ab	
J. planifolius	Ab	
J. prismatocarpus	O	
**J. tenuis* var. *tenuis*	C	
Sedges (19) (A:6 I:13)		
Baumea tenax	R	
Carex dissita	C	
**C. divulsa*	O	
C. inversa	C	
C. forsteri	R	
C.lambertiana	R	
C. solandri	O	
C. geminata agg. (cmn sp lvs >2.5 cm wide)	C	
**Cyperus eragrostis*	C	
**C. involucratus*	R	
**C. tenellus*	C	
C. ustulatus	R	
Isolepis inundatus	O	
**I. marginata*	R	
**I. sepulcralis*	C	
I. reticularis	C	
Machaerina sinclairii	Ab	
Uncinia distans	R	
U. uncinata	Ab	

Monocotyledonous Herbs (other than Grasses, Orchids, Rushes and Sedges) (12) (A:8 I:4)

**Allium triquetrum*	C	
**Asparagus setaceus*	R	
Astelia solandri	C	
**Canna indica*	R	
Collospermum hastatum	C	
**Crocosmia ×crocosmiiflora*	C	
**Hedychium gardnerianum*	R	
**Iris foetidissima*	R	
Lemna minor	C	
Phormium cookianum subsp. *hookeri*	R	
**Tradescantia fluminensis*	Ab	
**Zantedeschia aethiopica*	O	

Composite Herbs (24) (A:17 I:7)

**Aster subulatus*	O	
**Bellis perennis*	O	
**Bidens frondosa*	C	
**Cirsium vulgare*	R	
**Conyza albida*	O	
**C. bilbaoana*	R	
Cotula australis	O	
**Crepis capillaris*	R	
Gnaphalium gymnocephalum	R	
G. involucratum	O	
G. limosum	R	
**G. simplicicaule*	O	
**Hypochoeris radicata*	C	
**Lapsana communis*	C	
**Leucanthemum vulgare*	O	
**Pericallis ×hybrida*	R	
Pseudognaphalium "lowland"	O	
**Senecio bipinnatisectus*	O	
S. hispidulus	R	
**S. jacobaea*	O	
**S. mikanioides*	O	
S. quadridentatus	R	
**Sonchus oleraceus*	O	
**Taraxacum officinale*	C	

Dicotyledonous Herbs (Other than Composites) (39) (A:24 I:15)

**Calceolaria tripartita*	O	AK 208567
Cardamine debilis agg. "Long Style"	O	
**C. hirsuta*	C	

Callitriche muelleri	Ab	
C. petriei subsp. *petriei*	O	
**C. stagnalis*	C	
Crassula sinclairii	R	
**Digitalis purpurea*	O	
**Duchesnea indica*	C	
Elatine gratioloides	R	
**Epilobium ciliatum*	R	
E. nerterioides	R	
E. nummularifolium	C	
E. rotundifolium	O	
**Galium aparine*	Ab	
Geranium homeanum	R	
Glossostigma elatinoides	R	
**Gunnera tinctoria*	R	CHR
Haloragis erecta subsp. *erecta*	O	
Hydrocotyle heteromeria	O	
**Mentha* ×*spicata*	R	
**Myosotis sylvatica*	C	
Lobelia anceps	C	
**Oxalis incarnata*	O	
**Primula malacoides*	O	CHR
**Prunella vulgaris*	O	
**Ranunculus repens*	O	
**R. sardous*	R	
**Reynoutria japonica*	R	
**Rorippa nasturtium-aquaticum*	R	
**Rumex conglomeratus*	O	
**R. obtusifolius*	R	
**R. sagittatus*	R	
**Solanum nigrum*	O	
**S. pseudocapsicum*	C	
**Stellaria alsine*	R	
**S. media*	C	
Stellaria parviflora	O	
Urtica incisa	R	AK 210963
Total Taxa:	**234**	