Weed warning from downunder – the weed potential of selected South African plants in cultivation in California

Roderick P. Randall[1,2] and Sandra G. (Sandy) Lloyd[1,2]
[1] Department of Agriculture, Western Australia, Locked Bag 4, Bentley Delivery Centre, Western Australia 6983, Australia
[2] Cooperative Research Centre for Australian Weed Management

Summary Three geophytes and one small tree that are native to South Africa and environmental weeds in southwest Western Australia are all available from nurseries and other sources in California and other States of the USA. Climate predictions show that these species are well suited to naturalise in California. This and their weedy behaviour in Western Australia should be sufficient evidence for immediate action to prevent their establishment in any similar climate.
Keywords Climate, weed history, prediction, risk assessment, Mediterranean.

INTRODUCTION

The authors propose that any plant both:

a) native to one Mediterranean climate region, and

b) a known weed in at least one other,

should automatically be viewed as a threat to other Mediterranean climate regions where it has not yet naturalised, or has only a limited distribution. The focus of this paper is on species native to South Africa that are weedy in the southwest of Western Australia (Hussey *et al.* 1997) and available in the horticultural trade in California (USA). The species selected are three geophytes: bridal creeper (*Asparagus asparagoides* (L.) W.Wight, Asparagaceae), watsonia (*Watsonia meriana* (L.) Mill., Iridaceae), arum lily (*Zantedeschia aethiopica* (L.) Spreng., Araceae) and the small tree taylorina or blue scurf pea (*Psoralea pinnata* L., Fabaceae). Two Australian species, bluebell creeper (*Sollya heterophylla* Lindl., Pittosporaceae) and Victorian tea tree (*Leptospermum laevigatum* (Gaertner) F.Muell., Myrtaceae), are also discussed briefly.

METHODS

The native and naturalised distribution data for the three geophytes and taylorina in both South Africa and southwest Western Australia were determined and analysed, with CLIMATE predicting back to the world dataset to determine just how much of California would be suitable for establishment.

CLIMATE is a predictive application that uses long term meteorological station data from within the known range of a plant to determine similar climates within Australia. Originally developed by the Western Australian Department of Agriculture, and based in part on BIOCLIM (Nix 1986), this software can also be used to analyse back to the large internal global meteorological station data of 9460 weather stations. In countries where station coverage is very high, such as the USA, good predictions can be obtained.

CLIMATE uses 16 climatic variables all derived from long term monthly temperature and rainfall data. The output parameters in the prediction maps (Figures 1–4) equate to 0–30% variance from ideal climate (black squares) to 30–50% variance from ideal climate (open circles) based on the ideal native and naturalised climate mean. The black squares represent those areas most at risk of the analysed species establishing and becoming problematic.

The naturalised range in Western Australia (WA Herbarium 1998) was included in each analysis to increase the efficacy of the predictions. In many cases a species can survive climatic conditions overseas outside those it inhabits in its native range, and a subsequent CLIMATE analysis may predict a wider coverage than if the native range, alone, were used. This ability to adapt to or tolerate a range of climates is a common characteristic of many weed species.

RESULTS

All four species analysed by CLIMATE showed good climate matches for significant areas of California, from Sonoma County south to San Diego County. There were also a few locations further north in Washington State where populations of these species may establish, although the cooler winters may limit their spread and impact.

Bridal creeper is found along the south coast of South Africa and north east through the Drakensberg into the Transvaal (Kleinjan and Edwards 1999). It was introduced to Australia in the mid 1800s and earned its common name through its widespread use in bridal bouquets and floral arrangements. Populations increased dramatically in the late 20th century to the point where it was named as a Weed Of National Significance (WONS) in 1997 (Anon 2001). Bridal

creeper occurs from Dongara to Esperance in Western Australia, as well as other areas across southern Australia, and has been recorded as naturalising in California near San Diego, Los Angeles and San Francisco (CalFlora 2002). The CLIMATE prediction (Figure 1) shows that large areas of the Sacramento and San Joaquin Valleys around Los Angeles, San Louis Obispo and San Diego are climatically suitable for establishment of bridal creeper.

In South Africa, taylorina occurs along the coast from the Western Cape province inland to Lesotho and north to the Transvaal and is commonly found around wetlands or soaks (Palgrave 1996). Introduced to Western Australia as a source of honey, taylorina has naturalised extensively along the wetter south coastal fringes from Albany and Denmark to Margaret River and moist areas around Perth.

Taylorina is not yet known to be naturalised in California; however, plants are available from at least once source in San Francisco (Potrero Gardens 2002). The CLIMATE prediction (Figure 2) shows large areas of the Sacramento Valley, Los Angeles and San Diego to be climatically suitable for its establishment.

Watsonia is distributed along the southwest Capes of southern Africa (Goldblatt 1989) and was common in cultivation in Australia prior to being recognised as a 'garden thug' (Randall 2001).

Watsonia has naturalised through much of the southwest of Western Australia, as well as other areas across southern Australia. Already well naturalised in Mendocino and Sonoma counties in California (CalFlora 2002) watsonia is recognised as an invasive species in the County of Mendocino town planning regulations (County of Mendocino 2002). The CLIMATE prediction (Figure 3) shows large areas of the San Joaquin Valley and around San Diego and Los Angeles to be climatically suitable for establishment.

Arum lily, also known as calla lily, is a widely used ornamental around the world. Its distribution in South Africa stretches along the coast from the Western Cape province, inland to Lesotho and north to the Transvaal (Scott 1997). It is extremely invasive in Western Australian wetlands and irrigated pastures, particularly in the Busselton-Margaret River area, and is also naturalised in other southern States of Australia. Arum lily has already been noted naturalising around old homesteads and seeps in Sonoma, Monterey and Santa Clara counties (CalFlora 2002 and Randall pers. comm. 2002). The CLIMATE prediction (Figure 4) shows that large areas of the Sacramento and San Joaquin Valleys, Los Angeles, San Louis Obispo and San Diego are climatically suitable for establishment.

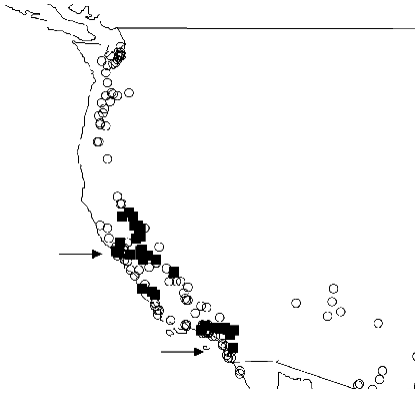

Figure 1. Potential distribution along the west coast of the United States of bridal creeper. Arrows indicate San Francisco (top) and San Diego (bottom).

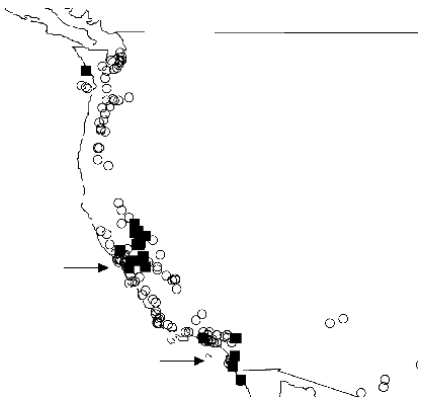

Figure 2. Potential distribution of taylorina.

Figure 3. Potential distribution of watsonia. Large arrow indicates the location of Sonoma and Mendocino counties.

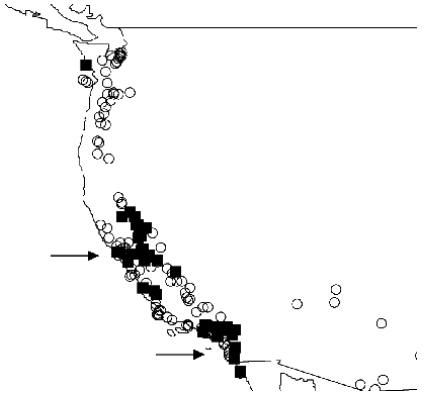

Figure 4. Potential distribution of arum lily.

DISCUSSION

Many countries are looking at risk assessment to identify and prioritise weed threats for a range of reasons, including:

- increased knowledge about the threat of invasive plants to natural ecosystems;
- knowledge of the 'sleeper weed' concept (i.e. the long lag phase between introduction and impact);
- trends towards an holistic biosecurity approach rather than just quarantine for agriculture;
- the adoption of quarantine policies that are based on formalised weed risk assessment rather than simple prohibited species lists; and
- increased pressure from communities expecting more from quarantine systems.

Some of these assessment processes are time consuming and costly, and it is often difficult to obtain data on particular species.

Many scientists consider that many parts of the world are entering an 'homogocene' era, or a 'McDonaldisation' of the world's species. That is, the replacement of regional diversity by homogenous ecosystems, characterised by cohorts of invasive species that are the same worldwide. The Mediterranean climate regions are no exception and, because of their mild climate and high human populations, are likely to be the worst affected regions. There is no shortage of examples of Mediterranean species that have made an impact around the world, including the ubiquitous charlock (*Sinapis arvensis* L.), which is found on every continent and is a weed of crops in over 50 countries (Holm *et al.* 1997) and common privet (*Ligustrum vulgare* L.) which was a favoured garden plant for centuries and is now a major environmental weed on several continents.

The Mediterranean climate is characterised by having cool, wet winters and warm to hot, dry summers. Regions sharing this climate are the southwest of Western Australia, parts of South Australia, southwestern California, southwestern Africa, parts of Chile and the Mediterranean basin itself.

Examples of Australian native species with demonstrated weedy behaviour in Australia, that clearly indicate potential invasiveness in similar climates overseas, are bluebell creeper and Victorian tea tree.

Bluebell creeper, a popular garden plant native to south-west Western Australia, has become an environmental weed in south-eastern Australia, creating dense clumps that grow over existing native vegetation (Blood 2001). It is present from Sonoma county to San Diego county (Hickman 1993) in California, but is not yet known to have established in South Africa.

Victorian tea tree, a native of south-eastern Australia, was used as an ornamental, coastal dune stabiliser and windbreak (Blood 2001). After being introduced to Western Australia, it quickly spread into coastal heath and woodlands in the lower southwest, creating dense thickets. It is a declared noxious weed in South Africa (Henderson 2001) and is also present in California (CalFlora 2002).

Climate matching programs such as CLIMATE or CLIMEX (Sutherst and Maywald 1985) are useful tools for predicting where such species may establish, but are not essential when generalising for major climatic types. Because of their demonstrated weediness in Australia, both Australian species mentioned should be considered to have significant potential to establish in other Mediterranean climates.

It is worth noting that predictions for three of the four species analysed show a small area near Aberdeen in Washington state (Figures 2–4) to be climatically suited to allow growth. This is a reminder that this type of analysis can only indicate the gross areas of climatic suitability, whereas many smaller microclimates with their potentially unique vegetation might not be indicated as suitable.

The documentation of known invasive plant species within identified climate types can be a fast and effective means to identify potential new weeds in regions with the same climate type.

REFERENCES

Anon. (2001). Bridal creeper (*Asparagus asparagoides*) Strategic Plan. National Weeds Strategy Executive Committee, Launceston. URL: www.weeds.org.au/

Blood, K. (2001). 'Environmental weeds: A field guide for SE Australia'. (C.H. Jerram and Associates, Melbourne).

CalFlora: (2002). Information on California plants for education, research and conservation. Berkeley, California: *The CalFlora Database*. URL: www.calflora.org/. (Accessed: March-April 2002)

County of Mendocino (2002). Gualala Town Plan Chapter 6 – Appendices, B. Landscape Species Lists. *Invasive species: Not recommended for use in landscaping plans*. (March 2002) URL: www.co.mendocino.ca.us/planning/GTP/gtpchap6.pdf

Goldblatt, P. (1989). 'The genus Watsonia'. (National Botanic Gardens, South Africa).

Henderson, L. (2001). Alien weeds and invasive plants. Plant Protection Research Institute and Agricultural Research Council, South Africa.

Hickman, J.C. (Ed.) (1993). 'The Jepson manual. Higher plants of California. 5th edition'. (University of California Press California, USA).

Holm, L.G., Doll, J., Holm, E., Pancho, J.V. and Herberger, J.P. (1997). 'World weeds. Natural histories and distribution'. (John Wiley and Sons New York, USA).

Hussey, B.M.J., Keighery, G., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). 'Western weeds, a guide to the weeds of Western Australia'. (The Plant Protection Society of WA (Inc.)).

Kleinjan, C.A. and Edwards, P.B. (1999). A reappraisal of the identification and distribution of *Asparagus asparagoides* in southern Africa. *S. African J. Bot.* 65, 23-31.

Nix, N.H. (1986). A biogeographic analysis of Australian elapid snakes. *In '*Atlas of Australian elapid snakes', ed. R. Longmore, pp. 4-15. (Bureau of Flora and Fauna, Canberra).

Palgrave, K.C. (1996). 'Trees of Southern Africa'. (Struik Publishers, Cape Town, South Africa).

Potrero Gardens (2002). *Rare and unusual plants*, San Francisco (Accessed: March 2002). URL: www.potrerogardens.com/autumn2001.htm

Randall, J.M. (2002). Personal communication. The Nature Conservancy, Wildland Invasive Species Team, California.

Randall, R.P. (2001). Garden thugs, a national list of invasive and potentially invasive garden plants. *Plant Protection Quarterly* 16 (4), 138-171.

Scott, J.K. (1997). The distribution of arum lily and its invasive potential. Proceedings of a workshop on arum lily (*Zantedeschia aethiopica*) eds J.K. Scott, and B.J. Wykes, 7 August 1997, Garden Island, Western Australia. CRC for Weed Management Systems, Adelaide, pp. 10-16.

Sutherst, R.W. and Maywald, G.F. (1985). A computerized system for matching climates in ecology. *Agriculture, Ecosystems and Environment* 13, 281-99.

Western Australian Herbarium (1998). *FloraBase – Information on the Western Australian flora*. (Accessed March–April, 2002). Department of Conservation and Land Management. URL: www.calm.wa.gov.au/science/florabase.html.