THE CURRENT STATUS OF WEEDS IN SELECTED NATIONAL PARKS OF SOUTH EAST QUEENSLAND

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Summary. A survey has shown that weed infestations in some national parks in south-east Queensland are extensive and probably uncontrollable. Lar'e areas require restoration. The worst invasions are historical due to practi#es which were totally incompatible with biological conservation. Some species are invading natural areas with little if any human assistance. The problem can only get worse as the remaining unprotected natural areas are fragmented and destroyed by development.

INTRODUCTION

Some of the greatest problems for conservation biology are resource over-use, pollution, and exotic invasions (3). Resource use and pollution can be managed but exotic invasions are often permanent and in many cases uncontrollable. Over the recent past, Australia has concentrated on enlarging the estate for nature conservation purposes with minimum attention being given to management. Weeds form an acute and insufficiently appreciated ecological problem with formidable management and control implications (4). These statements are reinforced by a survey of six National Parks situated on the Sunshine Coast between 50 and 100 km north of Brisbane. The area is sub-tropical with an annu!l rainfall of 1500 to 2000mm. Parks supporting three different broadly defined ecosystems, mountain heathland, heathland and forest were surveyed. The mountain heathland areas contain unique and rare heaths on their slopes, with relict species that were once more widely distributed. The heathland parks are characterised by large poorly drained areas which support heath or *Melaleuca quinquenervia* forests and woodlands. The forest parks are situated on the edge of a basalt plateau with rugged terrain. The ridges and escarpments support open forest with closed forest on the better soils in the gorges. All parks surveyed have, or are being rapidly isolated from surrounding natural vegetation by development. Extensive areas have been disturbed, particularly by logging and grazing.

METHODS

It was necessary to select a survey sampling method which was fast, reasonably accurate, objective as possible and non-destructive. A grid system with transects across ecological boundaries was considered most appropriate but this needed modification because of terrain, especially cliff lines and impenetrable vegetation, usually weeds. All drainage lines were followed if practicable as these represented naturally disturbed areas. 180 km of transect were completed for the survey, many travelled in both directions. Measurements recorded were modified during the survey. Initially a density was calculated for each weed encountered but a subjective cover measurement became relevant for areas where weeds dominated the landscape. Weed infestations were followed off transect to establish their range. With the use of aerial photographs it was possible to extrapolate point data with reasonable confidence to produce weed density distribution maps.

RESULTS AND DISCUSSION

An overview of the survey is shown in Table 1. The percentage of each park estimated as free of weeds does not necessarily reflect the magnitude or importance of the problem. Seventy species of weed were recorded. This total would be greater if all species in highly disturbed areas had been identified.

Table 1. Overall result of weed survey for six national parks in south-east Queensland

National Park	Area (ha)	% weed free	Weed status	Greatest problem species
Mt Coolum	72	80	Reasonable	*Cinnamomum camphora*
Mt Tibrogargan	692	40	Quite good	*Pinus elliottii*
Mooloolah	670	95	Reasonable	*Baccharis halimifolia*
Pumicestone	2000	40	Bad	*B. halimifolia/P. elliottii*
Kondalilla	327	10	Very bad	*Lantana camara/Desmodium intortum*
Mapelton Falls	26	20	Fairly bad	*L. camara/Ageratina riparia*

Herbs and grasses accounted for 50% of the total but most were found in highly disturbed areas with no apparent ability to invade natural systems. The growth form of weeds causing serious problems or potentially serious invaders identified are shown in Fig. 1.

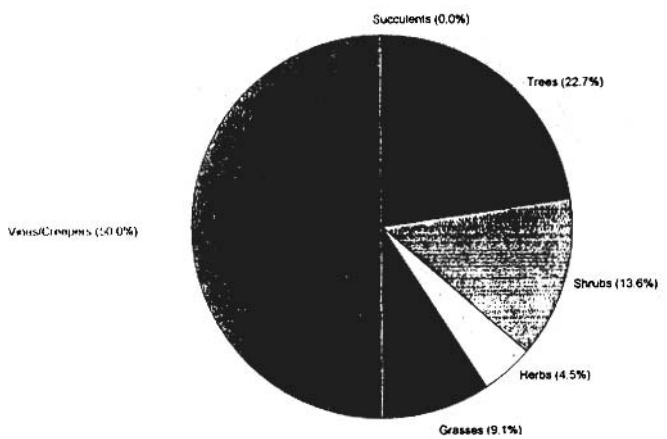

Figure 1. Growth form distribution of 22 problem weeds in selected national parks of south-east Queensland.

The most invasive environmental weeds encountered are shown in Table 2.

Lantana, *Lantana camara*. Lantana is present in 14% of the survey area. The percentage is much greater for the two rainforest parks. Lantana is an efficient pioneer species making use of both natural and anthropogenic disturbance. It grows best on the richer soils, but sparse stunted patches occur on very poor shallow soils. Large areas of Kondalilla and Mapelton Falls National Parks have a 100% understorey of impenetrable Lantana. These areas have been cleared or are logged tall open forest. It also occurs in open forest in patches, with dense stands occurring where the canopy has been opened by logging, tree fall or landslides. In the other parks it usually grows on drainage lines on the better soils. Because of its cost to agriculture in many countries of the world, conservatively estimated at five million dollars per annum in Queensland alone (1), biological control has received a lot of attention with 23 insects released. Three species have slowed the rate of spread but the great difficulty in Australia arises from the wide diversity of weedy *Lantana camara* taxa and their varying susceptibility to attack from natural enemies.

The only hope of control in natural areas is an integrated approach, changing the physical and biological environments, using biological control, manual small area clearing and active regeneration. Lantana is preventing soil erosion on steep slopes, so rapid removal is not advisable. Lantana is widely distributed throughout the whole region, and as it is readily dispersed by birds, complete eradication is an impossibility.

Table 2. List of problem weeds of different ecosystems in order of perceived threat

Closed forest and tall open forest	Coastal systems	Open forest and woodland	Heath
Lantana camara	*Pinus elliottii*	*Lantana camara*	*Pinus elliottii*
Desmodium intortum	*Baccharis halimifolia*	*Pinus elliottii*	*Baccharis halimifolia*
Tradescantia albiflora	*Lantana camara*	*Baccharis halimifolia*	*Melinis minutiflora*
Anredera cordifolia	*Cinnamomum camphora*	*Cinnamomum camphora*	
Rubus ellipticus		*Schefflera actinophylla*	
Ligustrum sinense		*Caesalpinia decapetala*	
Macfadyena unguis-cati		*Ageratina riparia*	
Ageratina riparia		*Melinis minutiflora*	
Zebrina pendula		*Passiflora suberosa*	
Ligustrum lucidum		*P. subpeltata*	
Caesalpinia decapetala		*Desmodium uncinatum*	
Cinnamomum camphora			
Passiflora subpeltata			

Groundsel, *Baccharis halimifolia*. This is a very widespread weed in the region. It is present in 30% of the survey area. Groundsel can grow in areas with low nutrient levels although seedlings are very sensitive to phosphorous deficiency. It can grow in soils with pH ranging from 3.8 to 8.2 (5). Groundsel's biological characteristics include (6):

- prolific seed production - up to one million seeds per plant in the open - it is a member of the Asteraceae family noted for seed production;
- long range dispersal;
- ability to produce viable seed under low light;
- wide tolerance to pH;
- tolerance to low nitrogen;
- survives flooding and drought; and
- ability to sprout new shoots after fire.

In Mooloolah and Pumicestone National Parks it has filled a structural niche not occupied by native species. It is the only understorey species in some *Melaleuca quinquenervia* and *Allocasuarina* spp. forests. Dense stands of groundsel grow along the transitional zone between salt marsh and open forest. The species is salt tolerant and the sea spray probably provides the essential phosphorous for the species spectacular success in this area. In the other parks, Groundsel is usually restricted to highly disturbed areas and drainage lines, its presence enhanced by the plumes of nutrients from developed areas. As infestations are so extensive with many patches inaccessible, biological control is the only viable long term control solution.

Slash Pine, *Pinus elliottii*. This weed is invading about 17% of the total area surveyed but potentially has a much greater range. It appears capable of invading, without anthropogenic disturbance, all ecosystems in the area except montane heath, closed forest and areas with permanent water. Slash pine has no significant disease or insect pests, which gives it a competitive advantage over most native species. Pumicestone National Park is being invaded along most of the eastern boundary, a length of 20 km. The species has progressed on average a distance of 160 m into the park. As the species produces seed in about ten years, the wind dispersed invasion wave should progress on average 15 m per annum. The rate of spread will be enhanced by the species radiating from a number of isolated nuclei established by bird dispersal. A detailed count was taken along six randomly selected transects each 10 m wide and the results averaged (Fig. 2). Other studies (2) have found that the number of exotic pines invading a native forest fell more or less logarithmically with increasing distance from a plantation - a pattern which reflects the distribution of a wind dispersed seed and supported by this study. The maximum density found was 58 trees per square metre. There is an estimated half a million trees in the park.

Mt Tibrogargan National Park is also extensively invaded by slash pine. The weed has been successfully removed from 50% of the park which indicates it is a species which can be controlled by manual effort. It is easy to identify and easy to destroy. There is a conflict of interest in this region as slash pine is a major plantation timber resource.

Other weeds. Species presenting significant management problems include camphor laurel, *Cinnamomum camphora, Desmodium intortum* and wandering jew, *Tradescantia albiflora*. Camphor laurels are readily dispersed by fruit eating birds. These trees could pose an insufficiently appreciated potential problem. There are numerous seed sources, the trees were found in most open-forest situations and they are difficult to identify and kill. *Desmodium intortum* is a vine which is rapidly increasing its range at Kondalilla. Small remnant rainforest parks are particularly vulnerable to vines. Wandering jew can reproduce asexually completely covering an area, to the total exclusion of all native species. The species loves water but is very drought resistant. It is very well established on flood plains at Kondalilla.

Conclusions. Humans have significantly influenced the distribution of weeds in National Parks. Timber exploitation, with little regard to the environment, is responsible for the worst infestations. Some areas which were partially cleared for agriculture are now 100% weeds. Some weeds including slash pine are expanding their range without human disturbances. Development is ensuring that the parks will become biologically isolated islands. The whole situation is exacerbated by park boundaries bearing no relationship to the ecology of the area.

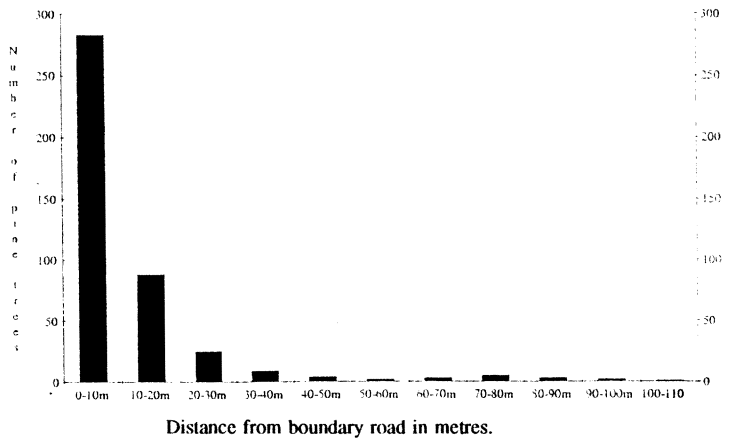

Figure 2. Pumicestone National Park - Average distribution of slash pine in six 10 m wide transects with increasing distance from the boundary road.

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