IMPACT OF LEGISLATIVE ACTIONS ON THE INVASION OF *CARDUUS NUTANS*

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Summary. Nodding thistle, *Carduus nutans* L. ssp. *nutans*, is a recent successful plant invader. The case illustrates that legislation has had little impact on its invasiveness in N.S.W., probably because of a long lead time from detection to pest recognition. Other problems and inadequacies in implementing legislative actions are discussed.

INTRODUCTION

In the order of 220 plant species or species complexes are proclaimed noxious throughout Australia. Of the 90 which occur in N.S.W., eight are not proclaimed elsewhere and two are native species; the majority were introduced during the 1800's and whilst some have localised distribution, many are now common widespread species. Nodding thistle is one of a few weeds which have been introduced and become naturalised (i.e. invaded) since the 1950's.

Because studies of the thistle commenced comparatively soon after its discovery in Australia, it is possible to chronicle the major events of its invasion somewhat more accurately than for the many species introduced during early European settlement. Consequently an assesssment of quarantine measures and of the effectiveness of having proclaimed it as noxious is possible.

HISTORY OF INVASION

Nodding thistle was originally recorded near Oberon, N.S.W. in July 1950, but may well have been present for a short number of years before this discovery. By the mid-1960's it had been recorded throughout the highlands of south-eastern Australia. Discoveries in both Victoria and Tasmania occured around mid-1960, and in W.A. in 1976 and S.A. in 1978 (Table 1). Over the past two decades the weed has continued to spread throughout N.S.W. and by 1980 more than 50,000 km^2 of pastoral land were infested. By contrast, the weed has been contained in Victoria to isolated scattered colonies, and to a lesser extent in Tasmania where occasional new infestations are found (Parsons and Hyde-Wyatt, pers. comm.). The single infestations recorded in W.A. and S.A. have been eradicated (Aplin and Cook, pers. comm.).

The chronologically and spatially disjunct appearance of infestations suggest that multiple primary introductions occurred throughout south-eastern Australia over fifteen or so years following discovery. The source of infection in each case was almost certainly contaminated pasture seed imported to this country (7).

Secondary spread progressed exponentially (Fig. 1) at a rate accelerated by the fact that the multiple introductions were widely scattered, as discussed by Auld *et al.* (4). Although natural long distance dispersal is possible, nodding thistle is not well adapted in this regard (7). Its dispersal over great distances has been due more to the mobility of modern society and agricultural practices. This has also been the case for parthenium weed, *Parthenium hysterophorus* L., another recent invader (3).

Table 1. Date of initial detection of nodding thistle throughout southern Australia along with a chronicle of proclamations. (Adapted from Medd (7))

Year	Primary invasion	Proclamation
1950 -	Oberon, N.S.W.	
1952 -		
	Crookwell, N.S.W.	
1954 -		
1956 -		
1958 -	Glen Innes, N.S.W.	
1960 -		
1962 -		
	Tasmania (sev-	Mulware Shire, N.S.W.
1964 -	eral locations)	
		Tasmania, statewide.
1966 -	Victoria (sev-	Oberon Shire, N.S.W.
	eral locations)	Victoria, statewide.
1968 -		Upper Macquarie[a], N.S.W.
		New England Tablelands[a]; Berrima, Crookwell, Gunning & Bombala Shires, N.S.W.
1970 -		Severn & Yass Shires, N.S.W.
		Castlereagh-Macquarie[a]; Tenterfield, Yarrowlumla & Canobolas Shires, N.S.W.
1972 -		Far North West Slopes[a]; Boorowa Shire N.S.W.
1974 -		Tumut & Tumbarumba Shires, N.S.W.
		Scone Shire, N.S.W.
1976 -	Green Mtn., W.A.	
		Central Northern[a]; Young & Harden Shires, N.S.W.
1978 -	Orroroo, S.A.	
1980 -		
1982 -		
		N.S.W., statewide.
1984 - 1988	NO FURTHER CHANGES RECORDED OR IMPLEMENTED	

[1] County Districts within N.S.W.

LEGISLATIVE ACTIONS

Quarantine measures were first enacted for nodding thistle by N.S.W. in 1964, and by the Commonwealth in 1968 when it was scheduled as a prohibited seed contaminant under the respective seed acts.

Proclamation of the weed also occurred first in N.S.W. in 1963 (Mulware Shire, Southern Tablelands) and proceeded for more than a decade until 1977 to embrace all known infested areas (Table 1). Statewide proclamation was invoked in 1983 in N.S.W. and currently stands. Statewide proclamations were invoked from the outset in Tasmania (1965) and Victoria (1969), and have been maintained.

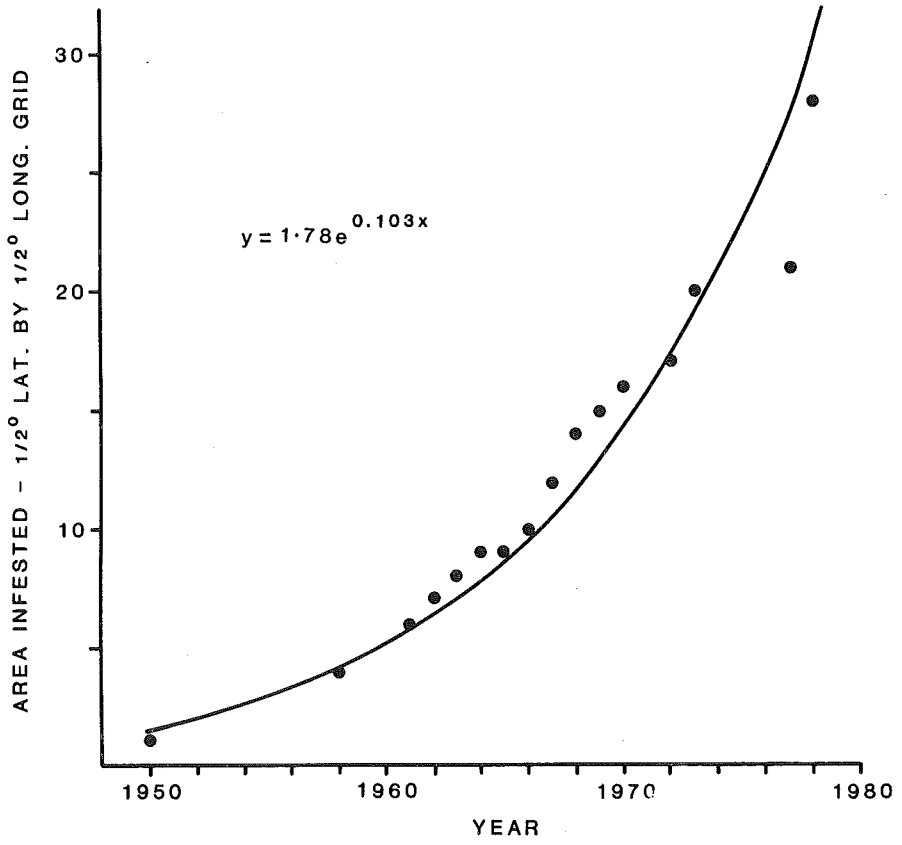

Figure 1. Cumulative area (number of 1/2° latitude by 1/2° longitude grid blocks) infested with nodding thistle within Australia, determined by mapping locations from herbarium specimens.

DISCUSSION

Nodding thistle has successfully invaded many cool temperate environments in south-eastern Australia, and is now widespread within N.S.W. The inherent botanical features of the weed in conjunction with a number of extrinsic environmental factors (7) suggest that it has the potential to continue spreading. This is likewise indicated by Fig. 1 since new areas are being colonised at an increasing rate. The rate will eventually decrease as the weed occupies available habitats and reaches the limits of its potential range.

The apparent ease with which nodding thistle invaded Australia calls into question the effectiveness of procedures to detect exotic weeds, recognition of their pest potential and the efficiency of eradication procedures, particularly in N.S.W.

Since the latter half of the 19th century, plants have continued to invade south-eastern Australia at a rate of about 100 plants every 15 years, according to Specht (10). From this Groves (6) speculated that 1 or 2% would

become weeds. Clearly, quarantine procedures are manifestly incapable of preventing the introduction of all unwanted plants. This is not unreasonable in view of the mobility of modern society and its wares.

When introductions occur, early detection and recognition of pest potential are vital steps in preventing invasion (9) since rarely have weeds been eradicated once they have become widespread (1, 8). This was probably the greatest single deficiency in efforts to contain nodding thistle in N.S.W. Pest recognition took in the order of 15 years before seed quarantine and proclamation measures were first implemented. Even then there was a lack of conviction in actions since declarations proceeded for another decade or so before all infested areas came under jurisdiction in N.S.W. Immediate legislative intervention following pest detection and recognition must be accredited for the success in containing nodding thistle in Victoria and Tasmania; but bear in mind detection in those states came after the eventual pest recognition in N.S.W. Nodding thistle was eradicated following early detection in both W.A. and S.A. without the need to proclaim it noxious.

Statewide proclamation of nodding thistle in N.S.W. after some three decades of unimpeded invasion would seem to have little merit in view of the convincing evidence that widespread weeds are unlikely to be eradicated. Indeed this points to a deficiency within the administration of noxious plants in N.S.W. where the effectiveness of proclaiming plants as noxious is rarely critically evaluated. Available funds are mostly expended on the detection and treatment of infestations with few established feedback mechanisms to gauge the impact of these actions. The question as to whether the use of funds to maintain programs for the large number of widespread species proclaimed in N.S.W. could be better utilized needs to be considered.

The invasion of nodding thistle in N.S.W. also highlights that procedures established to deal with plant invadors are uncoordinated. This contrasts with established protocols for exotic animal diseases (2) and some plant diseases (5). Interestingly a situation similiar to weeds exists for exotic insect invaders (Bower, pers. comm.) whereby actions stem from *ad hoc* decisions as and when the necessity arises. The establishment of a protocol to deal with plant invaders upon detection would appear to be a very worthwhile step as this is when eradication is most likely to be achieved.

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