Consolidated list of environmental weeds in New Zealand

Clayson Howell

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Consolidated list of environmental weeds in New Zealand

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A B S T R A C T

Over half of all wild plant species in New Zealand are exotic species, and several lists of those considered to be weeds have been drawn up over the years. To date, however, a comprehensive list that includes all weed species has been lacking. A 'Consolidated List' of environmental weeds in New Zealand has been compiled to improve consistency for what have been loosely referred to as 'DOC weeds'. This list comprises 328 vascular plant species. Eighty-six species that have previously been listed in at least one of the reviewed lists are rejected under the three new criteria used for inclusion. Eighty-three species are listed for the first time. Any type of plant can become weedy, and there are no consistent differences in weediness among plant growth forms. Almost half of all weeds are trees and shrubs. Two-thirds of environmental weeds had been deliberately introduced as ornamental plants. This naturalisation pattern of environmental weeds strongly matches that for the larger set of all naturalised exotic plants. As the rate of new naturalisations shows no indication of abating, it is expected that the 'Consolidated List' will continue to grow.

Keywords: environmental, weed, exotic, plant, naturalised, New Zealand

Howell, C. 2008: Consolidated list of environmental weeds in New Zealand. *DOC Research & Development Series 292*. Department of Conservation, Wellington. 42 p.

1. Introduction

New Zealand is a very weedy place. The indigenous vascular flora is believed to contain about 2357 taxa from 2158 species (de Lange et al. 2006). To November 2006, 2436 exotic taxa from 2390 species have been described as 'naturalised' (i.e. form a population self-maintained by seed or vegetative reproduction) or 'casual' (i.e. passively regenerating only in the immediate vicinity of the cultivated parent plant) (Howell & Sawyer 2006). Exotic species now make up half of all wild plant species in New Zealand. There are many more exotic species in cultivation, and although the precise number is unknown, it has been estimated at 24 700 (Williams et al. 2002). Well-established criteria determine when a species is naturalised, but the subset of naturalised species loosely referred to as 'DOC weeds' has no formal defining criteria. The aim of this paper is to review existing weed lists and establish a consolidated list of New Zealand environmental weeds. The Department of Conservation (DOC) manages approximately one-third of the land area of New Zealand and attempts to conserve a representative range of environments. DOC's mandate is national and it practices active management, and thus is in a good position to maintain a national list of environmental weeds. This list will be referred to as the 'Consolidated List'. The list will be maintained on DOC's BioWeb weeds database and updated every 2 years.

New Zealand lists of environmental weeds have been used for setting priorities for strategic research (Froude 2002); and for providing summary statistics on weed types and arrival pathways to support policy and advice (Timmins & Williams 1987; Williams et al. 2002). They are also key contributions to international weeds lists (Randall 2002). To ensure that the Consolidated List is exhaustive, all naturalised plants were assessed for inclusion (see below for criteria). Changes in environmental weed numbers over time can be accurately determined only by reassessment using the same criteria.

The Consolidated List 2008 considers only vascular plants. Several exotic non-vascular plants are already being treated as weeds; most notably, the marine alga *Undaria pinnatifida*, the freshwater alga *Hydrodictyon reticulatum* and the mosses *Pseudoscleropodium purum* and *Rhytidiadelphus triquetrus*. Little is known about the extent of the naturalised exotic non-vascular flora in New Zealand. However, the recent high profile invasion by another freshwater alga (*Didymosphenia geminata*) means that non-vascular weeds are clearly an issue that may be of considerable interest in the future.

2. Environmental weed lists

There have been several attempts to develop lists of environmental weeds in New Zealand. This report presents all the recent lists of environmental weeds and compares the species listed (Appendix 1). Species are listed alphabetically under their currently accepted botanical name, with synonyms and mis-applied names included. In New Zealand, there are at least six such lists that are currently used. The six lists are discussed in chronological order with particular focus on the number of species listed and the criteria used to establish the list. These lists were compiled for specific purposes, which usually did not include the purpose of maintaining or standardising the list. A further six publications are discussed, as they contain important information regarding species not included in these lists. I have not included the lists of plant species named in Regional Pest Management Strategies (RPMS), as these typically include some species listed for cultural and agricultural reasons, as well as some not yet considered naturalised. The lists presented here recognised a total of 490 species as environmental weeds, although the number of species in each list ranged from 33 to 254.

2.1 WEEDS IN NATIONAL PARKS AND RESERVES 1983

In 1983, the former Department of Lands and Survey distributed a questionnaire to ranger staff throughout New Zealand to determine the scale of the weed problem in reserves. The results were summarised in a report to the former National Parks and Reserves Board (Timmins 1983). For the purposes of this report, scientific names have been ascribed to the common names presented in the original publication after discussion with its author.

Only 33 species were listed in this report, but absence of a species from the list should not be interpreted as absence from reserves in 1983. Rather, the list serves as a record of the most obvious weed problems at the time and the dawning of awareness of environmental weeds in New Zealand.

The report title 'Weeds in national parks and reserves' indicates a focus on weeds on conservation land. The definition of problem weeds was left open to survey respondents, and the criteria used to include species were: 'a threat to native species', 'prevents seedling establishment', 'spreads rapidly', and 'smothers native vegetation' (Timmins 1983).

2.2 PROBLEM WEEDS IN PROTECTED NATURAL AREAS 1990

After the establishment of DOC in 1987, this was the first formal list produced regarding the status of weeds on DOC-managed land (Williams & Timmins 1990). The aim was to determine which species were the worst weeds, i.e. which species had the greatest impact on native diversity and were widely distributed. A total of 65 species were identified and some life-history information systematically collected. A further 83 species were included in an appendix. Many (but not

all) of these latter species were discussed in the text as having a high impact in specific situations, but were not yet widespread enough to rank as 'worst weeds'. In 1990, they were considered potential weed species and were indicated by the letter 'p' in the appendix. Between the worst weeds and potential weeds, all the species listed in the 1983 list were included in this 1990 list. For the first time, a New Zealand indigenous plant was included, with *Muehlenbeckia australis* recorded as a potential weed. While the list compilers focused on the worst weeds, there are some interesting inclusions. *Conium maculatum* was included because of its poisonous attributes. *Hypochoeris radicata*, *Quercus robur* and *Leontodon taraxacoides* were regarded as having minimal impact on biodiversity values. *Cerastium fontanum* and *Poa annua* were included as they were being controlled on the Snares Islands, but were generally not considered problem weeds on mainland New Zealand.

2.3 PROBLEM WEEDS IN FOREST AND SCRUB RESERVES 1991

This list (Timmins & Williams 1991) was built on the following: a study by Timmins & Williams (1987); those species considered weeds in the 1990 list; and the authors' personal observations. The list comprised 73 species but was confined to weeds of forest and scrub reserves, omitting many species of other habitats listed in Williams & Timmins (1990). Thus, it does not include coastal weeds (e.g. *Spartina anglica*, *Ammophila arenaria* and *Chrysanthemoides monilifera*), wetland weeds (e.g. *Lagarosiphon major*, *Salix fragilis* and *Lotus pedunculatus*) and grassland weeds (e.g. *Agrostis capillaris*, *Bromus tectorum*, *Dactylis glomerata*, *Nassella trichotoma* and *Rosa rubiginosa*).

2.4 WEEDS IN PROTECTED NATURAL AREAS 1995

A study by Timmins & Mackenzie (1995) was the first attempt to pull together a wide range of species attribute data (e.g. growth rates, response to physical damage) on environmental weeds in New Zealand. It produced a list of 66 species from a wide range of ecosystems, not just forests. An additional 84 species were listed as controlled or problematic but their attribute data were not included. A further eight species were listed as being potential problems.

The banana passionfruit *Passiflora mixta* was cited as a weed for the first time in this report. Its identification as a weed was based on its determination in *Flora of New Zealand Volume IV* (Webb et al. 1988). This determination has subsequently been revised and most material previously assigned to *P. mixta* is now identified as *P. tarminiana* (Heenan & Sykes 2003). The extent of true *P. mixta* is unclear and *P. tarminiana* is certainly much more common. Records of *P. mixta* as a weed dating to before 2003 should be considered mis-identifications of *P. tarminiana.*

2.5 ECOLOGICAL WEEDS ON CONSERVATION LAND 1996

This publication (Owen 1996) is a printed version of an electronic spreadsheet containing species attribute data as well as distribution and impact data for 161 'ecological weeds' (synonymous with environmental weeds). The list was used as the basis for several later lists. The author also presented details for 79 species thought to be significant but for which insufficient information was available for full inclusion. There were a further 52 species considered not significant enough to warrant inclusion. This list expanded considerably on previous lists and contained the first listing of many now troublesome weeds, including *Gunnera tinctoria*.

2.6 DOC WEEDS 2002

Produced as part of weed risk assessment procedure, this was a list of 254 species considered 'DOC weeds' (Williams et al. 2002). It expanded Owen's 1996 list. Two of the more obvious differences included the inclusion of the species within the *Rubus fruticosus* complex as separate species and the individual mention of the thistles *Cirsium arvense*, *C. brevistylum* and *C. vulgare*. *Asparagus setaceus* and *Lantana montevidensis* were added, although there are no records of these species having been controlled by DOC.

2.7 ADDITIONAL LISTS

In addition to the six national lists identified above, there are other lists that refer to environmental weeds. The lists discussed below contain important additions to the species already covered.

2.7.1 Weeds on Raoul Island 1996

Raoul Island is the largest island in the Kermadec group and has a long history of habitation and subsequent control of weeds introduced through human interactions. A list of 32 species was presented in a published assessment of the Raoul Island weed control programme (West 1996). Because of its sub-tropical location (to the north of mainland New Zealand), Raoul has some weed species not found elsewhere in New Zealand. In Appendix 1, as in West (1996), species were listed with their respective priorities (high to low): A (weeds with a reversible threat and that are covered by a current programme for extermination), B (weeds for which invasion is irreversible and no control is provided for in current programmes) and C (adventives that are a potential threat and are included in a current programme for surveillance and/or limited control).

2.7.2 Problem weeds on New Zealand islands 1997

This list (Atkinson 1997) provided a subset of environmental weeds in New Zealand by recording weeds found on 176 offshore and 20 outlying islands. The author defined a problem weed as 'either an alien or indigenous species introduced (i.e. adventive) to an island where it is capable of establishing a self-perpetuating population that disrupts the structure and functioning of the

indigenous communities it invades'. While not being a record of species confined to the mainland, the list contained a good proportion of all the species listed in Owen (1996). There were, however, some important additions.

This was the first documenting of Chilean guava (*Ugni molinae*) as widespread on Chatham Island. The New Zealand indigenous species *Metrosideros excelsa* and *Pittosporum crassifolium* were also listed. Atkinson also correctly identified *Calystegia silvatica* as a problem weed, not *Convolvulus arvensis* (as has been recorded on most other lists). Although grey willow was listed as *Salix caprea*, *S. caprea* is quite uncommon in New Zealand, and its inclusion was almost certainly a mis-identification of *S. cinerea*.

2.7.3 Ecological weeds on DOC-managed land 1997

A list of weeds was presented in an overview paper on weeds emphasising the importance of considering weed life-history characteristics when undertaking weed control (Williams 1997). The list was the same as the one used by Owen (1996), excluding those listed as minor or yet to be included. The list was not updated with current knowledge; *Senecio glastifolius* was not included despite a picture of this weed gracing the front cover.

2.7.4 Weeds affecting threatened plants 1998

In her report discussing the impacts of weeds on threatened plants, Reid (1998) presented a list of 122 threatened plants and the weeds that threaten their existence. A total of 150 weeds were listed, of which 14 were considered indigenous to New Zealand. This list is not considered exhaustive. Grasses constituted 35% of the records, and explanations of threats to many more species included references to 'pasture grasses'. Pasture grasses are a serious threat—they develop a thick sward that limits seedling recruitment for a number of threatened plant species (e.g. *Olearia hectorii* (Rogers 1996) and *Carmichaelia muritai* (Williams et al. 1996)). Threatened species are often geographically restricted, and a wide range of plants (including indigenous species) can also restrict their local abundance. Only when indigenous species were documented as repeatedly causing problems and found outside their pre-human distribution were they considered for the Consolidated List.

2.7.5 'Weed manager' 2000

DOC's 'Weed manager' (Craw 2000) is a practical guide to the identification and control of about 220 weeds in New Zealand. Because of its practical nature, this report presented many of the most commonly encountered weeds, but was not exhaustive. The species *Clematis tibetana*, *Cotoneaster franchetii*, *Glyceria declinata* and *Potamogeton perfoliatus* were listed as environmental weeds for the first time. Many listings were given only to genus level: *Hieracium*, *Pinus*, *Eucalyptus*, *Cirsium* and *Carduus*. All species within these genera were considered for inclusion in the Consolidated List.

2.7.6 South Island wilding conifers 2001

This list of conifer species in the South Island (Harding 2001) is mentioned because five species are listed that had not previously been recorded as problems: *Picea abies*, *P. stichensis*, *Pinus coulteri*, *Sequoia sempervirens* and *Thuja plicata*.

3. The Consolidated List 2008

The above lists were collated and species aligned on known synonyms. In addition, DOC weed staff in each of the 13 conservancy offices compiled a list of the weeds actively controlled in their area. Species having a significant effect on conservation land were included where they met at least one of the following new criteria:

1. There is at least one infestation of the species on land administered by DOC and DOC currently has a weed-led control programme for it.
2. The species is controlled on at least one site to protect the natural heritage values of the site (e.g. the site may support populations of threatened plant species). This excludes plants controlled only for recreation purposes.
3. The species is perceived by staff as having a damaging effect on the natural heritage values of at least one site, but resources are insufficient for the species to be controlled there.

A summary table including the species from all lists (but not weeds affecting threatened plants) discussed above is presented as Appendix 1. It includes known synonyms. In general, the letter 'w' is used to indicate inclusion. In some of the other lists various other letters are used because they were in the original publications. In particular, 'p' denotes potential weeds, 'm' denotes minor weeds and 'o' is used where a species was recognised as weedy but omitted for some reason. The Consolidated List 2008 includes a total of 328 plant species and appears in Appendix 1 as 'Howell 2008'. Twenty-eight species that had been on earlier lists have been omitted, because they are not known from conservation land at the time of writing. Further details of these species are included in Appendix 2. Appendix 3 lists 58 species that are controlled at some sites, even though (in my assessment) they do not have significant effects on site values at these places. All species listed as environmental weeds for the first time (83 species) are listed in Appendix 4. These came mainly from lists of the weeds controlled in conservancies. Because a species' threat to the environment is extremely variable, many of these plants are controlled in some places but not in others.

Taxonomic uncertainties caused several problems during compilation of the Consolidated List. Weed species have wide geographic origins and some have been subject to taxonomic revision by different authors writing in a variety of languages. Furthermore, weeds occasionally arise from cultivated plants that lack some of the features of the type specimen for the species. Details of occasions where similar species are commonly confused are presented in Appendix 5.

In earlier weeds lists, some species were named at the subspecies level. The plants contained in the Consolidated List are referred to only at the species level. While this omits the greater detail available for some species, it establishes a robust number of taxa at the species level. This is useful when describing the patterns among species in the list, e.g. typical growth forms, naturalisation trends and reasons for introduction. Details for the environmental weeds that have subspecific taxa are included in Appendix 6.

Hybrids further complicate taxonomy issues. Only hybrids that form self-sustaining populations without either parent are included in the Consolidated List (see Appendix 7 for details of hybrid species included in the list).

Several of the previous lists included a list of potential weeds. This category is not included in the Consolidated List. Consequently, even species that have a high profile in other countries and are known to occur in low numbers in New Zealand are not included (e.g. *Geitonplesium cymosum*, *Polygonum perfoliatum*, *Schinus terebinthifolius* and *Melaleuca quinquinervia*). More than 1500 species of exotic plants have been recorded from conservation land in New Zealand (BioWeb weeds database 2007). The potential weeds list would be very long indeed.

3.1 ALL NATURALISED PLANTS

In order to draw meaningful comparisons between species in the Consolidated List and all naturalised plants, I reviewed the status of all exotic species believed to be wild in New Zealand. The resulting checklist (see Howell & Sawyer 2006) was compiled from published lists of species recorded as wild in New Zealand up to December 2005 and contains 2436 taxa from 2391 species. Included in the total are six species that have previously been recorded from New Zealand and are now considered eradicated: *Acroptilon repens*, *Chondrilla juncea*, *Menyanthes trifoliata*, *Nymphoides peltata*, *Pistia stratiotes* and *Zizania palustris*. 'Eradicated' is used in the strict sense: deliberately controlled to a point where no plants have been seen for at least 5 years, and experts agree that undetected plants are very unlikely to exist anywhere within New Zealand. There may be several additional examples of taxa that have established, persisted and, although never actively controlled, may no longer be naturalised. These include (but are not restricted to) *Muellerina celastroides*, *Lathraea clandestina*, *Acroptilon repens*, *Alopecurus myosuroides*, *Trisetum flavescens* and *Viscum album*. As it stands, the 328 weeds in the Consolidated List constitute about 13% of the naturalised flora.

3.2 CHARACTERISTICS OF ENVIRONMENTAL WEEDS

The BioWeb weeds database has species records for all exotic plants that are naturalised or casual within New Zealand. A wide array of attribute data has been entered into the database and is available for analysis. Approximate date of naturalisation, growth form classification, weediness score and likely reason for introduction were analysed for the 328 species in the Consolidated List.

3.2.1 Naturalisation date

The date of first naturalisation is a very important attribute of invasive plants, but is almost always unobservable. Dates of first discovery, collection and publication have variously been used as surrogates. For this work, I obtained the date of first discovery for all exotic taxa that are naturalised or casual in New Zealand. These dates are compiled from published records, predominantly the checklists for naturalised exotic plants published in the *New Zealand Journal of Botany*.

When Daniel Solander came ashore from the Endeavour in 1769, he observed *Sonchus asper*, *Oxalis corniculata* and *Siegesbeckia orientalis* (Leach 2005). Wild populations of these species had resulted from either deliberate or accidental Polynesian introductions, and these species were the first adventive vascular plant taxa discovered wild in New Zealand. Solander also observed *Solanum americanum*, but the status of this species remains uncertain, and it is tentatively considered indigenous. Further exotic species such as *Bidens pilosa*, *Eleusine indica* and *Cyclosurus interruptus* were almost certainly present in 1769, but were not seen by Solander (Leach 2005). In addition, because Maori cultivated *Lagenaria siceraria*, *Brousonetia papyrifera*, *Ipomoea batatas*, *Colocasia esculenta*, *Dioscorea alata* and *Cordyline fruticosa* before 1769 (Horrocks 2004), these may have naturalised to some extent. *Pinus pinaster* was the first species in the Consolidated List to be discovered as adventive in New Zealand (in 1830).

Since 1770, 2433 taxa have been discovered wild in New Zealand. By analysing the cumulative data, it is clear that a simple linear model does not provide an accurate description of the history of plant discovery or a reliable predictor of future naturalisations (Fig. 1). The very long tail reflects very low naturalisation rates during Polynesian arrival and geographic expansion. Since the European arrival, the rate has grown almost exponentially. But the shape of the curve is complex. By aggregating the discovery data into 10-year periods (Fig. 2), several trends emerge. Firstly, very high peaks appear to reflect years of 'catch-up' after periods in which search effort was low and many naturalised species remained undiscovered. In particular, the periods prior to 1866 and between 1890 and 1940 indicate low levels of discovery. Since 1950, the rate has remained at around 20 taxa per annum, with a weak incremental increase. Finally, there is no indication that the rate is reducing. The trend for environmental weeds largely mirrors trends for all adventive plants and reached around four taxa per year in the 1950s and 1960s. However, the rate tailed off significantly in recent years:

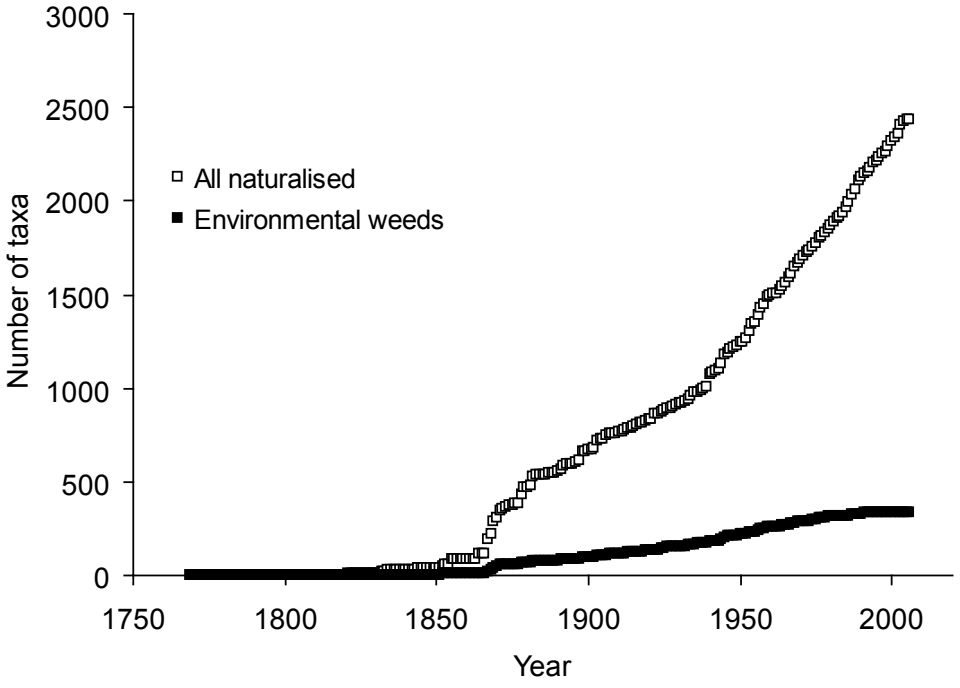

Figure 1. Cumulative totals for all plants and environmental weeds.

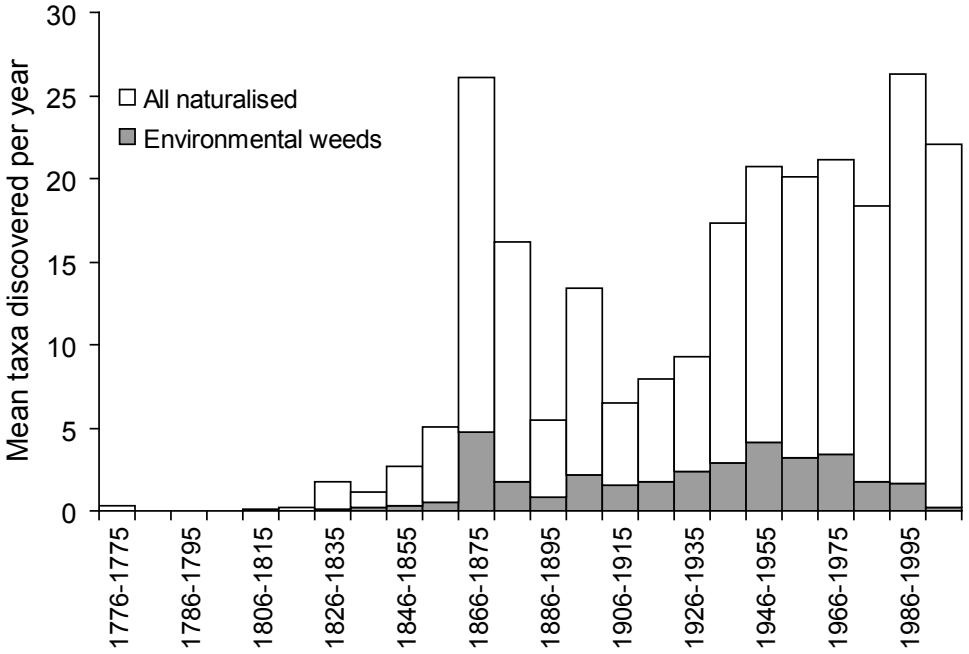

Figure 2. Discovery history for all plants and environmental weeds.

only 17 environmental weeds were discovered between 1986 and 1995, and just two species in the last decade—*Ficus macrophylla* (1996) and *Ochna serrulata* (1997). It would be optimistic to consider this to have been a response to recent biosecurity initiatives. Rather, it is more likely that it was a lag effect; species must naturalise and be discovered before they are recognised as environmental weeds.

3.2.2 Growth form classification

Earlier classifications such as that of Owen (1996) and Reid (1998) have separated 'aquatic' as a distinct growth form. The categories presented here are aggregated from more specific categories stored in BioWeb, and the list most closely resembles that of Timmins & Williams (1987). Aquatic plants are not separated, and can be found in all categories—e.g. *Azolla pinnata* (fern), *Glyceria maxima* (grass), *Iris pseudacorous* (herb) and *Salix cinerea* (tree). The categories used are:

- Ferns and fern allies: All species in the phylum Pteridophyta.
- Grasses: All species in the family Poaceae, except woody species such as bamboos.
- Herbs: All herbaceous species from the phylum Magnoliophyta. This includes species from the classes Magnoliopsida (dicotyledons) and Liliopsida (monocotyledons) except for the family Poaceae.
- Trees and shrubs: All species from the phylum Pinophyta (gymnosperms) and woody but not climbing plants from the phylum Magnoliophyta. This includes species from the classes Magnoliopsida (dicotyledons) and Liliopsida (monocotyledons).
- Vines: Climbing plants from the classes Magnoliopsida (dicotyledons) and Liliopsida (monocotyledons).

Almost half of all weeds in the Consolidated List are trees or shrubs. This proportion is consistent with the findings of Timmins & Williams (1987) based on their list of only 73 problem weeds. However, any kind of plant can become a weed. It is informative to compare the composition of the Consolidated List with all exotic plants that have naturalised in New Zealand (Fig. 3). Assuming equal representation, we can see that trees and shrubs and vines are over-represented as weeds, while herbs are under-represented. There are no consistent differences in weediness between different growth forms when all environmental weeds are assessed using the DOC weediness scoring system (Owen 1996) (Fig. 4).

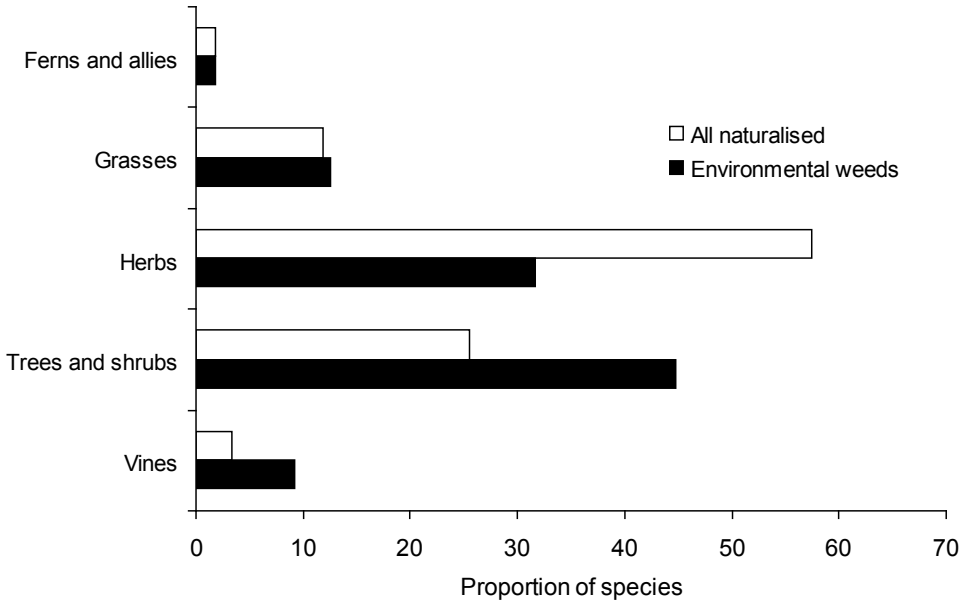

Figure 3. Growth form of all plants and environmental weeds.

Figure 4. Weediness of environmental weeds of different growth forms. Values are: minimum, lower quartile, median, upper quartile and maximum.

3.2.3 Reason for introduction

All plants have been classified according to five broad groups similar to the classification used by Buddenhagen et al. 1998:

- Accidental: Either known to be a contaminant of seed, ballast, wool, etc., or the reason for introduction is unknown and presumed to be accidental.
- Agricultural: Deliberately introduced for agricultural or horticultural reasons, including for shelterbelt use.
- Indigenous: Are considered to have naturally occurred somewhere in the New Zealand political area without human influence.
- Forestry: Deliberately introduced as a known or potential plantation tree.
- Ornamental: Deliberately introduced and cultivated as an ornamental plant; this category includes specimen trees.

Almost two-thirds (66.4%) of species in the Consolidated List were originally introduced as ornamental plants. This is a small reduction in the proportion of ornamentals that became weeds from the figures derived from the 1998 list of 240 species (Buddenhagen et al. 1998). The proportion is smaller primarily because the Consolidated List includes both terrestrial and aquatic species. Separating weeds into aquatic and terrestrial categories is problematic, particularly for marginal and semi-aquatic species. Species deliberately introduced for agriculture, horticulture or forestry represent almost one-quarter (22.5%) of the Consolidated List. They include trees introduced as shelterbelts or for land stabilisation. Only a very small fraction (10%) is believed to have been accidentally introduced. Common accidental pathways of introduction into New Zealand are as seeds attached to wool (e.g. *Arctium minus*), in contaminated ballast (e.g. *Juncus* spp.) or as contaminants in grass seed (e.g. *Hieracium* spp.) (Espie 2001). The balance of the weeds comprises a small (3.9%) but important fraction attributable to forestry species, and less than 1% of the weeds in the list are indigenous to New Zealand but weedy outside their native range.

These statistics help us to understand how the current suite of weeds came to New Zealand and what measures are likely to affect the rate of introduction of environmental weeds. Clearly, the majority of plants considered to be weeds were deliberately introduced, and were not accidental introductions. Improvements in national biosecurity measures address accidental introductions primarily. Of concern is that there are an estimated 24 700 exotic plant species grown in New Zealand (Williams et al. 2002), and existing biosecurity measures do nothing to address the threat that these plants represent. It seems most likely that future weeds will emerge from cultivated ornamental plants. Biosecurity measures, including weed risk assessment, need to target ornamental plants in order to stem the tide of environmental weeds.

4. Conclusions

This Consolidated List of environmental weeds has been compiled to improve consistency for what have been loosely referred to as 'DOC weeds'. For particular projects, it may be advantageous to dissect the list further using geographical area or growth form classification. The Consolidated List is maintained in the BioWeb weeds database along with additional information not presented in this report. It is intended that the basic list be updated by DOC every 2 years, and I invite comments regarding both the criteria and the species listed.

This Consolidated List of 328 species is considerably larger than previous lists, largely reflecting the diverse environments now under management for weeds. Newly naturalised plant species are being discovered at the rate of about 20 per year. Most of these are cultivation escapes and many more will become of conservation concern in the years to come.

A question repeatedly asked of weed ecologists is 'what is the worst weed?'. The answer is impossible to give at a national scale. Some species are clearly more troublesome than others across a wide range of habitats, but there are many 'grey' taxa. It is not even possible to single out particular growth forms, as there are weedy and non-weedy members in all groups, and effective biodiversity conservation requires a wide range of habitats to be kept in the best condition possible. The species in this list are not ranked, so no attempts should be made to deduce a national top 10, or 100. The DOC system of controlling any plant at a high-value site (the site-led approach), and targeting known problem weeds before they become widely established (the weed-led approach), represented an important progression in thinking about the way we manage weeds. A comprehensive list of all the plant species that currently affect conservation is a further step in this process.

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Appendix 1

SUMMARY OF ENVIRONMENTAL WEED LISTS IN NEW ZEALAND, INCLUDING THE CONSOLIDATED LIST (HOWELL 2008)

w = included, p = potential, o = omitted, m = minor, A–C = priority of management (high to low)

SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Abutilon darwinii × pictum					o								w	
Acacia dealbata		w	w	w	w	w		w			w		w	*Racosperma dealbatum*
Acacia decurrens		p	w										w	*Racosperma decurrens*
Acacia longifolia		p		o	w	w		w			w		w	*Racosperma longifolium*
Acacia mearnsii		p							w				w	*Racosperma mearnsii*
Acacia melanoxylon					o	w			w				w	*Racosperma melanoxylon*
Acacia paradoxa				o	w	w		w	w		w		w	*Racosperma paradoxum*
Acacia sophorae													w	
Acacia verticillata		p											w	*Racosperma verticillatum*
*Acaena agnipila**										w				
*Acaena novae-zelandiae**										w				
Acanthus mollis													w	
Acer pseudoplatanus	w	w	w	w	w	w		w	w		w		w	
Acmena smithii				o	w	w		w			w		w	
Actinidia deliciosa					m								w	
Aeonium × haworthii					m									
Agapanthus praecox					w	w		w			w		w	
Agave americana					o	w			w		w		w	
Ageratina adenophora		p	w	w	w	w		w	w	w	w		w	
Ageratina riparia		w	w	w	w	w		w	w	w	w		w	
Ageratum houstonianum													w	
Agrostis capillaris		w		w	w	w		w		w	w		w	
Agrostis stolonifera		p								w				
Ajuga reptans													w	
Akebia quinata													w	
Aleurites moluccana					m		C							
Alisma plantago-aquatica										w				
Allium triquetrum					w	w		w	w		w		w	
Alnus glutinosa				o	w	w		w			w		w	
Alnus viridis					m								w	
Alocasia brisbanensis		p			w	w	B	w	w		w		w	*Alocasia macrorrhiza*
Aloe saponaria					m									
Alopecuris pratensis		p												
Alstroemeria pulchella					m									
Alternanthera philoxeroides				w	w	w		w		w	w		w	
Ammophila arenaria		w		w	w	w		w	w	w	w		w	
Andropogon virginicus					o	w					w		w	
Angelica pachycarpa													w	
Anredera cordifolia		p		o	w	w	A	w	w	w	w		w	
Anthoxanthum odoratum		p								w				
Araucaria heterophylla							A		w					
Araujia sericifera		p		w	w	w		w	w		w		w	
Arctium minus													w	
Arctium spp.		p	w											
Arctotheca calendula					o	w							w	

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Appendix 1 continued from previous page

SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Aristea ecklonii				o	w	w		w			w		w	
Arrhenatherum elatius		p		o	w	w		w	w	w	w			
Arum italicum		p	w		w	w		w			w		w	
Arundo donax				o	w	w		w	w		w		w	
Asparagus asparagoides		w	w	o	w	w		w	w		w		w	
Asparagus aethiopicus					o						w			*Asparagus densiflorus*
Asparagus scandens		w	w	w	w	w		w	w		w		w	
Asparagus setaceus						w							w	
Asphodelus fistulosus													w	
Azolla pinnata					o	w					w		w	
Bambusa spp.											w			
Banksia integrifolia					o	w							w	
Bartlettina sordida					o	w					w		w	
Berberis darwinii		w	w	w	w	w		w	w	w	w		w	
Berberis glaucocarpa	w	w	w	o	w	w		w	w	w	w		w	
Beta vulgaris										w				
Betula pendula										w			w	
Bidens frondosa													w	
Bromus catharticus													w	
Bromus spp.		p												
Bromus sterilis										w				
Bromus tectorum		w			w	w		w			w		w	
Brugmansia suaveolens					m		C						w	
Bryonia cretica					o	w					w		w	
Bryophyllum pinnatum					m		B						w	
Buddleja davidii	w	w	w	w	w	w		w	w	w	w		w	
Buddleja madagascariensis													w	
Caesalpinia decapetala		w	w	o	w	w	A	w	w		w		w	
Cakile edentula					m									
Cakile maritima					m									
Callistachys lanceolata		p		o	w	w		w			w		w	*Oxylobium lanceolatum*
Callistemon rigidis													w	
Calluna vulgaris	w	w		w	w	w		w		w	w		w	
Calystegia silvatica									w				w	
Canna indica					o	w					w		w	
Cardiospermum spp.					o									
Carduus nutans		w		o	w	w		w					w	
Carduus spp.											w			
Carex divulsa					m									
Carex flacca					o	w							w	
Carex longebrachiata				o	w	w		w	w		w		w	
Carex lurida													w	
Carex ovalis										w			w	
Carica pubescens					m									
Carpobrotus chilensis					m								w	*Carpobrotus aequilaterus*

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Carpobrotus edulis					m				w	w			w	
Celastrus orbiculatus				o	w	w		w			w		w	
*Centipeda cunninghamii**										w				
Centranthus ruber					m									
Cerastium fontanum		p												
Cerastium spp.										w				
Ceratophyllum demersum					o	w					w		w	
Cestrum aurantiacum				o	w	w		w			w		w	
Cestrum elegans					w	w		w			w		w	
Cestrum fasciculatum											w			
Cestrum nocturnum					o	w					w		w	
Cestrum parqui					o	w					w		w	
Chamaecyparis lawsoniana		p	w									w	w	
Chamaecytisus palmensis		p	w		m								w	
Chlorophytum comosum					m									*Chlorophytum chloronotum* (*sic*)
Chrysanthemoides monilifera		w		w	w	w		w	w	w	w		w	
Cirsium arvense						w				w			w	
Cirsium palustre						w							w	
Cirsium spp.				o	w			w			w			
Cirsium vulgare						w	B						w	
Citrus sinensis													w	
Clematis flammula				p	w	w		w			w		w	
Clematis maximowicziana													w	
Clematis montana													w	
Clematis tangutica					o	w								
Clematis tibetana											w		w	
Clematis vitalba	w	w	w	w	w	w		w	w	w	w		w	
Cobaea scandens		p		o	w	w		w			w		w	
Conium maculatum		p	w		m									
Convolvulus arvensis				o	w	w		w			w			
Cordyline fruticosa							C							
Cortaderia jubata		w	w	w	w	w		w	w	w	w		w	
Cortaderia selloana	w	w	w	w	w	w	A	w	w	w	w		w	
*Cortaderia splendens**										w				
Cotoneaster franchetii											w		w	
Cotoneaster glaucophyllus				o	w	w		w			w		w	
Cotoneaster simonsii				o	w	w		w			w		w	
Cotoneaster spp.		p	w							w				
Crassula multicava					o	w			w				w	
Crataegus monogyna	w	w	w	w	w	w		w	w		w		w	
Crepis capillaris										w				
Critesion marinum		p								w				*Hordeum marinum*
Crocosmia × *crocosmiiflora*		p	w	o	w	w		w	w	w	w		w	
Cupressus macrocarpa		p	w						w			w	w	

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Cyathea cooperi					o									
Cynodon dactylon					o	w							w	
Cyperus eragrostis													w	
Cytisus scoparius	w	w	w	w	w	w		w	w	w	w		w	
Dactylis glomerata		w		w	w	w		w		w	w		w	
Datura stramonium		p	w											
Dendrobenthamia capitata													w	
Digitalis purpurea	w	p								w				
Dipogon lignosus		p		o	w	w		w	w	w	w		w	
Dryopteris filix-mas													w	
Echium plantagineum					o	w								
Echium vulgare		p		o	w	w		w		w	w		w	
Egeria densa		p		w	w	w		w			w		w	
Ehrharta erecta		w		w	w	w		w	w	w	w		w	
Ehrharta longifolia					o									
Ehrharta villosa				o	w	w		w			w		w	
Eichhornia crassipes										w				
Elaeagnus × reflexa		w	w	w	w	w		w	w		w		w	
Elodea canadensis		p			o	w					w		w	
Elytrigia pycnantha													w	
Embothrium coccineum													w	
Epidendrum ibaguense					m									*Epidendrum cinnabarinum*
Epilobium ciliatum					m									
Equisetum arvense				o	w	w		w			w		w	
Equisetum hyemale					o						w			
Eragrostis curvula					o	w					w		w	
Erica arborea													w	
Erica baccans									w				w	
Erica caffra													w	
Erica lusitanica		w	w	w	w	w		w	w		w		w	
Erica vagans													w	
Erigeron karvinskianus				o	w	w		w		w	w		w	
Eriobotrya japonica				o	w	w		w			w		w	
Erythrina × sykesii					w	w		w			w		w	
Eucalyptus botryoides					o	w								
Eucalyptus delegatensis													w	
Eucalyptus globulus		p			o	w								
Eucalyptus saligna					o	w								
Eucalyptus spp.											w			
Euonymus europaeus				o	w	w		w		w	w		w	
Euonymus japonicus				o	w	w		w			w		w	
Eupatorium cannabinum													w	
Fatsia japonica													w	
Festuca rubra										w			w	
Ficus carica					m	w							w	

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Appendix 1 continued from previous page

SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Ficus macrophylla					o	w					w		w	
Ficus pumila					o	w								
Ficus rubiginosa					o	w					w		w	
Foeniculum vulgare		p			m		A							
Fraxinus excelsior													w	
Furcraea foetida		p			o	w	A						w	
Galeobdolon luteum					o	w					w		w	
Galium aparine										w				
Gladiolus spp.					m									
Gladiolus undulatus					m									
Glaucium flavum										w				
Glyceria declinata											w		w	
Glyceria fluitans				o	w	w		w			w		w	
Glyceria maxima					o	w				w	w		w	
Gomphocarpus fruticosus					m		A							
Gunnera tinctoria					o	w				w			w	
Gymnocoronis spilanthoides				w	w	w		w			w		w	
Hakea gibbosa	w	w		w	w	w		w	w	w	w		w	
Hakea salicifolia	w	w	w	w	w	w		w	w		w		w	
Hakea sericea		w	w	w	w	w		w	w	w	w		w	
Hakea suaveolens													w	
Hedera helix		w	w	w	w	w		w	w	w	w		w	
Hedychium flavescens		w	w	w	w	w		w	w		w		w	
Hedychium gardnerianum	w	w	w	w	w	w		w	w		w		w	
Helianthus tuberosus					m									
Hibiscus tilaceus		p					C		w					
Hieracium argillaceum											w			
Hieracium aurantiacum						w					w		w	
Hieracium caespitosum						w					w			
Hieracium lepidulum						w					w		w	
Hieracium murorum						w					w			
Hieracium pilosella		w		w		w			w	w	w		w	
Hieracium pollichiae											w			
Hieracium praealtum		w		w		w					w		w	
Hieracium spp.					w			w						
Hieracium subaudum											w			
Hieracium × *stoloniflorum*											w			
Holcus lanatus		p								w			w	
Homalanthus populifolius					o	w							w	
Homeria collina					o	w								
Houttuynia cordata					o						w			
Humulus lupulus		w		o	w	w		w			w		w	
Hydrangea macrophylla													w	
Hydrilla verticillata				w	w	w		w			w		w	
Hypericum androsaemum				w	w	w		w	w		w		w	

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Hypericum perforatum					w	w		w			w		w	
Hypochoeris radicata		p								w				
Ilex aquifolium		p	w										w	
Impatiens glandulifera				p										
Impatiens sodenii					o	w					w		w	
Impatiens walleriana					m									
Imperata cylindrica					o	w							w	
Ipomoea indica				o	w	w		w			w		w	
Iris foetidissima	w	w	w	w	w	w		w	w		w		w	
Iris pseudacorus					w	w		w			w		w	
*Isolepis nodosa**										w				
Jasminum humile				o	w	w		w			w		w	
Jasminum polyanthum				o	w	w		w	w		w		w	
Juglans ailantifolia				o	w	w		w			w		w	
Juncus acuminatus					m									
Juncus acutus				o	w	w		w			w		w	
Juncus articulatus		p		o	w	w		w		w	w		w	
Juncus bulbosus				o	w	w		w			w		w	
Juncus effusus					w	w		w			w		w	
Juncus gerardii													w	
Juncus microcephalus					m								w	
Juncus spp.		w												
Juncus squarrosus				p	w	w		w		w	w		w	
Kennedia rubicunda													w	
Lagarosiphon major		w		w	w	w		w			w		w	
Lantana camara				o	w	w		w	w		w		w	
Lantana montevidensis						w							w	
Larix decidua		w	w	w	o	w					w	w	w	
Larix kaempferi		p	w											
Laurus nobilis													w	
Lavandula spp.					m									
Lavatera arborea													w	
Leontodon taraxacoides		p								w				
*Leptospermum scoparium**										w				
Leucanthemum vulgare		p								w				
Leycesteria formosa	w	w	w	w	w	w		w	w		w		w	
Leymus racemosus													w	
Ligustrum lucidum	w	w	w	w	w	w		w	w		w		w	
Ligustrum ovalifolium		p	w		m						w		w	
Ligustrum sinense		w	w	w	w	w		w	w		w		w	
Ligustrum vulgare		p	w											
Lilium formosanum					m								w	
Lilium tigrinum													w	
Lolium perenne				o	w	w		w		w	w		w	
Lonicera japonica		w	w	w	w	w		w	w	m	w		w	

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Lophospermum erubescens													w	
Lotus pedunculatus		w		o	w	w		w	w	w	w		w	
Ludwigia palustris					m					w			w	
Lupinus arboreus	w	w		o	w	w		w	w	w	w		w	
Lupinus polyphyllus	w	w		w	w	w		w			w		w	
Lupinus polyphyllus × *arboreus*		p												
Lycium ferocissimum	w	w	w	w	w	w		w	w	w	w		w	
Lythrum salicaria					o	w					w		w	
Malvaviscus arboreus					o	w								
Melianthus major		p		o	w	w		w			w		w	
Melissa officinalis										w				
Mentha spp.					m									
*Metrosideros excelsa**									w				w	
Mimulus guttatus				o	w	w		w			w		w	
Miscanthus nepalensis					o	w							w	
Monstera deliciosa					m									
*Muehlenbeckia australis**		p											w	
*Muehlenbeckia complexa**										w				
Mycelis muralis										w				
Myoporum insulare					o	w							w	
Myosotis laxa										w				
Myrica faya					o									
Myricarica germanica													w	
Myriophyllum aquaticum				w	w	w		w		w	w		w	
*Myriophyllum propinquum**										w				
Nardus stricta													w	
Nassella neesiana					w	w		w			w		w	*Stipa neesiana*
Nassella tenuissima				p							w			*Stipa tenuissima*
Nassella trichotoma	w	w		w	w	w		w	w	w	w		w	*Stipa trichotoma*
Nasturtium officinale					o	w							w	*Rorippa nasturtium-aquaticum*
Nephrolepis cordifolia				o	w			w	w		w		w	
Nerium oleander													w	
Nymphaea alba													w	
Nymphaea mexicana													w	
Nymphoides geminata						w								
Ochna serrulata													w	
Olea europaea		p			w	w	A	w	w		w		w	*Olea africana*
Opuntia monacantha													w	*Opuntia vulgaris*
Osmunda regalis				o	w	w		w			w		w	
Osteospermum fruticosum													w	
Ottelia ovalifolia					o	w					w		w	
*Ozothamnus leptophyllus**										w				*Cassinia leptophylla*
Pandorea jasminoides					o	w								
Pandorea pandorana				o	w	w		w			w		w	

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Paraserianthes lophantha	w	p	w	o	w	w		w	w	w	w		w	*Albizia lophantha*
Paspalum distichum				o	w	w		w		w	w		w	
Paspalum vaginatum													w	
Passiflora caerulea					m						w		w	
Passiflora edulis		p		o	w	w	A	w	w		w		w	
Passiflora mixta				w	w	w		w			w			
Passiflora tarminiana													w	*Passiflora mixta* (misapplied)
Passiflora tripartita	w	w	w	w	w	w		w	w		w		w	*Passiflora mollissima*
Pelargonium spp.					m									
Pennisetum clandestinum		w	w	w	w	w		w	w	w	w		w	
Pennisetum macrourum				o	w	w		w			w		w	
Pennisetum polystachion					m									
Pennisetum purpureum					o	w								
Pennisetum setaceum					w	w		w			w			
Phoenix canariensis					o	w			w		w		w	
Phoenix dactylifera					m		C							
Phragmites australis											w		w	
Phyllostachys aurea					m		A				w		w	
Physalis peruviana													w	
Phytolacca octandra		p	w	o	w	w		w		w	w		w	
Picea abies												w		
Picea stichensis												w		
Pinus banksiana						w					w		w	
Pinus contorta	w	w	w	w	w	w		w		w	w	w	w	
Pinus coulteri												w		
Pinus halepensis						w			w		w		w	
Pinus mugo											w	w	w	*Pinus unciniata*
Pinus muricata											w	w	w	
Pinus nigra		w	w	w		w			w		w	w	w	
Pinus patula						w					w		w	
Pinus pinaster		w	w	w	w	w		w	w		w	w	w	
Pinus ponderosa						w				w	w	w	w	
Pinus radiata	w	w	w	w		w			w		w	w	w	
Pinus spp.					w			w						
Pinus strobus						w					w		w	
Pinus sylvestris						w					w	w	w	
Pinus taeda											w			
*Pittosporum crassifolium**									w				w	
Plantago coronopus		p								w			w	
Plectranthus ciliatus					o	w					w		w	
Plectranthus ecklonii					o	w					w		w	
Plectranthus grandis					o	w					w			
Poa annua		p												
*Poa cita**										w				

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Poa pratensis		p								w				
Podalyria sericea													w	
Podranea ricasoliana					o	w								
Polygala myrtifolia		p		o	w	w		w	w		w		w	
Polygonum capitatum					m								w	
Polygonum spp.		p								w				
Populus alba					w	w		w			w		w	
Populus nigra					m		A							
Populus spp.				o										
Potamogeton crispus					o	w					w		w	
Potamogeton perfoliatus					o						w			
Prunella vulgaris										w				
Prunus avium		p	w	o	w	w		w	w		w		w	
Prunus campanulata					o	w					w		w	
Prunus ceracifera													w	
Prunus laurocerasus		p	w		o	w				w	w		w	
Prunus lusitanica					o	w					w			
Prunus persica					m		C						w	
Prunus serrulata					o	w					w		w	
Prunus × *domestica*													w	
Pseudosasa japonica		p	w										w	*Arundinaria japonica*
Pseudotsuga menziesii		w	w	w	w	w		w			w	w	w	
Psidium cattleianum		p			o	w	A		w		w		w	
Psidium guajava		p			o	w	A		w				w	
Psoralea pinnata		p		o	w	w		w	w		w		w	
*Pteridium esculentum**										w				
Pueria lobata				p										
Pyracantha angustifolia					w	w		w			w		w	
Pyracantha crenatoserata													w	
Pyrostegia spp.				p										
Quercus palustris										w				
Quercus robor		p	w											
Ranunculus flammula										w				
Ranunculus repens					m					w				
Ranunculus trichophyllus					m					w				
Reynoutria japonica					w	w		w			w		w	
Reynoutria sachalinensis					w	w		w			w		w	
Rhamnus alaternus		w	w	w	w	w		w	w		w		w	
Rhaphiolepis umbellata					o	w							w	
Rhododendron ponticum					o	w							w	
Ribes sanguineum					o	w							w	
Ribes uva-crispa										w			w	
Ricinus communis					m		A						w	
Robinia pseudoacacia		w	w	w	o	w							w	
Roldana petasitis													w	*Senecio petasitis*

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Rosa rubiginosa	w	w		w	w	w		w	w	w	w		w	
Rubus argutus						w								
Rubus cardiophyllus						w								
Rubus cissburiensis						w								
Rubus echinatus						w								
Rubus flagellaris						w								
Rubus fruticosus						w								
Rubus fruticosus agg.	w	w	w	w	w			w	w	w	w		w	
Rubus idaeus													w	
Rubus laciniatus						w								
Rubus leptothyrsos						w								
Rubus nemoralis						w								
Rubus ostryifolius						w								
Rubus phoenicolasius													w	
Rubus procerus						w								
Rubus ulmifolius						w								
Rumex sagittatus		p		w	w	w		w			w		w	
Sagittaria montevidensis					o						w			
Salix cinerea				o	w	w		w	w	w	w		w	*Salix caprea*
Salix fragilis	w	w		w	w	w		w	w	w	w		w	
Salvinia molesta					w	w		w		w	w			
Sambucus nigra	w	w	w	w	w	w		w	w	w	w		w	
Schedonorus phoenix		p		o	w	w		w		w	w		w	*Festuca arundinacea*
Schinus terebinthifolius					o	w								
Secale cereale										w				
Sedum acre				o	w	w		w		w	w		w	
Sedum mexicanum					m									
Selaginella kraussiana		w	w	w	w			w		w	w		w	
Senecio angulatus		p	w	o	w	w		w	w		w		w	
Senecio glastifolius										w			w	
Senecio jacobaea	w	p		o	w	w	A	w		w	w		w	
Senecio mikanioides		w	w	w	w	w		w			w		w	
*Senecio minimus**										w				
Senna septemtrionalis		p		o	w	w	A	w	w		w		w	
Sequoia sempervirens										w		w		
Sequoiadendron giganteum										w				*Sequoia giganteum*
Setaria palmifolia				p	w	w		w			w		w	
Silybum spp.											w			
Solanum diflorum		p			m						w		w	
Solanum dulcamara					m								w	
Solanum jasminoides				o	w	w		w			w		w	
Solanum linnaeanum	w	p	w	o	w	w		w	w		w		w	*Solanum hermanii*
Solanum mauritianum	w	w	w	w	w	w		w	w		w		w	
Solanum pseudocapsicum			w		w	w		w			w		w	
Sorbaria tomentosa													w	

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SPECIES * Denotes indigenous to NZ	TIMMINS 1983	WILLIAMS & TIMMINS 1990	TIMMINS & WILLIAMS 1991	TIMMINS & MACKENZIE 1995	OWEN 1996	WILLIAMS ET AL. 2002	WEST 1996	WILLIAMS 1997	ATKINSON 1997	REID 1998	CRAW 2000	HARDING 2001	HOWELL 2008	SYNONYMS
Sorbus aucuparia				o	w	w		w		w	w		w	
Spartina alterniflora		p		w	w	w		w			w		w	
Spartina anglica		w		w	w	w		w			w		w	
Spartina × townsendii					w	w		w			w		w	
Spartium junceum					o	w								
Spiraea japonica													w	
Stenotaphrum secundatum		p			o	w	B		w		w		w	
Syzygium australe				o	w	w		w			w		w	
Taraxicum officinale										w				
Tecomaria capensis					o	w							w	
Teline monspessulana		p	w		w	w		w			w		w	
Tetrapanax papyriferus					m									
Thuja plicata												w		
Thunbergia grandiflora					o									
Thymus vulgaris		p											w	
Trachycarpus fortunei					o	w					w		w	
Tradescantia fluminensis	w	w	w	w	w	w		w	w	w	w		w	
Trifolium campestre							B							
Trifolium dubium										w				
Trifolium fragiferum										w				
Trifolium spp.		p								w				
Trifolium repens										w				
Tropaeolum majus					w	w	B	w			w		w	
Tropaeolum pentaphyllum													w	
Tropaeolum speciosum		p	w	o	w	w		w			w		w	
Tussilago farfara				o	w	w		w			w		w	
Ugni molinae		p							w				w	
Ulex europaeus	w	w	w	w	w	w		w	w	w	w		w	
Ulmus × hollandica		p	w										w	
Undaria pinnatifida					o									
Urochloa mutica					o		A						w	*Brachiaria mutica*
Utricularia gibba					o	w					w		w	
Vaccinium corymbosum				o	w	w		w			w		w	
Verbascum thapsus		p								w				
Vicia sativa					m		B							
Vinca major	w	w	w	o	w	w		w	w		w		w	
Vitis vinifera					m		C						w	
Vittadinia gracilis		p												
Watsonia bulbillifera		p		o	w	w		w			w		w	
Wisteria sinensis													w	
Zantedeschia aethiopica		p	w		w	w		w			w		w	
Zizania latifolia				w	w	w		w		w	w		w	

Appendix 2

SPECIES THAT HAVE PREVIOUSLY BEEN LISTED BUT ARE NOT KNOWN FROM CONSERVATION LAND

SPECIES	JUSTIFICATION FOR REMOVAL
Asparagus aethiopicus	Recognised but no details given in Owen (1996)[a]. Listed in Craw (2000)[b] as *A. densiflorus*. Records from conservation land should be checked.
Bambusa multiplex	This was initially included from *Bambusa* spp. listed in the weed manager (Craw 2000[b]). There are many observations of *B. multiplex* on the database, almost all are now believed to be *Phyllostachys aurea* or *Pseudosasa japonica*.
Cardiospermum spp.	Listed in Owen (1996)[a]. Both *C. grandiflorum* and *C. halicacabum* are potential weeds but have not been recorded on conservation land.
Cestrum fasciculatum	Not recorded from conservation land. However, this may have been over-looked and confused with the very similar *C. rubrum*.
Clematis tangutica	Most observations formerly assigned to this species are now ascribed to *C. tibetiana*. *Clematis tangutica* is not known from conservation land.
Convolvulus arvensis	Records of this species are almost exclusively *Calystegia silvatica*. While present in New Zealand, *Convolvulus arvensis* is not known on conservation land.
Cyathea cooperi	Listed as a recognised weed that was yet to be included in Owen (1996)[a], this species is cultivated in New Zealand, but is not known to be present on conservation land.
Datura stramonium	Recorded in error in Williams & Timmins (1990)[c] and Timmins & Williams (1991)[d] for *Brugmansia suaveolens*. *Datura stramonium* is an annual plant but *B. suaveolens* is a tree, known by the common name Datura.
Ehrharta longifolia	Listed as a recognised weed that was yet to be included in Owen (1996)[a]. One population is known in Wanganui City, but not yet causing problems on conservation land.
Equisetum hyemale	Commonly cultivated and troublesome but not known from conservation land.
Homeria collina	Notifiable pest plant. Not really an environmental weed, was included mainly because it is toxic to stock. No known sites on conservation land.
Houttuynia cordata	Not known outside cultivation.
Larix kaempferi	Listed in Timmins & Williams (1991)[d], but probably listed in error, as the first reliable records of this species naturalised are from 1998 (Heenan et al. 2002[e]).
Malvaviscus arboreus	Eradicated from Little Barrier Island (Hauturu). Not uncommon in cultivation.
Myrica faya	Listed in Owen (1996)[a], but the comments actually apply to *Ugni molinae* (Carol West, Department of Conservation, pers. comm. 2004). *Myrica faya* has been cultivated in New Zealand but is not known to be naturalised.
Nassella tenuissima	Not known from conservation land. A potential weed of pastures.
Nymphoides geminata	Not known from conservation land. A potential aquatic weed species.
Pandorea jasminoides	Some plants have been found scrambling and layering away from houses on Great Barrier Island (Aotea Island) and in the Marlborough Sounds, but not known from conservation land.
Passiflora mixta	Not known to be present on conservation land, confined to Waitakere Ranges.
Pennisetum purpureum	Present in Northland. May occur on conservation land but not identified by DOC staff.
Pennisetum setaceum	Cultivated grass, only observations are from cultivated plants in Wanganui and Coromandel.
Pinus taeda	Listed in Craw (2000)[b]. No observations on weeds database. May be present on conservation land but not identified by DOC staff. Not listed in the South Island wilding conifer strategy (Harding 2001[f]).
Potamogeton perfoliatus	Listed in Craw (2000)[b], but not known outside ornamental ponds in Otago and Christchurch.
Sagittaria montevidensis	Some control of this species done in Auckland by Auckland Regional Council, but there are currently no known sites on conservation land.

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SPECIES	JUSTIFICATION FOR REMOVAL
Salvinia molesta	Notifiable pest plant. There are currently no known sites on conservation land.
Schinus terebinthifolius	Not known to be established on conservation land. Certainly a potential species, recently naturalised and appears to be very widely cultivated.
Spartium junceum	Not known to be present on conservation land. Not uncommon in cultivation. There was a site on Great Barrier Island (Aotea Island), now believed to be eradicated (P. Brown, Department of Conservation, pers. comm. 2006).
Thunbergia grandiflora	Listed as a species yet to be included in Owen (1996)[a]. This species is not yet naturalised in New Zealand. This species is now on the unwanted organisms list.

[a] Owen, S.J. 1996: Ecological weeds on conservation land in New Zealand: a database. Department of Conservation, Wellington. 68 p.

[b] Craw, J. (Ed.) 2000: Weed manager: a guide to the identification, impacts and management of conservation weeds of New Zealand. Department of Conservation, Wellington. 242 p.

[c] Williams, P.A.; Timmins, S.M. 1990: Weeds in New Zealand protected natural areas: a review for the Department of Conservation. *Science & Research Series No. 14*. Department of Conservation, Wellington. 114 p.

[d] Timmins, S.M.; Williams, P.A. 1991: Weed numbers in New Zealand's forest and scrub reserves. *New Zealand Journal of Ecology 15*: 153–162.

[e] Heenan, P.B.; de Lange, P.J.; Cameron, E.K.; Champion, P.D. 2002: Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 1999–2000. *New Zealand Journal of Botany 40*: 155–174.

[f] Harding, M. 2001: South Island wilding conifer strategy. Department of Conservation, Canterbury Conservancy, Christchurch. 54 p.

Appendix 3

SPECIES THAT ARE PRESENT AND MAY BE CONTROLLED ON CONSERVATION LAND BUT HAVE LOW IMPACT

SPECIES	JUSTIFICATION
Aeonium haworthii	Not known to be controlled.
Agrostis stolonifera	Not known to be controlled.
Aleurites moluccana	Category C on Raoul Island, low impact. Probably cultivated in warmer parts of mainland New Zealand.
Allium vineale	Not known to be controlled.
Aloe saponaria	Not known to be controlled.
Alopecuris pratensis	Not known to be controlled.
Alstroemeria pulchella	Not known to be controlled.
Arrhenatherum elatius	Two quite distinctive subspecies, neither of which are controlled.
Araucaria heterophylla	Very common ornamental tree. Some control is carried out on Raoul Island, but it is not considered serious enough to warrant inclusion.
Citrus limon	Cultivation relic in places (e.g. Cuvier Island, not controlled)
Citrus medica	Some relic plants have been removed from Raoul Island but were not spreading by seed.
Citrus reticulata	Some relic plants have been removed from Raoul Island but were not spreading by seed.
Cymbalaria muralis	Very widespread weed of waste places. Controlled in Auckland Area, but of low impact.
Daucus carota	Widely distributed, controlled in some special circumstances but generally low impact.
Echium plantagineum	Not known to be controlled.
Entolasia marginata	Some control in Warkworth Area, low impact.
Epidendrum ibaguense	Considered to have minimal impact.
Eucalyptus botryoides	Not known to be controlled.
Eucalyptus globulus	Not known to be controlled.
Eucalyptus saligna	Not known to be controlled.
Ficus pumila	Not known to be controlled. Very common in cultivation, persists around old homesteads.
Foeniculum vulgare	Listed as category A on Raoul Island, but has low impact. Widespread weed of roadsides, little impact.
Fuchsia magellanica	Controlled in Rotorua Lakes Area, minimal impact.
Gladiolus undulatus	Controlled in Kaitaia Area, minimal impact.
Glechoma hederacea	Controlled in Raukapuka Area, low impact.
Gomphocarpus fruticosus	Listed as category A on Raoul Island, but has low impact. Widely cultivated throughout New Zealand. Low impact.
Helianthus tuberosus	Listed as a minor weed in Owen (1996)[a].
Hibiscus tilaceus	Controlled on Raoul Island. Category C. Relatively low impact.
Hieracium argillaceum	Listed in Craw (2000)[b], but this is really just a list of all *Hieracium* spp. in New Zealand. This species is not very common (Espie 2001[c]). DOC staff have historically not distinguished this species.
Hieracium murorum	Listed in Craw (2000)[b], but this is really just a list of all *Hieracium* spp. in New Zealand. This species is not very common (Espie 2001[c]). DOC staff have historically not distinguished this species.
Hieracium pollichae	Listed in Craw (2000)[b], but this is really just a list of all *Hieracium* spp. in New Zealand. This species is not very common (Espie 2001[c]). DOC staff have historically not distinguished this species.
Hieracium subaudum	Listed in Craw (2000)[b], but this is really just a list of all *Hieracium* spp. in New Zealand. This species is not very common (Espie 2001[c]). DOC staff have historically not distinguished this species.
Hieracium × *stoloniflorum*	Listed in Craw (2000)[b], but this is really just a list of all *Hieracium* spp. in New Zealand. This species is not very common (Espie 2001[c]). DOC staff have historically not distinguished this species.
Ligustrum vulgare	Usually cultivation only.
Lonicera nitida	Was controlled as a precaution in St Arnaud Village.
Lonicera × *americana*	Was controlled as a precaution in St Arnaud Village.

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SPECIES	JUSTIFICATION
Miscanthus sinensis	Was controlled as a precaution in St Arnaud Village.
Malus × domestica	Cultivation relic, not usually controlled.
Picea abies	Four sites in South Island wilding conifer strategy (Harding 2001[d]).
Picea stichensis	One site in South Island wilding conifer strategy (Harding 2001[d]).
Pinus coulteri	Listed in South Island wilding conifer strategy (Harding 2001[d]) but only one site, low impact.
Pinus unciniata	Listed in South Island wilding conifer strategy (Harding 2001[d]), one site, low impact.
Podranea ricasoliana	Sites on Maud Island, vegetative spread from cultivated plants. Not a big problem.
Populus nigra	Listed as category A on Raoul Island, but has low impact.
Prunus lusitanica	Recorded from S.E. coast of the South Island. May be controlled in some areas where it persists from cultivation, may be confused with *Prunus laurocerasus*, low impact.
Quercus robur	Listed in Timmins & Williams (1991)[e], considered a minor problem.
Ranunculus ficaria	Controlled in Raukapuka Area, low impact.
Ranunculus flammula	Controlled in Rangataiki, Rotorua Lakes and Tauranga Areas, low impact.
Ranunculus repens	Controlled in Rangataiki, Rotorua Lakes and Tauranga Areas, low Impact.
Ranunculus trichophyllus	Controlled in Rotorua Lakes Area, low impact.
Sedum album	Controlled in St Arnaud Village, but no observations on conservation land from this area, low impact.
Sequoia sempervirens	Listed in South Island wilding conifer strategy (Harding 2001[d]) one site, low impact.
Thuja plicata	Listed in South Island wilding conifer strategy (Harding 2001[d]) two sites, low impact.
Trifolium campestre	Category B weed on Raoul Island, low impact.
Vicia sativa	Raoul island, Category B. but low impact.
Viola odorata	Was controlled as a precaution at St Arnaud Village, low impact.

[a] Owen, S.J. 1996: Ecological weeds on conservation land in New Zealand: a database. Department of Conservation, Wellington. 68 p.

[b] Craw, J. (Ed.) 2000: Weed manager: a guide to the identification, impacts and management of conservation weeds of New Zealand. Department of Conservation, Wellington. 242 p.

[c] Espie, P. 2001: *Hieracium* in New Zealand: ecology and management. AgResearch Ltd, Lincoln. 66 p.

[d] Harding, M. 2001: South Island wilding conifer strategy. Department of Conservation, Canterbury Conservancy, Christchurch. 54 p.

[e] Timmins, S.M.; Williams, P.A. 1991: Weed numbers in New Zealand's forest and scrub reserves. *New Zealand Journal of Ecology 15*: 153–162.

Note: 'Area/s' in this table are DOC Conservancy Areas.

Appendix 4

SPECIES RECORDED AS ENVIRONMENTAL WEEDS FOR THE FIRST TIME

SPECIES	JUSTIFICATION
Abutilon darwinii × *pictum*	Persistent garden plant throughout. Controlled in Greymouth, Hokitika, Buller and Rotorua Lakes Areas.
Acacia sophorae	Recorded only from Wanganui. Very similar to *A. longifolia* so may be more widespread.
Acanthus mollis	Widespread garden plant that spreads easily. Controlled in Rangitaiki, Rotorua Lakes and Tauranga Areas.
Actinidia deliciosa	Widely cultivated horticultural crop. Spreads freely from cultivation, Northland to West Coast of South Island. Problem exacerbated by dumping of fruit and neglected orchards.
Ageratum houstonianum	Widely cultivated and sold, usually as a dwarf form. Weed-led control in Northland Conservancy.
Ajuga reptans	Recorded from Ruapehu, Nelson Lakes and Aoraki Areas. Some control carried out.
Akebia quinnata	Cultivated throughout, controlled in Northland and on the West Coast.
Alnus viridis	Widely planted in South Island high country. Not often recorded on database. Many plants at Craigieburn.
Angelica pachycarpa	Reasonably common around central New Zealand. Can cause problems in coastal situations.
Arctium minus	Widespread, controlled in Rotorua Lakes and Nelson Lakes Areas.
Asphodelus fistulosus	Present throughout New Zealand. Controlled on Wairau bar and on Nelson Boulder bank. Troublesome in coastal places.
Betula pendula	Very widely cultivated tree. Controlled in Nelson Lakes, Aoraki and Rotorua Lakes Areas.
Bidens frondosa	Common wetland plant, some control in Rangitaiki and Tauranga Areas.
Bromus catharticus	Widespread on Conservation land in Wanganui Conservancy.
Bryophyllum pinnatum	Significant populations on Raoul Island; Category B Weed.
Buddleja madagascariensis	Occasionally cultivated tree. Weed-led control programme in Whangarei Area.
Callistemon rigidus	Very widely cultivated, controlled in Kaitaia Area.
Carex lurida	Wetland species. Controlled in Rangitaiki, Rotorua Lakes, Tauranga and South Marlborough Areas.
Carex ovalis	Wetland species common throughout. Controlled in Rangitaiki, Rotorua Lakes and Tauranga Areas.
Carpobrotus chilensis	Field observations made by C. Howell and examination of some photos revealed that *C. chilensis* is more common than had been thought, and the two naturalised *Carpobrotus* species are virtually impossible to distinguish without flowers.
Citrus sinensis	Many seedlings and ongoing control on Raoul Island. Was not thought to be a problem in 1996, and the observed increase may be a response to the removal of rats.
Clematis maximowicziana	Recorded from Westport and several sites in Wanganui. Controlled near Westport.
Clematis montana	Widely cultivated, occasionally spreads into conservation land. Impact considered significant at some sites.
Cyperus eragrostis	Very common sedge of wet places in North Island. Controlled in Rotorua Lakes Area.
Dendrobenthamia capitata	Very common cultivated tree. Controlled in Rotorua Lakes and Tauranga Areas.
Dryopteris filix-mas	Commonly cultivated fern. Control carried out in Rotorua Lakes and Nelson Lakes Areas.
Elytrigia pycnantha	Naturalised in Bay of Plenty and controlled in Rangitaiki and Tauranga Areas.
Embothrium coccineum	Seedlings are common near adult plants. Controlled in Rotorua Lakes Area.
Erica arborea	Not as common as *E. lusitanica*, with which it is often confused. Controlled in Tauranga Area. Widely dispersed and forming dense patches in Orongorongo Valley, Poneke Area.
Erica baccans	Dominant scrub where established. Controlled on Great Barrier Island (Aotea Island).
Erica cafra	Controlled in Tauranga Area. Similar impacts to *E. lusitanica*.
Erica vagans	Controlled in Coastal Otago Area. Also removed from cultivation in St Arnaud Village as a precaution.
Eucalyptus delagatensis	One of many cultivated Eucalyptus species. Controlled in Coastal Otago Area, esp. Trotters Scenic Reserve.
Eupatorium cannabinum	Controlled in Wanganui. Occasionally naturalised elsewhere.
Fatsia japonica	Common plant in areas with high rainfall. Controlled in Rotorua Lakes and Tauranga Areas.
Festuca rubra	Common pasture plant, displaces native tussock species. Controlled in Nelson Lakes Area. Also present on Subantarctic Islands (Campbell Island/Motu Ihupuku, Auckland Islands, Antipodes Islands).
Fraxinus excelsior	Common large ornamental tree. Controlled in Waimakariri and Raukapuka Areas.

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SPECIES	JUSTIFICATION
Hakea suaveolens	Controlled in Whangarei Area.
Holcus lanatus	Very widespread grass. Control carried out in many areas, particularly in wetland situations.
Hydrangea macrophylla	Widely cultivated, often reverts to fertile form. Controlled in Kauri Coast, Rotorua Lakes, Tauranga and Golden Bay Areas.
Juncus gerardii	Controlled in wetlands in Coastal Otago Area.
Juncus microcephalus	Present in clear springs in Northland, Taupo, and Golden Bay. Controlled in Waikoropupu springs, Golden Bay.
Kennedia rubicunda	Known only from Northland. Controlled in Kaitaia, Kauri Coast, Bay of Islands and Whangarei Areas.
Laurus nobilis	Widely cultivated, spreads by seed and suckers. Controlled in Raukapuka and Nelson Lakes Areas.
Lavatera arborea	Widely distributed weed of waste places. Controlled in some places in Kaitaia and Sounds Areas.
Leymus racemosus	Control carried out in Southland.
Lilium formosanum	Cultivated lily that spreads freely, troublesome in coastal areas. Controlled in Rangitaiki Area.
Lilium tigrinum	Widely cultivated lily that spreads freely, especially on the west Coast. Controlled in Nelson Lakes Area.
Lophospermum erubescens	Weedy on Great Barrier Island (Aotea Island).
Ludwigia palustris	Widely distributed in wetlands, difficult to manage.
Muehlenbeckia australis	Indigenous scrambling vine, treated as a weed in Southland.
Myricarica germanica	Naturalised and controlled in Waimakariri Area.
Nardus stricta	Widespread mat-forming grass in upland areas. Displaces native tussocks. North, South and Chatham Islands.
Nerium oleander	Controlled on Raoul Island. Was considered low priority by West (1996)[a].
Nymphaea alba	Very popular waterlily. Controlled in some situations in Rotorua Lakes Area. Also established populations on the West Coast.
Nymphaea mexicana	Uncommon waterlily controlled in Rotorua Lakes Area.
Ochna serrulata	Climbing plant, known only from Northland. Controlled in Kauri Coast, Kaitaia, Bay of Islands and Whangarei Areas.
Opuntia monacantha	The most widespread of the *Opuntia* species in New Zealand. Controlled on Great Barrier Island (Aotea Island).
Osteospermum fruticosum	Widespread coastal plant. Controlled on Great Barrier Island (Aotea Island) and in Auckland Area.
Paspalum vaginatum	Marginal saline-tolerant grass with increasing distribution. Controlled on Great Barrier Island (Aotea Island) and in Warkworth Area.
Passiflora tarminiana	Widespread and invasive. This species was recently described and is assigned to material previously identified as *P. mixta*.
Physalis peruviana	Very widely cultivated plant. Widely naturalised but of little conservation impact. Some control carried out in Rangitaiki, Rotorua Lakes and Tauranga Areas.
Plantago coronopus	Central and Coastal Otago Areas.
Podalyria sericea	Weed-led control in Wellington Conservancy.
Polygonum capitatum	Controlled in Rotorua Lakes and Tauranga Areas
Prunus ceracifera	Widely cultivated. Controlled in St Arnaud Village.
Prunus persica	Causing problems on Raoul Island. Category C.
Prunus × *domestica*	Widely cultivated, controlled in North Canterbury.
Pyracantha crenatoserrata	Widely cultivated, controlled in St Arnaud Village. Likely to be more widespread as it is confused with *P. angustifolia*.
Ribes uva-crispa	Weedy shrub in cold dry areas, e.g. Molesworth. Controlled in Nelson Lakes and Aoraki Areas.
Ricinus communis	Controlled in Tauranga and Rangitaiki Areas and on Raoul Island.
Roldana petasitis	Widely cultivated ornamental shrub, spreads freely. Controlled in Warkworth, Rangataiki, Rotorua Lakes and Tauranga Areas.
Rubus idaeus	Cultivated for edible fruits. Can become troublesome, controlled in Nelson Lakes and Aoraki Areas.
Rubus phenocolasius	Can be distinguished from *R. fruticosus*, not as common, but troublesome where it occurs. Controlled in Rotorua Lakes and Tauranga Areas.
Senecio glastifolius	Oversight that it had not been included earlier, especially as it appears as the cover photograph of Williams (1997)[b].
Solanum dulcamara	Common weed, especially in colder places. Controlled in Wakatipu and Wanaka Areas.

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SPECIES	JUSTIFICATION
Sorbaria tomentosa	Controlled in Wakatipu Area.
Spiraea japonica	Weedy from Hokitika to Franz Josef.
Thymus vulgaris	Widespread and common weed in Central Otago.
Tropaeolum pentaphyllum	Cultivated, controlled in Gisborne Area.
Ugni molinae	Very widespread and significant impact on Chatham Islands. Occasionally cultivated on main New Zealand Islands.
Urochloa mutica	Category A weed on Raoul Island. Control still being carried out.
Vitis vinifera	Grape is a category C weed on Raoul Island. Not known to spread far from cultivation. Also recorded as controlled in Kauri Coast Area.
Wisteria sinensis	Widely cultivated ornamental climber. Controlled in Rangitaiki and Rotorua Lakes Areas.

[a] West, C.J. 1996: Assessment of the weed control programme on Raoul Island, Kermadec Group. *Science & Research Series No. 98*. Department of Conservation, Wellington. 100 p.

[b] Williams, P.A. 1997: Ecology and management of invasive weeds. *Conservation Sciences Publication 7*. Department of Conservation, Wellington. 67 p.

Note: 'Area/s' in this table are DOC Conservancy Areas.

Appendix 5

TAXONOMIC PROBLEMS OF RELEVANCE TO THE CONSOLIDATED LIST

SPECIES	EXPLANATION
Agrostis capillaris and *A. stolonifera*	These two species are very similar and there is considerable variation.
Canna indica and *Canna* × *generalis*	Many plants are cultivation escapes of *C.* × *generalis*. Selective breeding has resulted in a wide variety of forms.
Carpobrotus edulis and *C. chilensis*	These two species can only be distinguished when flowering and it appears that *C. chilensis* is more common than previously thought. An image of *C. chilensis* was labelled *C. edulis* in Common weeds of New Zealand (Roy et al. 1998[a]). This has been corrected in the second edition of the book (Roy et al. 2004[b]).
Cestrum elegans and *C. fasiculatum*	These two species are both known as red cestrum.
Clematis tangutica and *C. tibetiana*	Both species are naturalised in Central Otago but most wild specimens can be ascribed to *C. tibetana* (Webb et al. 1995[b]).
Cotoneaster pannosus and *C. franchetii*	*Cotoneaster pannosus* has been confused with *C. franchetii* (Ogle & Sykes 2003[b]) and the former may be underestimated in its distribution and impact.
Glyceria declinata and *G. fluitans*	Most records have been ascribed to *G. fluitans*, but *G. declinata* may be more common than initially thought.
Juncus acuminatus and *J. microcephalus*	Both of these species have been recorded as potential weeds (Owen 1996[e]); but have been frequently confused with *J. articulatus*, which is listed on other lists.
Passiflora tripartita, *P. tarmininiana* and *P. mixta*	Identification to species within the sub-genus Tacsonia has been very confused. In Flora IV, Webb et al. (1988)[f] described four species and a hybrid. The genus has recently been revised and a new species (*P. tarminiana*) described (Coppens d'Eeckenbrugge et al. 2001[g]). In New Zealand, this most closely fits material previously ascribed to *P. mixta* (Heenan & Sykes 2003[h]). *Passiflora mixta* is still present in New Zealand, but is much more restricted than previously thought. *Passiflora mollissima* is now considered a synonym of *P. tripartita* var. *mollissima*.
Pyracantha angustifolia and *P. crenatoserrata*	*Pyracantha angustifolia* has been consistently recorded as weedy, but also common is *P. crenatoserrata* and this species may have been under-recorded. The image published in the first edition of the weed manager (Craw 2000[i])is *P. crenatoserrata*.
Rubus fruticosus	This name is in common usage for most blackberry species in New Zealand. Only the list from Williams et al. (2002)[j] separates these into micro-species. In some cases the micro-species are very difficult to identify confidently and even those familiar with *Rubus* spp. require many characters for accurate identification (Webb et al. 1988[f]). All the micro-species are weedy, and clarification would really only be useful for DOC staff if control techniques were different for the micro-species. At this stage lists should continue to refer to *Rubus fruticosus* agg.
Solanum pseudocapsicum and *S. diflorum*	These two species are very similar and different authors tend to ascribe specimens to one or other of the species.
Vitis vinifera	This is probably not *Vitis vinifera* sens. strict. The naturalised material is probably hybrids and subsequent cultivated varieties of *V. vinifera* and *V. labrusca* (Webb et al. 1988[f]).

[a] Roy, B.; Popay, I.; Champion, P.; James, T.; Rahman, A. 1998: An illustrated guide to common weeds of New Zealand. New Zealand Plant Protection Society, Canterbury. 282 p.

[b] Roy, B.; Popay, I.; Champion, P.; James, T.; Rahman, A. 2004: An illustrated guide to common weeds of New Zealand, New Zealand Plant Protection Society, Lincoln. 314 p.

[c] Webb, C.J.; Sykes, W.R.; Garnock-Jones, P.J.; Brownsey, P.J. 1995: Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 1988–1993. *New Zealand Journal of Botany 33*: 151–182.

[d] Ogle, C.; Sykes, B. 2003: *Cotoneaster pannosus* as an adventive plant in New Zealand. *New Zealand Botanical Society Newsletter 73*: 9–11.

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Appendix 5 footnotes continued from previous page

[e] Owen, S.J. 1996: Ecological weeds on conservation land in New Zealand: a database. Department of Conservation, Wellington. 68 p.

[f] Webb, C.J.; Sykes, W.R.; Garnock-Jones, P.J. 1988: Flora of New Zealand Volume IV; naturalised Pteridophytes, Gymnosperms, Dicotyledons. DSIR, Botany Division, Christchurch. 1365 p.

[g] Coppens d'Eeckenbrugge, G.; Barney, V.E.; Jorgensen, P.M.; MacDougal, J.M. 2001: *Passiflora tarminiana*, a new cultivated species of Passiflora subgenus *Tacsonia* (Passifloraceae). *Novon 11*: 8–15.

[h] Heenan, P.B.; Sykes, B. 2003: *Passiflora* (Passifloraceae) in New Zealand: a revised key with notes on distribution. *New Zealand Journal of Botany 41*: 217–221.

[i] Craw, J. (Ed.) 2000: Weed manager: a guide to the identification, impacts and management of conservation weeds of New Zealand. Department of Conservation, Wellington. 242 p.

[j] Williams, P.A.; Wilton, A.; Spencer, N. 2002: A proposed conservation weed risk assessment system for the New Zealand border. *Science for Conservation 209*. Department of Conservation, Wellington. 47 p.

Appendix 6

SUBSPECIFIC RANKS OF RELEVANCE TO THE CONSOLIDATED LIST

SPECIES	DETAILS
Bryonia cretica	All wild material in New Zealand is referable to *B. cretica* subsp. *dioica*.
Chrysanthemoides monilifera	All material in New Zealand is subspecies *monilifera* (boneseed). The other subspecies, *rotundata* (bitou bush), is not known from New Zealand.
Lantana camara	The variety 'aculeata' is most commonly wild; other varieties are present in New Zealand, but not usually considered invasive.
Olea europaea	Most of the weedy plants are *Olea europaea* subsp. *cuspidata*, (has been known as *O. africana* and *O. europaea* subsp. *africana*). More recently, numerous records of *Olea europaea* subsp. *europaea* have been collected (Heenan et al. 1999[a]).
Passiflora tripartita	Both subspecies *mollissima* and subspecies *azuarensis* are present in New Zealand.
Pinus contorta	There is considerable variation in wild material. Subspecies *contorta*, *latifolia* and *murrayana* have been used but they are very hard to confidently distinguish.
Pinus nigra	The two subspecies *nigra* and *laricio* are both present and naturalised but inter-grade so are troublesome to separate confidently.
Zantedeschia aethiopica	This includes both the standard white flowered variety and variety 'green goddess'.

[a] Heenan, P.B.; de Lange, P.J.; Glenny, D.S.; Breitwieser, I.; Brownsey, P.J.; Ogle, C.C. 1999: Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 1997–1998. *New Zealand Journal of Botany 37*: 629–642.

Appendix 7

HYBRIDS OF RELEVANCE TO THE CONSOLIDATED LIST

SPECIES	DETAILS
Abutilon darwinii × *pictum*	Garden hybrid of *A. darwinii* and *A. pictum*. Most cultivars referred to as *A.* × *hybridum*. Can set viable seed.
Carpobrotus edulis and *C. chilensis*	Both these species hybridise with the native species *Disphyma australe* (Chinnock 1972)[a]. While not yet recorded, the resultant hybrids are almost certainly present on conservation land.
Crocosmia × *crocosmiiflora*	A hybrid of *C. aurea* and C. *pottsii*, forms self sustaining populations, spreads by corms.
Elaeagnus × *reflexa*	Probably a hybrid of *E. pungens* and *E. glabra*, forms self-sustaining populations, although fruit are rare.
Erythrina × *sykesii*	Probably a hybrid of *E. coralloides* and *E. lystemon*. *Erythrina* × *sykesii* is sterile but spreads via root suckers and cut material.
Hieracium × *stoloniflorum*	Hybrid of *H. pilosella* and *H. aurantiacum*. Reported to be common (Espie 2001)[b], but not recorded by DOC staff.
Lonicera × *americana*	A hybrid of *L. caprifolium* and *L. etrusca*; forms self-sustaining populations.
Prunus × *domestica*	Plums are cultivated hybrids of *P. divaricata* and *P. spinosa*. Grow spontaneously from seed.
Spartina × *townsendii*	This a sterile hybrid of *S. alterniflora* and *S. maritima* that then produced *S. anglica* by chromosome doubling.
Ulmus × *hollandica*	Possibly a triple hybrid of *U. carpinifolia* × *U. glabra* × *U. plottii*. Suckers extensively and forms self sustaining populations.

[a] Chinnock, R.J. 1972: Natural hybrids between *Disphyma* and *Carpobrotus* (Aizoaceae) in New Zealand. *New Zealand Journal of Botany 10*: 615–626.

[b] Espie, P. 2001: *Hieracium* in New Zealand: ecology and management. AgResearch Ltd., Lincoln. 66 p.