Testing the weed risk assessment system for new conservation weeds in New Zealand

DOC RESEARCH & DEVELOPMENT SERIES 225

Peter A. Williams, Jonathon Boow, Graeme La Cock, and George Wilson

Published by
Science & Technical Publishing
Department of Conservation
PO Box 10-420
Wellington, New Zealand

DOC Research & Development Series is a published record of scientific research carried out, or advice given, by Department of Conservation staff or external contractors funded by DOC. It comprises reports and short communications that are peer-reviewed.
Individual contributions to the series are first released on the departmental website in pdf form. Hardcopy is printed, bound, and distributed at regular intervals. Titles are also listed in our catalogue on the website, refer www.doc.govt.nz under Publications, then Science and research.

ISSN 1176-8886
ISBN 0-478-14041-X

This report was prepared for publication by Science & Technical Publishing Section; editing and layout by Geoff Gregory. Publication was approved by the Chief Scientist (Research, Development & Improvement Division), Department of Conservation, Wellington, New Zealand.

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Peter A. Williams,[1] Jonathon Boow,[2] Graeme La Cock,[3] and George Wilson[2]

[1]Landcare Research, Private Bag 6, Nelson, New Zealand

[2]Department of Conservation, Private Bag, Auckland, New Zealand

[3]Department of Conservation, Private Bag 3016, Wanganui, New Zealand

ABSTRACT

New species of weeds are appearing on conservation land in New Zealand at such a rate that the Department of Conservation (DOC) does not have the resources to control them all. This report aimed to test and improve the weed risk assessment system for new conservation weeds (NCWR Version 1) invading woody vegetation by using it outside the Nelson/Marlborough conservancy where it was developed. These comparisons and modifications were undertaken after applying the system to weeds in the Auckland and Wanganui Conservancies. It was then re-tested against the Nelson/Marlborough species originally used to develop it. The resulting modified system, NCWR Version 2, produced rankings for weed risk that were more closely correlated with intuitive rankings by independent weed risk experts than those of the original version. NCWR Version 2 is likely to produce priority rankings similar to those that would be produced by experts in other regions of New Zealand. It can be applied to any region of New Zealand with broadly similar invading species and environments.

Keywords: weed risk assessment, ranking, new conservation weeds, New Zealand

Williams, P.A.; Boow, J.; La Cock, G.; Wilson, G. 2005: Testing the weed risk assessment system for new conservation weeds in New Zealand. *DOC Research & Development Series 225*. Department of Conservation, Wellington. 19 p.

1. Introduction

The process of weed invasion can be divided into four phases: entry, naturalisation, spread, and impact. New Zealand has a large pool of naturalised plant species, some of which will spread and be perceived by Department of Conservation (DOC) staff as requiring control, i.e. conservation weeds (termed weeds hereafter). We need to identify which species will be weedy *before* they have demonstrated their potential to have an impact (Williams 1997), and which species will be practicable to control, so we can prioritise them for early control.

The science of weed risk assessment is still in its infancy (Anderson et al. 2004), but several authors in Groves et al. (2001) have presented the background to the practice. Several weed risk assessment systems that aim to predict weediness of species that have not yet arrived in a country (reviewed in Williams & Newfield 2002) and systems that rank well-established weeds (reviewed in Williams & Newfield 2002) have been developed. Less attention has been directed towards ranking species that have naturalised only recently or that have only just begun to spread after a long lag-phase. However, a system focusing on the potential to control a species, as being the primary determinant of whether to undertake control, was developed by Panetta & Timmins (2004). Recently, a prototype 'new conservation weed risk assessment system' (NCWR assessment system) for potentially invasive naturalised species was developed by Williams & Newfield (2002).

The NCWR system recognises that the major threat from new weeds comes from within New Zealand's borders—from species already here—especially from garden plants, in places close to towns (Sullivan et al. 2005). This is not a system for prioritising all species in all places DOC may be controlling weeds; rather, it aims to prioritise only species of restricted distribution and low abundance, especially those not yet controlled. In some cases these may not yet appear on the DOC weeds database. Because the rank order of the species priority for control might differ in environments as diverse as, for example, Northland forests and Canterbury tussock grasslands, the NCWR system was developed originally for woody vegetation, with the thought of modifying it for other systems if there was a need. The NCWR score system was weighted so that recent invasions have relatively high scores, because these will tend to be the easiest to control. The system was originally designed for primarily bird-dispersed climbers and woody plants in the Nelson/Marlborough region, so that it was in approximate agreement with the authors' own assessment of priority species in the region at the time (Williams & Newfield 2002).

Because the weed rankings in the original NCWR system were based solely on the combined knowledge of the authors, and dealt with species found in one region, the system needed to be tested for species invading primarily woody vegetation in a different part of the country. It also needed to be tested for practicality for use by DOC staff unfamiliar with the system. This report deals with these efforts to widen the scope and utility of the weed risk system.

In addition, we made preliminary comparisons between the NCWR system and the expert opinion of a botanist in Canterbury as to the weediness of species recently naturalized (e.g. Heenan et al. 1999, 2002) in primarily non-woody vegetation in eastern South Island.

2. Aims

This report aims to test the 'new conservation weed risk assessment system' (NCWR assessment system), developed for woody vegetation, outside of the Nelson/ Marlborough Conservancy where it originated. The second part of the testing process was to determine whether it could be used for DOC planning processes, in the opinion of DOC staff entirely unfamiliar with the scheme. The third aim was to improve the system in the light of both these tests.

3. Methods

Weed risk assessment systems should provide results that approximate the ranking of weeds within an area based on expert knowledge of the weeds in that area (Hiebert 1997; Pheloung et al. 1999; Daehler et al. in press). In other words, the outcomes from any system must be generally in accordance with existing knowledge and understanding if the system is to gain acceptance and be applied. This approach captures all knowledge of the weeds of an area and formalises it within a system that is systematic, repeatable, and applicable to new species as they emerge. This was the approach used to develop the scheme (Williams & Newfield 2002), and we repeated it here, but involved the staff of two DOC conservancies who had not previously used the system.

We first compiled a list of 14 plant species recently recognised as potential weeds in woody vegetation in the Wanganui Conservancy, in consultation with Colin Ogle, a botanist with a particular interest in new plant naturalisations. None of the 14 species yet appear in the Wanganui Conservancy Weed Management Strategy. Species were ranked intuitively into 5 priority classes (1–5) by one of us (Graeme La Cock in consultation with Colin Ogle) based largely on perceived potential for further spread, and without reference to the NCWR system. The practicality of controlling them was largely ignored in this process, so that the relative rank reflects their perceived threat, and should be related to the *combined risk score* of the NCWR system (Appendices 1 and 2). We then scored these species using the original NCWR system, hereafter referred to as Version 1, without reference to the intuitive ranks.

The second part of the testing process was to determine whether Version 1 was practicable for DOC staff and whether it had utility for DOC weed control planning. We compiled a list of 12 plant species recently recognised as having

weed potential in woody vegetation in the Auckland Conservancy, in consultation with Ewen Cameron, botanist of the Auckland Museum. Two of us (J.B., G.W.), with guidance from P.A.W., then scored the species in Version 1 while noting parts of the system that were difficult to understand or unnecessarily complex. We then amended the system to overcome these problems, so creating Version 2. However, relatively few species were used for this part of the study because most weed-led control effort in the Auckland Conservancy is undertaken on offshore islands, reflecting the role undertaken by the Auckland Regional Council in controlling new naturalisations across the Auckland region as a whole.

The original Nelson/Marlborough species and the Wanganui species were scored using Version 2, and the rankings were compared, using Spearman's correlation coefficient corrected for ties.

We had originally intended to modify Version 1 specifically to deal with new weeds of non-woody vegetation but there were too few of these in one region to do so. Nevertheless we scored a short list of species ranging from succulents (*Sedum dasyphyllum*) to shrubs (e.g. green alder, thyme) using Version 2 and compared their ranks with those provided to us by Peter Heenan (Landcare Research), an expert on non-woody plants.

Common names are used in the text and tables, with scientific names in Appendix 3.

4. Results

Rather than present the results in the order the work was undertaken, for clarity's sake the changes are presented first and the rankings then compared.

4.1 CHANGES TO VERSION 1

The first section in Version 1 concerns weed history elsewhere in the world. This is valuable to know if a species has not arrived in the country. However, as Version 2 is to be used only for naturalised species already showing signs of being weedy in New Zealand, their weed history elsewhere will be less critical. This section was therefore removed. Section 5 on whether or not control techniques are available was also removed because this is largely a function of resources.

Where there was simply ambiguity that did not require changes to the scoring, such as what is meant by *cryptic* (D 3.4), clarity has been improved in the notes accompanying Version 2 (Appendix 2). Other changes involving the scoring system are summarised in Table 1.

No changes were made to the section dealing with public attitudes.

TABLE 1. THE ORIGINAL QUESTIONS AND NUMBERS IN VERSION 1 (TABLE 2 OF WILLIAMS & NEWFIELD 2002), THE CHANGES TO THESE QUESTIONS AND THEIR NEW NUMBERS IN VERSION 2, AND THE RATIONALE FOR THE CHANGE.

VERSION 1	VERSION 2	RATIONALE FOR CHANGE
A 2.1. Volume (m^3) of individual plants	A1. One category (<10) removed and maximum score decreased by 1	Very small plant species not important as individuals in forest systems
A 2.2. Totally pre-empts sites	A2. Maximum score increased by 1	A very important component of impact
B. Communities potentially invaded	This section removed in Version 2	Too complex, given the uncertainty of invasion trajectories.
C 3.1. 10 – (naturalisation decade minus decade became DOC weed)	B1. 10 – naturalisation decade	Too complex. The current increasing awareness of environmental weeds skews the score in favour of the most recent naturalisations.

The changes reduce the system to 13 questions divided into three groups (A–C) that are combined to produce the *combined risk score*. A fourth set (D) produces the *public attitude score,* reflecting the amount of effort required to educate or convince people to control the weed. In Version 1, these two scores, *combined risk score* and *public attitude score*, were added together to produce a *Total score*. This is not done in Version 2, so the risk of a species impacting on the environment is not confounded by the ability to manage the risk. Persuading people to remove plants or stop selling them is risk management rather than risk assessment.

The score sheet and two examples are in Appendix 1, and a guide to the questions in Appendix 2. A spreadsheet of the scoring system for Version 2 and all the scores used in this analysis is available from DOC Head Office, as 'NCWR assessment system 2.xls'.

4.2 COMPARATIVE RANKINGS

This section explains the rankings achieved by Version 2, compared with those of Version 1, beginning with the results from Auckland, then giving results from Wanganui, and finally the effects of the changes to rankings of the Nelson/ Marlborough species used to design the system originally. Several species are common to two regions but their rankings should not be expected to be the same throughout New Zealand.

4.2.1 Auckland

The *combined risk scores* are in approximately the same order for Version 1 and Version 2 (r_s= 0.82, $P < 0.01$), but the spread of score is greater in Version 2, namely 48–208 versus 40–144 (Table 2). As a consequence, no two species have the same rank.

Climbing spindleberry, coastal banksia, and two palms, have the highest-ranking *combined risk scores,* with only 16 points between them (192–208).

TABLE 2. COMBINED RISK SCORES AND THEIR RANKS, FOR SPECIES FROM AUCKLAND CONSERVANCY, GENERATED BY NCWR VERSION 1 AND VERSION 2.

SPECIES	VERSION 1		VERSION 2	
	Combined risk score	Rank	Combined risk score	Rank
Climbing spindleberry	144	1	200	2
Queen palm	128	2	208	1
Bangalow palm	112	3	192	3
Queensland poplar	91	4	90	9
Coastal banksia	88	5	160	4
Moreton Bay fig	80	6=	152	6
Port Jackson fig	80	6=	144	7
Olive	77	8	126	8
Brush cherry	72	9	153	5
Ivy	54	10	54	11
Buttercup bush	44	11	48	12
Queen of the night	40	12	76	10

Coastal banksia and palms have been identified only recently as weeds of major concern (Cameron 2000a, b).

4.2.2 Wanganui

The *combined risk scores* are in similar order for Version 1 and Version 2 (r_s = 0.699, $P < 0.01$) (Table 3). The spread of scores is higher in Version 1 than for Version 2, namely 60–171 versus 40–108. This was due to a very high score (171) for Queensland poplar in Question C3.1 of Version 1, because of its very recent naturalisation and recent status as a weed. As a result of changing this question in Version 2 to give less emphasis to its recent weed status, as shown in

TABLE 3. COMBINED RISK SCORES AND THEIR RANKS FOR SPECIES FROM WANGANUI CONSERVANCY GENERATED BY NCWR VERSION 1, COMPARED WITH SCORES AND RANKS FROM VERSION 2, AND THE INTUITIVE RANK CLASS.

SPECIES	VERSION 1		VERSION 2		INTUITIVE
	Combined risk score	Rank	Combined risk score	Rank	RANK CLASS
Queensland poplar	171	1	102	2	1
Silver birch	108	2=	108	1	1
Cotoneaster lacteus	108	2=	78	4	1
Coastal tea tree	105	4	63	6	2
Cedar wattle	100	5	60	7	5
Tree of heaven	95	6=	56	9=	5
Chilean fire bush	95	6=	56	9=	3
Asparagus fern	92	8	54	11	2
Buddleja dysophylla	90	9	52	12	3
Chinese wisteria	84	10	72	5	1
Fatsia	80	11	45	13	3
Mile-a-minute	77	12	88	3	1
Bomarea	66	13	44	14	5
Himalayan giant lily	60	14	40	15	2

Table 1, a much lower score (102) was generated for Queensland poplar. Only two species are ranked equal in Version 2. The correlation between the *combined risk scores* and the *intuitive rank* is not significant for Version 1 (r_s = –0.283, $P > 0.05$), and significant for Version 2 (r_s = –0.698, $P < 0.01$).

Three of five species with the highest *intuitive ranks* (i.e. 1), mile-a-minute, Queensland poplar, and *Cotoneaster lacteus*, are categorised as the top-priority species for control when considered together with the *public attitude score* (Table 4). Silver birch also has an intuitive rank of 1, and a high *combined risk score,* but is marked down (i.e. further to the right in Table 4) because of probable public resistance to accepting the weed potential of these popular trees. No species in this conservancy scored a 5 because none is a commercial species. None of these species is currently in a 'weed-led' control programme because only species at the earliest invasion stage were selected for the test.

TABLE 4. WANGANUI CONSERVANCY SPECIES SCORED BY NCWR VERSION 2, GROUPED INTO FOUR CLASSES OF PUBLIC ATTITUDE SCORES (COLUMNS) AND RANKED FROM HIGHEST TO LOWEST COMBINED RISK SCORES (ROWS).

Public attitude score[a]	1	2	3	4
Combined risk score[b]				
101–125	Queensland poplar[c]		Silver birch[c]	
76–100	Mile-a-minute[c]			
	Cotoneaster lacteus[c]			
51–75	Cedar wattle		Tree of heaven	Coastal tea tree
	Asparagus fern			Chilean fire bush
	Buddleja dysophylla			Chinese wisteria[c]
0–50			Bomarea	Fatsia
				Himalayan giant lily

[a] The higher the public attitudes score, the greater the propagule pressure from plantings, and the greater the effort required to educate people to take responsibility for their plantings.

[b] Species towards the top left of the table are the most likely candidates for a weed-led control, those towards the bottom right are the least likely. The species scores and positions are applicable for the Wanganui Conservancy area only.

[c] The five top priority species from the intuitive ranking of risk.

Note: there is no fifth column as in Table 6 because no species is a commercial crop.

4.2.3 Nelson/Marlborough

The *combined risk scores* are in very similar order for Version 1 and Version 2 (r_s = 0.966, $P < 0.001$) (Table 5). The spread of scores is marginally wider for Version 2, namely 30–176 versus 40–171. Four species are ranked equal in Version 1 and two species in Version 2. Moreover, such pairs are not in the upper rankings, where separation is more important, as there are in Version 1. As the *intuitive rank* of these species was used when calibrating the system originally (Williams & Newfield 2002), no correlation between independent ranks is possible.

Version 2 places two species (climbing spindleberry, evergreen buckthorn) of four in the upper quartile scores from Version 1 (equivalent to the *intuitive* rank), in the top category for control, when considered together with the *public attitude score* (Table 6). Boneseed is given currently much higher

TABLE 5. COMBINED RISK SCORES, AND THEIR RANKS, FOR SPECIES FROM THE NELSON/MARLBOROUGH CONSERVANCY GENERATED BY VERSION 1, COMPARED WITH SCORES AND RANKS GENERATED BY VERSION 2.

SPECIES	VERSION 1		VERSION 2	
	Combined risk score	Rank	Combined risk score	Rank
Monkey apple	171	1	171	2
Cascara sagradra	161	2=	168	3
Evergreen buckthorn[a]	161	2=	161	4
Climbing spindleberry[a]	147	4=	176	1
Kiwi fruit	147	4=	154	5
Strawberry dogwood	144	6	135	6
Madeira vine[a]	120	7	104	9
Elaeagnus	119	8	112	7
Climbing asparagus	114	9	95	11
Banana passion vine	112	10	98	10
Darwin's barberry	105	11	105	8
Rowan	104	12	88	13=
Italian jasmine	96	13	90	12
Jasmine	96	14	88	13=
Smilax	90	15	68	16
Cotoneaster microphyllus	85	16	64	18
Spindleberry	75	17	76	15
Woolly nightshade	70	18	56	19
Boneseed[a]	66	19	66	17
Chinese privet	60	20	52	20
Gooseberry	40	21	30	21

[a] Species currently forming part of the 'weed-led' programme in the region (M. Newfield pers. comm.).

TABLE 6. NELSON/MARLBOROUGH SPECIES FROM TABLE 5, GROUPED INTO FIVE CLASSES OF PUBLIC ATTITUDE SCORES (COLUMNS), AND RANKED FROM HIGHEST TO LOWEST COMBINED RISK SCORES (ROWS).

Public attitude score[a]	1	2	3	4	5
Combined risk score[b]					
> 175					
150–175	Climbing spindleberry,[c]↑ Evergreen buckthorn[c]	Cascara sagrada	Monkey apple		
126–150				Strawberry dogwood	Kiwifruit↑
101–125	Madeira vine,[c] ↓ Elaeagnus, Climbing asparagus	Darwin's barberry		Rowan	
76–100	Cotoneaster, ↓ Smilax ↓	Woolly nightshade↓	Italian jasmine, Jasmine	Spindleberry	
51–75	Boneseed[c]	Chinese privet ↓			
0–50				Gooseberry	

[a] The higher the public attitudes score, the greater the propagule pressure from plantings, and the greater the effort required to educate people to take responsibility for their plantings.

[b] Species towards the top left of the table are the most likely candidates for weed-led control; those towards the bottom right are the least likely. Scores are in their original positions for Version 1, and arrows indicate their having moved up or down a category for Version 2.

[c] Species currently forming part of the 'weed-led' programme in all or part of the Nelson/Marlborough region (M. Newfield pers. comm.).

priority by DOC, in a weed-led programme in the Marlborough Sounds, than is suggested might be appropriate simply by the combined risk score in Table 5. However, this applies to its invasion stage in the region, whereas in other parts of the Nelson/Marlborough region it has been naturalised for a long time, and regional extermination could not be achieved with chemical and manual control.

4.2.4 Canterbury

The few newly invasive species in Canterbury (Table 7) are morphologically diverse, ranging from small succulents (*Sedum dasyphyllum*) to shrubs (e.g. green alder, thyme). Green alder has the highest risk score because of its recent naturalisation and potentially smothering growth, although in fact it does not appear to be spreading by seed (Webb et al. 1988). Euryops has the next highest score, which concurs with the opinion of P. Heenan (Landcare Research, Lincoln), as do those species with scores below 51 (Table 7). Note that two species, green alder and thyme, fall into public attitudes score category 6, because unlike any Wanganui or Nelson/Marlborough species in Tables 4 and 6, they are both widely planted. This largely excludes them as targets for extermination despite their relatively high-risk score. None of these species is the subject of species-led control operations by DOC in Canterbury.

TABLE 7. SOME CANTERBURY WEEDS WITH RESTRICTED DISTRIBUTIONS GROUPED INTO SIX CLASSES OF PUBLIC ATTITUDE SCORES (COLUMNS), AND RANKED FROM HIGHEST TO LOWEST COMBINED RISK SCORES (ROWS).

Public attitude score	1	2	3	4	5	6
Combined risk score						
126–150						Green alder
101–125						
76–100		Euryops				
51–75	False tamarisk			Bell heather	Dyer's greenweed	Thyme
0–50	Sedum		Baccharis			
	Collomia					

5. Discussion and conclusions

This report aimed to test and improve a weed risk assessment system for new weeds invading woody vegetation by using it outside of the Nelson/Marlborough Conservancy where it was developed. These comparisons and modifications were undertaken after applying the system to species in the Auckland and Wanganui Conservancies; it was then re-tested with the species originally used to develop it.

The outcome was a less complex system; NCWR Version 2 gave very similar rankings to the original Version 1, but, advantageously, it tends to spread rankings more widely. Version 2 was better at 'correctly' identifying the species of highest priority in Wanganui, as determined by experts independent of the

system. It gave slightly less ambiguous results when applied to the original species in Nelson/Marlborough, and species currently undergoing weed-led control were identified as having the highest priority.

In conclusion, NCWR Version 2 is more likely than Version 1 to produce priority rankings similar to those that would be produced by experts familiar with the species, and it is simpler to use.

DOC staff preparing weed management strategies are recommended to include the NCWR Version 2 system as part of the process and report back any improvements that need to be made to the system. They might find it advantageous to use the system in any review of weed-led control programmes and plans.

6. Acknowledgements

This report was prepared by Landcare Research for the Department of Conservation as Science Investigation No. 3368. Thanks to Colin Ogle for assistance in ranking the Wanganui species, Peter Heenan with Canterbury species, Margaret Stanley, Duane Peltzer and Guy Forrester for comments, Anne Austin for editorial assistance, and Jemma Callaghan for typesetting.

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Appendix 1

NCWR VERSION 2 SCORES FOR TWO SPECIES IN THE EARLY STAGES OF INVASION

The example scores are for Chinese privet (*Ligustrum sinense*) and climbing spindleberry (*Celastrus orbiculatus*) in the Nelson/Marlborough region. Numbers in parentheses are weightings; for other details of the scores see Appendix 2.

		POINTS	SPECIES SCORE(S) EXAMPLES	
			Chinese privet	climbing spindleberry
A. Interactions				
1	Volume of individual plant m^3: 10, 100, 1000, 10 000	1 to 4	2	3
2	Totally pre-empts sites, or covers native species to form canopy	2 or 0	0	2
3	Growth appears faster than associated native species	1 or 0	0	0
4	Species persists: < 5 years, 5–20 years, > 20 years	1 to 3	2	3
	Impact score (Sum A1–4)		4	8
B. Invasion stage				
1	10 - (naturalisation decade)	10 to 0	4	8
2	Recently (< 5 yrs) recognised as weed	2 or 0	0	2
3	No./size infestations: one small (8), several small/single large (4), numerous small (2), numerous large (0)	8 to 0	0	4
C. Reproduction				
1	Species cryptic and cannot be detected before it reproduces	1 or 0	1	0
2	Produces viable seed	2 or 0	2	2
3	Seed dispersed primarily by: small birds, wind, or water (2), large birds or passive/accidental dispersal (1)	2 or 1	2	2
4	Minimum generation time < 3 years (2), > 3 years (1)	2 or 1	1	1
5	Persistent vegetative organs above or below ground, or seed bank (> 1 year)	2 or 0	2	2
6	Juveniles common within 100 m parents	1 or 0	1	1
	Spread score (sum B1–3 + C1–6)		12	22
	Impacts × spread score		52	176
D. Cultivation and perceptions				
1	Present as: mass plantings (3), frequent smaller plantings (2), infrequent small plantings (1), not planted (0)	3 to 0	2	1
2	No. nurseries selling species: > 3 ,< 3, 0	3 to 0	0	1
3	Is it a crop plant?	1 or 0	0	0
4	Does it have unpleasant features?	1 or 0	1	0
Public attitudes score (sum D1–3 minus D4)			1	2

Appendix 2

SCORING INSTRUCTIONS FOR NEW CONSERVATION WEED RISK NCWR VERSION 2

The rationale for the questions is in Williams & Newfield (2002).

The following notes are to be used when completing the score sheet shown in Appendix 1.

Except where otherwise mentioned, Y = 1, N = 0. Where there is no information, the default is to the larger score.

A. Interactions

1. Estimate the volume of an individual plant.
2. This applies to the canopy of the vegetation, i.e. the layer that intercepts direct sunlight. 'Pre-empts' means it arrives first and excludes native species. Otherwise it must grow taller via self-supporting stems or climb over and smother other plants, as do vines. Species that occupy only sub-canopy positions as shrub or herb layers score 0, because in the long term their effects may be less than plants that replace the native canopy.
3. This is a judgement about the growth rate of the weed, and rather than use terms like 'slow' or 'fast', comparisons are made with the native species it growths with or excludes.
4. Persistence may be either through the growth of the original individuals or through regeneration via sexual or vegetative reproduction. The sites where the species persists the longest should be considered here, but only in the habitat being considered. For example, gorse persists for a shorter time—at least as adult plants—in moist forest environments than in riverbeds.

B. Invasion stage

1. Here 10 is used only as a constant, and the score is derived from the decade in which a species was first recorded in the wild, as obtained from New Zealand floras or subsequent publications. Example: 1945 (year of first wild record) is 7 decades ago from 2004, therefore 10 – 7 = 3.
2. The species must have just (< 5 years) been recorded as a weed in the wild, irrespective of whether it is growing in cultivation or not.
3. The absolute 'size' of small as opposed to 'large' infestations will be ecosystem-specific, as will the density (individuals per area).

C. Reproduction and population dynamics

1. In this case, cryptic applies to the likelihood of a species being noticed by a person with some botanical knowledge but not actually searching for new species. Most species will receive a score here, but a few, e.g. wild ginger or pines, are highly distinctive.
2. Seed should be assumed to be viable unless there is evidence to the contrary.

3. This distinguishes species with relatively large fruit (> 12 mm diameter on their shortest axis), or which cannot be eaten in part and must be dispersed by large birds, from those that are able to be swallowed whole and dispersed by the more numerous species of small birds. Very small dry seeds without specialised attachments are likely to be wind-dispersed, e.g. heather (*Calluna vulgaris*).
4. Regeneration time is from seed to first seed of the next generation. Species that reproduce only by vegetative means are classed as < 3 years. Short generation times mean more frequent site inspections.
5. Species that reproduce by vegetative means, as well as those with a seed bank, are classed as persistent.
6. This means in practice, those juveniles can be located within 15 minutes of arriving at an area where they would be expected, given the dispersal mode and site characteristics of the adults. New plants of those reproducing vegetatively would be included.

D. Public attitudes

1. 'Mass plantings' means either commercial crops or civic plantings, etc. 'Frequently cultivated' means the species would occur on more than c. 1/1000 urban properties, and 'uncommon' means less than 1/1000. Data apply to the DOC conservancy undertaking the assessment.
2. Use the latest edition of New Zealand plant finder (e.g. Gaddum 1999). Data apply to New Zealand as a whole, because these are mainly wholesale outlets.
3. Does the plant produce food or fibre on a commercial scale?
4. Does the plant have any features that are both quite well recognised, although not necessarily widely so, and that could be used to prejudice public feeling about it (e.g. causes dermatitis, has prickly spines, is poisonous, etc.). If the answer is 'Yes', the score is reduced by 1 because it would be easier to gain control.

Appendix 3

SCIENTIFIC NAMES OF SPECIES MENTIONED IN THE TEXT

asparagus fern	*Asparagus setaceus*
baccharis	*Baccharis halimifolia*
banana passion vine	*Passiflora tripartita* var. *mollissima*
Bangalow palm	*Archontophoenix cunninghamiana*
bell heather	*Erica cinerea*
bomarea	*Bomarea multiflora*
boneseed	*Chrysanthemoides monilifera*
buddleia	*Buddleja dysophylla*
brush cherry	*Syzygium australe*
buttercup bush	*Senna septemtrionalis*
cascara sagradra	*Frangula purshiana*
cedar wattle	*Acacia elata*
Chilean fire bush	*Embothrium coccineum*
Chinese privet	*Ligustrum sinense*
Chinese wisteria	*Wisteria chinensis*
climbing asparagus	*Asparagus scandens*
climbing spindleberry	*Celastrus orbiculatus*
coastal banksia	*Banksia integrifolia*
coastal tea tree	*Leptospermum laevigatum*
collomia	*Collomia coccinea*
cotoneaster	*Cotoneaster microphyllus*
Darwin's barberry	*Berberis darwinii*
Dyer's greenweed	*Genista tinctoria*
elaeagnus	*Elaeagnus* × *reflexa*
euryops	*Euryops chrysanthemoides*
evergreen buckthorn	*Rhamnus alaternus*
false tamarisk	*Myricaria germanica*
fatsia	*Fatsia japonica*
gooseberry	*Ribes uva-crispa*
Himalayan giant lily	*Cardiocrinum giganteum*
Italian jasmine	*Jasminum humile*
ivy	*Hedera helix*
jasmine	*Jasminum polyanthum*
kiwifruit	*Actinidia deliciosa*
Madeira vine	*Anredera cordifolia*
mile-a-minute	*Dipogon lignosus*
monkey apple	*Acmena smithii*
Moreton Bay fig	*Ficus macrophylla*
olive	*Olea europaea*
Port Jackson fig	*Ficus rubiginosa*
queen of the night	*Cestrum nocturnum*
queen palm	*Syagrus romanzoffiana*
Queensland poplar	*Homalanthus populifolius*
rowan	*Sorbus aucuparia*
sedum	*Sedum dasyphyllum*
silver birch	*Betula pendula*
smilax	*Asparagus asparagoides*
spindleberry	*Euonymus europaeus*
strawberry dogwood	*Dendrobenthamia capitata*
thyme	*Thymus vulgaris*
tree of heaven	*Ailanthus altissima*
woolly nightshade	*Solanum mauritianum*