

THE ORIGIN AND WEED STATUS OF PLANTS IN CHRISTCHURCH LAWNS

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INTRODUCTION

Have you ever considered what species are in your lawn, and where they came from? Do you look at your lawn and see a thick sward of grass, or a diverse collection of 'weeds'? On close inspection urban lawns are interesting and diverse environments. Understanding their history helps us to understand why they dominate human-modified landscapes. Lawns originated in Europe in the Middle Ages (probably around the 13th century). Initially they were part of practical medieval gardens where food was cultivated and leisure time enjoyed. It was perhaps Lancelot Brown, a British landscape architect with a penchant for grass landscapes, who put lawns into the European cultural mainstream. His work heavily influenced the people of England, cementing the lawn as an iconic landscape in 18th century Europe (Bormann et al, 2001). As the British colonised the world they brought this landscape with them, and ever since it has been a prominent feature in regions colonised by western Europeans.

Christchurch, the second largest city in New Zealand, has varied natural environments including flood plains, sand dunes, wetlands, river banks, tidal estuaries and part of a volcanic crater rim (Christchurch City Council, 2004). Many of these environments have been modified by urban development, and currently the plant community covering the largest area of urban Christchurch is the lawn.

Over a period of 150 years, Christchurch has grown to a population of over 300,000. The theme of this 'garden city' is distinctively colonial, with plant communities in parks and suburban gardens featuring species from Europe, North America, Australia, Asia, and Africa (Stewart et al. 2004). Urbanisation and the systematic conversion from native to exotic plants, has greatly reduced Christchurch's indigenous plant diversity, although native herbs still persist in Christchurch lawns.

Landcare Research received funding from the Foundation of Research Science and Technology (FRST) to develop Low Impact Urban Design

and Development (LIUDD) technologies. Lincoln University, in conjunction with Landcare research, has an urban ecology team focused on unravelling the ecological processes of plant communities and classifying different biotopes in Christchurch. Through understanding the ecology, management decisions can be made to enhance biodiversity. Over the summer of 2004-2005 the most common urban biotope, the lawn, was surveyed. This article reports on the findings of this study with respect to the origin and weed status of the plant species found.

METHODS

Ninety random points were generated within the greater Christchurch area and from each of these the closest residential property was sampled. At each property the front and back lawns, and the strip of lawn bordering the street and/or footpath were sampled. The 'public' lawn nearest each property was also sampled; this included parks, traffic islands, cemeteries, and schools. The suburb, address and a GPS point of the property were recorded. The lawns were sampled using a 50 x 50 cm quadrat in which the species present and their percentage cover were recorded. Lawn area (m²), the type of lawn sampled (street lawn, front/back lawn, public lawn), soil type (sand, silt, loam, clay), and pH were recorded. Additionally, irrigation (yes/no), frequency of fertiliser use, herbicide use and type, retention or removal of clippings, and frequency of mowing disturbance were recorded. In total, 350 lawns were sampled within the city area.

Plant origin was classified according to the 19 global regions determined by the International Working Group on Taxonomic Databases (TDWG), which is a non profit scientific and educational association formed to collaborate on biological database projects. Its primary goals are to provide an international forum for biological data projects, and to facilitate data exchange (Brummitt et al. 2001).

Plants classified as weeds were categorised in accordance with the New Zealand plant conservation network (NZPCN) weed list and Massey University's weed data base; the latter considers weeds in the context of natural areas, horticulture, agriculture and amenity areas.

RESULTS

Christchurch lawns are diverse; we recorded 139 species in the 350 lawns sampled, with a mean of 12 species in each quadrat. Their species are overwhelmingly naturalised plants with the majority originating in the

Northern Hemisphere; 87 species from Europe, 81 from the Orient (including the Middle East, Turkey and the Mediterranean region), 42 from Asia, 35 from India, and 13 from North America (Table 1). Some of them are native to several regions. Sixteen species were native to New Zealand; however species like *Pseudopanax aboreus* and *Coprosma repens* will not survive mowing. Ignatieva et al. (2000) suggest there are 16 native species which can, and are growing successfully in Christchurch lawns.

DISCUSSION

Origin: why we have this species composition

Christchurch's vegetation was systematically converted from being exclusively indigenous to almost exclusively exotic over a short period of time. Lawns added to the landscape were typified by mixtures of 'cool season' grass species such as *Agrostis capillaris* and its cultivars, *Festuca rubra*, *Lolium perenne* and *Poa pratensis* (Morgan 2005). Non-grass species found in these lawns must tolerate repeated cutting and therefore be low growing. The Northern Hemisphere species we found seem to have these characteristics.

Weed status

New Zealand natural ecosystems are threatened by weed invasion, affecting indigenous biodiversity and ecosystem function (Williams & West 2000). As many of New Zealand's weeds are escapees from garden environments, the status of weeds in urban lawns is of interest.

According to the Massey University Weed Database and the NZPCN weed list, 101 of the species we recorded in Christchurch lawns are considered weeds, with many of them displaying traits determined by Lloret *et al.* (2005) to be typical of weedy species. These traits include vegetative propagation, large leaf size, summer flowering, long flowering period and dispersal by wind. Generally, exotic weed species are considered to out-compete native species for resources such as water, light and nutrients (Stapanian et al. 1998). Adding to this competitive advantage is assistance by high levels of human disturbance through mowing, herbicide and fertiliser application, and irrigation. Some lawn species are also typical of European meadows, thereby confirming the European "meadow" origin of lawns.

Table 1. Country of origin and weed status of species recorded in Christchurch public and private lawns 2004/2005.

| Species | Origin | Weed | | | |
|-------------------------|---------------|-------------|-----------------------------|-----------|---|
| Achillea millefolium | AOEIU | 1 | Cirsium arvense | OE | 1 |
| Aesculus hippocastanum | E | 1 | Cirsium vulgare | AOEI | 1 |
| Agrostis capillaris | AOE | 1 | Claytonia perfoliata | U | 1 |
| Agrostis stolonifera | AOEI | 1 | Conium maculatum | AOEI | 1 |
| Amaranthus powellii | U | 1 | Coprosma repens | NZ | |
| Anagallis arvensis | AOEI | 1 | Coronopus squamatus | OE | 1 |
| Anthoxanthum odoratum | AOE | 1 | Caryophyllaceae sp. | * | |
| Aphanes arvensis | OE | 1 | Cotula australis | NZ | |
| Arctotheca calendula | * | 1 | Critesion murinum | E | |
| Arrhenatherum elatius | AOE | 1 | Cynodon dactylon | AOEIU | 1 |
| Atriplex prostrata | AOEU | 1 | Cytisus scoparius | OE | 1 |
| Begonia sp. | * | | Dactylis glomerata | AOEI | 1 |
| Bellis perennis | OE | 1 | Dichondra brevifolia | NZ | |
| Betula pendula | AOE | 1 | Dichondra repens | NZ | |
| Bromus catharticus | * | 1 | Digitalis purpurea | OE | 1 |
| Bromus diandrus | OE | | Duchesnea indica | AI | 1 |
| Bromus hordeaceus | OE | 1 | Echinochloa crus-galli | E | 1 |
| Calendula officinalis | * | 1 | Elytrigia repens | AOEI | 1 |
| Calystegia silvatica | E | 1 | Epilobium | | |
| Capsella bursa-pastoris | * | 1 | nummularifolium | NZ | |
| Cardamine hirsuta | * | | Epilobium sp. | * | |
| Carduus tenuiflorus | OE | 1 | Erodium cicutarium | AOEI | 1 |
| Cerastium fontanum | AOE | 1 | Erodium moschatum | OE | 1 |
| Cerastium glomeratum | OEI | 1 | Euphorbia peplus | OEI | 1 |
| Cerastium medium | * | | Festuca rubra | AOEU | 1 |
| Chenopodium album | OE | 1 | Foeniculum vulgare | OEI | 1 |
| | | | Galega officinalis | OEI | 1 |

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|--------------------------------|-----------|---|
| Galium aparine | OE | 1 |
| Geranium dissectum | OE | 1 |
| Geranium molle | OEI | 1 |
| Gnaphalium audax | NZ | |
| Hedera helix | OE | 1 |
| Hieracium pilosella | AOE | 1 |
| Hirschfeldia incana | OE | 1 |
| Holcus lanatus | OE | 1 |
| Hordeum vulgare | AOEI | 1 |
| Hydrocotyle heteromeria | NZ | |
| Hydrocotyle moschata | NZ | |
| Hypochoeris radicata | OE | 1 |
| Juncus bufonius | AOEIU | 1 |
| Leontodon taraxacoides | * | 1 |
| Lepidium sp. | * | |
| Lobularia maritima | OE | 1 |
| Lolium perenne | OEI | 1 |
| Malva parviflora | OE | 1 |
| Malva sylvestris | OEI | 1 |
| Matricaria dioscoidea | AU | 1 |
| Medicago lupulina | AOEI | 1 |
| Medicago sativa | AOEI | |
| Micranthum sp. | * | |
| Myoporum laetum | NZ | |
| Myosotis discolor | E | 1 |
| Orobanche minor | OE | 1 |
| Oxalis corniculata | * | 1 |
| Oxalis exilis | NZ | |
| Petroselinum crispum | * | 1 |
| Phormium tenax | NZ | |

| | | |
|--------------------------------|-----------|---|
| Pittosporum eugenioides | NZ | |
| Plantago australis | U | |
| Plantago coronopus | OEI | 1 |
| Plantago lanceolata | AOEI | 1 |
| Plantago major | OE | 1 |
| Poa annua | E | 1 |
| Poa pratensis | AOEIU | 1 |
| Poa trivialis | AOEI | 1 |
| Polycarpon tetraphyllum | E | 1 |
| Polygonum aviculare | * | 1 |
| Portulaca oleracea | * | 1 |
| Pratia pedunculata | * | |
| Pratia sp. | NZ | |
| Prunella vulgaris | AOEIU | 1 |
| Pseudognaphalium sp. | * | |
| Pseudognaphalium | | |
| luteoalbum | NZ | |
| Pseudopanax aboreus | NZ | |
| Quercus rubra | U | 1 |
| Ranunculus parviflorus | OE | 1 |
| Ranunculus repens | AOE | 1 |
| Ranunculus sceleratus | AOEIU | 1 |
| Ranunculus sp. | * | |
| Rumex acetosella | AOE | 1 |
| Rumex crispus | AOEI | 1 |
| Rumex obtusifolius | OE | 1 |
| Rytidosperma sp. | * | |
| Sagina procumbens | AOE | 1 |
| Sherardia arvensis | OE | 1 |
| Silene gallica | OEI | 1 |

| | | | | | |
|--------------------------|-----------|---|------------------------|------|---|
| Silene sp. | * | | Trifolium repens | AOEI | 1 |
| Sisymbrium officinale | AOE | 1 | Trifolium subterraneum | OE | |
| Solanum aviculare | NZ | | Ulex europaeus | E | 1 |
| Solanum nigrum | AOEI | 1 | Veronica agrestis | OE | 1 |
| Soliva sessilis | * | 1 | Veronica arvensis | AOE | 1 |
| Spergularia rubra | AOE | 1 | Veronica persica | OE | 1 |
| Stellaria media | * | 1 | Vinca major | E | 1 |
| Taraxacum officinale | OE | 1 | Vinca tetrasperma | * | |
| Taxicara caro | * | | Viola arvensis | AOE | 1 |
| Trifolium arvense | AOE | 1 | Viola odorata | OE | 1 |
| Trifolium dubium | OE | 1 | Viola sp. | * | |
| Trifolium fragiferum | AOEI | 1 | Viola tricolor | AOE | 1 |
| Trifolium hybridum | OE | 1 | Vulpia myuros | EOI | |
| Trifolium pratense | AOEI | 1 | | | |

A=Asia, O=Orient; E=Europe; U=North America; NZ=New Zealand; I=India, * =Other; i.e. Temperate South America, West & East Tropical South America, West Indies, Australia, Central America, S Africa, Madagascar, Tropical Africa, Pacific Islands or Indo China. Native species in bold. 1: Classified as a weed

Is there a place for New Zealand native species in lawns?

There is potential to use lawns as a surrogate habitat for native species, including rare and threatened species. For example, in the eastern South Island the threatened herb *Mazus novae-zelandiae* is only known to occur in a campground lawn (Meurk et al. 2004). Conversely, under some circumstances native species are considered to be weeds, for example *Hydrocotyle* spp. due to their competitive nature and non grass-like texture. Shockingly, garden centres sell herbicides specifically targeted at this lovely native herb.

How should people manage their lawns to encourage native diversity? Growing species-rich lawns may be one way, as these incorporate multiple species as a desirable aim rather than the typical monoculture (Meurk et al. 2004; Bormann et al. 2001). Furthermore, they require less management and resources in the way of mowing, fertilizers, herbicides, irrigation and fuel, principles that are also valid for lawns in other parts of the world. Further research is being conducted to determine which conditions benefit native species, and how can these conditions be incorporated into lawns and lawn culture.

CONCLUSION

Lawns are a dominant feature of Christchurch's urban landscape. This study found them to be rich in species, but depauperate in native herbaceous species. The majority of plants found originated in the Northern Hemisphere, most of these being European species considered weeds in New Zealand. There is potential to incorporate more native diversity in our lawns, but this may require a change in human perceptions about lawns. Do we want to continue with the resource-hungry exotic-dominated European lawn? Or are we willing to make a cultural transition to a less resource-intensive, native-orientated lawn? The lawn is an exciting and diverse biotope filled with great potential for plant conservation. Next time you see *Hydrocotyle* disrupting your uniform turf, take a minute (if you can!) to appreciate its persistence as a native species in a European-dominated, weed-infested landscape.

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