New Zealand Garden Journal

Journal of the Royal New Zealand Institute of Horticulture (Inc)

Erythronium revolutum

The Erythronium species of California and SW Oregon
The 1997 Ian Galloway Memorial Lecture: Parks, People, and Politics – planning for parks in Wellington • Tourism and Horticulture
Biological Controls at the Christchurch Botanic Gardens

Volume two, number two, June 1997

NEW ZEALAND GARDEN JOURNAL

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Editors
Mike Oates
Sarah De Renzy

Contributory writers
Jayson Kelly
Frank Boffa
Alan Jolliffe
Bede Nottingham, Jenny Taylor
& Maria Adamski

Advertisement sales
Mike Oates

Editorial Address
Box 28 040
WELLINGTON

(04) 479 4453

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Cover Picture : *Erythronium revolutum*
Photo : Jayson Kelly

Plant and Garden News

Celebrating achievement

The Auckland branch of the Institute together with members of the Friends, Auckland Regional Botanic Gardens, the nursery trade and rose societies in Auckland met for afternoon tea at the Auckland Regional Botanic Gardens on Sunday 16 March to celebrate recent achievements by three distinguished Auckland members of the Institute:

Keith Hammett, on being awarded the Henry Eckford Gold Memorial Medal of the National Sweet Pea Society of the United Kingdom for his contribution to the sweet pea and, in particular, his work towards the development of a yellow sweet pea.

Jack Hobbs, on being elected an Associate of Honour of the Institute. Jack is well known for his work at the Botanic Gardens, his plant breeding, especially of *Hebe* and *Leptospermum*, his appearances as a television presenter and for his writings.

Sam McGredy, on being awarded a D.Sc. honoris causa last year by Massey University. Sam is a famous breeder of roses and this award recognizes his contributions to rose breeding, to the development of plant breeding in New Zealand, and to horticulture in New Zealand and throughout the world.

Andrew Maloy, chairman of the Auckland branch extended the congratulations of the Institute and of the more than 60 present. In reply, all three guests of honour acknowledged the help and support of family, friends, and colleagues.

Keith Hammett admitted that the Henry Eckford Gold Memorial Medal was something that he had always aspired to and he acknowledged the help given to him by Brian Murray and Ken Markham.

Jack Hobbs said that the awards made to himself and the late Brian Buchanan indicated the Auckland Garden had come of age. He also thanked his wife Sandra for letting him do what he enjoyed doing.

It was a coincidence that the function was held on the eve of St. Patrick's Day but Sam McGredy emphasized that he was now a kiwi as well. He stressed that the most important thing he had done for New Zealand was to encourage Plant Variety Rights legislation which allowed for the protection of new cultivars of plants.

Alders under threat in Europe

Alders, particularly the common alder, *Alnus glutinosa*, grey alder, *Alnus incana*, and Italian alder *Alnus cordata*, have become popular trees in New Zealand for ornamental, shelter and woodlot planting. They are becoming especially popular as street trees because of their ability to fix nitrogen and grow in poor soils.

In the UK however, alders have been killed following attack by a species of *Phytophthora*, yet to be given a name. The disease, first discovered in 1993, invades the roots and stem bases causing sparse yellowish foliage, and tarry exudates on the lower stem. In some sites 70 to 80% of alders have died, and the disease has been found on more than 20 river systems in southern England. Other countries in Europe including France and The Netherlands have also reported the disease.

Control is very limited with no practical way of removing the whole plant and root system after infection and death. It is hoped that selection for resistance is a possible solution and experimental plantings of a number of alder species and provenances have already been established by the British Forestry Commission.

New Caledonian flora and its introduction to cultivation

New Caledonia has one of the most distinctive island floras in the world. It contains 3222 species of plants, 77% of which are endemic. The island is particularly rich in conifers, with 43 of the 44 species being endemic. The island was part of the ancient super continent of Gondwana, and its flora has links with those of New Zealand and more especially Australia. The flora has also had to cope with the results of the serpentine volcanic rock which covers large areas of the island. The weathering of this rock has produced soils low in basic nutrients such as nitrogen, potassium and phosphorous, but high in iron, nickel cobalt and manganese, elements usually toxic to plant life.

In recent years there has been an increased interest in the flora and its horticultural potential. In Australia, Alistair Watt has spent the last 10 years working on the flora and introducing plants to Australia. He worked with conifers, introducing 35 species, and has more recently been evaluating the horticultural potential of flowering shrubs. In particular species of *Xanthostemon* have attracted much attention and a programme

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is under way at the Royal Botanic Gardens Melbourne to evaluate this genus and others in detail.

In New Zealand there has also been interest in the flora, with Dr John Dawson, Research Associate at Victoria University writing the Myrtaceae volume of the Flora of New Caledonia. Dr Dawson has made several visits to the island and has brought back material from several families that is currently being evaluated at Wellington Botanic Garden, Auckland Regional Botanic Gardens, and Victoria University Grounds. Species of *Xanthostemon, Cunonia*, and *Geissois* are showing great promise although some may not be hardy enough to be planted outside without protection.

It is hoped to publish an article on the flora of this botanical paradise in a future issue of the Journal.

Palm collection at the Auckland Regional Botanic Gardens

The increasing popularity of palms as garden plants in Auckland has been reflected in the establishment of a palm collection at the ARBG Garden at Manurewa. Development of the garden started in 1993 in association with the Palm and Cycad Society. Work was disrupted by widening of the Southern Motorway in 1995, recommencing in 1996. At this time a young Frenchman, Sebastien Bano became available to assist with planning and developing the Garden. He had experience at the Monaco Exotic Garden and was a member of the French Palm Society. He worked with Mitchell Graham, the gardener responsible for the collection to develop a list of palm species suitable for the site.

Within the area three different microclimates will be established:

1. Palms from subtropical regions where climate is warm all year round
2. Dry warm areas of the northern hemisphere Argentinean pampas - a savanna type environment
3. Perimeter areas where palms will be exposed to cool winds over winter and heavy frosts.

Currently almost 60 species have been sourced and are either planted or growing on in the nursery.

For more information please contact Mitchell Graham, ARB Gardens, Hill Road, Manurewa, South Auckland.

Environmental weeds in New Zealand

There has been a growing realization that many plants sold as garden ornamentals are in fact environmental weeds that are jumping over the garden fence and invading our native ecosystems. Some of these weeds were classified as noxious under the Noxious Plants Act, but this legislation was too restrictive to include the full range of environmental weeds. With the passing of the Biosecurity Act there is a requirement for all Regional Councils to prepare Regional Pest Management Strategies (RPMS's).

At the time these were being developed, a national list of environmental weeds was being prepared, in consultation with botanists, ecologists, the Nursery and Garden Industry Association and others. The intention was that plants in this list would be prohibited from sale, propagation, and distribution by inclusion in all RPMS's throughout New Zealand. The list, called the National Generic List, contains 111 species ranging from established weeds such as *Clematis vitalba* through to popular garden plants such as *Cobaea scandens, Erigeron karvinskianus,* and *Plectranthus ecklonii.*

In early 1997 Forest and Bird commissioned a report on the implementation of the list by Regional Councils, The results were generally pleasing and showed that 14 of the 16 Regional Council's included or intended to include 105 or more of the plants on the list. The two remaining Councils were Otago (69 species listed) and West Coast (19 species listed in a 1993 Noxious Plants Programme).

Waitangi Tribunal Claim on native plants

The Waitangi Tribunal has before it a claim ('Wai 262') relating to the protection, control, conservation, management, treatment, propagation, sale, dispersal, utilisation, and restriction on the use of, and transmission of the knowledge of, New Zealand indigenous flora and the genetic resources contained therein. The claimants seek as remedies to wrongs suffered:

- the acceptance by the crown of te tino rangatiratanga
- compensation to be negotiated
- control of indigenous flora (and fauna) in a manner which recognises te rino rangatiratanga o te iwi Maori.

The claim was lodged several years ago and will finally be heard in Northland from 16 - 20 June. It is difficult to say at this

stage what the implications will be for those growing, selling, breeding or researching native plants. Overseas experience suggests that some of the issues will relate to intellectual property rights and the rights of indigenous people to have a say in, and compensation for, the exploitation of native plants for profit especially when the benefits are exported. This has been the case with the development of pharmaceuticals from tropical plant products, where in many cases companies have made millions and the country where the plant originated and its people have not benefited. The unique nature of the Treaty of Waitangi and the claim will probably ensure wider implications that this.

Notable Trees Update

There have been some changes to the Notable Trees Administration. The work has continued for many years with great personal effort from many volunteers both in committee and in the field. Now there is an need to review the workings of the committee and bring a more active approach to tree registrations. I was approached and have accepted the task.

The primary function of tree registration is to publicise the importance of trees to the community with the ultimate aim of tree protection by legislation. The Resource Management Act 1991 has helped in that councils are required to list items of Heritage importance. Many Councils have included extensive tree lists. This listing offers limited protection only in that any alteration to listed trees has to be publically notified. This relies on surveillance (which is time consuming) or public notices (which are often overlooked).

New Zealand's tree heritage is great and we have many worthy trees. To help in this process of protection we need to have many volunteers to list or register trees which they have seen as worthy, both for the local heritage list as well as the RNZIH Notable Trees Register.

As a starting point the Local Authority's Heritage List should be viewed. This should be contained in the Council's District Plan whether proposed or finalised. The plan is available to the public at Council Offices and at Public Libraries. Information on the listings would be most helpful to us and even more helpful would be to ensure that there is a tree list. We would like to be informed . In this way we can draw attention to the fact and make the appropriate submission. The information will also bring attention to potential notable trees for our RNZIH Register.

Nelson is the new home for sending information and for processing RNZIH Notable Tree Registrations. The address is as follows:

RNZIH Notable Trees, c/- Ron Flook, 539 Rocks Rd, Tahunanui, Nelson.
Tel/fax 03 54 8659, e mail flook@netaccess.co.nz

Obituary Felix Jury 1912 - 1997

The plant world of New Zealand suffered the loss of one of its most notable plant breeders with the death, at 84 years of age, of Felix Jury.

One of two brothers noted for their breeding of plants, Felix was not only a very discerning plantsman but was a collector of outstanding material. His taste in plants was wide and varied and ranged from the dramatic giants of the garden, like Magnolia 'Lanarth' to the diminutive forms of *Narcissus cyclamineus*. The plant collection at his Tikorangi (North Taranaki) garden reflected his wide interest in outstanding plants and his ability to see the potential of them as breeding stock for his programmes. Introductions of plants was an unceasing interest and included Magnolia 'Lanarth', *Rhododendron macgregoriae, Schleffera* species, the New Guinea horseshoe fern and Ficus species.

From his collection, Felix undertook an endless succession of hybridising across a wide variety of plant genera including Camellia, Rhododendron, Astelia, Cordyline, Magnolia, Lilium, Prunus, Narcissus, Nerine and Celmisia. In each case he had an extraordinary eye for garden quality habits and ruthlessly rejected plants which did not meet his criteria. As a result, many of his introductions are well known in the garden inventory today. Camellia 'Dreamboat', Rhododendron 'Felicity Fair', Magnolia 'Vulcan', and 'Iolanthe', Hosta 'Goldrush', Prunus 'Mimosa' and Vireya Rhododendrons 'Golden Charm' and 'Cherry Pie' ..... the list goes on.

Felix Jury was an outstanding plantsman, recognised for his contribution to ornamental horticulture by receipt of the Institute's Plant Raisers' Award in 1984. International recognition was given in 1992 when he was awarded the prestigious Veitch Memorial Medal from the Royal Horticultural Society.

New Zealand has lost one of its truly outstanding plantsmen and hybridists but the legacy of high quality garden plants which represents his life's work will endure as testimony to the skill and knowledge of Felix Jury.

A.D. Jellyman, June 1997

The Erythronium Species of California and SW Oregon

by Jayson Kelly

Erythronium multiscapoidium

It all started when I landed at San Francisco Airport, California, on the 31st March. I found myself alone in a strangers land with only a hotel address and a mission to lead my way. I had allocated the next few days to tracking down supplies such as food, maps, equipment etc. and to re-adjust to the time and custom of west coast USA. In three days I would be picking up my rental car, braving the flow of right hand drivers, and setting off on my steady but sure migration north to bordering State Oregon. For what reason? I had not come for the seafood pizzas, vineyards and Mediterranean like spring (well maybe...). I was here to study a group of plants. To see them in the wild in the hope that it made some sense of their cultivation in the garden. Of the 26 or so species of *Erythronium*, I wanted to find the nine species and one variety concentrated in northern California and southwest Oregon. Locally, they are called Trout or Fawn Lilies on account of the mottling pattern on the leaves. In New Zealand, they are mistakenly named Dogs Tooth Violets, a name more appropriately applied to their European relatives.

Leaving "down town" San Francisco at 5.00am. under the influence of a NZ drivers license, I headed north and slightly inland towards the Napa Valley. As well as being home to California's famous wine industry, the valley provided the first stop and only locality of *E. helenae*. Aptly named, this plant is restricted to an approximately 40km radius centered on Mt St. Helena. *Erythronium helenae* has pure white petals with golden centres, which are quite broad for the genus (each of the five petals up to 2cm. across), making it quite striking. As with most of the soils encountered later, this plant grew in the red clay loams of the area. These are generally inhospitable nutrient deficient soils derived from the serpentine bedrock scattered through the area. With a climate conducive to viticulture, plants of this region experience a moist early spring which rapidly heats up to a bone dry 40°C in summer. This explained why these plants go dormant in November in New Zealand. Of the three sites studied, two were found under scrub (called locally chaparral, the dominant species being sparse *Pinus coulteri* and thickets of 2 to 3m. *Arctostaphylos*

sp.) and the other under mixed broadleaf forest (primarily *Quercus keloggii* and *Arbutus menziesii*). Surprisingly a few hardy plants were out in full sun, but most preferred the shade.

With preconceived notions about moist rich woodland habitats evaporating, I left *E. helenae* in search of a plant cursed with a mouthful of a name - *E. multiscapoideum.* Located still further inland on the foothills of the Sierra Nevada Ranges I made my new base of operations at Chico. Like the botanical name suggests, *E. multiscapoideum* differs from its relatives by bearing in appearance at least, several flowering stems (or scapes) from each bulb. I observed superbly mottled foliage in conjunction with very large flowers. Two sites in particular provided flowers of exceptional size (plants from these populations are sometimes available and erroneously labeled *E. cliftonii*). This example showed just how much variation can be observed with species growing in the wild, and hence in the garden if seed is regularly sown and grown on.

E. multiscapoideum also has the desirable trait of increasing by stoloniferous offshoots from the bulb. This means the plants are not only increased vegetatively (and thus good ones able to be cloned) but as a result they often grow in clumps setting off this species in its best possible light. I have a very dear memory of standing on a hillside amongst thousands of these large flowered plants. Each in clumps forming drifts, growing in stark contrast to the rocky ground supporting them. As if this were not enough, they were growing in association with the choice and rare (in cultivation) red *Fritillaria recurva* and equally interesting *Calochortus tolmei* . This form of *E. multiscapoideum* (as *E. cliftonii*) should become established in cultivation with any luck.

Leaving behind what I thought had to be the find of my trip, I headed more or less northwest, back towards the Pacific coast and into the Trinity Mountains - Bigfoot country. I was now in search of a recently described plant called *E. citrinum* var. *roderickii*. Located on the slopes of the Trinity River Valley, this Trout Lily is in possession of remarkably dark mottling on the leaves. The flowers are the same colour as *E. citrinum*, that is white petals with distinct golden yellow centres. What makes them a distinct variety is their consistent maroon rather than white anthers. *E. citrinum* var. *roderickii* is a smaller, more graceful plant which would best be displayed in a pot. It should be noted that the melting snow line was not far from each of the sites where I found this plant, at altitudes of 1000m and 1220m.

With two weeks behind me and the flowering season progressing I needed to find *E. californicum* before it was too late. This plant grows on the Coast Ranges under either evergreen or deciduous cover. The topsoil is again a red clay loam, augmented by the decaying leaves of the surrounding trees. It typically has a pH 5.5 to 6.5 and a profile depth from 20 to 40 cm. before hitting subsoil or bedrock. *Erythronium californicum* could be considered bland in comparison to the rest of its peers. Its flowers are neither large nor exceptionally attractive, being off white with yellowish centres marked with darker redbrown streaks. The flowers are often produced singly, and I did not see any plants with more than three flowers on any one plant. Its saving grace is the finely mottled foliage

E. hendersonii

of a typical red brown colour, but often very distinct and dark.

Ending my search for the solely Californian connection to this group of plants, I drifted further north into the "Siskiyou Island". The Siskiyou Mts., which straddle the border with Oregon, were an island 100 million years ago. This allowed the isolated flora to evolve under slightly differing influences. The result is a concentrated area of wilderness where many of the plants present are of high ornamental value. This is true of the three Siskiyou endemics I wanted to find next ie. *Erythronium hendersonii, E. citrinum* and *E. howellii.*

I found *E. hendersonii* with relative ease thanks to contacts I had made in New Zealand. It is one of my favorite members of *Erythronium*, being robust and having attractive lavender flowers with white then purple centres. One fine group of specimens I found near Medford had large multiflowered stems almost 30cm. tall. The leaves were also large, finely mottled and almost glaucous in appearance. Probably because of its colouring and relative ease of cultivation, this plant is often found in many of the seed lists offered by horticultural societies. They were growing in typical Hendersons fawn lily territory - under a canopy of *Pseudotsuga menziesii*, with *Arbutus menziesii* as sub-canopy, amongst sparse grass and a creeping shrubby *Mahonia* sp. The top 5-10cm. of the soil profile comprised of slowly decomposing leaves and other humus. The

E. oregonum

A Horticultural Key to Section *Pardalinae* of Northern California and South West Oregon

1.	Flowers predominantly white or cream		2.
	Flowers predominantly pink or purple		7.
2	Bulb stoloniferous, scape branched at or near ground level	***E. multiscapoideum***	
	Bulb not stoloniferous, scape branched well above leaves		3.
3.	Flowers white/cream with/without orange-brown markings at base, stigma lobes >1mm.		4.
	Flowers white/cream with yellow base, stigma lobes < 1mm.		5.
4.	Filaments slender	***E. californicum***	
	Filaments dilated at base	***E. oregonum***	
5.	Perianth segments without sac-like appendages	***E. howellii***	
	Perianth segments with sac-like appendages		6.
6.	Anthers white	***E. citrinum***	
	Anthers purple	***E. citrinum*** var. ***roderickii***	
	Anthers yellow	*E. helenae*	
7.	Flowers pink, filaments dilated at base	***E. revolutum***	
	Flowers lavender with purple base, anthers buff coloured	E ***hendersonii***	

topsoil was a deep (30cm.+), very stony, clay loam. I suspect the vigour of this particular population resulted from the excellent crumb structure of the soil and its drainage and moisture retention qualities. In any case, I have not seen as fine an example of *E. hendersonii* since - perhaps one day a similar plant might find its way into general cultivation.

E. citrinum was easy to find and variable in the wild. It grows in a range of habitats from moist forests on the coast through to dry sloping turf areas further inland. The flower size is variable, with petals varying in length from 2 - 5.5cm. I found one particular population that had very distinct yellow round markings at the base of each petal, giving rise to a particularly striking effect. I also observed a hybrid with E *hendersonii,* which although not a stunning plant does illustrate this genus' ability to be promiscuous which is good news to the plant breeder.

Unlike most of the others, *E citrinum* is scented. Although I will describe this as pleasant, I shan't try and categorise it further - Helen my partner is forever criticising both my ability to interpret what is pleasant and the accuracy of my nose. I have grown this plant in pots with relative ease and would recommend it to any rock or woodland gardener.

Next on the hit list, *E. howelli,* is one of the lesser gems on the crown. Compared to the others, it has relatively small flower parts. Its colouration is similar but inferior to *E. citrinum*, and differs botanically in that there are no "sac" like appendages at the base of the petals. It does however have the interesting distinction of being very limited in distribution, and is known to be local to the areas immediately surrounding the missing town of Waldo - missing because it existed in the 30's when this species was described, but no longer exists on any maps today. *E. howelli* is probably doomed to remain in the domain of the enthusiast or collector and is little known in general cultivation. I have no personal experience of growing this plant but suspect it is as easy to cultivate as its relatives.

Seven down and two to go, I set off in search of the widely distributed *E oregonum* and *E. revolutum*. Both these plants deserve a spot in the garden, but not at the expense of its presence in the wild. Although *E. revolutum* occurs from northern California right up into Canada, in its southern limits it has become rare and hard to find - primarily because of over collection of bulbs by "instant gardeners". Of all the plants I was trying to locate, this was by far the most difficult. Lying always within about a 50k zone from the coast, *E. revolutum* inhabits moist shaded sites where drainage is very good. Having said this, I found one population growing in a stream! I should add that it was a shallow and seasonal flow that covered the plants and that they were growing in about 90% gravel. Most plants were growing in humus rich soil where they would be unlikely to experience the summer baking of their cousins further inland. There are a couple of forms in cultivation. *E. revolutum* "Johnsonii" is a particularly dark rose pink form. "Alba" occurs naturally in the wild, predominantly in its southern range. This plant is in effect indistinguishable from *E. oregonum.*

E. revolutum is generally a robust plant which can be used to great spring effect naturalising in moist spots under deciduous trees.

Before beginning this journey, I was a little sceptical about the merits of *E. oregonum.* Seedlings raised by myself and at the Dunedin Botanic Garden proved to be small and uninteresting. This all changed when I "got some perspective". Being exposed to the largest nursery of *E. oregonum* in the World,

the variation of plants in the wild was quite staggering. Small and large, single or multiflowered, white, cream or even yellow. It became obvious that the plants I had seen in cultivation were poor examples of the species. The plant typically has white flowers with yellow centres surrounded by a slim burnt orange ring. Some botanists have split this species into two sub species. *E. oregonum* ssp. *oregonum* supposedly has yellow anthers, whilst ssp. *leucandrum* has white ones. In its southern extreme where ssp. *leucandrum* is supposed to predominate, I only found mixed populations, with the yellow anthers in ssp. *oregonum* being rather pale. This was obviously a genetically diverse species. To further add to this, I found a smallish population in Douglas Co., Oregon where the flowers were distinctly yellow. This is not supposed to happen to this species. Perhaps this was a hybrid with the plain leaved, yellow flowered *Erythronium grandiflorum* ? If so this latter species was not obvious in the area.

In all, with its sometimes very large flowers, its varying colour, and its ease of cultivation, *E. oregonum* would make a good start as breeding stock for commercial production.

With this last one in the bag I headed south again to San Francisco to return my unscathed rental car. Six weeks had flown by. The temperatures were now hovering around 38 deg. Celsius. It was time to head back home to Autumn.

A lot wiser for the experience, the greatest appreciation I found was in the diversity of nature. I would strongly recommend for any keen gardener to stray off the track, whether here in New Zealand or some other place, and to take a closer look at whats on offer in Mother Natures Nursery.

Propagation

At present most *Erythronium* stock is propagated from seed. This is best sown as soon as it's ripe (usually mid summer) onto a free draining media. For example equal parts of sieved peat and round sand. As its best to leave the seedlings undisturbed for 2-3 years, use this medium only on the top 10mm. of the pot with the rest of the media being able to support the plants for the next 2-3 years (see Cultivation in Containers). Seeds should be sown lightly (20 - 30 seeds per 15cm. pot), pressed into the medium and then just covered with the same. Mulch the container with 5mm. washed grit to disperse water and help maintain surface structure.

The pot should then be placed in the shade and kept just moist at all times. Germination begins the following year in early spring with seedlings appearing grass like at first. From germination, some plants take as little as three years to flower but with most it is four to five years.

Propagation from seed is an effective way of raising large numbers of plants. However vegetative propagation is the only reliable way of increasing good hybrid crosses and desirable forms.

In the wild most species grow where rainfall is negligible over the summer period. The botanist Applegate (1935) observed that in *E. hendersonii* and *E. helenae* " the tendency to reproduce by multiplication of corms from the base of the old ones is greatly stimulated by irrigation, a single corm gradually producing by sessile offsets a clump or bed, instead of becoming dormant as the ground dries under natural conditions". At most sites plants were found with a chain of what looked like old bulbs. Some were fully turgid and still had roots attached. These offsets appeared to have the potential to grow and it may be to these that Applegate refers.

Cultivation and use in the Garden

In the wild, most *Erythronium* experience a Mediterranean climate. That is cool moist winters followed by hot dry summers. In the west and further north temperatures decrease and precipitation increases over the summer months. The various habitats of *Erythronium* alter to reflect this change.

Erythronium thrive in a moist, cool environment whilst in active growth. This is emulated in the garden by varying the amount of shade, depending on the local climate, and by altering the soil. A loam or crumb structure is the preferred medium. Where soils are alkaline, peat or composted conifer needles will help lower the pH. Dressing with Ammonium sulphate in the spring will also increase acidity. A pH of 5.5 to 7.0 is suitable.

Bulbs should be planted between 10-15cm deep if mature. Seedlings should be planted shallower and will find their own depth with time. The best time to transplant plants is as soon as they are dormant. At this stage top growth has stopped but warm, moist autumn conditions allow the bulbs to settle in.

As a general rule these plants are relatively free of pests and diseases. Bulb flies are rarely a problem and occasionally the leaves are subject to minor slug damage. Storage rots can establish and the bulbs are well known to dehydrate quickly when exposed to the air.

Erythronium look best if planted in clumps of five or more bulbs, and in drifts. They are well suited to woodland areas, wild gardens, peat and rock gardens.

Cultivation in Containers

The media used should be free draining; provide good moisture retention, adequate nutrients and retain its structure over time. As a result repotting will be less frequent, allowing the bulbs time to settle and mature. A suggested mix would be 2 parts fibrous loam, 1 part decomposed pine needles, and 1 part 10mm. gravel.

The container should be at least 15cm. deep. Ideally seedling bulbs should be kept in the same pot for 2-3 years before being planted out or potted on. If being kept in pots, they should then be repotted 5cm. below the surface, in at least a 15 x 15cm. container, with no more than 6 or 7 to a pot. The media should be kept moist over the growing season and just moist at other times. Containers are best positioned where they have 30-50% shade over the hottest part of the day and receive good air movement. They should be kept closely packed where possible, acting as a whole to maintain a cool moist environment.

References

Applegate, E.I. 1935 : The Genus *Erythronium* : A taxonomic and distributional study of the western North American species. Modrono, 3(2): 58-113.

The 1997 Ian Galloway Memorial Lecture

Parks, People and Politics – Planning for Parks in Wellington

Frank Boffa

Wellington's Open Space

People often refer to the abundance of open space in Wellington citing the surrounding hills, the town belt, the harbour and more lately, the developments within the inner harbour. Wellington may be well endowed with open space, however, much of it tends to be contextual and visual and is not readily accessible or available for public use. Compared to other major overseas cities, Wellington does not have a generous quantity or quality of urban open space particularly within the inner city area. I define the inner city area as the crescent shaped area between the railway station and Courtenay Place and extending out to Buckle Street. Within this area there are several well used open spaces such as Midland Park, Frank Kitts Park and Civic Square. Generally these spaces tend to be event type places or spaces that are utilised for specific activities, events and promotions.

Broadly I categorise Wellington's open space in the following manner:

i) Structural or framework open spaces such as the hills, Town Belt and the harbour.

ii) Special purpose open space such as the Botanic Garden and the Zoo (both of which are within the town belt).

iii) Scenic and passive recreation reserves and parks such as Wrights Hill Reserve and Trellisick Park.

iv) Sport and active recreational areas and parks such as the Basin Reserve and Kelburn Park.

v) Inner city parks such as Midland Park, Justice Park and Te Aro Park.

vi) Building forecourts and urban plazas.

Open Space Opportunities

During the 1970's and 80's downtown Wellington was practically rebuilt. Today we are once again at an interesting and critical stage in the redevelopment of the City. While we may not have fully capitalised on the boom time redevelopment of the central city in the 70's and 80's I believe the timing is now right for the City Council to be proactive by initiating a clear public policy and plan for inner city open space. To date inner city open space planning has tended to be somewhat adhoc. Many open spaces within the city tend to be 'left over spaces' and are consequently poorly sited with respect to the urban fabric of the city. Many of our urban spaces have been designed with little regard to environmental factors or an understanding of peoples needs and requirements.

In a New Zealand context, Wellington's recent achievements in inner city redevelopment are, however, relatively significant and the Council can be congratulated for its achievements. The greening of Lambton Quay, pedestrian improvements within the city, the Lambton Harbour Development and Civic Square are all developments that have considerably improved the appearance and amenity of the city.

On the other hand there have also been lost opportunities and/or opportunities that could and should be investigated. For example:

i) During the 1970's and 80's, downtown Wellington was practically rebuilt. The podium level which essentially follows The Terrace level could have been developed in an extended and integrated public plaza incorporating retail ing, open space and other public oriented developments. Instead it is largely occupied by car parking and/or isolated pockets of open space that were created as part of the bonus provisions which gave additional commercial space in return for open space. While pedestrian linkages be tween Lambton Quay and The Terrace have been created along with isolated public forecourt plaza type open space developments we could have planned and created a bold and imaginative urban plaza extending above Lambton Quay for almost the entire length of The Terrace between Bowen Street and Boulcott Street.

Unfortunately, no one really saw the big picture and the

opportunities that were available. Instead we have a lot of small and unrelated open space developments with motor vehicles occupying some of what could have been prime public open space. I don't believe cost would necessarily have been an issue as the developments could have been funded largely by way of bonus incentives.

ii) Perhaps we could achieve more on Lambton Quay. Why not close the eastern side to traffic and create a lineal urban park or pedestrian plaza extending from Parliament Build ings to somewhere near Stewart Dawson's corner?

iii) At the risk of opening up an old wound, the site of the Old BNZ Buildings offered what I still believe was a unique opportunity for a major central city open space. History records that politics prevailed.

iv) I believe that a well located and planned park in the upper Cuba Street area would be a great public asset. Imagine a Midland Park type development at or near Cuba Mall with perhaps another in the Courtenay Place area. Closed and widened pedestrian streets provide a level of public amen ity, however, they are no substitute for a well located and planned public park.

v) Currently Courtenay Place is experiencing a much needed revitalisation. While Council has and is undertaking some excellent pedestrian improvements in this area I believe there is an opportunity, and I suspect a need, to create a major public park or focal point in the Courtenay Place area.

vi) The Te Aro flat area is an area that will clearly experience a major change in the next 10 years or so. What, if anything, has been planned for open space? While this may sound extravagant, I believe Wellington needs a major inner city park occupying an area of around a hectare or a city block. Given the size and opportunities within the Te Aro area why don't we plan for a major central city park - an Albert Park; a park that has large areas of grass, trees, topographic relief and possibly water. When Wellington was planned in the 1850s land was set aside for public parks, the Basin Reserve, Central Park, the Botanic Garden, and other areas. In the past 150 years what additional sizeable areas have been set aside? I can only think of the Lambton Harbour Development which tends to be utilised more and more as a successful event space.

The old Museum site on Buckle Street is a grand building on a superb site. I wonder to what extent has this been factored into the redevelopment of the Te Aro flat. What connections can be established between the old Museum and the Te Aro area and indeed the rest of the city. I suspect very little, as the recent development of a Mobil Station and a vehicle testing station appear to indicate. Urban open space should be seen as a structural component within the city - it should not be treated as left over space or the difficult-to-handle space between buildings. The open space and urban design opportunities within the Te Aro area must be identified now and planned for or we run the risk of losing another major urban design opportunity. The old museum site has been mentioned as a possible casino site - this building and site is far too grand and stately to be given out to a casino.

Recognising the need for a comprehensive survey and assessment of Wellington's urban open space, the Wellington City Council in the early 1990s sought consultant proposals. However, Council never made an appointment and to my knowledge the work brief has never been carried out. I believe Council should initiate the study and extend the original brief to include a survey of people's needs and perceptions of urban open space. Knowing what people want and understanding their behavioural patterns is vitally important. Open space and park planning in Wellington has been somewhat adhoc and will continue to be so until Council obtains meaningful facts and more detailed information as a basis for developing an integrated open space strategy and plan for Wellington. Perhaps this could be the city's millennium project.

In the recent past the provision and management of urban parks was the responsibility of the local authority with funding coming primarily from rates and supplemented occasionally by way of generous donations and bequests from individuals and organisations. In more recent times there has been a trend toward having developers provide public open space and/or public art works as part of bonus incentive provisions within the District Plan. Developers could seek and be granted additional floor space in the form of an extra height and/or floor space if they provided an acceptable area of public open spaces usually determined by some formulae. The Henry Moore sculpture 'Bronze Form' that used to sit in Midland Park was acquired by the City Council as part of Councils' arts bonus scheme. The old BNZ buildings were acquired by the City Council for public open space in return for increased height and floor space for the adjacent BNZ Centre development.

While the bonus provision concept has resulted in some well used and attractive open space, primarily in the form of building forecourts, there are examples where the concept has been quite ineffective. Observation of park and forecourt usage seems to indicate that some places are more popular and better utilised than others. Clearly factors such as location, access, context, environmental setting, design, safety and maintenance all influence the success or failure of urban parks, plazas and building forecourts.

What then makes a park, plaza or forecourt successful?

Why is Midland Park more popular than Justice Park?

Why doesn't the redeveloped Te Aro Park work?

Why is Glover Park relatively unknown and under utilised? Indeed you may well ask where is Glover Park!

In attempting to address these questions I would like to review some work carried out in the USA in the early 1970's which I believe is relevant and provides some useful insights into park and plaza usage and the behavioural patterns of park and plaza users. This work dramatically changed the way New York and many other cities around the world planned for and designed inner city parks.

Park Use and Behavioural Patterns

In 1961 New York City Council sought to encourage the provision of open space in the central city area in the form of plazas. To this end the city introduced a system of bonus provisions. For every square foot of plaza that was provided, the developer could claim an additional 10 square feet of commercial space. By 1972 (11 years later) approximately 20 acres or 8 hectares of some of the world's most expensive open space was created in downtown New York City. During the 1980s Wellington City promoted similar bonus provisions, many of which resulted in what I consider were little more than landscaped forecourts to buildings, with little consideration as to how the public might use or enjoy these spaces.

Following New York's plaza boom in the 60s William H Whyte, an American social commentator and conservationist observed inconsistencies in the use of plazas. In 1971 he formed the Street Life Project with the objective of studying the behavioural patterns and the variation in the public usage of these newly created plazas. The methods used by Whyte and his researchers was based on time lapse photography, observations and interviews.

In 1980 the results of the Street Life Project were published in a book titled *The Social Life of Small Urban Spaces*. Although Whyte's ground breaking research was carried out some fifteen years ago it is still very relevant today. Some of Whyte's study conclusions confirm the obvious. However, his work is nevertheless worth noting as it goes some way to explaining the reasons and factors why some urban parks and plazas in Wellington work and others don't. Whyte's work also provides some very useful insights into the behavioural patterns of park users.

With respect to the life and use of plazas Whyte found that:

- Most people who used plazas were young office workers.
- Plaza users like to put a little distance between themselves and the office. However, they usually do not go beyond a 3 block radius from their place of work.
- Plaza users tend to meet and congregate in groups usually with 2, 3 or 4 people per group. This tallies with subse quent research carried out in Australia and Europe.
- Generally there are more females, than males in plazas.
- Where there are more females the plaza is invariably more successful than those that attract more males.
- Other than during specific events, peak plaza use was between 12 noon and 2.00pm.
- Off peak use gave the best indication as to people's preference and use of the plaza. Thus the most popular areas become quite apparent. When crowded, people take whatever space is available.
- Men like to be on the front row or edge seats - girlwatchers. Women often tended to seek the more discreet and secluded areas. Lovers tended to seek out the more public locations rather than the secluded spaces.
- Whyte found that there were conflicts between what people said attracted them to a park or plaza and what occurred in reality. When interviewed people said they went to plazas/parks to 'escape' to 'retreat' or because the place was an 'oasis'. In reality they sought other people. They liked to see other people and they liked to be seen. This points to the need to carry out interviews as well as observations.
- People also tended to meet, talk and sit on or adjacent to the main pedestrian routes and accessways.

With respect to sitting Whyte found that:

- Most of the successful plazas contain considerably more sitting space than unsuccessful plazas. People sit wherever they can find space - this was not specific to benches or seats as such. People liked to sit on ledges, walls, steps and other elements.
- Sitters did not seek out the standard 450mm high seats or ledges. Sitting edges ranged between heights between 300mm and 900mm.
- Bench and ledge widths were particularly important as was access to them. Benches/ledges that were wide enough to accommodate people on both sides were pre ferred.
- Steps were identified as extremely important sitting places. Chairs and benches were often placed in areas that people tended to avoid.
- Whyte concluded that sitting space and sitting character istics were one of the most important findings of the Street Life Project. The amount of sitting area was as important, if not more important, than the size of the plaza.

When Whyte's findings were presented to the New York City Council, bonus provisions, particularly with regard to design standards, were modified to take into account the plaza sitting characteristics developed during the study.

With respect to sun, wind and trees Whyte found that:

- Sun was vital - people move with the sun except when it is too hot or bright. They then sought shade.
- People avoided windy and draughty locations. Trees were sought for shelter be it for shade or from wind.
- People liked warmth and comfort - liked to be propped up against warm and sunny walls.
- Water was a particularly important feature - people liked to see and hear water. They also like water to be accessible.

With regard to food Whyte found that:

- Food outlets were an essential ingredient in successful plazas.

As far as the plaza relationship with the adjoining street Whyte found that:

- Street/plaza relationship was the most critical design factor in plaza planning.
- A good and successful plaza starts at the street corner.
- There must be a positive relationship with the street.
- The front view or edge to the street was the prime location people sought to occupy. Whyte found that many plazas did not make provision for sitting in this area.
- Store frontages to the plaza were an important factor. The best plaza frontages contained food and retail activities.
- Sightlines into the plaza were important. People appeared to like to be beckoned into a plaza - sense of entry, change of elevation, entry points.
- In sunken plazas people tended to seek out the change of level rather than being on the upper or lower level.

With regard to plaza capacity Whyte found that use tended to be self regulating - as people moved out others moved in to fill the void. If there were too many people in the plaza then others tended to move on to another location.

As far as undesirables were concerned, well used spaces did not experience any problems. Poorly used plazas tended to receive more attention from so called undesirables.

Wellington's Inner City Parks

Given the validity of Whyte's work and its application to Wellington's inner city parks and forecourts how do some of our more prominent urban spaces measure up?

Midland Park

Midland Park is undoubtedly the most successful inner city park in Wellington. A large measure of this park's success can, in my opinion, be attributed to the following:

i) Its strategic location on the golden mile. You may recall that when the plans for the demolition of the Midland Hotel were notified there was a public outcry. If today the Midland Park were to be sold off (as it could be) there would, I suggest, be considerably more vocal and widespread public interest and concern than there was previously. Midland Park is not currently gazetted as a reserve - it is simply zoned as open space. You will recall that the old BNZ buildings were zoned open space. However, the Council of the day voted to change the zoning to retail. In order to ensure Midland Park's future it should be gazetted as a reserve and come within the provisions of the Reserves Act.

ii) Many of the use and behavioural characteristics observed by Whyte are apparent and influenced the design of Midland Park.

iii) Environmentally the site is very good with respect to climatic influences.

iv) The park design was competently carried out by a very sensitive and talented landscape architect - Ron Flook.

Fig. 1 Midland Park at peak time

Fig. 2. View of Midland Park showing its strategic location along Lambton Quay

v) Politically the Council of the day and in particular Michael Fowler and if I recall correctly Keith Spry backed the proposal through its stormy beginnings.

vi) Finally, and most importantly, Ian Galloway, not only had a vision for the park but worked tirelessly behind the scenes to ensure that Midland Park was going to be a successful prototype for future inner city park developments.

Overall, Midland Park had everything going for it (the right site in terms of location and access and on the well established pedestrian routes, a competent and sensitive designer, and a determined client - Galloway, Spry and Fowler). Midland Park is a successful prototype for inner city park development. In fact I would suggest that Midland Park's success has played a major role in influencing and shaping people's attitudes to, and use of urban open space in Wellington.

Justice Park

Justice Park is certainly used by lunchtime workers, however, it is certainly not as popular as Midland Park - why is this?

i) Its location at the northern end of the Golden Mile is not exactly on the well established and densely populated inner city pedestrian routes.

ii) Justice Park is not well defined - spatially it tends to 'spill out' over into the wider open space of the Government Centre.

iii) The entry points are not inviting, in spite of the large steel portals that signify the park entry locations.

iv) The park is not seen as an integral part of the street - it is separated by the wall remnants of the old law court building.

v) There are no focal points or features within the park. Essentially the park lacks vitality.

vi) There are no retail or food outlets adjacent or close to the park.

Overall the park appears as a pleasant and relatively ordinary open space. It lacks vitality and probably suffers from being a temporary or interim use for what may probably become a building site at some future time. The future of Justice Park is even more tenuous than Midland Park. Justice Park is not even zoned as open space in the District Plan. Likewise Civic Square is not zoned as open space.

Te Aro Park

Prior to its redevelopment Te Aro Park appeared to be a popular sitting and lunching area. Why doesn't Te Aro Park work as well today as it did when it was Pigeon Park and what are the constraints to having a successful park in this location?

Firstly in terms of location the area has to contend with the following constraints.

i) The site appears and feels like a traffic island.

ii) The site is a difficult shape.

iii) The area is exposed and has no sense of visual or physical enclosure.

Secondly in terms of layout:

iv) The design is hard to read and bears little relationship to how the area might be used and enjoyed.

v) The design is partially successful as an abstract form or sculpture which has to be seen from above to the appreciated.

Fig. 3. Justice Park, a temporary park at the northern end of Lambton Quay

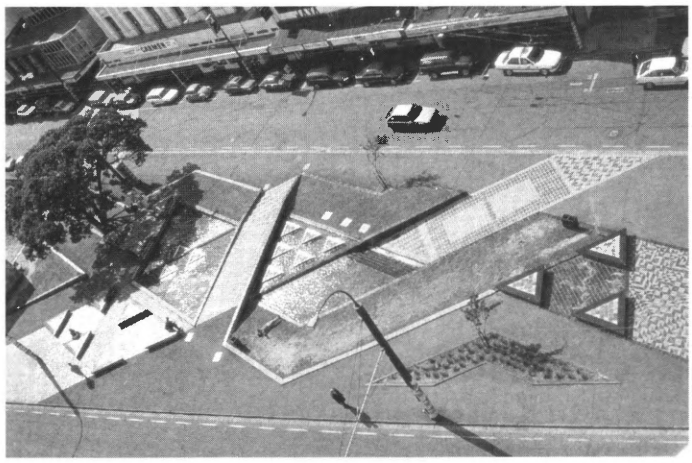

Fig.4. Birds' eye view of Te Aro Park showing the strong abstract forms not appreciated from ground level

vi) The design has a hostile or aggressive feel to it - it is not user friendly in its forms, shapes or colours.

vii) While the park does contain an elaborate water feature it still lacks a focal point.

viii) Other than at the western end there are few retail frontages adjacent to the park. The public toilets effectively screen and isolate retail shops.

In my opinion Te Aro Park should be seen and treated as a piece of road reserve. If an inner city park is to be created in this location then it would best be located on the site of the Oaks complex, possibly incorporating part of Cuba and Manners Mall.

Overall the park displays some bold patterns and imaginative use of materials. However, as a park for people to use and enjoy it appears to fall short.

Glover Park

Glover Park between Ghuznee and Garrett Streets was developed in Ian Galloway's time prior to the redevelopment of the Midland Hotel site. Glover Park is a pleasant space and relatively well designed, however, it has never been a popular inner city park and as a consequence has at various times been colonised by unsociable sections of the community. The land for Glover Park was purchased with money from the Glover bequest. The park that currently exists was, I believe, to be the first stage of a larger park proposal which was to extend through to Cuba Street. I am, however, unsure as to the status of the original proposal and Council's future plans for extending the park as was originally intended.

Glover Park is not easy to access and is located off the main pedestrian routes. Were Glover Park to be located on Cuba Street it would undoubtedly have been considerably more successful. Presently the City Council is assessing the effectiveness of Glover Park and is about to promote measures that will improve the use and hopefully the popularity of the existing park.

Conclusion

In this address I have canvassed a range of issues relative to inner city parks and open spaces. Clearly we have precious few inner city parks and open spaces that are gazetted as reserves. Consequently their long term future remains in doubt. Council can, as it has done in the past, change the zoning on land zoned as open space. I consider this to be unacceptable as there must be some surety for the strategic and important open spaces within the city.

i) There is a need to survey and review open space provisions and use, and then establish and maintain open space standards that are relevant to the real rather than the perceived needs and requirements of the public.

ii) There is a need for Council and/or some other organisation to initiate/survey? and monitor behavioural patterns of park users with the view of incorporating relevant factors in all aspect of park planning, design and management.

iii) A comprehensive and integrated Council strategy for open space, particularly inner city open space is required. Hopefully this would identify the needs and opportunities I have eluded to in terms of possible new parks.

In conclusion there are many other important open spaces within the city that require addressing now if we are to secure the best outcomes. In the days when there was a City Planner and a Parks Director it was relatively straight forward and easy to make approaches and gain some measure of confidence that consideration and/or action would result. Today it's considerably more difficult to identify who is responsible for what and how best one should direct one's enquiries. In case there is someone out there who cares and can see and appreciate the big picture, let's not forget Mt Crawford and the Miramar Peninsula - potentially another millennium project and a strategic piece of open space the city must acquire.

Fig 5. Glover Park

Tourism & Horticulture

Alan Jolliffe
Associate Dean, Faculty of Commerce, Christchurch Polytechnic, New Zealand.

Abstract

This article provides information on basic tourism concepts for an audience not traditionally exposed to tourism. It aims to show the interrelationships between tourism, tourists and horticulture and gardening. It also examines briefly the media coverage of horticulture, horticultural features, and horticultural events to show the direct relationship between tourism and horticulture.

Key words: Horticulture, gardening, tourism.

Introduction

There has been an upsurge in the interest of people and businesses trying to cash in on the tourism boom in New Zealand. Of interest in this article is the relationship between horticulture and gardening and tourism.

Tourism is a major growth industry in New Zealand and indeed the world. With NZ tourism growth rates expected of up to 10% per annum many people are promoting tourism as one of the saviours of the NZ economy in the future.

In this article Tourism is defined in the broad context, and tourism activities related to horticulture are discussed. The extent of interrelationships between horticulture and tourism is shown through a snapshot investigation of various media. Finally a short discussion on the impacts of tourism is provided.

Tourism

There are a number of definitions of tourism. Murphy (1982) defined Tourism as "... the temporary movement of people to destinations outside their normal places of work and residence, the activities undertaken during their stay in those destinations, and the facilities created to cater for their needs."

The four factors identified in tourism which affects profitability of businesses and regional development are (Jolliffe 1993):

1. visitor numbers
2. length of stay
3. level of expenditure
4. repeat and referral visits

Visitor Numbers

The Truth about Tourism Figures

	Current	**Year 2000 Estimate**
International Market		
International Visitors	1.2 million	2.5 million
Gross Expenditure	$3.5 billion	$10.0 billion
Less Air Transportation	$1.2 billion	$3.6 billion
Nett Ground Expenditure	$2.3 billion	$6.2 billion
Domestic Market		
Domestic Trips	15 million	20 million
Pleasure	$2.7 billion	$3.5 billion
Business	$1.5 billion	$2.00 billion
Gross Expenditure	$4.2 billion	$5.5 billion

Source NZTB

When examining figures like this we have to know how they are made up. Gross figures are fine but a large area of expenditure like air travel can make a big difference to the picture painted by those wishing to enhance the value of tourism to the economy.

Ground figures are also general because they comprise two main components of each:

1. Business Travel
2. Pleasure Travel

Business travel has a different set of expenditure patterns to pleasure travel.

Pleasure travel can be subdivided into the following distinct groups:

1. **FIT** - Free independent traveller - people who hire camper vans, cars, bicycles etc and make up their own itinerary as they travel around. This is a growing market.

2. **SIT** - Semi independent traveller - people who have a partly organised itinerary but can fit in a range of other activities of their own choice.

3. **Package Tours** - Fully inclusive trips where groups fly in, get on a coach and are taken around New Zealand and only visit predetermined locations. This type of traveller is predicted to decline or at least stay level in the future.

In general we are told of a rapid increase in numbers. What businesses need to know is which group is growing to determine the marketing mix of a business.

Length of Stay

Length of stay is defined in this article as the time period visitors stay in New Zealand, a region or in accommodation or an attraction.

Historically the average length of stay in New Zealand was about 27 days. Currently the average length of stay is about 19 days. A significant drop.

In the future there is predicted to be a world wide trend towards short break holidays. It is expected that this the length of stay will fall even further.

Regionally one can measure tourism in length of stay because it has high economic impact. Auckland's length of stay is up to 6 days with Wellington at 2 days (NZTB).

Expenditure

There are a range of measures looked at in determining expenditure.

Mean Expenditure/person/holiday $

Germany	3314
Japan	3148
Australia	1320

Mean Expenditure/person/day $

Germany	105
Japan	237
Australia	96

NZTB (NZ Tourism Board) has a policy to attract medium to high income earners to visit NZ to increase these expenditure patterns.

Repeat and Referal Business

This is vital to all business and services. Organisations totally focused on the customer will have no problem obtaining repeat business. Service, customer focus, activities, programmes and social interaction all have a major part in repeat business.

Summary

It is the mix of these four factors which will increase profitability of regions and individual businesses.

International Visitor Activities

Over the years there have been a variety of surveys undertaken to determine what activities visitors undertake. In the 1984 International Visitor Survey the main attractions visited were:

Top 7 Activities

1. Historic Homes
2. Sightseeing
3. Forest Parks
4. City Parks
5. Scenic Drives
6. Tramping/Walking
7. Cable Car (entrance to Wellington Botanic Garden)

The 1993 International Visitor Survey which is in a different format to the 1984 version provides the following information.

Activities Undertaken

In this survey 9% (90,000) of people visited gardens. Notice though the activities which could have some horticultural/ conservation content.

Top activities undertaken by international visitors

- Short bush walk
- scenic boat cruise (views)
- jet boating (views)
- wine tasting - vineyards
- long bush walk
- golf

Attractions Visited

Again note those attractions that have a horticultural/conservation content -

- geothermal
- historic site

- wildlife park/zoo
- formal attractions.

One of the prime reasons we are attracting people to New Zealand is the 'Clean Green' image portrayed to the world. Every piece of New Zealand seen by visitors is judged by the imagery sent overseas.

The Tourism Product

The tourism product is composite in nature and includes everything that the tourist purchases, sees, experiences and feels from the time they leave home until they return. (Collier 1991)

From the definition alone we can deduce that it is the total experience that is vital to the success of tourism in New Zealand. If everything that is seen and experienced is important, much of that seen in the urban and rural landscape is related to horticulture in its broadest sense.

Tourism - Inbound/Outbound/Domestic

Turning now to the relationship of tourism to horticulture we need to consider the three areas of tourism.

Inbound is people coming into New Zealand - many arriving to experience the 'clean and green' that is promoted overseas. This image should be enhanced.

9% of international visitors visit gardens in New Zealand and that is increasing. Currently there are various package tours of New Zealand which have a horticultural aspect to them including,

- Garden Tours
- Botanical Tours (gardens, flora etc)
- Historic Tours (Historical Homes and Gardens)
- Specialist Tours (Rhodos)
- Horticulture Event Tours (Roses etc)
- Tree Tours (IDS)
- Alpine Trekking.
- Eco Tourism

NZ should be taking advantage of this interest and bring the native and introduced flora to the visitor through a different style of horticulture. Can NZ gardeners take an idea from Kelly Tarltons and provide a wide range of flora in attractive environments?

Outbound Tourism

To further illustrate the relationship between tourism and horticulture consider some aspects of outbound tourism. There are two examples

Garden Tours - pick up any magazine and you will find an advertisement by a travel agent taking a special interest in garden tours to England, Europe, Japan, California, Australia etc. New Zealander's are great travellers with a love of gardening. These tours, often led by personalities (Maggie Barry, Eion Scarrow etc), are very popular.

Wild Flower Tours - wildflower tours to South Africa, Nepal or Western Australia are regularly advertised.

Domestic Tourism

One of the long forgotten elements in the whole tourism promotion is Domestic Tourism, "Kiwis on holiday in Kiwiland". They can be divided into two markets: Day Trippers, and long stay (1 night or more).

Day Trippers - people leaving home for less than 24 hours. A market that is being exploited more and more in New Zealand. In horticultural terms there are many opportunities to capture this market including

Open Gardens - Absolutely gone mad in NZ. In the spring of 1994 in Wellington up to 4 different groups organised open gardens for various reasons - mainly community fund raising.

- Some small towns like Marton use Open Gardens as a major draw card for visitors to the town. The whole community benefits through the increased expenditure. Increases in petrol sales, food sales, product sales, nursery sales and the like are made.

Many special events are run for this particular market. The significance of it has been recognised in such things as Garden Festivals, Ellerslie Flower Show, Garden Tours, Wine events, even the Alexandra Blossom Festival.

Longer stay tourists - These are people who stay away from home more than 24 hours, ie overnight. This group is broken down into three groups Business Travellers, Pleasure Travellers and Visiting Friends and Relatives.

Business Travellers - may or may not visit a horticultural attraction but be sure they will notice horticultural features in a city or region. Business travellers enjoy going to well maintained areas.

Pleasure Travellers - particularly FIT (free independent travellers), take advantage of the opportunity to visit many areas of the country including parks, gardens (private and public etc.)

Visiting Friends and Relatives - to capture this part of the market the local population needs to have a high awareness of horticultural attractions within the local area.

A recent survey by Wellington City Council showed that:

98% of residents knew of the facilities it provided
84% used parks and gardens
The Botanic Garden was at the top of the list

One could extrapolate from this that domestic visitors may also like to visit such attractions when in another location.

Horticulture

Gardens - Crompton (1993) suggested it was public parks and recreation facilities that attracted tourists to an area. Gardens vary in their type in different areas and are attractions in their own right.

Botanic Gardens - Concentrate on high quality displays including colour and form, geographical collections, plant trials, specialist collections and many more. A great deal of work is put into interpretation work such as signs and various educational programmes.

These are a major drawcard for both domestic and international visitors.

In the results of a survey in Christchurch Botanic Gardens (Jolliffe, 1976) where a question asked "What is the main reason you came to the Botanic Gardens". The most responses were, "to feed the ducks". Maybe there is a lesson there. The need for some excitement, movement or something people can relate to.

Public Gardens and Domains - these are generally nice places to go and have a high profile in the local community.

Horticultural features - there are many of these in every town or city. Outside the town hall and in prominent places. All to beautify the area and make it more attractive to both locals and visitors.

The survey in 1976 examined what people did in the CHCH Botanic Gardens.

Activities in order of importance

1	Strolling	
2	Looking at trees and plants	
3	Looking at wildlife	
4	Relaxing	
5	Visiting conservatories	Jolliffe 1976

This provides a guide to the type of design elements that need to be included.

Private Gardens - contrary to popular opinion some of the best plant collections in New Zealand are in private gardens. These are owned and maintained by serious amateurs or semi-professionals.

Today many of these are open to the public either regularly, occasionally or seasonally. There may be a charge for charity or a charge to pay for the upkeep or even run as a business. Some of the better ones have associated food and beverage outlets, souvenirs, merchandise, plants etc to increase revenue.

Farms - one of the fastest growing tourism ventures in New Zealand today is Farm Stay/Home Stay. Everything from the Hobby Farm to the High Country Station is offering a range of truly NZ "get to know you" opportunities.

Associated with many of these areas are some of the country's best private gardens. In fact, in some cases the garden is the prime attraction.

Not only is it the garden but also the farm with its high number of trees planted on the land. Some of the country's largest collection of trees either generally or in specific generic collections are to be found on farms (MacKay, 1993).

Attractions - Kiwifruit Country, Disneyland, Sea World, Dreamworld all use horticulture to enhance the quality of the visit.

Take for example Disneyland. It always looks great, is extremely well landscaped, with not a plant out of place. It is the gardens - its horticultural expertise in planning, design, planting and maintenance that sets it apart from others.

Kiwifruit Country serves to enthuse people to learn more about horticulture. Living education - and it is only a small part of the horticulture that fascinates people.

Nurseries Retail - there are the old fashioned plantsman nurseries which are a joy for the specialist to visit. However, Palmers have changed the face of nursery retailing turning it into an adventure and a day out. With its special guests - Maggie Barry and Bill Ward - coffee shop, range of other garden related products and of course plants. Swafield (1992) stated "Garden centres rival shopping centres as a weekend leisure focus".

Ecotourism

Turning now to another aspect of Tourism, Ecotourism. In the forest, in alpine areas, along the coastline and in National Parks the visitor/tourist is offered many opportunities to experience nature. Short bush walks are the most popular visitor activity by tourists (IVS 1994/5) Skills are needed to preserve these assets to ensure they are sustained in the future.

Already alpine walks and treks, mountain bike trips, all terrain tours, mountain walks, coastal walks are operated by tour companies. This will grow and mean more work for horticulturalists, park managers, planners and rangers. More and more horticultural skills will be required to maintain the natural heritage.

Resorts

(Swafield 1992) stated resorts were "created because of a particular scenic attraction". Take for example Rotorua where the Government Gardens has long been regarded as one of the major attractions in Rotorua. Featured on postcards in promotional leaflets, books, movies, videos etc.

In Nelson in 1982 the Council decided to reduce bedding plants by 25% to save costs. Inspection showed that the uncontrolled use of bedding plants had led to a dilution of their effect. The new plan concentrated bedding where it mattered

- high profile and set in the landscape to provide excellent bedding features. Two years later Council were asking for more because visitors commented on it, locals loved it and it did something for the city - pride! Needless to say staff actually refused to plant more because - it would water down what was being done and reduce the dramatic impact on people of those displays.

Attractions should be absolutely fabulous with design, displays and maintenance being of a high standard, but often they are not.

In summary there is a great deal that can be done to improve horticulture as a major drawcard to a city ,town etc based upon the way people are flocking to horticultural events, garden tours and the like.

Tourist Attractions - Gardens

There is a growing interest in visiting gardens. Everywhere there are garden visits organised. In the Wellington Region in August 1995, 5 or more separate organisations ran garden visits with some 150 private gardens open to the public. In addition NZ Rail organised a train trip to the Wairarapa to visit gardens. Palmers Garden Centre and Williams Garden Centre also organised them. The list goes on.

Deloitte Touche Tohmatsu (1993) conduct an annual visitor survey of attractions in NZ.

The following chart shows the dates when public and private gardens in the survey were first opened to the public:

Pre 1930	2.7%
1930-49	35.1%
1950-69	18.9%
1970-79	8.1%
1980-85	10.8%
1986-90	0%
1991-92	24.3%

Opening Hours
Gardens have the longest opening hours of all attractions.
51% of all gardens have an entrance fee.

Marketing
92% spend less than $5,000 on marketing.
Gardens have the lowest marketing budget of all attractions.

Gardens know less about visitor make up than other attractions.

When looking at this information one gets the impression that everyone is getting on the bandwagon - especially private gardens. One thing this survey does not state is the quality of those gardens, best season, outstanding feature or landscape design. This issue needs to be addressed.

Note that the majority of the visitors are not international but domestic. Of the domestic visitors I suggest a high % are local ratepayers. If the locals take their out of town visitors to the gardens are they going to feel proud of the gardens? that is the test!

Local authorities which want to attract tourists and use their parks and gardens to add to the overall landscape of the city or be an attraction have to meet the competition head on. Take a look at their parks and gardens, change them, improve them or lose the tourism race.

Media Survey

In order to test the popularity of horticulture as a tourism attraction I looked at different media and the programmes being offered.

Television

Documentaries	Several have featured gardens. The Ellerslie Flower Show is being filmed as a documentary.
News	Various news items feature high profile horticultural events.

Visitor numbers to Gardens

Total Visitors (includes domestic and international tourists)
Gardens 2.76 million visitors
This compares with
Museums 3.82 million visitors
Attractions 4.09 million visitors (Includes theme parks etc.)

Average number of visitors per garden 95,366

77% of all gardens have less than 30,000 visitors.

International Visitors
Estimated only 9% (248,000) of international visitors visit gardens

70.3% of gardens predict an increase in visitor numbers of between 1-20%.

Palmers Garden Show	Includes gardening, garden visits, landscaping, nurseries, etc. Its ratings are extremely high.
Living Earth	Conservation, gardening, gardening visits etc.
Advertisements	Flowers, plants, gardens all feature.
Travel Programmes	Places to visit
Videos	Gardening, Gardens etc

Magazines

The following information was taken from the New Zealand Gardener August 1994 Circulation 60,000.

Advertisements
National Trust Gardens
Small Acorns 15 gardens to visit
Taranaki Garden Festival
Eden Garden
Huntly School Garden Festival
Stallard Farm

Garden to Visit -	Brown Sugar Cafe
	Pams Lavender Patch
Flowershows	Ellerslie
	Roseworld (Christchurch)
	Waikato Flower Show
	Dunedin Rhododendron Festival
	Matamata Festival of Flowers
	Manawatu Rose & Garden
Nurseries	Cannock Wood
	Bay bloom
	Cross Hills
	Coehaven
Travel	To New Caledonia
	Thomas Cook
	Coromandel Peninsula
	Small Acorns 8 garden tours advertised
	Nelson Town and Country Tours
	Travel Works 4 tours overseas
	Travelwise 6 NZ and overseas tours
	Youngs Garden Tours East Coast
Education	Garden Marlborough
	Garden Galaxy - Masterton

Articles
Gardener holiday in New Caledonia

This shows the range of advertising using horticulture to promote tourism.

NZ Gardener 1993-94

From the index - feature articles on gardens and tourism

13	Country Gardens
13	Gardens to Visit
1	Article about gardens to visit
8	Articles on nurseries.

Radio	Gardening shows
Newspapers	Garden Sections
	Articles
	Advertising
Brochures	General

When looking at brochures promoting cities and regions parks and reserves feature strongly.

NZTB uses amazing photographs of flora, scenery, parks and gardens. The range of photographs is wide.

Brochures	Specific

Brochures of specific attractions always features plants, garden setting, views or scenery.

Special Events - Horticulture

Horticultural events are proving more and more popular all the time and create a major inflow of domestic tourists. The daytripper is just as important as the overnighter.

At some point in time these events will reach market saturation reducing the liklihood of them being repeated in the future due to insufficient visitors to make it profitable.

The decline in attendance may also be caused by too many poor quality events rather than too many good events.

Other Horticulture

Looking at the nature of tourism a range of other horticultural sectors influences tourism.

Horticulture	**Use**
Pot plants	decoration
Cut flowers	decoration, gifts
Food	vegetables
Salads	food
Fruit	fresh fruit
Timber	souvenirs, packaging
Highway landscape	scenery
Open space	green image
Decorations	Events
Turf	Stadiums, sports grounds

The influence of horticulture is immense.

Impacts on Tourism

There are 4 major impacts of tourism. Each has its good points and bad points. Right now everyone is promoting the good points and in some cases ignoring the bad.

Economic Impact

Local authorities and other groups see tourism as a saviour creating employment and wealth in a region. Jobs are created in three ways directly, indirectly and induced. The indirect and induced jobs are as a result of the multiplier effect of tourism dollars spent in your community.

There may also be jobs created in horticulture.

Environmental Impact

Natural areas often don't have a high level of development and may deteriorate rapidly and unseen to the eye. Photographs on a 12 monthly basis help if a comparison needs to be made.

Use and effects on the environment must be considered under the Resource Management Act. The normal aspects of new developments are dealt with but managers must now consider the physical carrying capacity of the area.

Gardens with good paths that don't wear out, grass well maintained, vandalism minimised and with litter cleared up have a high carrying capacity. Garden areas are very suitable to develop to take pressure off natural areas.

Social carrying capacity is also important. Visitors do not mind sharing the discovery of a fine garden with 50 others. This issue is greater in National Parks where low social carrying capacity has to be managed to ensure a high quality experience.

Cultural Impact

What impact does tourism have on the NZ culture? What is the typical NZ garden? Does the number and type of visitors influence garden design? A range of issues need to be addressed.

Social Impact

How does tourism impact on the local population? Studies have shown that the constant flow of visitors can have either a negative or positive impact on the social structure of our society. Attitudes and habits will change as people interact with tourists from other culures.

Interrelationships of impacts

These impacts while delt with separately need to be considered in an interrelated way. Managers need to understand the nature of tourism, tourist behaviour and land management issues to derive the greatest benefit from increased visitor numbers.

Conclusion

1. Horticulture and Tourism are intertwined to such an extent that without horticulture tourism would suffer.

2. Public agencies provide the bulk of good horticulture.

3. Garden visitors are made up of 91% domestic and 9% international visitors.

4. Horticulture impacts more on tourism than just aesthetically as the food and beverage and decoration industries also rely on horticulture.

5. There are opportunities for horticultural businesses - from arborist to food production, from landscape to garden maintenance etc.

6. Promotion of regions often depends upon the images portrayed by horticultural features.

7. The local population need to have pride in their area to generate more visitors.

8. The role of horticulture will change in the future as we will use different techniques to maintain and improve our environment.

9. The influence of the media, festivals, shows, open gardens and the like will place more pressure on professionals to provide higher quality public horticulture features.

References

Collier A. 1991. Principles of Tourism. A New Zealand Perspective. Pitman. Auckland

Crompton (1993). Paper presented to NZ Recreation Association Conference Wellington.

Deloitte Touche Tohmatsu (1993) Attractions Survey. Deloitte Touche Tohmatsu. Christchurch.

Murphy PE.(1982). Tourism A Community Approach. Methuen. London

Jolliffe AG. 1993. Tourism Profitability. Unpublished paper CIT. Wellington

Jolliffe, AG. 1976. Visitor Surveys - A Practical Guide. Dissertation. Lincoln University. Lincoln.

Mackay M (1993). Paper presented to Royal NZ Institute of Horticulture Conference. Rotorua.

New Zealand Gardener. (August 1994) Wilson and Horton . Auckland.

NZ Tourism Board. 1994. International Visitor Survey 1993/4. NZ Tourism Board. Wellington

Swafield (1992). Landscapes of Leisure. Leisure Recreation and Tourism.
Eds Perkins HC., & Cushman G. Longman Paul. Auckland

Biological Controls at the Christ-church Botanic Garden

Fig. 1. Whitefly, Enforce cards which carry the black resting stage

By Bede Notingham, Jenny Taylor and Maria Adamski.

Introduction

Heightened awareness of the environmental and health issues of agrichemicals has placed increased public and political pressures on councils to reduce chemical usage.

In response the Christchurch Botanic Garden has moved away from traditional chemical dependent pest control methods. Biological control agents have recently been introduced within a developing Integrated Pest Management programme(IPM).

The incorporation of biological controls has brought about a change in approach to controlling pests on ornamentals. Previously a zero tolerance of pest presence was tolerated now threshold levels are determined with some pest presence being acceptable.

Historically, appropriate chemicals were selected to control pests. Today knowledge of lifecycles, ecosystems and how to monitor and target pests is needed before selecting a control/s. Integration of control options and relationships of these controls is vital for success.

Three areas in which biological controls are used are:

Nursery and conservatories
Rose Garden
Grounds

Nursery and conservatories

Some of the biological controls introduced to the nursery and conservatories have been very successful. Observations show it is very important to introduce biological controls at an early stage to effectively control pest problems. Pests on which controls are used are whitefly, mealybug and mites.

Whitefly control is achieved by introducing Enforce, *Encarsia formosa,* a small parasitic wasp. Enforce is purchased in its black scale resting stage on a small cardboard tag. It is hung on

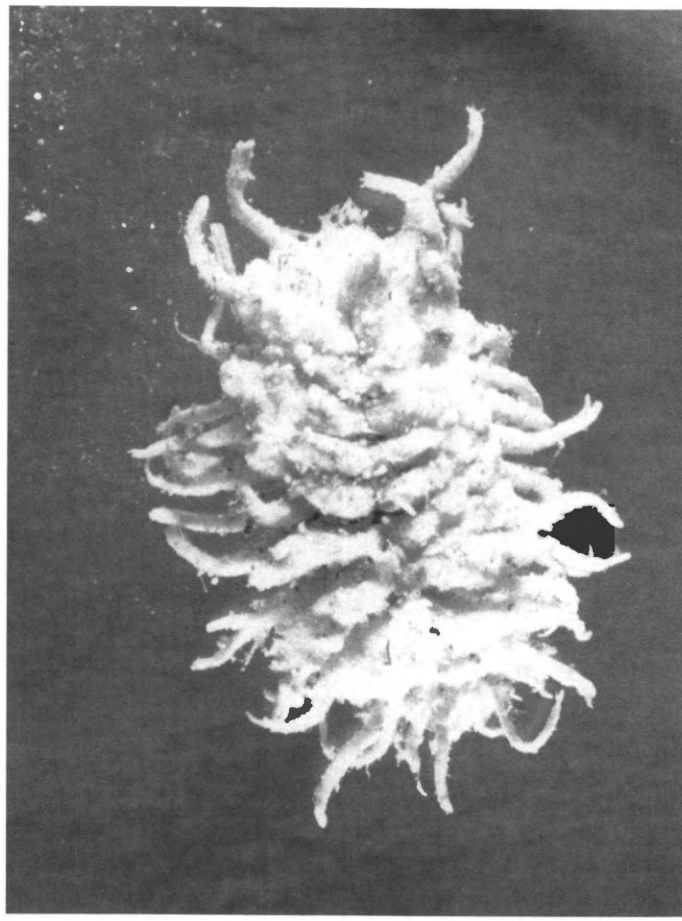

Fig. 2. Mealy bug predator, (Larvae of) Cryptolaemus montrouzieri

Fig. 3. Mealy bug predator, Cryptolaemus montrouzieri

the affected plants fortnightly during summer and monthly in winter as its availability is dependent on the Tomato Growers programme. This has been so successful whitefly is rarely found in the glasshouses, conservatories and fern house.

A predatory ladybird, *Cryptolaemus montrouzieri,* is used on all stages of mealy bug from eggs to the adult. The ladybird adult lays its eggs among mealy bug colonies where they hatch and feed. Early introduction of the ladybird is most effective for control. Continuous introduction is required as the adult ladybird may fly out the vents.

This ladybird is easily bred by introducing mealybug to sprouted potatoes in an enclosed ventilated container. The ladybird is introduced to the containers and it feeds on the mealybug. The ladybird reproduce and the larvae are placed from the container onto infected plants. This cycle takes about four weeks.

Predatory mite E, *Phytoseiulus persimilis,* is occasionally released to feed on two spotted and red spider mite. Mite E is released when the pest occurs and feeds on all stages of the mites. Cultural control by spraying water on the plant, especially under the leaves, will control mite populations without the need to release mite E.

Another predatory mite, *Amblyseius cucumeris* or mite A, has proved very effective against bud mite, the eggs and early stages of twospotted mite and the larval stages of some *Thrip* sp.

The naturally occurring *Aphidiidae* sp. parasitic wasp, Tasmanian lacewings and common ladybirds are seen in the glasshouses assisting in the control of aphids as the result of using less pesticides. Flower beds around the glass houses are being developed to encourage and provide a habitat for these predators. Plants from the Asteraceae and Umbelliferae families are used because of the shallow nectaries of the flowers.

Rose Garden

The two major pests in the Central Rose Garden are the two-spotted mite, *Tetranychus urticae* and aphids *Macrosiphum* sp.

During the last two summers, the predatory mite E, *Phytoseiulus persimilis,* has been introduced to control twospotted mite. Predators are received on bean leaves which are stapled to rose leaves. Observations have shown a significant reduction in plant damage limiting the two spotted spider mite population to an acceptable level.

The pop-up irrigation system is a contributing factor to this success. This wets the undersides of leaves and lower parts of rose bushes once a week from October to April creating an environment detrimental to mites.

Observations have shown that the population of mite E in the rose garden is increasing and spreading. This indicates future, introductions of mite E may not be required to maintain twospotted mite under damage thresholds.

No biological control agents have been introduced to control aphids. The replacement of non-selective pesticides with deterrent type agrichemicals on a 14 day cycle has been successful in limiting aphid populations. Natural predators and parasites have established populations within the rose garden as a result. Predators such as hover fly *Melanostoma fasciatum,* Tasmanian lacewing *Micromus tasmaniae* and two spotted ladybird *Adalia bipunctata,* and the parasitic wasps, *Aphelinus* sp. and *Aphidiidae* sp., have been observed. Their presence has been successful in assisting to keep aphid numbers below damage thresholds.

Reliance on natural predators and parasites can be unreliable from season to season. For long term management of aphids in the Rose Garden, investigation of an introduced biological control agent will need to be undertaken.

Grounds

Five main pests within the grounds of the Christchurch Botanic Garden have involved the use of biological controls, common wasp *Vespula vulgaris,* German wasp *Vespula germanica,* grass grub *Costelyta zealandica,* thrips *Thrips* sp. and white fly *Trialeurodes vaporariorum.* All trials to control these pests by biological controls, are in early stages of development.

The common wasp and German wasp both become major problems over the summer months. They establish themselves along the river banks and around the lakes in the Botanic Garden.

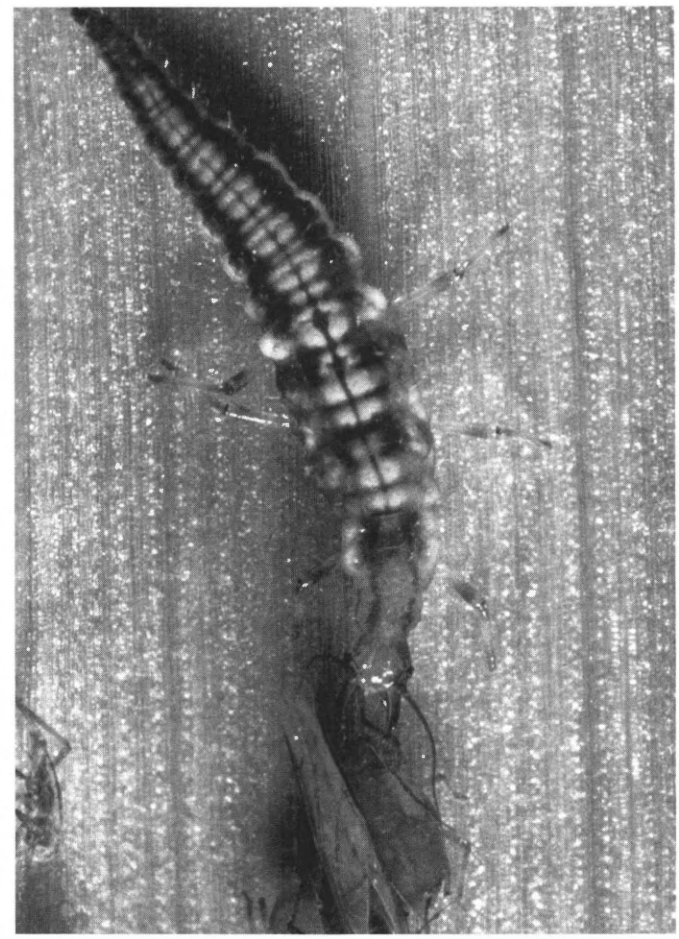

Fig. 5. Micromus tasmaniae larvae. Tasmanian lacewing aphid predator

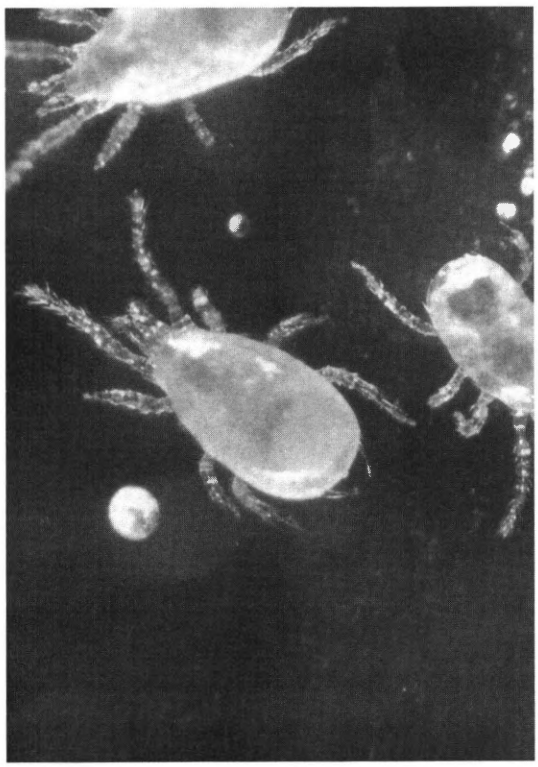

Fig. 4. Amblyseius cucumeris, Mite A. Predator of thrips

In the spring of 1996, in conjunction with Global Bees Limited, a parasitic wasp, *Sphecophaga vesparum vesparum,* was introduced.

Three release boxes were stationed at equal intervals along the Avon River boundary of the Garden. Each box contained at least 1000 wasp parasite cocoons. The parasitic wasp will emerge each spring over the next four years. It is too early to determine if there has been a reduction of the common and German wasp populations.

Movement of the wasp parasite is monitored by digging up accessible wasp nests to see if they are present. If a nest can not be removed this way it is poisoned for public safety reasons. A reduction in wasp numbers is expected as the parasite establishes itself.

Grass grub has become a problem on specific genera within the Herbaceous Border namely *Aster* sp. and cv., *Monarda* sp. and cv., *Geum* sp. and *Geranium* sp. though not all species and cultivars of these genera are affected. Grass grub damage has gradually increased to the extent a control measure was required. Invade, a commercially available bacterial agent, *Serratia entomphila,* has been researched and developed for use on agricultural pastures by direct drilling. It affects the digestive system of the grub causing it to stop eating in 2-3 days and to die in 2 - 3 months.

Monitoring of grass grub in the Herbaceous Border has taken place since Feb. 1997 with significant numbers at the second to third instar found in late April to early May Sites have been identified and numbered. A count of grass grub numbers was made in $10cm^3$ soil samples at each site.

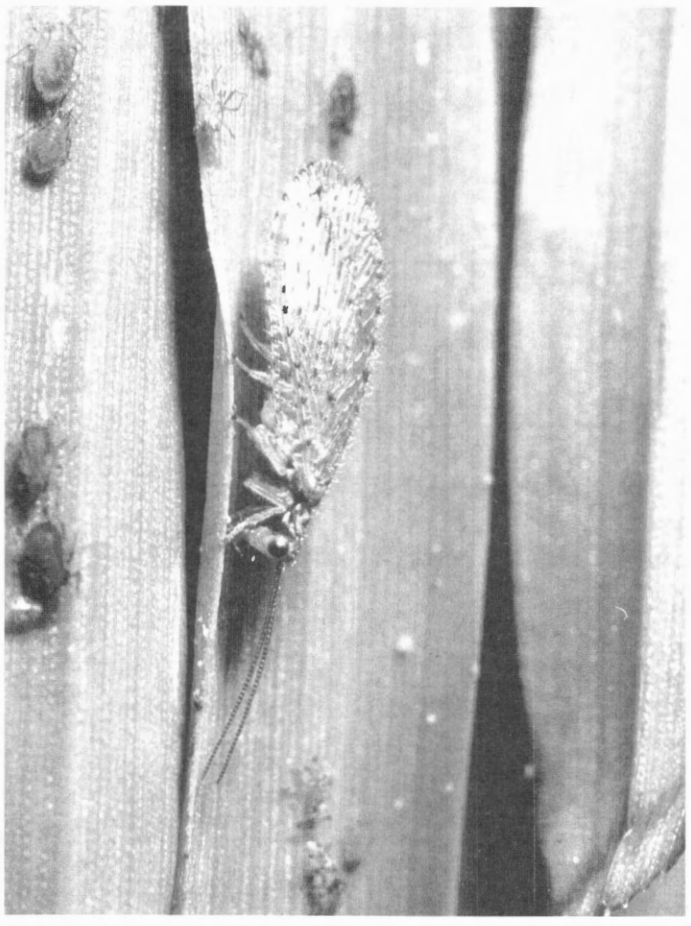

Fig. 6. Micromus tasmaniae. Tasmanian lacewing aphid predator.

Continued monitoring of grass grub numbers will be required to determine the effectiveness of the application of bacteria. A count of grass grub pupae in October will determine the amount of grass grub we will expect to see next year. A sample of grass grub will be tested for the presence of the bacteria in Feb. 1998. Results of grass grub monitoring will determine the degree of success and effectiveness of the method used for application.

Thrips sp. have caused damage to *Rhododendron* sp., *Viburnum* sp. and *Amomyrtus* sp. in the Botanic Garden.

In 1994 Codacide oil with pyrethrum was used to control thrip numbers. The following year codacide oil only was used. At the same time a small trial on a group of *Viburnum davidii* releasing mite A, *Ambluseius cucumeris,* was conducted. Mite A comes in a bran mix which is divided up, placed in envelopes and hung within affected/susceptible plants. Thrip damage was noticeably reduced. This year the mite A release was extended to two groups of rhododendrons and an *Amomyrtus.* Monitoring throughout the season showed the mites had spread through the plants.

The most significant improvement has been in the *Amomyrtus* sp. where for the first time in years there has been no signs of thrip damage and the plant has put on 1m of growth.

Although monitoring for the presence of thrips has taken place, numbers have not been recorded. We suspect mite A is able to over winter as a release of mite A on the *Viburnum davidii* did not take place this season and mite A have been observed on the plants.

Next season the thrips will be monitored and the release of mite A withheld. Records of the numbers and presence of both thrips and mite A will be made.

Mite A should be released in spring at or before the first signs of thrips. It is sensitive to insecticides and requires humidity. When the thrip population source runs out mite A is able to feed on pollen until thrips are present again.

White fly, though rarely found outdoors on ornamentals, has colonized one particular *Rhododendron* sp. yearly to the extent by the end of summer it is black with sooty mould. Past control involved using an insecticide and fungicide yearly. As Enforce, *Encarsia formosa,* is used in the glasshouse an attempt was made to introduce it on the *Rhododendron* sp. late in the season of 1995. Enforce had no effect on the numbers of whitefly.

Enforce was retrialed this season stating late October 96 by introducing two cards of Enforce at two week intervals through to April 97. Visually there has been less whitefly and sooty mould has not been as extensive as in previous years.

In January 97 there was a noticeable population explosion of whitefly which indicates the number of Enforce cards should have been increased in late November/early December. Again no specific counts have been made of whitefly numbers.

For the 97/98 season whitefly numbers will be monitored. Enforce cards will be increased in early December. Temperature readings will be taken throughout the season because Enforce has a specific temperature range of 20-35°C, in which it is active. Enforce works best under a low density of whitefly which means a chemical application is required early in the season to reduce whitefly numbers before Enforce is introduced.

Cultural practices such as pruning to allow better air flow may also have an effect on the whitefly.

Summary

In the early stages some biological controls have been used with success. In some instances they have been introduced with little knowledge in an attempt to nullify chemical usage.

Research into life cycles, pest and environmental relationships, establishing acceptable damage thresholds and monitoring has been required.

Biological controls are not used as a single system at the Christchurch Botanic Garden. They are used as part of an Integrated Pest Management system. Relying on a totally biological control system will ultimately fail due to fluctuations in seasons.

It must be recognized that monitoring must be done to determine what pests are present and at what levels. Presence of a pest does not mean that something has to be done and reliance on any one control tactic (biological, chemical or cultural) will eventually fail.