

**Biological Success and Weediness of Some Terrestrial Weeds
Not Presently in the Northland Regional Council's RPMS**

Peter A. Williams

Landcare Research
Private Bag 6, Nelson
New Zealand

Landcare Research Contract Report: LC0708/079

PREPARED FOR:
Northland Regional Council

DATE: February 2008



ISO 14001

Reviewed by:

Approved for release by:

Lynley Hayes
Scientist
Landcare Research

Matt McGlone
Science Manager
Landcare Research

© Landcare Research New Zealand Ltd 2008

This information may be copied and distributed to others without limitation provided Landcare Research Limited and the source of the information are acknowledged. Under no circumstances may a charge be made to this information without the written permission of Landcare Research Limited.

Contents

| | | |
|---|---|----|
| 1 | Introduction..... | 5 |
| 2 | Objective..... | 5 |
| 3 | Methods and Data Sources..... | 5 |
| 4 | Species Summaries | 7 |
| | African olive (<i>Olea europaea</i> subsp. <i>africana</i>) | 9 |
| | Agapanthus (<i>Agapanthus praecox</i> subsp. <i>orientalis</i>) | 11 |
| | Akebia (<i>Akebia quinata</i>) | 12 |
| | Aristea (<i>Aristea ecklonii</i>) | 13 |
| | Arum Lily (<i>Zantedeschia aethiopica</i>)..... | 14 |
| | Bangalow palm (<i>Archontophoenix cunninghamii</i>) | 15 |
| | Bear’s breaches (<i>Acanthus mollis</i>)..... | 16 |
| | Blue passion flower (<i>Passiflora caerulea</i>) | 17 |
| | Camphor laurel (<i>Cinnamomum camphora</i>) | 18 |
| | Cats claw creeper (<i>Macfadyena unguis-cati</i>)..... | 20 |
| | Century plant (<i>Agave americana</i>)..... | 22 |
| | Chinese fan palm (<i>Trachycarpus fortunei</i>)..... | 23 |
| | Coastal banksia (<i>Banksia integrifolia</i>)..... | 24 |
| | Coral pea (<i>Kennedia rubicunda</i>)..... | 25 |
| | Giant reed (<i>Arundo donax</i>) | 26 |
| | Himalayan fairy grass (<i>Miscanthus nepalensis</i>) | 28 |
| | Ivy (<i>Hedera helix</i> spp. <i>helix</i>) | 29 |
| | Japanese walnut (<i>Juglans ailantifolia</i>)..... | 30 |
| | Jasmine (<i>Jasminum polyanthum</i>)..... | 31 |
| | Mickey Mouse plant (<i>Ochna serrulata</i>)..... | 32 |
| | Mountain blueberry (<i>Elaeocarpus reticulates</i>) | 33 |
| | Mugwort (<i>Artemisia verlotiorum</i>)..... | 34 |
| | Norfolk Island hibiscus (<i>Lagunaria patersoni</i>) | 36 |
| | Paperbark poplar (<i>Melaleuca quinquinervia</i>) | 37 |
| | Pepper tree (<i>Schinus terebinthifolius</i>)..... | 38 |
| | Phoenix palm (<i>Phoenix canariensis</i>) | 40 |
| | Queen of the night (<i>Cestrum nocturnum</i>) | 41 |
| | Queensland poplar (<i>Homolanthus populifolius</i>) | 43 |
| | Sexton’s bride (<i>Rhaphiolepis umbellata</i>)..... | 44 |
| | Sharp rush (<i>Juncus acutus</i>) | 45 |
| | Sweet pittosporum (<i>Pittosporum undulatum</i>) | 46 |
| | Sydney golden wattle (<i>Acacia longifolia</i>)..... | 47 |
| 5 | Acknowledgements..... | 49 |
| 6 | General Bibliography and List of Websites..... | 49 |
| | Appendix 1 Descriptors of stages in the invasion curve (from Williams 2007) | 50 |
| | Appendix 2 Full list of potential candidates for review | 51 |

1 Introduction

This report summarises information on many terrestrial weeds that are not yet included in the Northland Regional Council's Regional Pest Management Strategy, that may need to be considered for inclusion in future strategies.

The Northland Regional Council (NRC) Regional Pest Plant Management Strategy (RPMS) became operative in 2005 and is due for review in 2009. This shall be referred to as the NRPMS hereafter. Prior to that review the NRC requires further information on the threats posed by the many new weeds in Northland. This report deals with terrestrial weeds. Existing terrestrial weeds in the NRPMS, including new aquatic weeds, are dealt with in Williams & Champion (2008).

2 Objective

- To provide information about possible new weed threats to the Northland Region that can be used during the forthcoming review of the NRPMS.

3 Methods and Data Sources

I visited Northland for a day in November 2008 and inspected weed infestations there with DOC staff. I also noted the weeds during the course of other fieldwork in Northland in November 2007 and February 2008. However, I make no pretence in the following notes that the actual situation on the ground in Northland has been well covered. Most effort in this report was directed towards searching all available databases and published and unpublished reports.

The primary data sources used were:

- Species listed in the NRPMS (2005)
- List of naturalised plants of Northland provided by Tony McCluggage, DOC
- Weediness scores from the DOC Weeds database (Clayson Howell, DOC, September 2006)
- Plants on the National Pest Plant Accord
- Number of overseas weed lists the species is on, derived from Randall (2002)

In addition, a large number of online data sources were examined and used to score the species according to a well-established format (Esler et al. 1993). This scoring system has 15 categories for scoring the plant from 0 to 3 and they are summed into a Biological Success rating (max 21) and Esler's Index of Weediness (max 24). The details of this system are not repeated here but are fully described in Esler et al. (1993). This report should also be read in close conjunction with *Guidelines for determining and naming categories of plants in regional pest management strategies* (Williams 2007) because principles discussed there, such as feasibility of eradication, stages of the Invasion Curve etc., are not repeated here.

The potential number of species that threaten Northland to some degree, and which could have been summarised and scored using this format, number at least 50 and the true number is probably in the order of 100. A degree of prioritisation was therefore required in determining which species to score. Emphasis was placed on doing those species that were at a relatively early invasion stage, were

known to be spreading, were likely to have high impacts in one sector or another, and which were relatively little known as weeds in New Zealand. Species were less likely to be scored if they were not presently growing in the wild but which are well-known weeds overseas (e.g. kudzu vine) or which had already been the subject of review by DOC (e.g. *Celastrus orbiculatus*), were widely grown and popular and likely to counter major resistance in including them in an RPMS (e.g. swan plant). Others showing the earliest signs of invasion but known only from tropical area (e.g. fire spike) and for which very limited information was available were also given low priority. However, there are many exceptions and deciding which species to review was essentially an exercise in getting 'bangs for bucks'. A few species I had scored previously, without the justifying script, for the Auckland Regional Council in 2006 are included here (e.g. sweet pittosporum). All species provided to me as potential candidates for investigation are included in Appendix 2. Overall, the amount of information available for individual species varies enormously.

In the reports of Esler et al. (1993), most species scores are accompanied by a reference to the material in the text. This is time consuming so I have just put a list of the major sources at the end. However, in a few cases, where particular scientific papers or other reports were uncovered, these are included following the scores for the relevant species.

4 Species Summaries

Table 1 A summary of Biological Success ratings and Index of Weediness (Esler et al. 1993) listed in order of common name and their page number within the text. For some species there is insufficient information to derive a score for either or both components.

| Page | Name | | Biological Success rating (max 21) | Esler's Index of Weediness (max 24) |
|------|---|--|---|--|
| 9 | African olive | <i>Olea europaea</i> subsp. <i>africana</i> | 11 | 15 |
| 11 | Agapanthus | <i>Agapanthus praecox</i> subsp. <i>orientalis</i> | 18 | 13 |
| 12 | Akebia | <i>Akebia quinata</i> | .. | 6 |
| 13 | Aristea | <i>Aristea ecklonii</i> | 16 | 9 |
| 14 | Arum lily (note: "Green Goddess" is a form of this species) | <i>Zantedeschia aethiopica</i> | 13 | 11 |
| 15 | Bangalow palm | <i>Archontophoenix cunninghamii</i> | 11 | .. |
| 16 | Bear's breaches | <i>Acanthus mollis</i> | 13 | 8 |
| 17 | Blue passion flower | <i>Passiflora caerulea</i> | 10 | 8 |
| 18 | Camphor laurel | <i>Cinnamomum camphora</i> | 12 | 13 |
| 20 | Cats claw creeper | <i>Macfadyena unguis-cati</i> | 17 | 11 |
| 22 | Century plant | <i>Agave americana</i> | 12 | 11 |
| 23 | Chinese fan palm | <i>Trachycarpus fortunei</i> | 9 | 9 |
| 24 | Coastal banksia | <i>Banksia integrifolia</i> | 13 | 10 |
| 25 | Coral pea | <i>Kennedia rubicunda</i> | 10 | 8 |
| 26 | Giant reed | <i>Arundo donax</i> | 14 | 13 |
| 28 | Himalayan fairy grass | <i>Miscanthus nepalensis</i> | 13 | 8 |
| 29 | Ivy | <i>Hedera helix</i> spp. <i>helix</i> | 18 | 14 |
| 30 | Japanese walnut | <i>Juglans ailantifolia</i> | .. | .. |
| 31 | Jasmine | <i>Jasminum polyanthum</i> | .. | 9 |
| 32 | Mickey Mouse plant | <i>Ochna serrulata</i> | 12 | 8 |
| 33 | Mountain blueberry | <i>Elaeocarpus reticulatus</i> | .. | .. |
| 34 | Mugwort | <i>Artemisia verlotiorum</i> | 13 | 6 |
| 36 | Norfolk Island hibiscus | <i>Lagunaria patersoni</i> | .. | .. |

| | | | | |
|----|----------------------|---------------------------------|----|----|
| 37 | Paper bark poplar | <i>Melaleuca quinquinervia</i> | 13 | 13 |
| 38 | Pepper tree | <i>Schinus terebithifolius</i> | 15 | 14 |
| 40 | Phoenix palm | <i>Phoenix canariensis</i> | 13 | 16 |
| 41 | Queen of the night | <i>Cestrum nocturnum</i> | 11 | 9 |
| 43 | Queensland poplar | <i>Homolanthus populifolius</i> | 11 | 11 |
| 44 | Sexton's bride | <i>Rhaphiolepis umbellata</i> | .. | .. |
| 45 | Sharp rush | <i>Juncus acutus</i> | 15 | 13 |
| 46 | Sweet pittosporum | <i>Pittosporum undulatum</i> | 12 | 11 |
| 47 | Sydney golden wattle | <i>Acacia longifolia</i> | 15 | 13 |

African olive (*Olea europaea* subsp. *africana*)

Family

Oleaceae

Origin

East Africa southwards to Cape Province, South Africa.

Weed

Known to be a weed in several countries and is of particular concern in Australia, including Tasmania.

Form

Olea europaea is a much-branched evergreen tree of variable size, ranging from 2 to 15 m in height with a dense, round crown; the most common height is 5–10 m, and 15 m is rarely reached. The fruit, ripening in summer, is a fleshy and glaucous drupe, globose to ellipsoid, from 10 to 30 mm, commonly only 15–25 mm long and approximately 6 mm in diameter and normally a blue-black colour when ripe. Depending on the tannin content, especially in feral olives, the fruit can be very bitter.

Ecology

Habitat: the habitat of *Olea* spp. is semi-arid to sub-humid, warm to temperate regions, with hot dry summers and winter-dominant rainfall. Olives prefer a Mediterranean climate comprising a relatively cool, but not too frosty winter, and a long, hot growing season.

Means of spread: birds and animals.

Impacts

Negative

Agriculture: none known in NZ.

Conservation: competes for space and shades out native biota.

Amenity: none known.

Landscape: some may consider them obtrusive, but olives in NZ are scarcely distinguishable from native species.

Positive

Widely grown for their fruit and also as a garden plant. Some plantings have historical value because of their association with early settlement, e.g., at Waitangi. Listed from four nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** it grows in most circumstances, full sun or heavy shade (but not really dense subcanopy shade as found in NZ forest), moist or dry conditions and thrives in moist shady sites on riverbanks. In more eastern areas of Australia it is more a weed of open areas such as headlands and dune systems. It is probably significant to the spread of African olive that Northland was considered too cold for commercial olive production.
- 2 **Maturation rate:** fruits within several years.
- 3 **Seeding ability:** readily produces large numbers of fruit at least as far south as Nelson. The seeds have the ability to germinate under heavy shade.
- 2 **Dispersal and establishment:** bird dispersed and also by marsupials in Australia. Starlings can carry up to 6 seeds for 40 km, whereas blackbirds carry only a single seed to cover over a distance of c. 100 m. Silvereyes are of very minor importance and mostly just peck the fruit on the spot. It is not known if the seeds are eaten by native NZ birds.
- 0 **Cloning**
- 3 **Recovery:** olives re-sprout prolifically if severed or burnt.
- 2 **Competitive ability:** competes strongly in open situations but because it has limited height it cannot compete with rapidly growing and dense crowned native NZ trees.

14 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** in Australia olives block access to areas by forming dense scrub but it is uncertain if this would apply in NZ.
 - 2 **Suppression:** suppresses smaller plants.
 - 2 **Health impairment:** the pollen of olives is highly allergenic.
 - 0 **Quality impairment:** no interference with crops in NZ.
 - 3 **Damage to natural areas:** African olive plants will grow in dense colonies, infesting and overpowering native bushland in Australia. The wilting branches of the plant shade native plants from sunlight and the plants themselves vigorously compete with native plants for water and nutrients in the surrounding area. In Northland they tend to be as scattered shrubs and trees in coastal areas.
 - 0 **Other:**
- Opportunity**
- 3 **Extent of suitable habitat:** large areas of coastal Northland especially are vulnerable, as are many offshore islands.
 - 2 **Resistance to management:** in Australia olives are considered relatively easy to kill individually using standard techniques.

14 Esler's Index of Weediness

Griffiths et al. 2003. Use of climate soil and crop information for identifying potential land use changes in the Hokianga and Western Kaipara region. NIWA client report AKL 2003/037.

Spennemann DHR, Allen LR, Dirk HR 2000. The avian dispersal of Olives *Olea europaea*: implications for Australia. Emu 100: 264–273.

Agapanthus (*Agapanthus praecox* subsp. *orientalis*)

Family Liliaceae

Origin South Africa

Weed

Known as a weed in Australia, USA, and Britain.

Form

Agapanthus praecox is a hardy perennial lily that grows in thick clumps. The plant produces large, rounded heads of massed tubular flowers, blue or white, on a strong thick stem, to 1.2 m tall, in summer. Spreads vegetatively, the underground structure forming large continually extending clumps. Roots are fleshy, crowded, strong and tenacious.

Ecology

Agapanthus is highly invasive in rocky open places in New Zealand, especially coastal cliffs and outcrops. *Agapanthus* also has the potential to become a serious weed of forest edges.

Means of spread: naturally by gravity and water but also widely planted and dumped.

Impacts

Negative

Agriculture: none, apart from obstruction.

Conservation: vigorous plant covering others and occupying space.

Amenity: none to date.

Landscape: intrusive non-native element in the landscape especially when flowering, though many folk like it.

Positive

Very widely sold by the garden industry because it is a very popular garden/amenity plant. Used as a garden or container plant, and for mass planting along driveways and on banks. Currently widely available including via the Internet and mail-order. Numerous cultivars. Desirable for their year round lush foliage, long flowering time and hardiness. Listed from 17 nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 3 **Versatility:** occupies a wide range of sites including many stressed sites such as cliffs, sand dune margins, as well as wetter sites such as ditches.
- 2 **Maturation rate:** can set seed in the first year following establishment.
- 2 **Seeding ability:** numerous small black shiny seeds in a 5-cm three-sided capsule.
- 2 **Dispersal and establishment:** seed spread by gravity and by water. It is only because of relatively slow dispersal that *agapanthus* has not become more of weed than it has.
- 3 **Cloning fragments:** grows easily and often spread by dumping.
- 3 **Recovery:** tolerates a great deal of cutting, and fragments of roots can live a long time in the air.
- 3 **Competitive ability:** highly competitive for resources.

18 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** spreads along roadsides, clogging drains and causing flooding which can damage road surfaces.
- 2 **Suppression:** very little interference with production systems but impacts in other areas.
- 1 **Health impairment:** some irritation in some people.
- 0 **Quality impairment:** not a contaminant of crops.
- 2 **Damage to natural areas:** forms very dense clumps in damper patches of coastal dune lands, coastal and inland cliff/bluff areas, riparian areas, forest margins, and regenerating native vegetation, competing with and displacing native communities in these areas. Monocultures can completely exclude native plants and animals in habitats at risk, e.g. *Arthropodium cirratum*.
- 0 **Other:**

Opportunity

- 3 **Extent of suitable habitat:** large areas of fairly open habitats are vulnerable in Northland, including offshore islands.
- 3 **Resistance to management practices:** very difficult to remove manually, and requires several applications of chemical to cut-stumps.

13 Esler's Index of Weediness

Akebia (*Akebia quinata*)

Family

Lardizabalaceae

Origin

East Asia

Weed

Known as a weed in eastern USA, Britain, Japan.

Form

Scrambling, highly branched vine capable of covering scrub and small trees.

Ecology

Habitat: scattered through the North Island and upper South Island in shrublands and forest margins near domestic gardens and old homesteads especially.

Means of spread: does not set seed in NZ, partly perhaps because the plant is monoecious. It is spread by humans and machinery such as roadside mowing. Overall, while localised spread can be rapid, range expansion through establishment of outlying populations is slow. It was first recorded in NZ in 1940.

Impacts

Negative

Agriculture: none.

Conservation: vigorous and rampant vine that smothers vegetation it climbs on, including native forest and naturalised plant communities.

Amenity: none to date.

Landscape: not intrusive to the untrained eye.

Positive

No longer sold, but occasionally grown.

Ratings

Biological Success and Environmental Impact (0–3)

? **Versatility:** insufficient information to describe the range of sites it might occupy.

? **Maturation rate:** no records found.

0 **Seeding ability:** no reports of seeding in America where it is naturalised either.

2 **Dispersal and establishment:** small numbers of seeds means dispersal is relatively slow. People are an important vector.

0 **Cloning:**

2 **Recovery:** tolerates a great deal of cutting.

1 **Competitive ability:** requires a gap for establishment and tends to take over other plants rather slowly.

? **Biological Success and Environmental Impact Rating**

Weed status assessment (0–3)

1 **Obstruction:** minimal.

0 **Suppression:** very little interference with production systems.

0 **Health impairment:**

0 **Quality impairment:**

2 **Damage to natural areas:** covers native plants but seldom becomes as rampant as some other climbers.

0 **Other:**

Opportunity

2 **Extent of suitable habitat:** large areas of roadside and bush margins are vulnerable.

1 **Resistance to management practices:** foliar applications of Garlon (triclopyr) at 7 litres per hectare to foliage or cut stems and follow-up treatments have proved successful in the USA.

6 Esler's Index of Weediness

Langdon CS 2004. Managing *Akebia quinata*: an assessment of control methods. MSc Thesis, George Mason University, Fairfax, VA, USA.

Aristea (*Aristea ecklonii*)

Family Iridaceae

Origin South Africa

Weed A weed in England and eastern Australia.

Form

An iris-like perennial up to 0.5 m with woody rhizomes, and bunches of blue flowers on scapes up to 0.5 m.

Ecology

Habitat: sandy and open situations in its native range. In NZ, North Auckland and Auckland City along roadsides (ARC). First collection 1933 Helensville (CHR9064). Spreading into forest areas via tracks and roadways in the Waitakere Ranges, Rodney District and parts of Northland, forming dense monocultures. Thick swards have been noted under kauri forest. It is primarily in open situations such as roadsides but also in bare areas in other habitats including poorly drained habitats and light scrub.

Means of spread: spreads by seed, which is slightly flattened and probably helped by wind. Pieces of the woody rhizomes are spread in garden rubbish and by disturbance of the ground where it is growing, e.g. by mowing on roadsides and ploughing in paddocks.

Impacts

Negative

Agriculture: none known in NZ, although blocks drains.

Conservation: invades forest margins, dunes and open areas (especially noted on clay banks), creating thick monocultures that outcompete ground cover/low-growing species (e.g. native orchids) and reduce/halt regeneration.

Amenity: none known.

Landscape: coloured flowers could be seen as an intrusive foreign element.

Positive

Desirable hardy perennial with bright blue flowers that spreads to fill difficult sites. Listed from eight nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** quite a range of substrates but relatively narrow climate range. Very tolerant of semi-shade, low fertility environments, e.g. disturbed gumland.
- 2 **Maturation rate:** probably matures within 1 or 2 years of seeding.
- 2 **Seeding ability:** moderate amount of seed.
- 2 **Dispersal and establishment:** seeds probably wind dispersed, as well as fragments and whole plants by human means.
- 3 **Cloning:** pieces regenerate readily.
- 3 **Recovery:** clearly tolerates mowing.
- 2 **Competitive ability:** competes only with relatively short vegetation.

16 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 0 **Obstruction:**
- 2 **Suppression:** applies only to relatively short vegetation.
- 0 **Health impairment:**
- 1 **Quality impairment:** colour is an obtrusive element in the landscape.
- 2 **Damage to natural areas:** not great yet, but has potential in open sites and in nutrient-poor habitats.
- 0 **Other:**

Opportunity

- 2 **Extent of suitable habitat:** many open areas on poor soils of Northland are vulnerable.
- 2 **Resistance to management practices:** Weedbusters' website indicates sprays are effective but rhizomes lead to persistence.

9 Esler's Index of Weediness

<http://www.biodiversityasia.org/books/alien/Chapter%205.pdf>

Martin ARH 1960. The ecology of Groenvlei, a South African fen: Part I. The primary communities. The Journal of Ecology Vol.: 55–71.

Arum Lily (*Zantedeschia aethiopica*)

(Note: 'Green Goddess' is a form of this species)

Family

Liliaceae

Origin

South Africa

Weed

Widespread weed globally.

Form

Large-leaved perennial herb up to 1.5 m tall.

Ecology

Habitat: moist soils in a wide range of habitats.

Means of spread: widely planted. Seeds dispersed by birds and water. Rhizome fragments by dumping of garden rubbish.

Impacts

Negative

Agriculture: denies grazing only on a very localised scale in NZ although blocks drains.

Conservation: shades out native biota in stream margins, damp places, shady bush margins.

Amenity: none known.

Landscape: very intrusive foreign element.

Positive

Widely used in gardening and in floral arrangements. The various forms are sold in dozens of nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** relatively narrow range of habitats such as wet pastures and streamsides.
- 2 **Maturation rate:** produces flowers in 3 or so years.
- 2 **Seeding ability:** moderate number of seeds produced.
- 2 **Dispersal and establishment:** bird dispersed and also by water. Overall rather slow to spread, which makes control possible over quite large areas.
- 1 **Cloning:** vegetative fragments can establish if spread by water or machinery but these are large and not spread by machinery etc. Can be dispersed locally by feral pigs where they grub for the roots.
- 2 **Recovery:** recovers fairly rapidly from cutting.
- 2 **Competitive ability:** competitive only in open situations or under moderate shade.

13 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** blocks drains.
- 2 **Suppression:** tends to monopolise space where it occurs. Not a weed of crops.
- 2 **Health impairment:** horses reported killed in NZ.
- 0 **Quality impairment:**
- 2 **Damage to natural areas:** crowds out native species.
- 0 **Other:**

Opportunity

- 2 **Extent of suitable habitat:** large areas of Northland are vulnerable and its present extent is a reflection of its slow rate of spread, usually starting from old habitations, and not a reflection of suitable habitat. In recent years there has been increasing concern about spread in the Bay of Plenty.
- 1 **Resistance to management practices:** can be removed physically. Much detail concerning control on the Environment Bay of Plenty website.

11 Esler's Index of Weediness

<http://www.ebop.govt.nz/weeds/Weed232.asp>

Bangalow palm (*Archontophoenix cunninghamii*)

Family

Palmae

Origin

Australia

Weed

Weed in New Zealand, particularly in the Auckland region (ARC).

Form

Tall palm up to 30 m tall in its native range and 14 m in New Zealand.

Ecology

Habitat: native to the rainforests of north-eastern Australia down to latitudes equal to Whangarei in NZ. Mostly on moist, fertile soil, in conditions very similar to nikau palms. Frost tender in the juvenile stage but adults can withstand very light frosts. Grows in a range of light conditions from high shade to full sunlight. Scattered infestations in the Auckland region.

Means of spread: very widely planted. Spread naturally by birds, and by gravity.

Impacts

Negative

Agriculture: none

Conservation: shades out native biota.

Amenity: none yet apparent.

Landscape: apart from plantings, has yet to appear as introduced foreign elements into the landscape.

Positive

Widely planted as an amenity and specimen tree and considerable money invested in growing it. This has generated considerable nursery industry resistance to having this species listed in the Auckland RPMS. Listed from 17 nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

2 **Versatility:** mainly in shaded habitats with moist soils.

1 **Maturation rate:** very slow to mature.

3 **Seeding ability:** produces vast quantities of seeds, which germinate readily.

3 **Dispersal and establishment:** bird dispersed by a range of species and establishes mainly beneath the canopies of other trees.

0 **Cloning:**

? **Recovery:** no data on this.

2 **Competitive ability:**

11 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

? **Obstruction:**

3 **Suppression:**

0 **Health impairment:**

0 **Quality impairment:**

2 **Damage to natural areas:** this species clearly has the capacity to establish as a subcanopy tree in shady forest sites that would be occupied by native palms and other species.

0 **Other:**

Opportunity

3 **Extent of suitable habitat:** this species is at the earliest stage of its invasion in NZ. Unlike most 'weeds', it has the capacity to establish as a shade species under intact native forest and therefore its weed potential should be taken very seriously.

2 **Resistance to management:** apart from pulling seedlings, no control operations have been reported.

? Esler's Index of Weediness

Insufficient time has elapsed since this species began to spread in NZ to really give it sound ratings for several factors.

Bear's breaches (*Acanthus mollis*)

Family

Acanthaceae

Origin

South-western Europe - Portugal to the Balkans. Naturalised in Britain in W. Cornwall.

Weed

Known as a weed in Australia and California.

Form

Stout perennial herb.

Ecology

Habitat: scrub, open land, waste places.

Means of spread: explosive seeds and rhizomes.

Impacts

Negative

Agriculture: none.

Conservation: not sufficiently abundant to estimate.

Amenity: none to date.

Landscape: looks distinctly non-native.

Positive

Widely planted for horticulture.

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** the plant prefers light (sandy) and medium (loamy) soils and can grow in heavy clay soil. It can grow in semi-shade (light woodland) or no shade. It requires dry or moist soil and can tolerate drought. Cold tolerant.
- 2 **Maturation rate:** sets seed 2 years after germination.
- 2 **Seeding ability:** large numbers of small seeds.
- 2 **Dispersal and establishment:** not highly specialised and most seed dispersal is by gravity; often dumped.
- 2 **Cloning:** grows readily from divided clumps but this is not a common means of spread in the wild.
- 3 **Recovery:** recovers fairly readily from a deep rooting system if simply cut.
- 2 **Competitive ability:** covers small plants, but not highly competitive in situations where it can be shaded out.

13 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 1 **Obstruction:** not particularly troublesome
- 1 **Suppression:**
- 0 **Health impairment:**
- 0 **Quality impairment:**
- 2 **Damage to natural areas:**
- 0 **Other:**

Opportunity

- 2 **Extent of suitable habitat:** the plant tends to be rather localised around habitations but there is some potential for spread into open areas in Northland.
- 2 **Resistance to management practices:** fairly difficult to kill by mechanical means and sprays are best applied to cut plants.

8 Esler's Index of Weediness

http://www.ibiblio.org/pfaf/cgi-bin/arr_html?Acanthus+mollis&CAN=LATIND

Blue passion flower (*Passiflora caerulea*)

Family

Passifloraceae

Origin

South America

Weed

Known as a weed in Australia, the Pacific and Ceylon.

Form

Stout scrambling vine.

Ecology

Habitat: in NZ it occupies, lowland and coastal shrublands and forest margins, light gaps, roadsides, wastelands, farm and orchard hedges, domestic gardens. Prefers fertile soil.

Means of spread: birds and possibly mammals eating the pulp.

Impacts

Negative

Agriculture: none.

Conservation: vigorous and rampant vine that smothers vegetation it climbs on, including native forest margins.

Amenity: none to date.

Landscape: looks distinctly non-native.

Positive

Widely planted for horticulture and used as a root-stock for black passionfruit (*P. edulis*).

Ratings

Biological Success and Environmental Impact (0–3)

- 1 **Versatility:** fairly light demanding as a seedling and not tolerant of highly infertile soils or poor drainage.
- 2 **Maturation rate:** no records found, but probably fruits within 2 years of seedling establishment on the assumption it behaves like other *Passiflora* species.
- 2 **Seeding ability:** actual numbers and viability of seeds unknown.
- 2 **Dispersal and establishment:** bird dispersed but relatively small numbers of seeds and the fact that fruits are not eaten whole by birds means dispersal is relatively slow. People are an important vector.
- 0 **Cloning:**
- 1 **Recovery:** will regrow from cut stumps because the underground system is quite extensive.
- 2 **Competitive ability:** clearly has some ability to smother the vegetation it is using as a climbing frame, and also the ground layer where it is in a sprawling mode.

10 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 1 **Obstruction:** minimal.
- 1 **Suppression:** very little interference with production systems.
- 1 **Health impairment:** produces alkaloids and leaves are toxic if eaten, and may cause skin irritation.
- 0 **Quality impairment:**
- 2 **Damage to natural areas:** covers native plants but seldom becomes as rampant as some other climbers.
- 0 **Other:**

Opportunity

- 2 **Extent of suitable habitat:** large areas of roadside and bush margins are vulnerable in Northland.
- 1 **Resistance to management practices:** can be readily killed in site-led programmes by cutting and pasting with herbicide.

8 Esler's Index of Weediness

Camphor laurel (*Cinnamomum camphora*)

Family

Lauraceae

Origin

South East Asia and Japan.

Weed

Widespread and very bad weed in Queensland and Victoria, and the Pacific, to the extent that there is a website devoted to information on all aspects of its ecology, impacts and control. It has not reached the stage in NZ where its impacts are noticeable.

Form

A large evergreen tree that grows up to 20–30 m tall. The leaves have a glossy, waxy appearance and smell of camphor when crushed. It has a pale bark that is very rough and fissured vertically. In spring it produces bright green foliage with masses of small white flowers. It produces clusters of black berry-like fruit around one centimetre in diameter.

Ecology

Habitat: in Australia, it covers a wide range of moist habitats and open grasslands.

Means of spread: by human planting and birds.

Impacts

Negative

Agriculture: in Australia it takes over good grazing land but no agricultural impact in NZ.

Conservation: in Australia, camphor laurel forms multi-faceted, multi-stemmed infestations around the edges of rainforest remnants, making those natural ecosystems more prone to burning and fire-damage in serious drought years.

Amenity: in Australia it forms thickets which inhibit use of open areas.

Landscape: intrusive foreign element and in Australia it changes grassland landscapes to woodland.

Positive

Used in gardening and sold in 12 nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** although camphor laurel is a semi-tropical species it is widely naturalised in Melbourne with climates similar to northern NZ.
- 1 **Maturation rate:** trees take several years to mature.
- 3 **Seeding ability:** a mature tree in Australia produces up to 100 000 fruits with a single seed per fruit. These are viable for 2–3 years.
- 3 **Dispersal and establishment:** in Australia it is widely dispersed and readily establishes. But in NZ there is very little evidence yet of it naturalising. No studies have been done on its dispersal in NZ.
- 0 **Cloning:**
- 1 **Recovery:** withstands cutting but not if taken right back.
- 2 **Competitive ability:** highly competitive in Australia and elsewhere but cannot be rated for NZ.

12 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** massive and spreading root systems disrupt urban drainage and sewerage systems, and degrade river banks.
- 2 **Suppression:** the camphor content of the leaf litter helps prevent other plants from germinating successfully.
- 3 **Health impairment:** camphor is a toxin that is poisonous to people. Toxic to some native Australian birds and the exudates when they get into waterways are believed to kill fish.
- 0 **Quality impairment:**
- 3 **Damage to natural areas:** none yet in NZ but in Australia it is highly damaging in a variety of ways from suppressing native regeneration to poisoning native species.
- 1 **Other:** in Australia camphor laurel tends to germinate most frequently under fences and power lines (wherever birds rest and deposit the seed). As a result, very large camphor laurel trees can push over fences and disrupt power facilities.

Opportunity

- 2 **Extent of suitable habitat:** it is difficult to predict this in NZ because there are likely to be climatic

- limitations on its spread. The fruit are also fairly large which limits the range of dispersers in NZ.
- 2 Resistance to management practices:** young plants can be pulled and adults readily poisoned.

13 Esler's Index of Weediness

<http://www.camphorlaurel.com>

http://www.floridata.com/ref/C/cinn_cam.cfm

<http://www.northcoastweeds.org.au/site-files/docs/camphor/1a-bg.pdf>

Cats claw creeper (*Macfadyena unguis-cati*)

Family

Bignoniaceae

Origin

South America, native to Brazil and Argentina.

Weed

Overseas this species is weedy from the tropics (e.g. Niue) to warm temperate climates (New South Wales). Is also a weed in South Africa and is subject to biocontrol initiatives there and in Australia.

Form

Cats claw creeper is a woody climber with tendrils and stems extending for 20 m or more. Large yellow trumpet flowers in late spring, followed by long bean-like seed pods. It is named because the leaves have branched claw-like tendrils which cling tightly to whatever they are climbing on. Has tubers up to 40 cm long.

Ecology

Habitat: a climber over other vegetation and as a sprawling forest floor mat. Most common near waterways in Australia.

Impacts

Negative

Agriculture: none known.

Conservation: not causing problems in NZ yet.

Amenity: no impacts reported.

Landscape: intrusive foreign element.

Positive

Not listed in Gaddum (1999), but it is sold here. Commonly used in gardens to cover trellises and fences.

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** it seems to prefer a relatively narrow range of soils in Australia. Cats claw creeper is highly tolerant of low-light situations, though it is much more vigorous in sunny gaps and on the edge of remnant areas. In South Africa it is thought of as being fast growing, frost hardy and drought tolerant.
- 2 **Maturation rate:** seeds mature 10–18 months after flowering.
- 3 **Seeding ability:** produces large amounts of seeds, but these have a short life of 12–18 months.
- 2 **Dispersal and establishment:** wind and gravity and commonly by water in Australia.
- 2 **Cloning:** the root system of the plant is quite extensive and produces a large number of tubers (950 tubers recorded in one square metre) at about 50-cm intervals along the lateral roots. Each tuber produces individual climbing runners that climb all surrounding vegetation. Can spread by layering.
- 3 **Recovery:** if merely cut it will always regenerate.
- 3 **Competitive ability:** highly competitive with low-growing plants.

17 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 1 **Obstruction:** can block stream channels in Australia.
- 3 **Suppression:** mature plants smother taller vegetation while the runners can also grow as a ground cover along the forest floor of scrub remnants and can form a thick carpet of stems and leaves that chokes out small existing plants and stops germination of all species.
- 0 **Health impairment:** none reported.
- 0 **Quality impairment:** no impact on produce.
- 3 **Damage to natural areas:** even in Australia, the populations are localised, but these are highly damaging.
- 0 **Other:**

Opportunity

- 2 **Extent of suitable habitat:** in Australia its potential distribution is not expected to extend into Victoria, which suggests its NZ range would be limited by temperature. However, presumably a lot of marginal vegetation in particular is vulnerable to this plant in Northland.
- 2 **Resistance to management practices:** cannot be controlled by physical means but can be controlled by cutting stumps and painting with herbicide.

11 Esler's Index of Weediness

Downey PO, Turnbull I 2007. The biology of Australian weeds 48. *Macfadyena unguis-cati* (L.) A.H. Gentry
Plant Protection Quarterly 22(3): 82–90.

Century plant (*Agave americana*)

Family

Agavaceae

Origin

Mexico

Weed

Widespread weed globally.

Form

Stout stemless herb with robust leaves in a rosette up to 2 m long. Flower stem reaches 10 m when flowering.

Ecology

Habitat: scattered throughout coastal areas particularly sand dunes and cliffs.

Means of spread: widely planted. Main spread is by rhizomes. Young plants tolerant of seawater dispersal.

Lesser spread by birds and bulbils that make up the seed heads.

Impacts

Negative

Agriculture: no agricultural impact in NZ.

Conservation: shades out native biota and causes rearrangement of mobile sands.

Amenity: spines of young plants protruding through the sand are a menace for people on sandy beaches.

Landscape: intrusive foreign element.

Positive

Widely used in gardening. Listed from two nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** confined to open areas with light soil and mostly coastal.
- 1 **Maturation rate:** extremely slow, and dies after flowering.
- 1 **Seeding ability:** forms an oblong dehiscent capsule, 40–60 mm long and 20–25 mm wide. Does not appear to spread very much by seed in NZ.
- 2 **Dispersal and establishment:** apart from the lateral expansion of colonies it is spread mainly by people and by dumping. Also, because it grows on the coast, chunks of plant are spread by the sea, of which it is highly tolerant.
- 2 **Cloning:** spreads by runners which can become separated from the parent.
- 1 **Recovery:** once adult plants are killed, they do not regenerate (although the isolated plants do).
- 2 **Competitive ability:** although it outcompetes dune plants and others in open habitats, young plants are slow growing and need to be in the open.

11 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction**
- 2 **Suppression**
- 3 **Health impairment:** causes photosensitivity and children have been poisoned by the fruits. Spine wounds can become septic.
- 0 **Quality impairment**
- 2 **Damage to natural areas:** infestations still rather localised, but has the capacity to smother native vegetation.
- 0 **Other**

Opportunity

- 1 **Extent of suitable habitat:** overall rather limited although it could become extensive in some coastal areas.
- 2 **Resistance to management practices:** because the plant is readily identifiable and relatively easy to kill, there should be little problem in eliminating it from areas where it is not wanted.

12 Esler's Index of Weediness

Chinese fan palm (*Trachycarpus fortunei*)

Family

Palmae

Origin

China

Weed

Weed in South East Australia and New Zealand (ARC). Google searches indicate it establishes freely in many parts of the world from Florida to England.

Form

Palm up to 12 m tall.

Ecology

Habitat: scattered in bush remnants and along creeks on well-drained, fertile soil in sheltered positions. Most vigorous in full sun but tolerates partial shade. Very frost tolerant. Also very drought tolerant.

Means of spread: very widely planted. Spread naturally by birds.

Impacts

Negative

Agriculture: none.

Conservation: shades out native biota.

Amenity: some obstruction where growing near tracks.

Landscape: appears as a foreign element in the landscape.

Positive

Widely planted as an ornamental and specimen tree. Listed from 13 nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** one of the most frost hardy palms. Tolerates a range of soils and moderate shade. Quite drought tolerant.
- 1 **Maturation rate:** growth rate is rather slow and takes several years to fruit.
- 2 **Seeding ability:** produces a moderate number of fruit.
- 2 **Dispersal and establishment:** seeds are distributed by blackbirds in England so presumably they would be in NZ also.
- 0 **Cloning:** no reported cloning capacity.
- ? **Recovery:** no data on this.
- 2 **Competitive ability:** not highly competitive and requires localised open conditions to establish, but once above 1 m, can compete with surrounding vegetation.

9 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** can be a nuisance on tracks and so on near city walkways.
- 2 **Suppression:** limited capacity for suppressing existing vegetation other than low-growing plants such as ferns.
- 0 **Health impairment**
- 0 **Quality impairment**
- 2 **Damage to natural areas:** locally suppressing native species in some areas, mostly close to the original plantings.
- 0 **Other**

Opportunity

- 1 **Extent of suitable habitat:** mainly a peri-urban species so far in NZ, but in the long term probably capable of inhabiting a range of open scrub and light forest.
- 2 **Resistance to management practices:** some regenerative capacity and young plants quite hard to pull out. No data on response to herbicides.

9 Esler's Index of Weediness

Coastal banksia (*Banksia integrifolia*)

Family Proteaceae

Origin Australia

Weed

Widespread coastal weed in NZ. Not known as a weed elsewhere except in Western Australia where it has been introduced outside its native range.

Form

Small tree with bushy habit, commonly 5–8 m, up to 20 m.

Ecology

Habitat: *B. integrifolia* is native to the south-east coast of Australia from Queensland to Victoria. Drought and frost tolerant. Prefers well-drained soils and can withstand alkalinity and salt. Grows in a wide range of sites in NZ.

Means of spread: by gardening and wind dispersal.

Impacts

Negative

Agriculture: none known.

Conservation: shades out native biota and competes with native species in vegetation succession.

Amenity: no impacts reported.

Landscape: intrusive foreign element.

Positive

Widely used in gardening especially in coastal areas, and as a hedge. Several internet sites offering it in NZ. Listed from 24 nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 3 **Versatility:** will grow in clay, sand, acid and even alkaline soils, and it shows good resistance to wind and salt. Has a wider latitudinal range than any other banksia in Australia. It grows on a wide range of stressed sites in NZ.
- 2 **Maturation rate:** flowering begins at around 4–6 years from seed, i.e. 3–5 years after establishment.
- 2 **Seeding ability:** unlike some banksias, the seed is released spontaneously on reaching maturity in late summer.
- 3 **Dispersal and establishment:** wind dispersed, up to at least 300 m.
- 0 **Cloning**
- 1 **Recovery:** has limited capacity for recovery if cut.
- 2 **Competitive ability:** competitive only in harsh sites.

13 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 1 **Obstruction:** some minor interference on coastal tracks.
- 2 **Suppression**
- 0 **Health impairment**
- 0 **Quality impairment:** no agricultural contamination.
- 3 **Damage to natural areas:** presently spreading into coastal communities in several places in NZ. It imposes a tree structure in some communities which otherwise would not have this life form, in other words, it is a ‘transformer’.
- 0 **Other**

Opportunity

- 2 **Extent of suitable habitat:** large areas of coastal dune systems are vulnerable in Northland.
- 2 **Resistance to management practices:** some recovery from cutting, but little information.

10 Esler’s Index of Weediness

http://en.wikipedia.org/wiki/Banksia_integrifolia#Ecology

Cameron E 2000. The naturalisation of *Banksia integrifolia* in New Zealand. New Zealand Botanical Society Newsletter 59: 15–18.

Coral pea (*Kennedia rubicunda*)

Family

Leguminosae

Origin

Australia

Weed

NZ seems to be the only country in which it has naturalised. Also considered a weed in Australia where it grows outside its natural range. There was insufficient information to have this species included on the NPPA list. It is being controlled by DOC at three sites near Kerikeri.

Form

Vigorous climbing or prostrate twining vine, alternate leaves, and clusters of dark red to purplish flowers.

Ecology

Habitat: in Northern NZ it is scattered in the wild. Also recorded from Wellington on a dry bank. Precise habitat requirements are uncertain.

Means of spread: by gardening, and dumping presumably.

Impacts

Negative

Agriculture: none known.

Conservation: in Australia it occupies sites where short native species and herbs are found and scrambles over shrubs.

Amenity: no impacts reported.

Landscape: looks like a native species although the flowers are clearly an obtrusion.

Positive

Sometimes used in gardens. Listed from one nursery (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** a relatively light demanding species. Recognised as being frost sensitive by the nursery trade internationally.
- ? **Maturation rate:** no reliable data, but probably quite a short juvenile stage.
- 2 **Seeding ability:** abundant seed in Australia.
- 2 **Dispersal and establishment:** presumably seed dispersed by gravity in NZ.
- 0 **Cloning:** does not clone.
- 2 **Recovery:** seeds are dormant and survive long periods in the soil. Can be stimulated by fire, particularly hot fires.
- 2 **Competitive ability:** only in relatively open sites and is shaded out by dense native scrub in Australia.

10 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 0 **Obstruction**
- 2 **Suppression:** crowds out smaller native species in Australia.
- 0 **Health impairment**
- 0 **Quality impairment**
- 2 **Damage to natural areas:** its potential impact has yet to be realised in NZ but it clearly has the capacity to be yet another invasive species occupying forest edges and other open sites.
- 0 **Other**

Opportunity

- 2 **Extent of suitable habitat:** very uncertain in NZ and likely to be frost limited except in the warmest areas.
- 2 **Resistance to management practices:** persistent seed bank.

8 Esler's Index of Weediness

Floyd AG 1966. Effects of fire upon weed seeds in the wet sclerophyll forests of northern New South Wales. Australian Journal of Botany 14: 243–256

There is very little information available on this species.

Giant reed (*Arundo donax*)

Family

Gramineae

Origin

India and countries surrounding the Mediterranean Sea, including Italy, Greece, Egypt, and Algeria.

Weed

Giant reed is a weed in many countries, particularly in Canada and the USA, and South America.

Form

A tall robust bunch grass growing to 6 m, in ideal conditions it can exceed 10 m, with hollow stems 2–3 cm diameter, and heads up to 80 cm long.

Ecology

Habitat: it is primarily a plant of any area with a high water table, especially where there is moving water.

Means of spread: entirely by vegetative fragments in water, carried in by machinery etc.

Impacts

Negative

Agriculture: none known apart from blocking drains and other obstructive impacts. Consumption of water is a major impact in the USA. In a review for Horizons Regional Council, Champion (2006) considered it not to be a major problem in NZ.

Conservation: giant reed forms dense thickets of distinct clumps which choke riversides and stream channels, crowd out native plants, interfere with flood control, increase fire potential, and reduce habitat for wildlife. It ignites easily and can create intense fires. Giant reed can float miles downstream where root and stem fragments may take root and initiate new infestations. Due to its rapid growth rate and vegetative reproduction, it is able to quickly invade new areas and form pure stands at the expense of other species.

Amenity: no impacts reported.

Landscape: looks obtrusive because of its size.

Positive

Sometimes used in gardens and is now being considered as a biofuel.

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** it becomes established in moist places such as ditches, streams, and riverbanks, growing best in well-drained soils where abundant moisture is available. It tolerates a wide variety of conditions, including high salinity, and can flourish in many soil types from heavy clays to loose sands, and from moist well-drained soils to those with a water table at or near the surface.
- 1 **Maturation rate:** not really applicable because of lack of seeding but it is one of the fastest growing plants in the world.
- 0 **Seeding ability:** does not produce viable seed. This factor alone explains why giant reed is not more of a problem than it is.
- 2 **Dispersal and establishment:** requires dispersal of fragments, either by water or machinery etc., and carried by people such as in dumping.
- 3 **Cloning:** clones readily from pieces as small as 5 cm long as long as these have a node.
- 3 **Recovery:** withstands cutting and will withstand chemical sprays if not applied appropriately.
- 3 **Competitive ability:** extremely competitive with other plants within the relatively narrow range of habitats it occupies.

14 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 3 **Obstruction:** The long, fibrous, interconnecting root mats of giant reed form a framework for debris dams behind bridges, culverts, and other structures that lead to damage.
- 2 **Suppression:** crowds out smaller native species but in NZ this has been less of a problem so far because of the disturbed nature of the sites it has occupied.
- 0 **Health impairment**
- 0 **Quality impairment**
- 2 **Damage to natural areas:** its potential impact has yet to be realised in NZ because it is still confined largely to highly disturbed areas. Due to its rapid growth rate and vegetative reproduction, it is able to quickly invade new areas when it is introduced and form pure stands at the expense of other species. Once established, giant reed has the ability to outcompete and completely suppress native vegetation.

- 1 **Other:** in the USA, it is considered a major fire hazard because of the biomass build-up, but that has yet to be a major issue in New Zealand.

Opportunity

- 2 **Extent of suitable habitat:** as a plant of open places including transport corridors for dispersal, large areas, or rather strips of Northland are vulnerable in the long term. Some of these have high biodiversity values. There are many isolated roadside stands in Northland from which further spread can be assured.
- 3 **Resistance to management practices:** in theory it can be effectively controlled using any of several readily available general use herbicides such as glyphosate, but in practice, there are many reports of how difficult it is to control. Apply to clumps of giant reed, after flowering (spring) with multiple applications to regrowth, either as a cut stump treatment or as a foliar spray. In the USA, amazapyr has recently been approved for use on giant reed. Prescribed burning, either alone or combined with herbicide applications, may be effective if conducted after flowering but this is seldom an option in NZ.

13 Esler's Index of Weediness

Champion P 2006. Rangitikei River phragmites (*Phragmites australis*) investigation. NIWA, Hamilton.

Himalayan fairy grass (*Miscanthus nepalensis*)

Family

Gramineae

Origin

Bhutan, India, Myanmar, Nepal; introduced in Malaysia.

Weed

NZ seems to be the only country in which it has naturalised to any extent.

Form

A tall robust bunch grass with heads up to 80 cm.

Ecology

Habitat: in Northern NZ it occupies roadsides, tracks, clay banks, and some areas of lightly shaded forest and scrub.

Means of spread: by gardening and wind dispersal, possibly also by attachment and by machinery.

Impacts

Negative

Agriculture: none known.

Conservation: occupies sites where short native species and herbs are found.

Amenity: no impacts reported.

Landscape: looks like a native species.

Positive

Sometimes used in gardens and can be mistaken for a native plant.

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** a relatively light demanding species and possibly not tolerant of very poor drainage.
- 2 **Maturation rate:** no reliable data, but probably quite a short juvenile stage.
- 3 **Seeding ability:** abundant seed.
- 2 **Dispersal and establishment:** seeds spread by wind and attachment to clothes and machinery. No data on establishment requirements.
- 0 **Cloning:** does not clone although possibly plants can be distributed if broken up by mowing etc.
- 2 **Recovery:** withstands cutting.
- 2 **Competitive ability:** only in relatively open sites and is shaded out by dense native scrub. Found to be less competitive than several pasture species in China.

13 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 0 **Obstruction**
- 2 **Suppression:** crowds out smaller native species.
- 0 **Health impairment**
- 0 **Quality impairment**
- 2 **Damage to natural areas:** its potential impact has yet to be realised in NZ but it clearly has the capacity to be yet another invasive species occupying banks and places occupied by native orchids and the like. These habitats are now under threat from a wide range of exotic species. In forested areas it is eventually overgrown by native species on stabilised surfaces, just as tall native grasses are.
- 0 **Other**

Opportunity

- 2 **Extent of suitable habitat:** as a plant of open places including transport corridors for dispersal, large areas of Northland are vulnerable. Some of these have high biodiversity values.
- 2 **Resistance to management practices:** some recovery from spraying because plants are cryptic and difficult to find.

8 Esler's Index of Weediness

Zhong H-P, Fan J-W, Du Z-C, Liang B, Han B 2004. Correlation of interspecific competition of *Lolium perenne* with quantitative management indexes of pasture. *Pratacultural Science* 2: 30–37.

Ivy (*Hedera helix* spp. *helix*)

Family

Araliaceae

Origin

Europe

Weed

Widespread weed in the temperate world including NZ.

Form

Vigorous smothering climber.

Ecology

Habitat: ivy is widespread in a range of habitats from the coast to central regions of NZ. Occupies a very wide range of sites wherever there is suitable vegetation or structures to grow on. Drought and frost tolerant and grows in a wide range of sites in NZ.

Means of spread: by gardening and bird dispersal.

Impacts

Negative

Agriculture: none known.

Conservation: shades out native biota and damages it sufficiently to allow wind into forests.

Amenity: smothers buildings and structures.

Landscape: intrusive foreign element.

Positive

Widely used in gardening.

Ratings

Biological Success and Environmental Impact (0–3)

| | |
|---|------------------------------------|
| 3 | Versatility |
| 2 | Maturation rate |
| 2 | Seeding ability |
| 3 | Dispersal and establishment |
| 2 | Cloning |
| 3 | Recovery |
| 3 | Competitive ability |

18 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

| | |
|---|--------------------------------|
| 2 | Obstruction |
| 2 | Suppression |
| 2 | Health impairment |
| 0 | Quality impairment |
| 3 | Damage to natural areas |
| 0 | Other |

Opportunity

| | |
|---|--|
| 2 | Extent of suitable habitat |
| 3 | Resistance to management practices: difficult to kill unless stems cut and poisoned. Those remaining up trees with well-imbedded suckers can persist. |

14 Esler's Index of Weediness

Included here only because scoring had already been done previously.

Japanese walnut (*Juglans ailantifolia*)

Family

Juglandaceae

Origin

Japan

Weed

Listed as an environmental weed in Australia and USA. Listed in the Taranaki Regional Council and Environment Waikato RPMSs. Subject to local weed programmes.

Form

Japanese walnut is a quick-growing, wide-spreading deciduous tree up to 15 m tall capable of forming dense stands.

Ecology

Habitat: along stream banks, low and disturbed forests, amenity areas, drainage channels and wetlands.

Means of spread: seeds float and carried by people. They may also be dispersed by rats in NZ because they are carried by mice and squirrels in Japan.

Impacts

Negative

Agriculture: none yet in NZ, but in the USA they block farm drains.

Conservation: form dense stands that could be occupied by native species.

Amenity: none to date.

Landscape: looks very much like a native tree but then becomes conspicuous when it changes colour in autumn.

Positive

Widely planted for horticulture, especially in northern half of North Island. Listed from four nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

1 **Versatility:** requires fairly moist soils.

1 **Maturation rate:** this is an estimate.

2 **Seeding ability:** large amount of seed produced.

1 **Dispersal and establishment:** no specialised means, carried by gravity and water.

0 **Cloning**

? **Recovery:** no data.

2 **Competitive ability:** in riparian zones competes with slower-growing native species such as kōwhai.

? **Biological Success and Environmental Impact rating**

Weed status assessment (0–3)

1 **Obstruction:** roots block drains.

1 **Suppression**

0 **Health impairment**

0 **Quality impairment**

1 **Damage to natural areas:** occupies space along stream banks, low and disturbed forests, amenity areas, drainage channels and wetlands.

0 **Other**

Opportunity

2 **Extent of suitable habitat:** this tree could occupy large areas of riparian land especially in Northland.

? **Resistance to management practices:** no data.

? **Esler's Index of Weediness**

Insufficient data to generate scores.

Jasmine (*Jasminum polyanthum*)

Family Oleaceae

Origin Western China

Weed

Listed as an environmental weed in Australia. However, information as to its weediness elsewhere is very sparse.

Form

A vigorous scrambling climber that forms dense mats over many square metres, including climbing up trees, and produces underground runners that begin new patches.

Ecology

Habitat: forest margins, forest gaps, shrubland margins, general shrubland and forest, farm hedges, roadsides, abandoned houses and gardens, wasteland.

Means of spread: mainly vegetatively.

Impacts

Negative

Agriculture: none.

Conservation: forms dense stands, sprawling mats covering low-growing native species.

Amenity: none to date.

Landscape: looks very much like a native plant.

Positive

Widely planted for horticulture, and listed from two nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

2 **Versatility:** moderately resistant to high salt concentrations in the soil. Quite tolerant of poor drainage and a range of soil types. Not tolerant of very heavy frosts.

? **Maturation rate:** its life cycle from seed in the wild is unknown.

1 **Seeding ability:** does not often produce seed, despite comments on some websites that seeds are dispersed by birds. This lack of seed production is probably the biggest single reason the plant is not more widespread and a greater nuisance. However, no studies of seed production are known.

1 **Dispersal and establishment:** the fruit are small enough (5–8 mm diameter) to be distributed by a range of birds, but this seems to happen only rarely, if at all. Garden dumping is the main means of new infestations.

3 **Cloning:** readily grows from pieces of the runners.

2 **Recovery:** readily regrows if pieces are left.

2 **Competitive ability:** in riparian zones and clearings it competes with slower-growing native species, particularly when these are at the juvenile stage.

? **Biological Success and Environmental Impact Rating**

Weed status assessment (0–3)

2 **Obstruction:** blocks tracks in some cases and needs to be cleared.

1 **Suppression:** no impact on agricultural plants.

0 **Health impairment**

0 **Quality impairment**

2 **Damage to natural areas:** sprawls over native species along margins of forest, light scrub, gullies, and some revegetation plantings.

0 **Other**

Opportunity

2 **Extent of suitable habitat:** large areas of shrub margins, damp gullies, and lightly shaded understorey are vulnerable, in Northland.

2 **Resistance to management practices:** very difficult to kill by mechanical means because of the long runners. Herbicides can be used and Greater Wellington website recommends spraying in summer with Escort 5 g/10 L water + penetrant; or Tordon BK 6 ml/L water + penetrant, or stump swab with Escort 5 g/L water.

9 **Esler's Index of Weediness**

Mickey Mouse plant (*Ochna serrulata*)

Family Ochnaceae

Origin

Occurs on the subtropical (east) coast of southern Africa.

Weed

Known as a weed in Australia and Hawai'i.

Form

Shrub

Ecology

Habitat: it is widely distributed in its native range from sea level to altitudes of up to 1800 m. This species can be found on the margin of evergreen forests as well as in the forest, in scrub forests, on rocky hill slopes, in bush veld and it is common in the grasslands of KwaZulu-Natal and the former Transkei area. It is also found in the south-eastern part of Western Cape and the Eastern Cape, Gauteng and Swaziland. It often forms part of the understorey in the forest, although it grows in many different habitats in South Africa.

Means of spread: deliberately planted, and by birds.

Impacts

Negative

Agriculture: none.

Conservation: in Australia it occupies the understorey and shades out native species, but less evidence of that yet in NZ.

Amenity: none to date.

Landscape: none to date; looks very much like a native tree when not flowering or fruiting.

Positive

Widely planted for horticulture. Listed from two nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** grows very well in frost-free areas, but it can withstand light frost. It enjoys full sun, but also does well in semi-shade where it is a natural understorey plant. Likely to be frost intolerant in NZ.
- 2 **Maturation rate:** grows fairly rapidly.
- 2 **Seeding ability:** produces moderate numbers of seed in its native range.
- 2 **Dispersal and establishment:** seed must be very fresh, it does not keep at all, not even in the fridge. Large numbers of seedlings are found in the field in Australia.
- 0 **Cloning**
- 2 **Recovery:** recovers readily from damage and will grow from cuttings.
- 2 **Competitive ability:** appears moderately competitive in Australia at least.

12 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 1 **Obstruction**
- 1 **Suppression:** has some impact on associated plants, but not noted as reducing crops.
- 0 **Health impairment**
- 0 **Quality impairment**
- 2 **Damage to natural areas:** forms understorey thickets in Australia, shading out native species.
- 0 **Other**

Opportunity

- 2 **Extent of suitable habitat:** many marginal habitats are available to it Northland, but it is probably too dependent on frost free environments to become a major weed.
- 2 **Resistance to management practices:** recovers after damage. No persistent seed bank.

8 Esler's Index of Weediness

Breaden R, Armstrong T 2004. Control methods for ochna (*Ochna serrulata*) (Hochst.) Walp. in south-east Queensland. Plant Protection Quarterly 19(1): 33–35.

<http://www.plantzafrica.com/plantnop/ochnaserrulat.htm>

Mountain blueberry (*Elaeocarpus reticulatus*)

Family

Elaeocarpaceae

Origin

Endemic to the eastern seaboard of Australia. It is found in a wide range of habitats that spread from southern Queensland to Flinders Island.

Weed

Known to be a weed in Western Samoa and Northland.

Form

It is a small conical evergreen tree reaching up to 15 m in height.

Ecology

Habitat: naturally found in a wide range of environments, from moist gullies through to rocky ridge outcrops and sandy coastal scrubs.

Means of spread: small fruit are spread by birds.

Impacts

Negative

Agriculture: none known.

Conservation: shades out native biota.

Amenity: none known.

Landscape: intrusive foreign element.

Positive

Widely used in gardening. Listed from one nursery (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

2 **Versatility:** seedlings have been found in Northland in full sun to approximately 50% shade. In Australia it is mainly a subcanopy rainforest species. It can tolerate frost to -4.5 degrees C.

? **Maturation rate:** no data.

2 **Seeding ability:** readily produces fruit. The 12 mm long blue oval berries take until the next flowering season to ripen. No seedlings have yet been found in Auckland despite the presence of adult trees. Reported that in Australia, germination from seed is slow and can take up to 2 years, although fermentation may assist this process (i.e. substituting for travel through an animal or bird gut).

2 **Dispersal and establishment:** bird dispersed and by marsupials in Australia.

0 **Cloning**

? **Recovery:** no data.

? **Competitive ability:** no data.

? **Biological Success and Environmental Impact Rating**

Weed status assessment (0–3)

? **Obstruction:** no data.

? **Suppression:** no data.

0 **Health impairment**

0 **Quality impairment**

? **Damage to natural areas**

0 **Other**

Opportunity

2 **Extent of suitable habitat:** from the very limited area currently invaded it is hard to imagine how far it could spread. However, damp watercourses in parks and reserves, 'waste places', and marginal habitats are probably vulnerable in the long term.

? **Resistance to management:** after pruning, it will resprout thickly, indicating some resistance.

? **Esler's Index of Weediness**

Insufficient data to generate scores.

Bannister P, Lord J 2006. Comparative winter frost resistance of plant species from southern Africa, Australia, New Zealand, and South America grown in a common environment (Dunedin, New Zealand) New Zealand Journal of Botany 44: 109–119.

Mugwort (*Artemisia verlotiorum*)

(Several species go under this name worldwide).

Family

Asteraceae

Origin

South China

Weed

Known as a weed in Australia, from Victoria to Queensland. An important weed from Brazil down to Argentina. Widespread in Eurasia but not reported as an economic or environmental weed there.

Form

Herbaceous perennial, dying back to rootstock annually, c. 1 m high; stems erect, ±tomentose becoming glabrous below, ribbed, unbranched below inflorescence.

Ecology

Habitat: grows in disturbed areas, often in moist sites in Australia. In Europe, occurs in diverse habitats, mostly growing in relatively fertile and wet environments such as river and lake banks, field margins, gardens and ruderal places.

Means of spread: wind.

Impacts

Negative

Agriculture: cropping weed.

Conservation: not sufficiently abundant to estimate.

Amenity: none to date.

Landscape: none to date.

Positive

Widely grown as a herb.

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** grows in a range of habitats although appears to favour moist soils.
- 2 **Maturation rate:** perennial, producing new plants the year following flowering.
- 2 **Seeding ability:** numerous achenes 1–1.5 mm long, ±smooth; pappus absent or a small scabrous ring.
- 3 **Dispersal and establishment:** wind dispersed. Also spread by pieces of rhizomes.
- 0 **Cloning**
- 3 **Recovery:** recovers from rhizomes if damaged.
- 2 **Competitive ability:** competes against grasses and crops.

14 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 0 **Obstruction:** none reported.
- 2 **Suppression:** suppresses crops such as maize.
- 0 **Health impairment:** none reported.
- 0 **Quality impairment:** none reported.
- 0 **Damage to natural areas:** despite widespread distribution in Eurasia, no damage reported.
- 0 **Other**

Opportunity

- 2 **Extent of suitable habitat:** its general habitat description and current habitat suggests a lot of potential habitat in Northland.
- 2 **Resistance to management practices:** difficult to control using herbicides in cropping systems but Dicamba the most effective.

6 Esler's Index of Weediness

Breaden R, Armstrong T 2004. The susceptibility of Chinese wormwood (*Artemisia verlotiorum* Lamotte) to various herbicides. *Plant Protection Quarterly* 19(3): 96–97.

- Jakelaitis A, Silva AA, Ferreira LR, Silva AF, Freitas FCL 2004. Weed management in corn and signal grass (*Brachiaria decumbens*) intercrops. *Planta Daninha* 22: 553–560.
- Jakelaitis A, Silva AF, Silva AA, Ferreira LR, Freitas FCL, Vivian R 2005. Influence of herbicides and sowing systems on maize - *Brachiaria brizantha* intercrop. *Planta Daninha* 23: 59–67.

Norfolk Island hibiscus (*Lagunaria patersoni*)

Family

Malvaceae

Origin

Norfolk Island

Weed

Weed in Australia and NZ.

Form

Evergreen tree to 15 m.

Ecology

Habitat: forms part of a community called the *Lagunaria* Swamp Forest on Lord Howe Island, low-lying swampy areas at altitudes below 20 m. Individual plants of *L. patersonia* may be scattered through the forests from sea level to about 600 m elevation on Lord Howe Island.

Means of spread: not specialised but by gravity or water.

Impacts

Negative

Agriculture: none known.

Conservation: none reported despite its invasion (spread) being noted.

Amenity: recommended as shelter belt by Environment Bay of Plenty.

Landscape: not significant as yet.

Positive

Widely used in gardens and as a shelter tree. Listed from 15 nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

2 **Versatility:** tolerates frosts to about –5 degrees C. Requires good drainage.

1 **Maturation rate:** plants grow slowly.

2 **Seeding ability:** readily sets seed, but viability in NZ not reported.

1 **Dispersal and establishment**

0 **Cloning**

? **Recovery**

? **Competitive ability**

? **Biological Success and Environmental Impact Rating**

Weed status assessment (0–3)

1 **Obstruction:** none reported.

? **Suppression**

3 **Health impairment** the fruit, a five-valved capsule, remains on the tree for long periods and contains silicon crystals which if handled or imbedded into clothes can cause skin irritations. This is why it is also referred to as ‘itch tree’ and ‘cow itch tree’ and has caused trees to be removed from some areas of Australia.

0 **Quality impairment:** none reported.

? **Damage to natural areas:** none reported.

0 **Other**

Opportunity

? **Extent of suitable habitat**

0 **Resistance to management practices:** some recovery from cutting, but little information.

? **Esler’s Index of Weediness**

Pickard J 1983. Vegetation of Lord Howe Island. *Cunninghamia* 1: 133–265.

Apart from its native communities, horticultural attributes, and deleterious health properties, little is reported on this species. Insufficient data to generate scores.

Paperbark poplar (*Melaleuca quinquinervia*)

Family

Myrtaceae

Origin

Australia

Weed

A serious and widespread tropical weed. Subject of a successful biological control programme in Florida, USA.

Note: not present in the wild in NZ and the following analysis applies to its weediness overseas.

Form

Small tree

Ecology

Habitat: wetland

Means of spread: wind

Impacts

Negative

Agriculture: blocks drains.

Conservation: shades out all associated native plants and animals; fire hazard.

Amenity: blocks waterways.

Landscape: covers open wetland.

Positive

Not listed as offered for sale in Gaddum (1999).

Ratings

Biological Success and Environmental Impact (0–3)

| | |
|---|-----------------------------|
| 2 | Versatility |
| 2 | Maturation rate |
| 3 | Seeding ability |
| 2 | Dispersal and establishment |
| 0 | Cloning |
| 1 | Recovery |
| 3 | Competitive ability |

13 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

| | |
|---|-------------------------|
| 3 | Obstruction |
| 3 | Suppression |
| 0 | Health impairment |
| 0 | Quality impairment |
| 3 | Damage to natural areas |
| 0 | Other |

Opportunity

| | |
|---|------------------------------------|
| 2 | Extent of suitable habitat |
| 2 | Resistance to management practices |

13 Esler's Index of Weediness

Based on overseas data only.

Pepper tree (*Schinus terebinthifolius*)

Family

Anacardiaceae

Origin

Peruvian Andes; Argentina, Paraguay, and Brazil.

Weed

Widely reported as a weed overseas in several countries. Naturalised in most tropical and subtropical regions, including other South American countries, parts of Central America, Bermuda, the Bahamas Islands, the West Indies, Guam, Mediterranean Europe, North Africa, southern Asia, South Africa, and Australia. In the United States, occurs in Hawai'i, California, southern Arizona, and Florida – in Florida as far north as Levy and St Johns counties and as far west as Santa Rosa County.

Form

It is a small tree 4.5 m wide and 6 m tall with a short trunk usually hidden in a dense head of contorted, intertwining branches with leathery fern-like leaves. There are separate male and female trees. Small white flowers on the female trees are followed by bright red fruits which are dispersed by birds.

Ecology

Habitat: in its natural range, it is reported to occur as scattered individuals in a variety of habitats, from sea level to over 700 m elevation.

Means of spread: seeds are wind blown a short distance although they are mostly carried by water. Vegetative parts are spread by floods.

Impacts

Negative

Agriculture: none

Conservation: suppresses native vegetation.

Amenity: none to date.

Landscape: looks similar to native trees.

Positive

Widely planted as a wind break. Listed from five nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** in its naturalised range in the USA it has invaded a variety of areas including, but not limited to, fallow farmland, pinelands, hardwood hammocks, roadsides, and mangrove forests, in areas with a high degree of disturbance and natural areas with little disturbance. Most abundant in wet sites.
- 1 **Maturation rate:** Reproduction can occur 3 years after germination.
- 3 **Seeding ability:** seeds from Brazil were reported to average 80 600 seeds/kg. Seed viability is 30–60% and can last up to 2 months, but declines to 0.05% at 5 months.
- 3 **Dispersal and establishment:** dispersed by birds. The species has an intermediate tolerance of shade and can survive and grow slowly under forest canopies until disturbance releases it.
- 0 **Cloning:** does not clone.
- 3 **Recovery:** sprouts easily from the trunk and roots, even if the plant is undamaged.
- 3 **Competitive ability:** highly competitive species in wet habitats.

15 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** generally obstructive only in situations where it has become more bulky than the species it replaces.
- 2 **Suppression:** suppresses many other smaller wetland species.
- 2 **Health impairment:** in some people, sneezing and asthma-like reactions often occur in the proximity of the blooming plant. Direct contact with the exudate from the trunk causes vesication (blistering) and severe itching, the lesions resembling second-degree burns. It is also recorded that the resinous exhalation from the tree causes skin eruptions resembling those of measles or scarlet fever. This may be observed in people resting under the tree, and in those engaged in felling, trimming, or pruning the branches, especially while the plant is in bloom. Plant may also cause eye inflammation, and is toxic if ingested. Unripe fruits can be fatal to horses.
- 0 **Quality impairment:** none known.
- 3 **Damage to natural areas:** nearly all terrestrial ecosystems in central and southern Florida are being

encroached upon by the Brazilian pepper tree. This low-growing, evergreen, deciduous tree is an aggressive invader of most mesic to wet lowland environments. It shades out other plants, as well as preventing reestablishment of other species.

0 Other

Opportunity

3 Extent of suitable habitat: assuming climatic suitability, large areas of wetland throughout Northland are vulnerable to this plant. The problem as far as prediction goes is that despite a long history in warmer parts of NZ it has not yet become highly invasive.

2 Resistance to management practices: can be controlled by cutting and poisoning, but dense multi-stemmed thickets are difficult to work in.

14 Esler's Index of Weediness

Phoenix palm (*Phoenix canariensis*)

Family

Palmae

Origin

Canary islands

Weed

Weed in Australia and NZ.

Form

Stout palm up to 6 m tall, with large leaves that have huge spines at their basal ends.

Ecology

Habitat: cool temperate to semi-tropics on a wide range of soil conditions and from partial shade to full sun, in coastal forest, sand dunes, margins of saline wetland areas.

Means of spread: very widely planted. Spread naturally by birds, and by gravity. Possibility of being hoarded by rats.

Impacts

Negative

Agriculture: none.

Conservation: shades out native biota.

Amenity: young plants with spines at 'human level' are a menace because of their spines.

Landscape: introduces foreign elements into the landscape.

Positive

Widely planted as an amenity and specimen tree in Northland. Listed from five nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** grows in a wide range of habitats, many of which are stressed sites, e.g. margins of sand dunes and mangroves.
- 1 **Maturation rate:** very slow to maturity.
- 3 **Seeding ability:** produces abundant seed.
- 2 **Dispersal and establishment:** widespread by several bird species and possibly rats but this is not matched by frequency of establishment which is relatively uncommon.
- 0 **Cloning**
- 3 **Recovery:** extremely difficult to kill.
- 2 **Competitive ability:** not highly competitive at a very early stage but once it is well established it becomes more resistant to competition from other species.

13 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** large plants block access because of spines. Roots can be particularly bad in blocking drains.
- 2 **Suppression:** covers other plants but not at a very fast rate.
- 3 **Health impairment:** well-documented cases of severe wounds caused by spines and requiring hospitalisation. Extremely dangerous to children because the spines are at their height in younger plants.
- 1 **Quality impairment:**
- 2 **Damage to natural areas:** Is naturalising in native bush, estuarine environments, mangroves, and coastal cliffs and but has not reached a stage of abundance where its present impact is obvious.
- 0 **Other:**

Opportunity

- 3 **Extent of suitable habitat:** very large areas of Northland are vulnerable across a wide range of habitats on the mainland and offshore islands.
- 3 **Resistance to management practices:** seedlings difficult to remove and adults regrow from base if cut.

16 Esler's Index of Weediness

Queen of the night (*Cestrum nocturnum*)

Family

Solanaceae

Origin

Central and South America

Weed

Widely known as a weed overseas because of its toxicity but also because of its competitive ability in warmer forests such as Hawai'i.

Form

Shrub or small tree to 2.5 m tall with pale greenish white tubular flowers and pale berries 0.5–1.0 cm diameter. Strongly smelling.

Ecology

Habitat: shrubland areas, secondary forest and shrubland margins, secondary forest, waste places, stream banks in northern NZ.

Means of spread: by human planting and birds.

Impacts

Negative

Agriculture: all parts of the plant are toxic to livestock and may cause hay-fever-like symptoms in humans.

Conservation: occupies space that might otherwise be occupied by native species.

Amenity: poisonous plant in vicinity of human habitations parks etc.

Landscape: looks largely like a native species.

Positive

Used in gardening, especially the night perfume, and was previously widely sold (now prohibited). Listed from one nursery (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** occupies a range of sites and soils but not tolerant of really harsh sites. Prefers higher rainfall areas. Very frost tolerant. In Florida it has been described as a salt-tolerant plant highly resistant to salt drift and can be used in exposed environments.
- 1 **Maturation rate:** plants seed within 18 months of establishment.
- 2 **Seeding ability:** large number of seeds produced, a few to each globose fruit.
- 2 **Dispersal and establishment:** seeds are small enough to be dispersed by silvereyes and other birds. Also by fragments.
- 1 **Cloning:** reproduces vegetatively from buds from creeping roots.
- 1 **Recovery:** seeds remain dormant in the soil for many years.
- 2 **Competitive ability:** highly competitive in Australia. Seeds dispersed by birds and water. Pieces of cut root spread by cultivation. Also reproduces vegetatively from buds from creeping roots. Seeds remain dormant in the soil for many years.

11 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 0 **Obstruction:** none reported.
- 1 **Suppression:** some interference with native plants in open sites.
- 3 **Health impairment:** all parts extremely toxic to animals. No reports to the National Poisoning Centre of harm to humans since 2002.
- 0 **Quality impairment**
- 2 **Damage to natural areas.** occupies shrubland areas, secondary forest and shrubland margins, secondary forest, waste places, stream banks. In Hawai'i, cestrum appears to be more suited than native Hawaiian species for capturing and utilising light resources particularly in high-light environments, such as those characterised by relatively high levels of disturbance.
- 0 **Other:**

Opportunity

- 2 **Extent of suitable habitat:** there are potentially large areas of forest margins that could be occupied by cestrum. It has been naturalised only since 1980 so its potential is far from realised.
- 1 **Resistance to management practices:** young plants can be pulled and adults poisoned easily enough.

9 Esler's Index of Weediness

Pattison R, Goldstein G, Ares A 1998. Growth, biomass allocation and photosynthesis of invasive and native Hawaiian rainforest species. *Oecologia* 117: 449–459.

Queensland poplar (*Homolanthus populifolius*)

Family

Euphorbiaceae

Origin

NE and E Australia (Queensland, New South Wales), Solomon Islands and Melanesia.

Weed

Mauritius and South Africa and is becoming a weed in Hawai'i.

Form

Small tree

Ecology

Habitat: Open forest, woodland, scrub, waste places.

Means of spread: Birds

Impacts

Negative

Agriculture: blocks drains.

Conservation: shades out all associated native plants and animals; fire hazard.

Amenity: none to date.

Landscape: none to date.

Positive

Widely planted for horticulture.

Ratings

Biological Success and Environmental Impact (0–3)

| | |
|---|------------------------------------|
| 2 | Versatility |
| 2 | Maturation rate |
| 2 | Seeding ability |
| 2 | Dispersal and establishment |
| 0 | Cloning |
| 1 | Recovery |
| 2 | Competitive ability |

11 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

| | |
|---|--------------------------------|
| 2 | Obstruction |
| 2 | Suppression |
| 0 | Health impairment |
| 0 | Quality impairment |
| 2 | Damage to natural areas |
| 0 | Other |

Opportunity

- | | |
|---|--|
| 2 | Extent of suitable habitat: the potential extent of this species is very uncertain. It grows mainly in areas warmer than northern NZ so it may become more widespread with climate warming. |
| 2 | Resistance to management practices: Small seedlings can likely be pulled, and small plants can likely be dug up. It is uncertain if cutting at ground level without herbicide applications will result in effective control or if plants will resprout. |

11 Esler's Index of Weediness

These ratings are mostly based on overseas situations.

http://www.hear.org/starr/hiplants/reports/pdf/omalanthus_populifolius.pdf

Sexton's bride (*Rhaphiolepis umbellata*)

This species is not known as a weed elsewhere in the world, and is as yet of insufficient abundance in NZ to state its impact.

Family

Rosaceae

Origin

Japan, Korea

Weed

Known as a weed only in NZ.

Form

Small tree.

Ecology

Habitat: open forest, woodland, scrub, waste places.

Means of spread: birds

Impacts

Negative

Agriculture: none.

Conservation: not sufficiently abundant to estimate.

Amenity: none to date.

Landscape: none to date, but looks very much like a native tree.

Positive

Widely planted for horticulture. Listed from four nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

| | |
|---|---|
| 2 | Versatility |
| 2 | Maturation rate |
| 2 | Seeding ability |
| 2 | Dispersal and establishment |
| 0 | Cloning |
| ? | Recovery: no data |
| ? | Competitive ability: no data |
| ? | Biological Success and Environmental Impact Rating |

Weed status assessment (0–3)

| | |
|---|--------------------------------|
| 1 | Obstruction |
| 1 | Suppression |
| 0 | Health impairment |
| 0 | Quality impairment |
| 1 | Damage to natural areas |
| 0 | Other |

Opportunity

| | |
|---|---|
| 2 | Extent of suitable habitat |
| ? | Resistance to management practices |

? **Esler's Index of Weediness**

Insufficient data to generate scores.

Sharp rush (*Juncus acutus*)

Family

Juncaceae

Origin

Europe, Africa, Macronesia, North and South America, Australia.

Weed

Form

Very stout rhizomatous rush forming clumps with harsh leaves up to 1 m tall.

Ecology

Habitat: mainly damp places in sand country, but many open habitats outside of Europe. In Chile, reaches over 2000 m, and occurs in the Australian Alps in Victoria.

Means of spread: no specialised system, but reported carried by water and birds.

Impacts

Negative

Agriculture: competes in very poor pasture.

Conservation: shades out small associated native plants and potentially a bad weed in saline environments.

Amenity: none.

Landscape: not readily distinguishable from native species.

Positive

Used as a nutrient scavenging plant in some countries.

Ratings

Biological Success and Environmental Impact (0–3)

2 **Versatility:** very versatile plant, but requires salt content to soil, and not tolerant of burial by sand.

2 **Maturation rate:** produces seed second year after sowing.

2 **Seeding ability:** moderate number of seeds, c. 200 per head.

2 **Dispersal and establishment:** seeds are very light and can be dispersed by wind and water. Requires light for germination.

0 **Cloning**

3 **Recovery:** readily recovers from damage. Plants can live for 30 years.

3 **Competitive ability:** not competitive with crops or grasses other than in the harshest saline soils.

15 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

0 **Obstruction**

2 **Suppression:** smothers grasses in saline habitats.

0 **Health impairment**

0 **Quality impairment:** no impact on agricultural products.

2 **Damage to natural areas:** generally occupies space.

0 **Other**

Opportunity

3 **Extent of suitable habitat:** large amounts of sandy coastal habitats available in Northland and climatically suited to the region.

2 **Resistance to management practices:** difficult to control and not palatable to stock. Not eaten by rabbits.

13 Esler's Index of Weediness

Sweet pittosporum (*Pittosporum undulatum*)

Family

Pittosporaceae

Origin

Australia: Queensland, New South Wales, Victoria.

Weed

Australia outside native range and many other countries, especially in Caribbean. Its status in Northland is doubtful and some even consider it a native plant arrived naturally in NZ from Australia.

Form

Small tree.

Ecology

Habitat: open forest, woodland, scrub, waste places.

Means of spread: birds.

Impacts

Negative

Agriculture: none.

Conservation: shades out all associated native plants and animals; fire hazard.

Amenity: none to date.

Landscape: none to date. It looks very much like a native tree.

Positive

Widely planted for horticulture. Listed from two nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

| | |
|---|-----------------------------|
| 2 | Versatility |
| 2 | Maturation rate |
| 2 | Seeding ability |
| 2 | Dispersal and establishment |
| 0 | Cloning |
| 2 | Recovery |
| 2 | Competitive ability |

12 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

| | |
|---|-------------------------|
| 2 | Obstruction |
| 2 | Suppression |
| 0 | Health impairment |
| 0 | Quality impairment |
| 3 | Damage to natural areas |
| 0 | Other |

Opportunity

| | |
|---|------------------------------------|
| 2 | Extent of suitable habitat |
| 2 | Resistance to management practices |

11 Esler's Index of Weediness

Note: these ratings are based entirely on the behaviour of the species outside its native range in Australia and in other countries.

Sydney golden wattle (*Acacia longifolia*)

Family

Leguminosae

Origin

South-eastern Australia, from the extreme south-east of Queensland, eastern New South Wales, eastern and southern Victoria, and south-eastern South Australia.

Weed

Naturalised in parts of Australia outside native range, USA, Uruguay, Argentina and South Africa, the Iberian Peninsula and several other Mediterranean to cool-climate countries. Subject of a successful biological control programme in South Africa.

Form

Small tree to 4 m with many fine branches. Masses of small yellow flowers.

Ecology

Habitat: in its native range it occupies disturbed places, coastal dunes and scrub up to 150 m, riparian habitats, woodland, grassland. Outside its native range it occupies a wide range of shorter vegetation.

Means of spread: gravity and water and possibly by wind if some remain attached to pod. Also because of hard seeds, will be carried by tyres.

Impacts

Negative

Agriculture: none in NZ.

Conservation: shades out all associated native plants and animals; fire hazard, changes soil chemistry.

Amenity: no impacts.

Landscape: covers naturally open landscapes in tree life form.

Positive

Is widely cultivated in subtropical regions of the world. Its uses include prevention of soil erosion, food (flowers, seeds and seed pods), yellow dye (from the flowers), green dye (pods) and wood. The tree's bark has limited use in tanning, primarily for sheep skin. It is useful for securing uninhabited sand in coastal areas, primarily where there are not too many hard frosts. Listed from seven nurseries (Gaddum 1999).

Ratings

Biological Success and Environmental Impact (0–3)

- 2 **Versatility:** in its native range it grows on any well-drained sandy soil, clay soil or rocky places with sandy soil. In Northland it appears to tolerate periodic poor drainage.
- 2 **Maturation rate:** seeds within a 2–3 years of establishment but tends to be short lived.
- 3 **Seeding ability:** masses of seeds are produced and these accumulate in the seed bank which becomes a major component of its persistence.
- 2 **Dispersal and establishment:** dispersed mainly by gravity in all its forms, and not by wind or birds. Also as a contaminant in sand for building.
- 0 **Cloning**
- 3 **Recovery:** recovers rapidly from cut stumps and also from a long-lived soil seed bank. However, these reports are often from drier and warmer areas and the seed bank life in the damper Northland climate would need to be investigated.
- 3 **Competitive ability:** highly competitive with shorter vegetation although less so with fast-growing native woody species such as on forest margins. It cannot establish under heavy shade and so forms only the first-order successional vegetation following disturbance.

15 Biological Success and Environmental Impact Rating

Weed status assessment (0–3)

- 2 **Obstruction:** grows over tracks and in open areas.
- 3 **Suppression:** complete suppression of all associated plant species.
- 0 **Health impairment**
- 0 **Quality impairment**
- 3 **Damage to natural areas:** this species is a true 'transformer' of ecosystems it invades, totally smothering shorter vegetation and changing the nitrogen regime in the soil.
- 0 **Other**
- Opportunity**
- 3 **Extent of suitable habitat:** large areas of open gumland and 'waste places' are vulnerable to this

species in Northland.

- 2 Resistance to management practices:** mechanical felling and burning is a costly and the effects are short lived because the original infestation is replaced by an even denser stand of seedlings. Fire therefore encourages the formation of dense stands. The seedlings can be effectively treated with a range of herbicides.

13 Esler's Index of Weediness

Marchante et al. 2004. Recovery potential of dune ecosystems invaded by an exotic Acacia species (*Acacia longifolia*). *Weed Technology* 18: 1427–1433.

Pieterse P-J 1994. Foliar-applied herbicides for chemical control of *Acacia longifolia* and *Paraserianthes lophantha*. *Applied Plant Science* 8: 54–56.

5 Acknowledgements

Thanks to Tony McCluggage (DOC) and Don McKenzie (NRC) for helpful discussions, and Clayton Howell for the weed scores from the DOC database. This project was funded by the Foundation for Research, Science and Technology through an Envirolink advice grant to Landcare Research.

6 General Bibliography and List of Websites

Esler AE, Liefting LW, Champion PD 1993. Biological success and weediness of the noxious plants of New Zealand. Auckland, Ministry of Agriculture and Fisheries.

Gaddum M 1999. Gaddum's plant finder 2000. Gisborne, Plantfinder.

Groves RH, Shepard RCH, Richardson RG 1995. The biology of Australian weeds Volume 1. Meredith, Australia, RG & FJ Richardson.

Panetta FD, Groves RH, Shepard RCH eds 1998. The biology of Australian weeds Volume 2. Meredith, Australia, RG & FJ Richardson.

Parsons WT, Cuthbertson EG 2001. Noxious weeds of Australia. Collingwood, Australia, CSIRO Publishing.

Randall RP 2002. A global compendium of weeds. Melbourne, RG & FJ Richardson.

Sullivan J, Timmins S, Williams P 2005. Movement of exotic plant into coastal native forest from settlements in northern New Zealand. *New Zealand Journal of Ecology* 29: 1–10.

Williams PA 2007. Guidelines for determining and naming categories of plants in regional pest management strategies. Landcare Research Contract Report LC0607/080.

Williams PA, Cameron EK 2005. Creating gardens: the diversity and progression of European plant introductions. In: Allen RB, Lee WG eds *Biological invasions in New Zealand*. Heidelberg, Berlin, Springer.

Williams PA, Champion P 2008. Biological success and weediness of existing terrestrial pest plants and aquatic weeds in Northland. Landcare Research Contract Report LC0708/080.

Williams PA, Hayes L 2007. Emerging weed issues for the West Coast Regional Council and their prospects for biocontrol. Landcare Research Contract Report LC0607/109.

http://www.biosecurity.org.nz/files/Blueberry_ash.pdf

<http://www.weeds.org.au>

<http://www.weeds.crc.org.au>

<http://en.wikipedia.org>

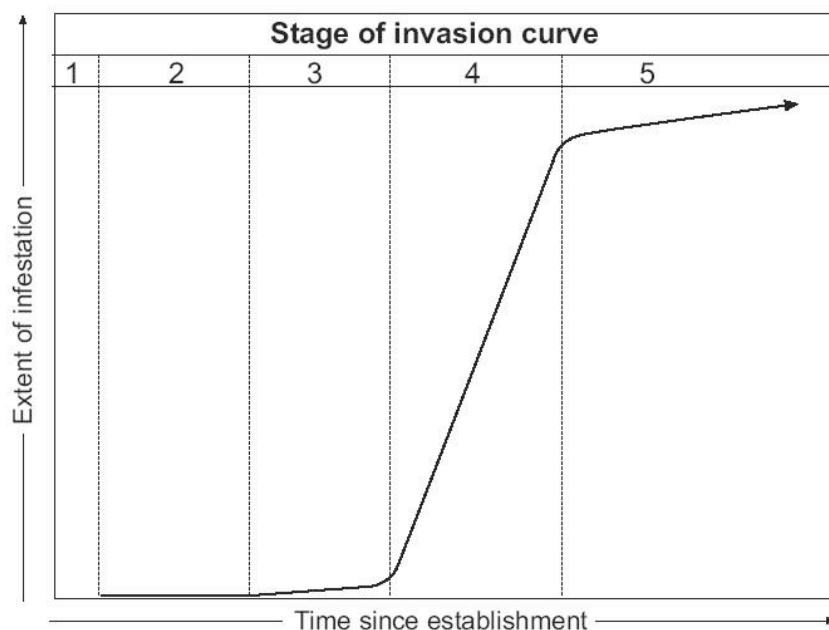
<http://www.anbg.gov.au>

<http://www.nationalparks.nsw.gov.au>

<http://www.hear.org/pier/wra>:

<http://www.fs.fed.us>; USDA forest Service.

Appendix 1 Descriptors of stages in the invasion curve (from Williams 2007)



| Stage no. | Shape of infestation curve | Distribution | Regional number of wild infestations and total area infested ¹ |
|-----------|----------------------------|----------------------------|---|
| 1 | Absent | Outside the region or only | None |
| 2 | Flat | Local | 1-2, <100 ha |
| 3 | Starting upwards | Local | 3-20, <1000 ha |
| 4 | Rising steeply | Region wide | 20+, >1000 ha |
| 5 | Levelling off | Region wide | Innumerable, >10 000 ha |

¹ Defined as total area requiring surveillance delimited by the total extent of all known plants and their probable potential dispersal distance.

Appendix 2 Full list of potential candidates for review

| Species | | DOC weediness score (C. Howell Sept. 06) | No. weed lists overseas, ex. NZ ¹ | Invasion stage ² in Northland |
|----------------------------------|---|--|--|--|
| African olive | <i>Olea europaea</i> subsp. <i>africana</i> | 28 | >10 | |
| Agapanthus | <i>Agapanthus praecox</i> | 19 | 10 | 4 |
| Akebia | <i>Akebia quinata</i> | 24 | >10 | 2 |
| American fireweed | <i>Erechtites hieraciifolia</i> | .. | >10 | ? |
| Aristea | <i>Aristea</i> | 27 | 9 | 4 |
| Arum lily | <i>Zantedeschia aethiopica</i> | 22 | >10 | 4 |
| Bangalow palm | <i>Archontophoenix cunninghamiana</i> | .. | 0 | 4 |
| Bears breaches | <i>Acanthus mollis</i> | | >10 | 4 |
| Blue passion flower | <i>Passiflora caerulea</i> | 27 | >10 | 3 |
| Brazilian pepper tree | <i>Schinus terebithifolius</i> | 24 | >10 | 1? |
| Californian bulrush ³ | <i>Schoenoplectus californicus</i> | 0 | 7 | 2 |
| Camphor laural | <i>Cinnamomum camphora</i> | 0 | >10 | 2 |
| Cape ivy | <i>Senecio angulatus</i> | 29 | >10 | |
| Cats claw creeper | <i>Macfadyena unguis-cati</i> | .. | >10 | 4 |
| Centuary plant | <i>Agave americana</i> | 22 | >10 | |
| Chinese fan palm | <i>Trachycarpus fortunei</i> | 26 | >10 | 4 |
| Climbing spindle berry | <i>Celastrus orbiculata</i> | 30 | >10 | 2 |
| Coast banksia | <i>Banksia integrifolia</i> | 23 | 3 | 4 |
| Coastal wattle | <i>Acacia sophorae</i> | 28 | >10 | 3+ |
| Coral pea | <i>Kennedia rubicunda</i> | 31 | 4 | 3 |
| Fire spike | <i>Odontonema strictum</i> | .. | 6 | 2 |
| Fork leaved hakea | <i>Hakea drupacea</i> | .. | 8 | 2 or 3 |
| Hillock bush | <i>Melaleuca hypericifolia</i> | .. | 4 | 1 |
| Himalayan fairy grass | <i>Miscanthus nepalensis</i> | 27 | 4 | 3 |
| Holly grape | <i>Mahonia lomariifolia</i> | .. | 0 | 1 |
| Homalanthus | <i>Homalanthus populifolius</i> | 24 | 5 | |
| Ivy | <i>Hedera helix</i> | 25 | >10 | |
| Japanese walnut | <i>Juglans ailantifolia</i> | 21 | 4 | 2 |

| Species | | DOC weediness score (C. Howell Sept. 06) | No. weed lists overseas, ex. NZ ¹ | Invasion stage ² in Northland |
|----------------------------|--|--|--|--|
| Jasmine | <i>Jasminum polyanthum</i> | 30 | 6 | 4 |
| Kudzu vine | <i>Pueraria montana</i> var. <i>lobata</i> | 0 | >10 | 1 |
| Ladies legs | <i>Tropaeolum pentaphyllum</i> | 22 | 0 | 1 |
| Long-leafed bush pea | <i>Pultanaea daphnoides</i> | .. | 0 | 1 |
| Mickey mouse plant | <i>Ochna serrulata</i> | | >10 | 4 |
| Monkey musk ³ | <i>Mimulus guttatus</i> | 21 | >10 | 1 |
| Mountan blueberry | <i>Elaeocarpus reticulatus</i> | .. | 0 | 2 |
| Mugwort | <i>Artemisia verlotiorum</i> | .. | 5 | |
| Norfolk Island hibiscus | <i>Lagunaria patersonii</i> | .. | 1 | |
| Osmundia | <i>Osmundia regalis</i> | .. | 3 | 2 |
| Paper bark poplar | <i>Melaleuca quinquinervia</i> | .. | >10 | |
| Pepper tree | <i>Schinus terebithifolius</i> | 24 | >10 | |
| Phoenix palm | <i>Phoenix canariensis</i> | 30 | >10 | 4 |
| Purple broom | <i>Polygala virgata</i> | 20 | >10 | 3 |
| Queen of the night | <i>Cestrum nocturnum</i> | 27 | >10 | 4 |
| Queensland poplar | <i>Homalanthus populifolius</i> | 24 | 6 | 4 |
| Sextons bride | <i>Rhaphiolepis umbellata</i> | .. | 5 | 4 |
| Sweet pea shrub | <i>Polygala myrtifolia</i> | 20 | >10 | 3 |
| Swan plant | <i>Gomphocarpus fruticosus</i> | .. | 10 | 4 |
| Sydney golden wattle | <i>Acacia longifolia</i> | 26 | >10 | 4 |
| Turks cap | <i>Malviscus arboreus</i> | 23 | 0 | 3 |
| Velvet groundsel | <i>Senecio petasitis</i> | | 3 | 4 |

¹ Randall (2002)

² Stages are from Williams (2007) but the species scores are derived from discussion with Northland weed workers.

³ See Williams & Champion (2008)