

RESEARCH REPORTS

Weed status of twelve thistle species in New South Wales

D. T. Briese

CSIRO Biological Control Unit, 335 Ave Paul Parguel, 34090 Montpellier, France

Summary

Officers responsible for noxious weed control were requested to rate the status of 12 species of thistle in each of 128 local government areas in New South Wales based on the need to control them and the difficulty and cost of such control. This information was used to produce maps showing patterns of weed status throughout the State that identified the areas in which particular thistles were economically important. The data suggested that overall the most serious thistle weed problems for the State were caused by *Carthamus lanatus* and *Onopordum acanthium*/*O. illyricum*, followed by *Cirsium vulgare*, *Carduus nutans*, *Silybum marianum*, *Centaurea calcitrapa* and *C. solstitialis*, *Carduus pycnocephalus*/*C. tenuiflorus*, *Onopordum acaulon* and finally *Cirsium arvense*. As well as contributing to the selection of priorities for research into weed control, the results highlight the need for changes to current noxious weed legislation in New South Wales, along the lines suggested by the Noxious Plants Advisory Committee of that State.

Introduction

As a group, thistles are important weeds in pastoral, cropping and non-agricultural land throughout various regions of Australia. Recently, Medd (1981) published estimates of the areas infested, at different levels of severity, by seven species of carduine thistle in New South Wales. This information had also been used to estimate the economic cost of one such species (*Carduus nutans* L.) in that State (Vere and Medd 1979). Such studies are valuable in assessing the importance of a weed, but, as Vere and Medd (1979)

point out, the unreliability of available data on area infested, production losses and control costs detract from the usefulness of the information in formulating control policies and setting research priorities. For example, Briese *et al.* (1988) have shown that estimates of area infested may vary by 5-fold or more, depending on the method used. To obtain the detailed information necessary for an accurate economic statement on the importance of a weed would be a very large and costly logistic exercise. A rapid method of estimating weed status, while not replacing such studies, could aid researchers and policy makers in taking immediate decisions.

This paper describes an attempt to assess the extent of the problem posed by several thistle species in New South Wales without resorting to the time-consuming collation and analysis of large volumes of data on distribution, abundance, chemical usage and costs, etc. In New South Wales, the enforcement of noxious weed legislation and extension services are largely carried out by a network of independent local government officers. Each of these supervises a relatively small area and regularly inspects properties throughout his shire. They undertake control of weeds on roadsides and vacant crown land and

may advise on, manage or contract to carry out control of weeds on private land. As a result, they have acquired a detailed knowledge of the extent of infestations, the difficulty of control and the costs associated with control of particular weeds. Such information may be kept more or less formally as written records, but is more generally kept mentally. Local experience enables these officers to judge, albeit with some subjectivity, the severity of weed infestations in their regions.

Such assessments were obtained by questionnaire and the information collated to produce an overall picture of the weed status of 12 thistle species in New South Wales. The species examined were the seven species of carduine thistle, considered by Medd (1981) to be among the foremost weeds in the State—*Carduus nutans* L. (nodding thistle), *C. pycnocephalus* L., *C. tenuiflorus* Curtis (slender thistles), *Cirsium vulgare* (Savi) (spear thistle), and *Silybum marianum* (L.) (variegated thistle)—plus the other species of carduine thistle known to occur in Australia, namely *Cirsium arvense* (L.) (perennial thistle) and *Onopordum acaulon* L. (stemless thistle), as well as the three most widespread species of centaurine thistle—*Carthamus lanatus* L. (saffron thistle), *Centaurea calcitrapa* L. (star thistle) and *C. solstitialis* L. (St Barnaby's thistle).

The usefulness of these assessments is discussed and examples given of their use for weed control policy and research planning.

Methods

New South Wales has 128 local government regions outside the urbanized areas. The majority of these employ an officer or officers specifically to control noxious weeds. Often neighbouring shires collaborate and some have formed county councils to sharing weed control costs (Table 1). In those few local government bodies where a noxious weeds officer is not employed the responsibility for weed

Table 1 Organization of responsibility for noxious weed control in local government regions of New South Wales

Authority responsible for noxious weed control	Number of shires
County council covering several shires	45 (9)
Weeds officer shared between shires	4 (2)
Individual shire weeds officer	70
No specific officer	9

Number of county councils or share arrangements involved (in brackets).

control falls on the shire engineer, health surveyor or ordinance officer.

Questionnaires were sent to these people in 1986, requesting them to rank the severity of the problems they experienced with thistles in their area. They were provided with four categories from which to choose: class 0, the weed was not present; class 1, the weed was present but did not cause any problems; class 2, infestations of the weed caused problems but could be controlled economically; and class 3, infestations of the weed caused problems which were difficult and/or costly to control. Space was also provided for any additional comments or qualifying remarks to be made.

The severity of the problem in each shire was then indicated on local government maps of New South Wales to show the overall pattern in weed status of each thistle species. Because of difficulties in distinguishing between them, *O. acanthium* and *O. illyricum* have been combined, as have the two slender thistles, *C. pycnocephalus* and *C. tenuiflorus*. The maps also indicate shires in which particular weed species have been declared noxious.

Whilst these maps reflect where the thistle species occur they are not accurate distribution maps since often only parts of a shire may be infested, nor do they indicate density *per se*. They reflect the cost in effort and money put into the control of the thistle, which is in turn determined by the extent to which it is perceived to cause, or threaten to cause, deleterious effects and economic losses.

Table 2 Severity of reported thistle infestations and frequency of their declaration as noxious plants amongst local government regions of New South Wales (total surveyed 128)

Thistle species	Without an infestation	Number of regions				Where declared noxious
		1	2	3	Total	
Carduinae						
<i>Carduus nutans</i>	98	10	13	7	30	128
<i>Carduus pycnocephalus</i> + <i>C. tenuiflorus</i>	49	59	19	1	79	0
<i>Cirsium arvense</i>	126	2	0	0	2	11
<i>Cirsium vulgare</i>	5	72	40	11	123	4
<i>Onopordum acanthium</i> + <i>O. illyricum</i>	72	24	16	16	56	43
<i>Onopordum acaulon</i>	106	21	0	1	22	11
<i>Silybum marianum</i>	15	73	36	4	113	0
Centaureinae						
<i>Carthamus lanatus</i>	16	53	43	16	112	5
<i>Centaurea calcitrapa</i>	49	63	13	3	79	49
<i>Centaurea solstitialis</i>	68	43	15	2	60	5

¹1, present, but not a problem; 2, a problem, but can be controlled economically; 3, a problem which is difficult or costly to control.

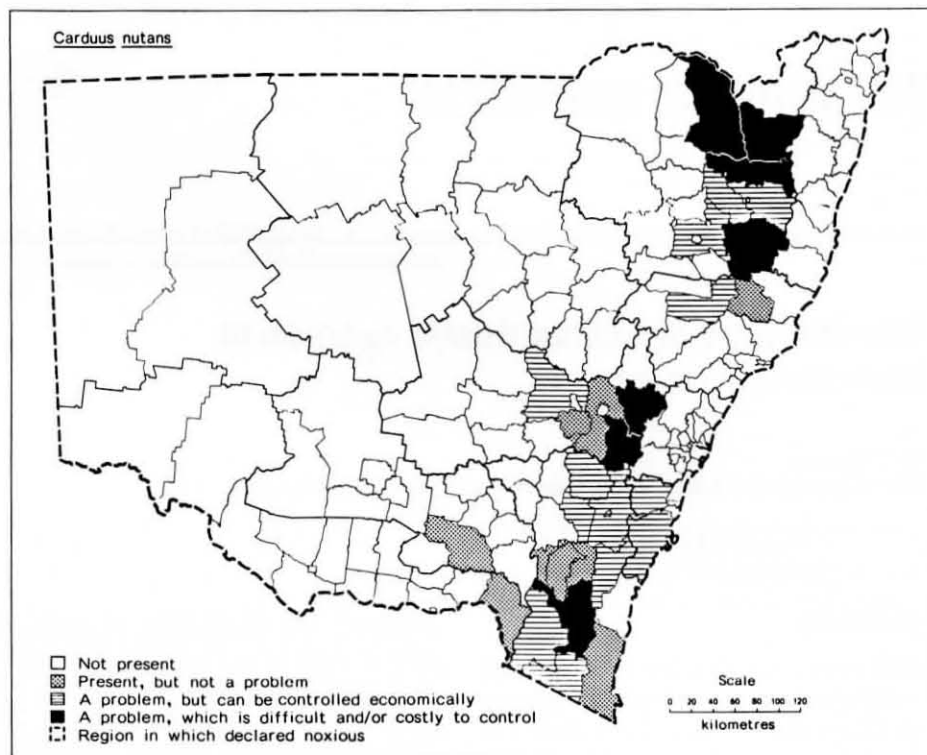


Figure 1 Perceived weed status of *Carduus nutans* in local government areas of New South Wales

Results

The results of the survey are presented in Table 2 and in Figures 1 to 10. *C. vulgare* is the most widespread, infesting 123 shires, but in the majority of these (59%) it is not considered a problem (Figure 3). The most important problem areas for this thistle are in the tablelands shires where it is a weed of pastures, particularly those in the north. However, it is also considered a difficult

problem in some western shires in irrigated crops, and it is the only thistle considered a problem in coastal areas.

S. marianum is the second most widespread thistle, infesting 113 shires, but again it was not considered a problem in most (62%) of the infested shires (Figure 7). It was, however, rated highly as a weed in pastoral areas in some tablelands shires and in cropping areas in several shires in the Northwest Slopes. *C. lanatus* was also considered a difficult problem in cereal crops in this area, as well as posing serious control problems in pastoral areas of the Central and Southern Tablelands (Figure 8). Generally, it was rated a much more severe problem than either of the other two widespread thistles mentioned previously (Table 2). Interestingly though, several correspondents commented that infestations had declined in the Riverina region over the past 10–20 years.

In addition to *C. lanatus*, *O. acanthium*/*O. illyricum* were considered by the greatest number of shires to be difficult or costly weed problems (Table 2). These two thistles have a more restricted range, but form problem infestations in 57% of the shires in which they occur, centred mainly in the Southern and Central Tablelands (Figure 5). The only thistle showing a greater intensity of infestations was *C. nutans*, a relatively recent introduction (Medd 1986), which was reported as a problem by 67% of shires in

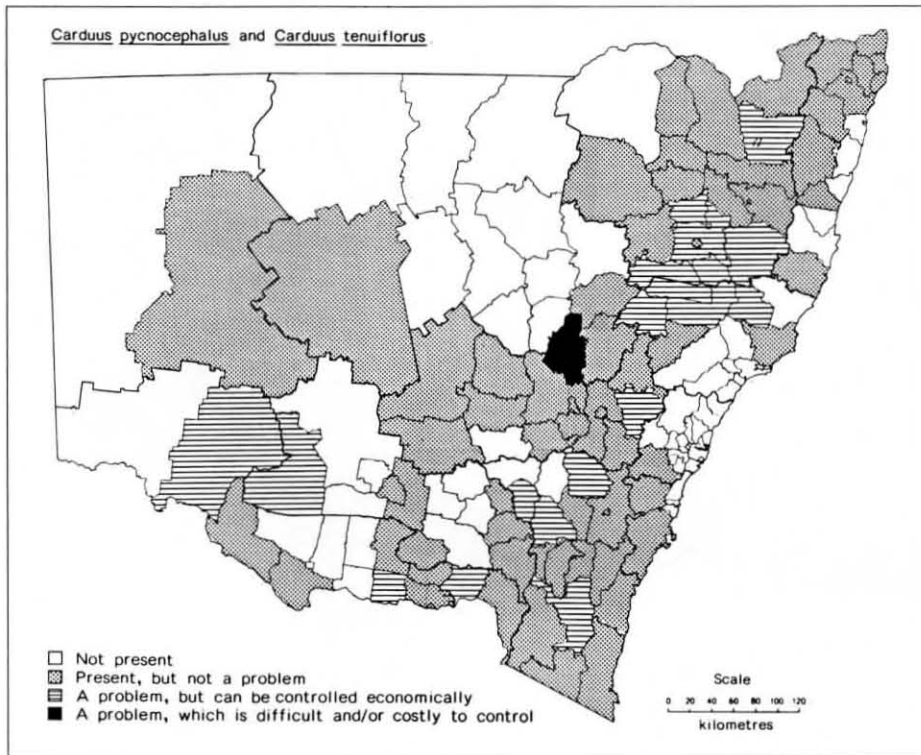


Figure 2 Perceived weed status of *Carduus pycnocephalus*/*C. tenuiflorus* in local government areas of New South Wales

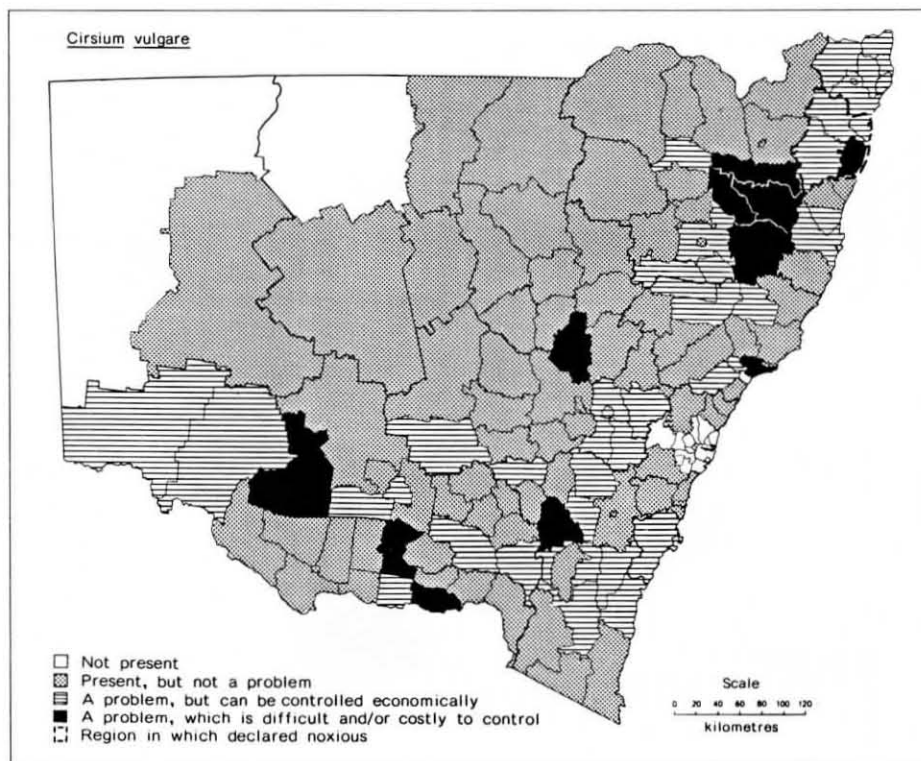


Figure 3 Perceived weed status of *Cirsium vulgare* in local government areas of New South Wales

which it occurred (Table 2). This species also has a restricted distribution (Figure 1) centred on the Northern, Central and Southern Tablelands.

The remaining species do not pose significant problems except in localized areas. *C. calcitrapa* and *C. solstitialis* are relatively widespread, except for the coastal and western parts of the State (Figures 9 and 10), and mainly are not troublesome to the shires in which they occur, the exceptions being in some northern shires where both species can cause problems in crops. The two slender thistles, *C. pycnocephalus* and *C. tenuiflorus*, are also relatively widespread, but not a problem in the majority of shires (Figure 2). Apart from the south-west, where it is considered a difficult weed to control in dryland wheat crops, *O. acaulon* occurs in scattered shires in the western region and Northern Tablelands (Figure 6) without posing any problems. Finally, *C. arvense* is restricted to two shires in central western New South Wales and one in the south-east (Figure 4).

Some comment is necessary on the subjectivity, sometimes apparent, of ratings provided by field officers. For instance, in Wellington Shire virtually all species present were rated in the highest category, which in some cases conflicted with ratings in surrounding districts (see Figures 2 and 3). However, this did not affect the relativity between thistle species and, for identifying problem regions, importance was placed more on the overall pattern produced by grouping the shires rather than on the results from individual ones. Thus for any particular shire, the ratings of neighbouring shires provided a check. On this basis, it is relatively clear that the major problem regions for *C. nutans* cover shires in the Northern Tablelands (Figure 1), for *C. vulgare*, shires in the Northern Tablelands and Northern Coastal regions (Figure 3), and for *O. acanthium*/*O. illyricum* and *C. lanatus*, in the Central and Southern Tablelands (Figures 5 and 8).

Discussion

It can be argued that the importance of thistles is determined by the extent to which they require control and whether this can be achieved economically by existing means. Table 2 suggests that, on this basis, the order of importance of thistles in New South Wales is: 1, *C. lanatus*; 2, *O. acanthium*/*O. illyricum*; 3, *C. vulgare*; 4, *C. nutans*; 5, *S. marianum*; 6, *C. calcitrapa*; 7, *C. solstitialis*; 8, *C. pycnocephalus*/*C. tenuiflorus*; 9, *O. acaulon*; 10, *C. arvense*. This is quite a different rating to that obtained solely by estimates of density/

distribution. For example, using Medd's (1981) data on carduine thistles, both *C. vulgare* and *S. marianum* would be rated higher than either *O. acanthium/O. illyricum* and *C. nutans*.

Clearly, the most widespread weeds are not necessarily those that consume the most time and effort in control attempts, though should systematic control procedures be undertaken they would pose a large economic burden to agriculture in the State. A weed might be more likely to attract the considerable cost and effort to contain or eradicate it if it is a relatively recent invader which, while not occupying a large area, poses a serious threat of spreading (e.g. *C. nutans* in Inverell Shire) or if it forms dense infestations that are presently causing serious economic losses (e.g. *O. illyricum* in Boorowa Shire). Additionally, differences in response to traditional control methods may affect the perception of the weed, e.g. the present inadequacy of chemical herbicides against *O. acanthium/O. illyricum* (Keys *et al.* 1985) partly explain its generally high rating in contrast to the more widely distributed *S. marianum* which is relatively easy to control by cheap herbicides (Keys *et al.* 1985).

CSIRO has recently commenced a series of biological control programs against thistles. The first target, *C. nutans*, was selected because it is still spreading aggressively and the existence of proven control agents overseas augured well for successful biological control in Australia (Wapshere 1984). The choice of the next target thistle was not as clearcut because none of the other priority targets had been extensively surveyed overseas for possible control agents and all had been present in the country for a long time and had relatively stable distributions. The information on relative weed status obtained here would rate *C. lanatus* highly, but it was not considered because of a very close affinity to the important crop plant safflower, *C. tinctorius* L., which would reduce the prospects of finding a sufficiently host-specific control agent (Wapshere 1984). These results did, however, provide part of the basis for the choice of *O. acanthium/O. illyricum* as the next targets for biological control (Briese 1988).

A hierarchy based on the number of shires in which the thistles were declared noxious (Table 2) would again be different. Under the Local Government Act of 1919, weeds in New South Wales are declared noxious for the State or for individual

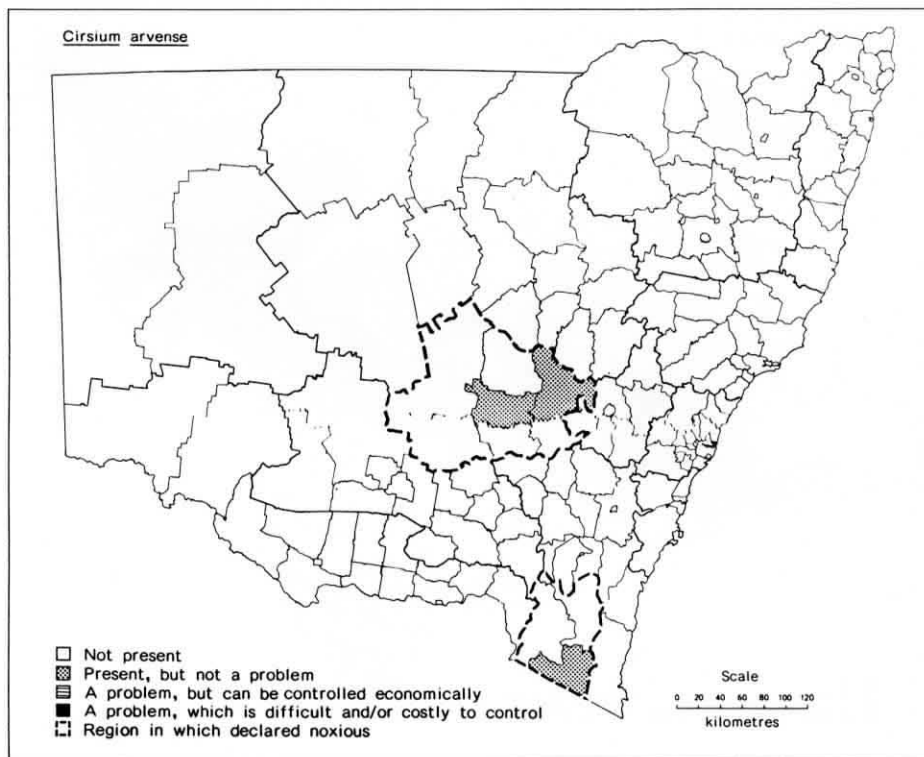


Figure 4 Perceived weed status of *Cirsium arvense* in local government areas of New South Wales

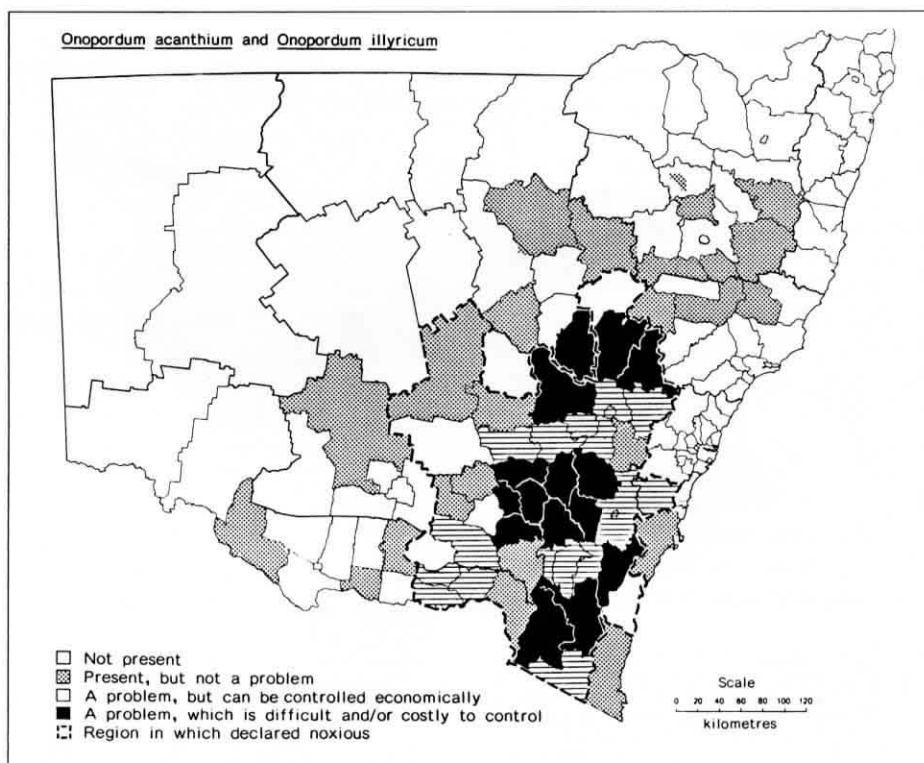


Figure 5 Perceived weed status of *Onopordum acanthium/O. illyricum* in local government areas of New South Wales

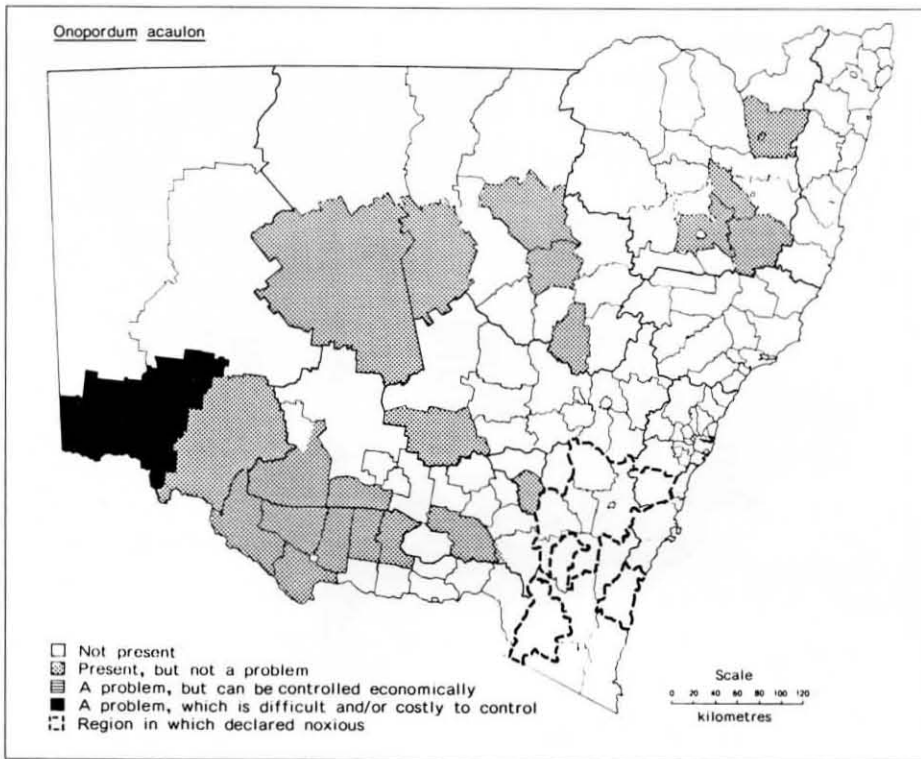


Figure 6 Perceived weed status of *Onopordum acaulon* in local government areas of New South Wales

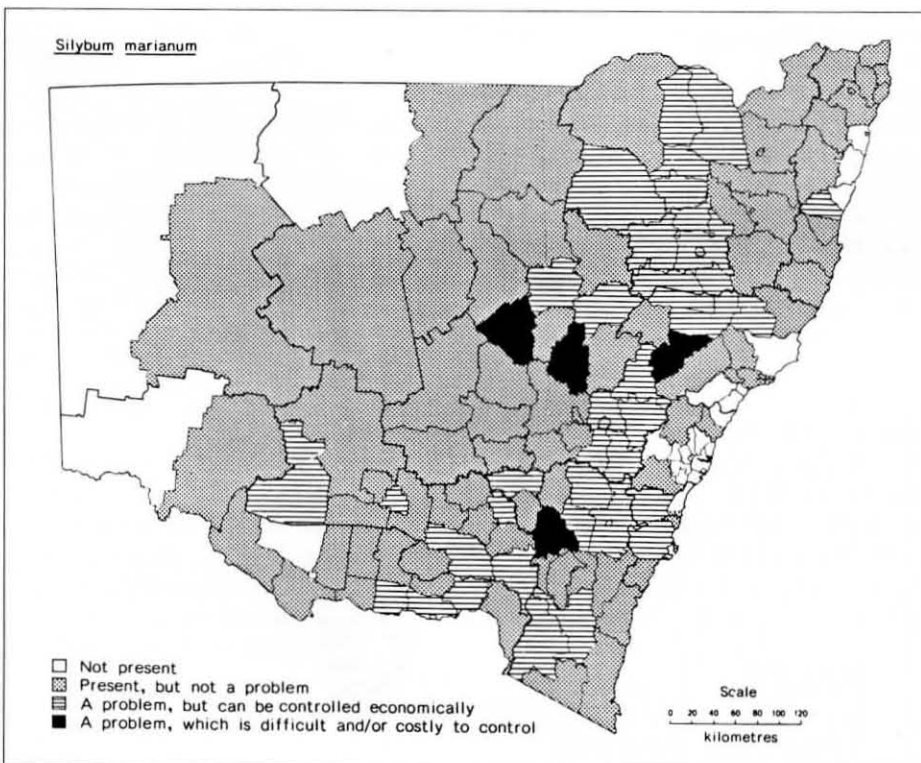


Figure 7 Perceived weed status of *Silybum marianum* in local government areas of New South Wales

shires on the recommendation of the Noxious Plants Advisory Committee which considers requests made by individual councils. However, subjective differences in the perception of weed problems, such as noted in this survey, coupled with the fact that local councils are naturally concerned with the problems in their region and do not normally consider them on a wider basis, have resulted in some curious patterns in the number and locations of shires that have declared certain thistle species to be noxious. In fact, some declarations bear little resemblance to the location of affected shires. For example, *O. acaulon*, is not declared in the only shire (in the south-west of the State) in which it is considered a difficult problem, yet it is declared in 11 shires in the south-east where it does not even occur (Figure 6). This is probably a result of these shires making blanket declarations for the genus *Onopordum*. *O. acanthium* and *O. illyricum* are declared in 43 shires in this south-eastern region, and this largely reflects the area of main concern (Figure 5).

These two species illustrate a further problem with existing weed legislation. The Local Government Act of 1919 states that it is the obligation of every council to 'keep and maintain entirely free from noxious plants' land that is not yet infested, and to 'eradicate noxious plants from any land which is not free'. However, it is clearly impossible to eradicate a weed once it has become widespread within a region, such as is the case with the two species of *Onopordum*. As there is no flexibility in the present Act, local officers must, for practical reasons, enforce it on a selective basis once a weed has become well established in the district, even when these weeds have been correctly declared. It also places unrealistic burdens on the administrations of state forests and national parks to control weeds in areas where it is economically not feasible (Auld *et al.* 1987).

Eradication of weeds may be possible when only very small areas are involved and the weeds can be dealt with soon after their appearance. Thus, while the present statewide declaration of *C. nutans* is appropriate for restricting its spread into new areas, a classification requiring containment rather than eradication is more appropriate in those shires already heavily infested. Piecemeal regional declarations, often made well after a weed has become established, do little to contain the spread of noxious weeds, as illustrated by the case of *C. nutans* (Medd 1986).

The more widespread thistles in New South Wales appear to have reached the limits of their climatic ranges (Medd 1981) making further spread unlikely. Thus the declarations of *C. vulgare* (Figure 3), *C. lanatus* (Figure 8) and *Centaurea* spp. (Figures 9 and 10) are to a large extent anachronisms. This is particularly true in the case of *C. calcitrapa*, which was once a more important weed of crops (Auld and Medd 1987), and remains declared in 49 shires, only 10 of which now consider it still a problem (Figure 10). This change in status reflects both changes in land utilization and an improved ability to achieve control by chemical herbicides. While declarations of widespread weeds in a few isolated shires may benefit those shires, they do not aid in the management of the weed on a statewide basis.

Overall there is a mixture of noxious weed declarations in the State; widespread weeds being declared in a few isolated pockets of their range, restricted weeds being locally declared far from their areas of occurrence, weeds that are no longer declared in shires where they are still considered a problem, and adjacent shires with similar problems having different legislation. Such anomalies in the declaration of noxious weeds would be more easily avoided if there were a centralized system capable of overseeing the whole State and permitting several classifications for noxious weeds, based on land use, density of infestation and potential to cause economic losses such as exists in most other Australian States. Under such a system, a weed could be declared a target for eradication where feasible, while areas of heavy widespread infestation could be declared targets for containment with the flexibility of having discretionary enforcement of control. Auld *et al.* (1987) have pointed out that, on economic grounds, methods other than eradication may be better options for weed control situations.

The Noxious Plants Advisory Committee proposed such a reform in 1984, but failure of the government departments involved to agree over its implementation has delayed its inception (L. Smith, pers. comm.). The information obtained in the present survey highlights some of the deficiencies of existing legislation and supports the efforts of the committee to improve the system of weed management in New South Wales.

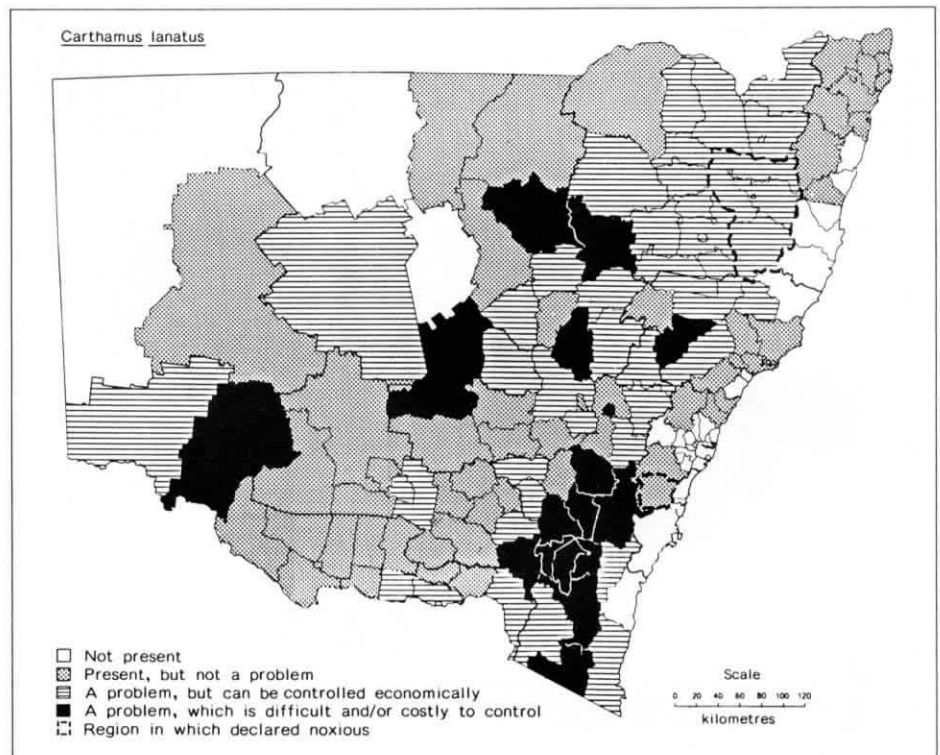


Figure 8 Perceived weed status of *Carthamus lanatus* in local government areas of New South Wales

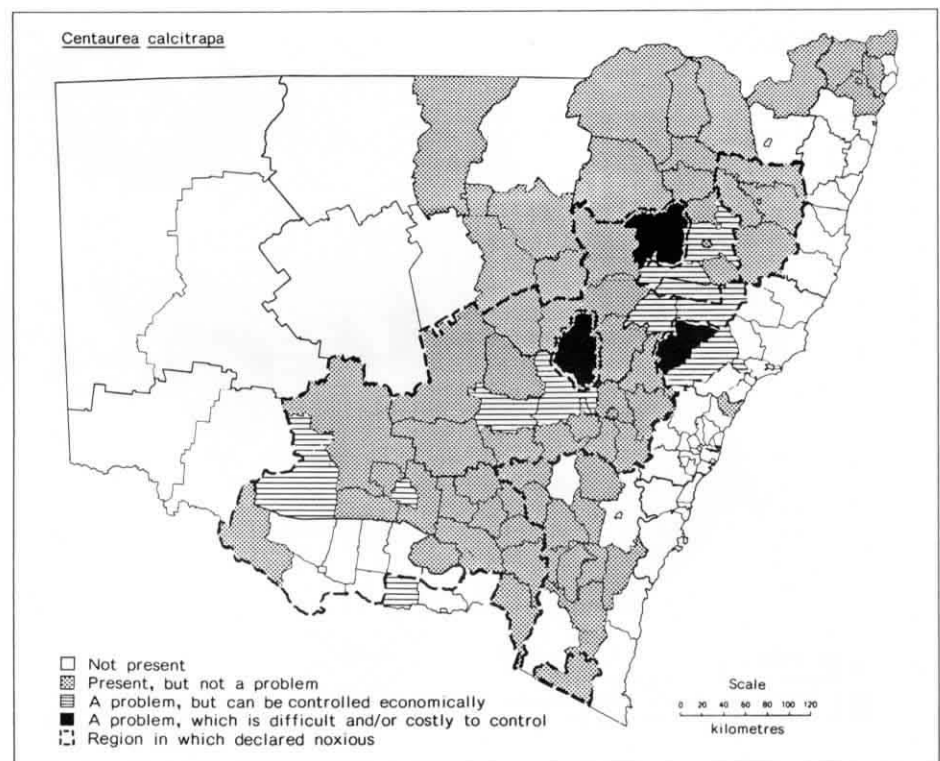


Figure 9 Perceived weed status of *Centaurea calcitrapa* in local government areas of New South Wales

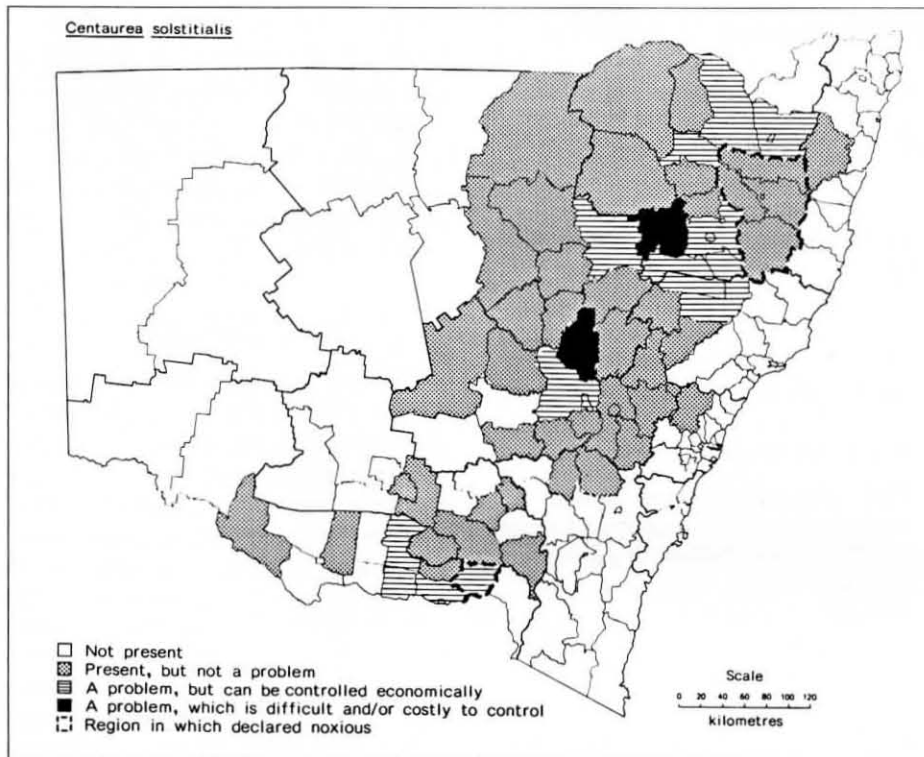


Figure 10 Perceived weed status of *Centaurea solstitialis* in local government areas of New South Wales

Acknowledgements

I would like to thank all the noxious weeds officers, shire engineers and district agronomists who supplied information on the thistle problems in their respective regions. I would also like to thank Leon Smith for his helpful comments on this paper.

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