# ECOLOGICAL ASPECTS OF SWEET PITTOSPORUM (*PITTOSPORUM UNDULATUM* VENT.): IMPLICATIONS FOR CONTROL AND MANAGEMENT

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**Summary** Motivation for the control and management of environmental weeds often relates to the presumed impacts of these species on natural systems. Knowledge about the reproductive biology, dispersal, colonization patterns, community relationships and the actual invasion impacts exerted by the target species is often incomplete, and this may reduce the potential for effective management.

Control and management of populations of the environmental weed, sweet pittosporum (*Pittosporum undulatum* Vent.) is further confounded by modifications to ecosystem processes and ecological relationships across the landscape. The range and local densities of populations of *P. undulatum* have expanded due to factors such as increased dispersal opportunities and changed fire regimes. *P. undulatum* is highly plastic and has successfully colonized a range of habitat types throughout south-east Australia. To date, control programs for *P. undulatum* populations invading public lands and forests have had limited success.

## INTRODUCTION

Sweet pittosporum (*Pittosporum undulatum* Vent.) is one of an increasing number of native species acting as an environmental weed in habitats outside its natural ecological range (Mullett and Simmons 1995). Prior to European settlement, the distribution of *P. undulatum* was believed to encompass a range of habitat types including wet and dry forest environments, riparian and coastal communities and dry rainforests occurring along the eastern seaboard of south-east Australia (Gleadow and Ashton 1981, Short 1987). This 'pre-adaption' to a range of habitat types is likely to be an important component of the species success in invaded habitats west of its natural range in Australia, and also in many locations overseas where the species functions as a serious environmental weed.

The ecological impacts associated with *P. undulatum* invasion are considerable, with a reduction in the floristic and structural diversity of invaded sites being of prime conservation concern. Changes in habitat opportunities associated with *P. undulatum* invasion also pose concern for the long term management of wildlife populations at invaded sites (Brown *et al.* 1991, Mullett and Simmons 1995).

Much is known about the biology of *P. undulatum* (Gleadow and Ashton 1981, Gleadow 1982, Gleadow and Rowan 1982, Gleadow *et al.* 1983), however aspects of the species ecology, particularly its interactions with components of invaded communities are largely unknown. This lack of quantitative data on the ecological impacts of environmental weed invasions is a common impediment to successful weed control programs.

This paper discusses some preliminary findings about aspects of the ecology of *P. undulatum* in natural and invaded habitats in south-east Australia and implications posed for control and management.

## METHODS

Characteristics of *P. undulatum* population structure were investigated at six sites in Victoria in Spring 1995. The height and sex (where possible) of *P. undulatum* individuals occurring in five 30 × 10 m transects at each site were recorded.

The role of vertebrates as dispersal vectors of *P. undulatum* are currently being investigated through observation, collection of scats and pellets and germination trials.

The impacts of *P. undulatum* invasion on native vegetation communities were investigated at four sites in the greater Melbourne region in 1993. At each site, progressive changes in the composition, diversity, cover and abundance of indigenous species was recorded across five *P. undulatum* clump profiles (Mullett 1993, Mullett and Simmons 1995).

## RESULTS AND DISCUSSION

**Reproductive biology** Although *P. undulatum* is dioecious, minor occurrences of functionally female flowers have been observed on otherwise predominantly male flowering individuals. At Woods Reserve on the Mornington Peninsula, Victoria, nearly 9% of predominantly male flowering plants recorded in five 10 × 30 m grids were observed bearing fruit remnants from the previous fruiting period (Mullett unpublished data 1995). This incidence in fruit production in some predominantly

male plants may represent increased recruitment opportunities for invading populations as anecdotal evidence suggests germination in seed from predominantly male flowering plants is equal to that of seed from female plants. Additionally, predominantly male flowering plants in cultivated settings have been observed producing considerable quantities of fruit. These findings conflict with management advice to concentrate control efforts on female plants—although obviously these pose a greater recruitment threat.

Preliminary analysis of sex structure in populations of *P. undulatum* indicate a male bias may be evident at invaded sites. Further analysis will be undertaken to investigate any spatial sex segregation in *P. undulatum* populations.

**Dispersal of *P. undulatum*** Knowledge of dispersal mechanisms are a fundamental component of successful environmental weed control programs. In 1982, Gleadow reported the introduced blackbird (*Turdus merula* Linnaeus) to be the principal dispersal agent of *P. undulatum* in the greater Melbourne area, and suggested that '*P. undulatum* may be behaving as a weed because such a dispersal vector has been introduced' (Gleadow 1982). If this is the case, the dispersal potential of this species has probably increased because since this time, little or no control efforts have been made to reduce populations of *T. merula.*

Geldenhuys *et al.* (1986) suggested that the 'time lag' between the introduction of *P. undulatum* to South Africa and its recognition as a serious environmental weed was largely due to an adaption period by frugivorous species. In south-east Australia, an increasing number of native and introduced birds, including pied currawong (*Strepera graculina* Shaw), silvereye (*Zosterops lateralis* Latham) and satin bowerbird (*Ptilonothynchus violaceus* Vieillot) are recognised as utilizing the now abundant food resource provided by populations of *P. undulatum* (Cooper 1959, Gleadow 1982, Mulvaney 1986, Buchanan 1989, Brown *et al.* 1991). Unconfirmed reports have also been made of some mammals utilizing *P. undulatum* as a food resource including, brushtail possum (*Trichosurus vulpecula* Kerr), red fox (*Canis vulpes* Linnaeus) and even black rats (*Rattus rattus* Linnaeus). The role of these species as dispersal vectors of *P. undulatum* however, are yet to be determined.

The relationships formed between *P. undulatum* and opportunistic species able to exploit abundant quantities of *P. undulatum* fruit (and other introduced fleshy fruits) raises important management concerns. The presence of fleshy fruiting weed species can alter seasonal migration patterns for some frugivorous species (Debussche and Isenmann 1990). Mulvaney (1986) suggests that populations of pied currawongs in the Canberra district have increased due to their ability to exploit the abundance of introduced fleshy fruits, and this in turn, has lead to an increase in predation by *S. graculina* on nestlings of various bird species.

The impact of *P. undulatum* and other environmental weeds on faunal populations has been largely neglected, but is an important area for future study as the influence on habitat opportunities are likely to be substantial, as are the ecological implications of these fundamentally new relationships.

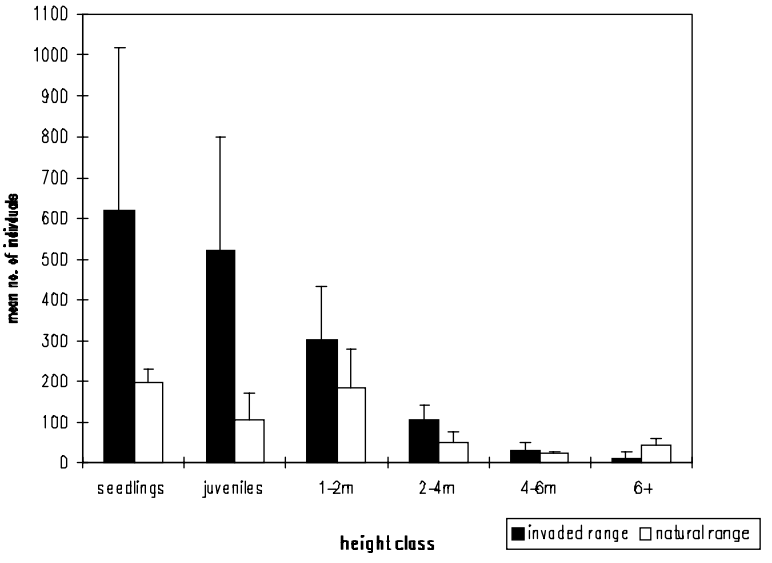


**Figure 1.** Variation in recruitment profiles between populations of *P. undulatum* occurring within and external to the species natural ecological range. Error bars indicate one standard error.

**Population structure** Height class data recorded at three sites within and external to the natural range of *P. undulatum* were pooled to assess variation in population profiles.

Figure 1 illustrates considerable differences in height class profiles between populations of *P. undulatum* at invaded sites, compared to sites sampled within the species natural range. A more balanced population

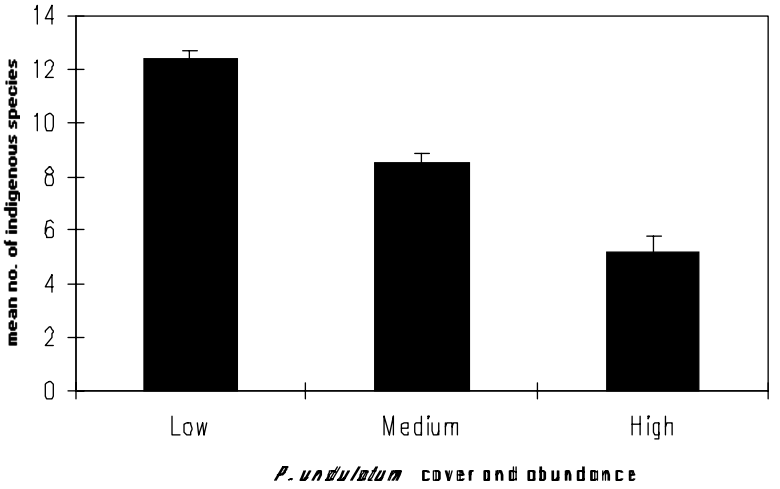


**Figure 2.** Decline in mean indigenous species diversity associated with increasing cover and abundance of *P. undulatum* at sites sampled near Melbourne (260 3 × 3 m quadrats). Cover and abundance values of *P. undulatum* are, Low £ 29%, Medium 30–69%, High 70% +.

structure is evident at sites within the natural range of *P. undulatum*. The mean number of individuals in the seedling and juvenile categories is considerably higher at invaded sites indicating that these populations are still actively invading. This recruitment potential should be seriously addressed, given the potential for invasion to become more entrenched, and hence, more resource intensive to control.

**Ecological impacts of *P. undulatum* invasion** Mullett and Simmons (1995) reported that the deep shade cast by mature individuals and possible allelopathic influences are primary factors in the displacement of indigenous species by invading *P. undulatum*. Figure 2 clearly demonstrates the impacts of increasing cover and abundance of *P. undulatum* on indigenous vegetation at invaded sites. A highly significant relationship (one-way ANOVA, $P < 0.001$) is evident between increasing cover of *P. undulatum* and a decline in indigenous species diversity.

These data, supported by the recruitment characteristics of invading populations shown in Figure 1, indicate that a serious decline in indigenous species diversity will result at invaded sites unless the invasion of *P. undulatum* is immediately addressed by aggressive control programs.

**Control options** Fire is often recommended as an effective means of control for *P. undulatum* invasion as the species is generally fire sensitive (Gleadow and Ashton 1981). While fires hot enough to kill the basal buds in the trunk may be an effective control measure, prescribed and naturally occurring fires are controlled to the extent that this venture is rarely successful as a control measure, particularly in an urban or urban fringe context.

A common control measure undertaken at invaded sites near Melbourne is to fell mature *P. undulatum* individuals and paint the stump with herbicides (usually glyphosate). This method provides instant results, but the consequent increase in light infiltration might in itself, impose such a disturbance to the site that opportunistic weed species may be able to exploit the altered conditions, particularly in the absence of follow up control measures. Felled individuals are also generally left on-site which raises further concerns about the potential influence of allelopathic properties present in decaying leaf matter.

A more appropriate control method for *P. undulatum* is the 'drill and fill' technique where herbicides are injected into the trunk and individuals senesce over time. This reduces the disturbance associated with instant control techniques but is more labour intensive and as such, is not often implemented in weed control programs due to severe resource restraints.

Control attempts will have little long term success without management of source populations and dispersal agents. Despite *P. undulatum* being recognised as a serious environmental weed (Carr *et al.* 1992) and the spread of the species into areas outside its natural range being listed as a 'potentially threatening process' under the Flora and Fauna Guarantee Act 1988 (Scientific Advisory Committee 1995), the species is still commercially available from Nurseries and continues to be a favoured horticultural specimen in urban gardens where an increasing number of dispersal agents assist the spread of the species into remnant vegetation.

While the issue of environmental weed control is now starting to receive some attention on the political and conservation management agendas, public education campaigns are urgently required to increase the profile of this issue and encourage responsible horticultural practices and awareness about the issue which has been described as 'the greatest conservation problem in Australia…' (Carr *et al.* 1986).

Control programs must incorporate information about the biological and ecological characteristics of the target

species to ensure limited management resources are allocated effectively. Hobbs and Humphries (1995) further stress the importance of addressing the causes of weed invasion, particularly the role of the gross structural and functional modifications imposed on ecosystems and ecosystem processes since settlement. While these underlying causes of weed invasions are perhaps difficult to quantify, this approach represents a new challenge for weed management, and will require knowledge and research to encompass a range of disciplines.

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