

Are we doing enough about early detection of weed species naturalising in Australia?

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Summary Considerable effort goes into keeping weedy species out of Australia but is enough being done to detect species that are already naturalising here and likely to become major problems? We argue that a number of species that government authorities have been attempting to keep out are already naturalised here and greater effort and resources need to go into their early detection. Examples of such species recently found naturalised in Australia include *Asystasia gangetica* (L.) T.Anderson subsp. *micrantha* (Nees) Ensermu, *Hieracium murorum* L., *Hieracium pilosella* L., *Hieracium praealtum* Vill. ex Gochnat, *Chromolaena odorata* (L.) R.M.King & H.Rob., *Mikania micrantha* Kunth, *Croton hirtus* L'Hér., *Limnocharis flava* (L.) Buchenau, *Clidemia hirta* (L.) D.Don, *Miconia calvescens* DC. and *Nassella charuana* (Arechav.) Barkworth. Most of these species appear to have been present for several to many years before they were detected and some now occupy areas that make eradication less feasible than if the species had been detected earlier. Early recognition of new invaders is essential for cost-effective intervention. We suggest that an increased detection effort should initially target areas around population centres as this is where most weeds first appear.

Keywords Early weed detection.

INTRODUCTION

Plant species may be prevented from naturalising in a country by interception at the border and by detection and eradication of founding populations that penetrate the border. Significant resources are invested in preventing weedy species from entering Australia and even more in attempting to contain and eradicate weeds that are already widespread. Mechanisms include weed risk assessments completed by Biosecurity Australia for proposed introduction of plant species not present in Australia, and border inspection and interception efforts by the Australian Quarantine and Inspection Service (AQIS). The latter includes quarantine inspections at airports and seaports, inspection of incoming mail (direct inspection, detector dogs and X-rays are used in an attempt to achieve full coverage) and

activities conducted under the auspices of the Northern Australian Quarantine Strategy (NAQS).

In the past, weed control authorities in States have hoped that they will be informed by National or State herbaria of unrecorded naturalised plant species that have recently been recorded in their States. This has occurred on an 'ad hoc' basis and a recent WeedAlert system instituted by the National Herbarium of New South Wales in 1998 overcame this problem for New South Wales (NSW) (Carter *et al.* 1999). The WeedAlert system is an automatic system that notifies users of new plant introductions and extensions in range within NSW, via changes to the main collections' database of the Royal Botanic Gardens, Sydney. For new plant introductions changes are based on new names being added to the database and not on the date of collection as plants may not be identified, correctly identified or databased for some time (in some cases this could be many years) after the initial collection. This alert system is currently being re-developed so that it is compatible with the new collections' database of the herbarium.

Other attempts to increase detection of weedy species have been the 'Weed Alert Network' in Tasmania and the 'Weed Spotters' network in Victoria but to date neither network has found any species not previously recorded in those states. Both networks are of people with botanical skills and interested in weed control and vary from government employees to private individuals. NSW Agriculture, the New South Wales Noxious Weeds Grant and the CRC for Australian Weed Management (through the 'Sentinel Sites' project) have directed some resources towards weed detection in New South Wales. The Department of Agriculture, Western Australia encourages submission of plant specimens to the Department for identification. AQIS also directs resources towards early detection of quarantine weeds in the most northern parts of Australia through the NAQS program. Otherwise little effort goes into early detection of new weeds. Most are found simply by chance. Without collections and positive identifications of new naturalisations, those responsible for managing the impact of weeds will be

unaware of potential new problems in their jurisdiction. Our review shows that current resources available for early detection of naturalised or naturalising species are inadequate.

DETECTION

Why is better detection needed? The likelihood of eradication increases if the weed occupies only a small area when first detected as the cost and difficulty of eradication increases steeply with increased infestation size (Rejmanek 2001, Rejmánek and Pitcairn 2002, Panetta and Timmins 2004). Early detection is therefore critical for successful eradication.

A number of species that government authorities have been attempting to keep out are already naturalised here. Examples of species that have recently been found naturalised in Australia (and States in which they occur) include *Asystasia gangetica* (L.) T.Anderson subsp. *micrantha* (Nees) Ensermu (NSW), *Hieracium murorum* L. (NSW), *Hieracium pilosella* L. (Tas), *Hieracium praealtum* Vill. ex Gochnat (Vic), *Chromolaena odorata* (L.) R.M.King & H.Rob. (Qld), *Mikania micrantha* Kunth (Qld), *Croton hirtus* L'Hér. (Qld), *Limncharis flava* (L.) Buchenau (Qld), *Clidemia hirta* (L.) D.Don (Qld), *Miconia calvescens* DC. (Qld) and *Nassella charruana* (Arechav.) Barkworth (Vic). A few of these species, such as *C. odorata* and *N. charruana*, and to a lesser extent *A. gangetica* subsp. *micrantha*, had spread over many hectares prior to detection.

Between 2000 and 2003 in New South Wales alone, 112 species were recognised as naturalised or naturalising, which suggests many more remain uncollected and unrecorded.

How are plants currently detected? New plant naturalisations are detected, or first recognised, mainly by those with a good knowledge of both exotic and native flora.

Over the last four years the 'Weed Alert Network' in Tasmania has not detected any previously unrecorded naturalised species in Tasmania (C. Hanson pers. comm.). The 'Weed Spotters' network in Victoria has been running for less than a year and has also not found any previously unrecorded naturalised species in that state (V. Stajsic pers. comm.). However, both networks have led to new site records for known weed species. Such finds are important as they can facilitate the commencement of local eradication or other management activities.

Of the 112 species recently recognised as naturalised or naturalising in New South Wales, 102 were first collected by those with a good knowledge of native and exotic species (68 of these by, or with,

JRH) and 10 by the general public. Similarly, in the last decade, skilled botanists have been responsible for the majority of collections of new naturalisation records in Queensland (Queensland Herbarium unpublished data, March 2004). In some cases collections from the general public are converted into herbarium specimens by those with plant collection skills as the general public does not have the facilities to prepare specimens of some species (for example succulents) or does not know how to prepare labels with adequate information to determine if a species is naturalised or not. In New Zealand all recent first detections of new plant naturalisations (>300) at the Allan Herbarium, Lincoln (CHR) were by those with botanical training or with some skills in plant identification (P.A. Williams and P. Heenan unpublished data).

In the case of weedy species that are considered to be a problem most of those listed above were collected by those with a good botanical knowledge or after being brought to the attention of these individuals.

Better ways of plant detection There are several methods for detecting species not currently recorded as naturalised.

(i) Plant collectors targeting naturalised exotic species Most Australians cannot distinguish a native plant from an exotic plant. Personnel expected to detect previously unrecorded naturalised plants, especially those likely to become weeds, require botanical knowledge. Even botanists trained in plant taxonomy may have trouble recognising naturalised exotic species superficially similar to native species, plants that are from families that they do not work on, or plants that grow in regions where they are not familiar with the flora. Another problem with use of unskilled collectors is the potential for these collectors to collect threatened native species, because like new naturalisations these are generally uncommon.

As shown above, most detections are made by those with a good knowledge of native and exotic species. It therefore seems more cost effective to fund taxonomists and those with skills in plant identification to go out and collect specimens of uncommon (at present) naturalised plants for identification. JRH and Clive Barker (a consultant funded by the CRC for Australian Weed Management, see below) were involved in the detection of 73 of the 112 recently recorded naturalisations in New South Wales. This illustrates the benefit of using botanists with a good knowledge of native and exotic species in detection of species not previously collected. Another advantage of the use of skilled collectors is that they are likely to question identifications if they consider that the identification is incorrect. Misidentifications can delay control

programs by many years. A good example of this is the misidentification of *Solanum elaeagnifolium* Cav. as the native *Solanum esuriale* Lindl. in South Australia (Hosking *et al.* 1996).

Submission of substandard specimens and omission of vital details from specimen labels are problems that may arise if relying on the general public, and in some cases even those with plant identification skills, for collection of new naturalisation records. Poor specimens are less likely to be correctly identified and if the label gives no information about its naturalised status or weediness then it may be discarded or overlooked as a garden ornamental by herbarium staff. Methods of collecting species and labelling plants are covered in Hosking *et al.* (2001, 2003) and a University of New England botany website http://www.une.edu.au/botany/plant_collecting.htm.

(ii) Specimens in herbaria that have not been identified correctly In herbaria, specimens only identified to family and genus are often filed in a folder at the end of family and genera collections. There is a need to check these incompletely identified herbarium specimens for unrecorded naturalisations. In some cases the original collection site may need to be revisited at a time when flowering or fruiting material is available (if labels are suitably accurate to determine location of the collection site).

Exotic species are often misidentified, so a number of unrecorded plant species may be found by examining exotic specimens in herbaria. This is particularly true where identification of species is difficult, for example many grasses and sedges. Some naturalised species may also be overlooked because they have been misidentified as native species. Reasons why species are misidentified are given in Hosking *et al.* (1996).

(iii) Checklists of naturalised species and records of naturalised species There are many lists of species recorded for various areas that are not backed by herbarium specimens. This literature is often termed the 'grey literature'. If the lists contain a number of species that are likely to be naturalised, or better still pictures of naturalised plants that are not recorded as naturalised, such areas could be visited and specimens made of these previously unrecorded species. This should be done if the species are likely to be a serious problem. Many records will be misidentifications but they still may point to a number of species that have not been recorded as naturalised previously. A recent project carried out by Matthew Goodwin (2002) on naturalised plants around Lightning Ridge led to the collection of five species not previously recorded as naturalised in New South Wales. In this case digital photographs confirmed the presence of species not previously recorded by the National Herbarium

of New South Wales as naturalised in New South Wales.

Targeted surveys – where? We suggest that an increased detection effort should initially target areas around population centres because most plants first naturalise in urban bushland around cities or other areas with high concentrations of gardens. Most new naturalisation records for New South Wales have come from these areas in recent years. In New Zealand, 91.5% of all collections of plant species that first naturalised between 1985 and 2000, were found within one km of a building, and <1% were >10 km from a building (P.A. Williams and P. Heenan, unpublished data).

The CRC for Australian Weed Management set up a 'Sentinel Sites' project to see if use of an area that was reinspected over time would indicate plant species that are of concern. The Blue Mountains City Council was chosen as a collaborator in this project since it had funded a weed mapping project in their area in 2000/2001. Other reasons for choosing this area were the high concentration of gardens in close proximity to natural vegetation and the diversity of climate and soil types over the mapped area. Remapping of parts of the area was carried out in 2003. To date this has resulted in many species previously not recorded as naturalised in New South Wales being collected in the Blue Mountains City Council area. Some of these records were the result of 'Sentinel Sites' mapping but many were the result of funding of a local consultant, Clive Barker, to assist with collection of specimens for the 'Sentinel Sites' project. Clive collected a number of specimens (often with JRH) as part of this project but many other specimens were collected in nearby areas that were not remapped. The jury is still out on the benefit of 'Sentinel Sites'. Collating information on whether previously unrecorded species are a problem elsewhere and local knowledge with regard to how they behave in the collection area would seem to be more cost effective than funding large mapping projects repeated over time.

Notification of new detections by herbaria A number of previously unrecorded naturalised species are recorded by herbaria each year but this information does not always reach those responsible for weed control. As pointed out above, early notification of weedy species is essential if eradication is to be attempted. The automatic notification system 'Weed-Alert' mentioned above is considered to be the most suitable notification system. Queensland herbarium (BRI) and the Western Australian herbarium (PERTH) are proposing similar systems and the CRC for Weed

Management is providing funds to Australia's Virtual Herbarium project (<http://www.chah.gov.au/avh/>) to set up a similar Australia-wide automatic notification system.

CONCLUSION

The more trained people look for naturalised species the more they will find, so the most cost-effective way to detect new weeds is to fund more skilled collectors. This will increase the likelihood of significant species being found when eradication is feasible rather than when a species has become so abundant that eradication is impossible. Less skilled individuals, and groups in the general public have an important role to play in the follow-up to detection of new weeds. These groups are best utilised to seek further occurrences and consolidate distribution data once a new weed has been recognised.

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