An investigation of weed problems in Sydney Harbour National Park

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SUMMARY

Exotic weedy plant species are causing concern in the natural bushland areas comprising Sydney Harbour National Park.

This study was undertaken to ascertain the extent and types of plants constituting the problem and lists of the problem weeds have been prepared. Several methods of weed control have been examined in the study but individual problem weeds will require their own special measures for control. The control measures adopted will need careful consideration of all factors to allow for maximum re-establishment of native species in the area.

INTRODUCTION

Sydney Harbour National Park brings together a number of previously state-owned reserves under the management of the New South Wales National Park and Wildlife Service. Proclaimed in 1975 it consists of over 100 ha of harbour foreshores. Eventually other Commonwealth land will be added to the park.

The areas included in the park vary in topography and aspect from gentle slopes at Nielson Park to a steep peninsula at Ashton Park, to a plateau and rugged cliffs at North and South Head. Soils over the area are derived from Hawkesbury Sandstone formations and thus are the characteristic sandy Sydney soils low in nitrogen and phosphorous. Variations in vegetation over the area are due mainly to differences in topography and aspect; for example, North Head and Grotto Point support a heath community, while the sheltered gullies in Nielson Park support a low temperate rain forest type community. Much of the area has been preserved in its native state owing to management as natural recreation land. However landscaped gardens have been created and buildings erected in some of the reserves notably Nielson Park, Ashton Park and Shark and Clark Islands. Also rubbish dumps, quarries and military works (old gun emplacements) have contributed to disturbed areas.

Disturbances of this nature have introduced exotic plants and destroyed the natural vegetation. The National Park and Wildlife Service aims to manage the areas as a natural reserve, preserving the existing natural vegetation and re-vegetating where necessary. This presents several problems in such a disjointed area with a long history of human disturbance.

The disjointed nature of the park has resulted in a number of small reserves with a large boundary to surface area ratio. The small size of the reserves thus results in an "island ecology" which is especially evident with the fauna and increased capacity for invasion by exotics especially from privately owned land abutting the parks.

Over most of the parkland intensive use is a problem. Experience of those concerned with the Royal National Park has shown that weed infestation increases with increased access to the area by firstly vehicles and then people. The extra stress placed on an ecosystem which is already in delicate balance, i.e. heathland, is often enough to prevent regrowth of young native plants and eventually to destroy communities.

The following study is aimed at examining the problem of exotic weeds in Sydney Harbour National Park and to recommend management strategies where necessary to control these weeds so that the natural vegetation can flourish.

METHODS

(a) Field surveys

In order to determine the nature of the problem the areas involved were first mapped according to type and extent of weed infestation. Initially, efforts have been concentrated in Nielson Park, but the methods employed will be extended later to other park areas.

Use was made of aerial photos (1972 - Port Jackson Moorings) to locate major infestations of weeds (e.g. lantana (*Lantana camara*) and morning glory (*Ipomea* spp.) patches. Areas where weeds existed as ground cover or undergrowth were mapped by ground reconnaissance. A list was made of all exotic plants found in Nielson Park and these have been grouped according to the threat they posed to the natural ecosystem (Table 1).

The vegetation types of the area under study were also mapped according to the naturally occurring community types (Table 2). Mapping was done using the 1972 aerial photos with comparisons made back to photos in 1949 and 1965.

Ground reconnoitring in areas where vegetation had apparently not changed enabled a species list to be made for each community group. The information gained will be used for re-vegetation work at a later date.

(b) Glasshouse trials

Herbicide trials in a glasshouse were carried out on three of the species classed as major weeds i.e. wandering jew (*Tradescantia albiflora*), asparagus fern (*Asparagus sprengerii*) and turkey rhubarb (*Acetosa sagittata*). Plants of these three species were established in 15 cm pots from propagules brought from the field (cutting, crowns and tubers respectively). When the plants were 6 to 8 weeks old they were sprayed with two different rates of three herbicides as indicated in Table 3. Results were recorded as a comparison of health of the treated plants to untreated plants at various time intervals and as fresh and dry weights of top and root growth 6 months after spraying.

(c) Field trials of weed control methods

Several weed control methods were tested in the field, these included:

Table 1. Exotic plants and their status as weeds in Nielson Park

Scientific name	Common name	Status
Asparagus sprengerii	asparagus fern	xxx
Acetosa sagittata	turkey rhubarb	xxx
Tradescantia albiflora	wandering jew	xxx
Chrysanthemoides monilifera	boneseed	xxx
Ipomea cairica	coast morning glory	xxx
I. indica	blue morning glory	xxx
Eupatorium adenophorum	crofton weed	xxx
Lantana camara	lantana	xxx
Pennisetum clandestinum	kikuyu grass	xxx
Bidens pilosa	cobbler's pegs	xx
Brassica rapa ssp. *campestris*	wild radish	xx
Erigeron spp.	fleabane	xx
Homeria breyniana	cape tulip	xx p
Hypochoeris radicata	catsear	xx
Lonicera japonica	honeysuckle	xx p
Ochna serrulata	ochna	xx p
Nothoscordum inodorum	onion weed	xx
Araujia hortorum	moth plant	xx p
Tropaeolum majus	nasturtium	xx
Cyperus rotundus	purple nutsedge	xx p
Solidago canadensis	golden rod	xx p
Briza maxima	lantern grass	x
B. minor	shivery grass	x
Capsella bursa-pastoris	shepherd's purse	x
Cerastium glomeratum	mouse-eared chickweed	x
Ceratochloa unioloides	prairie grass	x
Coronopus didymus	lesser swinecress	x
Gnaphalium japonicum	Japanese cudweed	x
Holcus lanatus	Yorkshire fog grass	x
Lolium rigidum	Wimmera ryegrass	x
Medicago polymorpha	Burr medic	x
Paspalum dilatatum	paspalum	x
Plantago lanceolata	plantain	x
Poa annua	winter grass	x
Romulea longifolia	onion grass	x
Senecio vulgaris	groundsel	x
Solanum nigrum	blackberry nightshade	x
Stellaria media	common chickweed	x
Trifolium glomeratum	cluster clover	x
T. repens	white clover	x
Vicia hirsuta	hairy vetch	x
V. angustifolia	narrow leaf vetch	x
Soliva pterosperma	bindii	x
Chloris gayana	Rhodes grass	x
Phytolacca octandra	inkweed	-
Anagallis arvensis	scarlet pimpernel	-
Anredera cordifolia	lamb's tails	-
Amaranthus viridus	green amaranth	-
Canna indica	canna	-
Cassia colluteoides	cassia	- p
Chlorophytum comosum		- p
Cirsium vulgare	spear thistle	-
Lepidium bonariense	peppercress	-
Ligustrum sinense	privet	- p

Table 1 (cont'd)

Scientific name	Common name	Status
Modiola caroliniana	red-flowered mallow	-
Olea africana	wild olive	- p
Opuntia stricta	prickly pear	- p
Oxalis corniculata	yellow wood sorrel	-
O. corymbosa	pink shamrock	-
O. incarnata		-
Plantago major	plantain	-
Rhaphiolepis indica	Indian hawthorn	- p
Silene anglica	French catchfly	-
Solanum mauritianum	wild tobacco tree	-
Taraxacum officinale	dandelion	-
Watsonia angusta	watsonia	- p
Vernonia cinerea	vernonia	-
Erythrina spp.	coral tree	-
Vinca major	blue periwinkle	-
Sonchus oleraceus	common sowthistle	-
Fumaria spp.	fumitory	-
	jonquils	-
Galinsoga parviflora	potato weed	-

xxx plants considered to be a major weed in the park.

xx plants of secondary importance, not considered to be a major weed at present.

x minor weed (possibly existing in balance with native species).

\- scattered through park.

p plants considered to be potentially capable of causing a bigger weed problem than at present.

Table 2. Plant communities in Nielson Park

1.	Closed forest	- Foliage cover:	70-100%
		Canopy height:	5-10 m
		Dominant:	*Ficus rubiginosa*
2.	Open forest	- Foliage cover:	30-70%
		Canopy height:	10-30 m
		Dominant:	*Eucalyptus haemastoma*
			E. piperita
3.	Low open forest	- Foliage cover:	30-70%
		Canopy height:	5-10 m
		Dominant:	*Eucalyptus robusta*
4.	Closed scrub	- Foliage cover:	70-100%
		Height:	2-8 m
		Dominants: (a)	*Kunzea ambigua* (clumped)
		(b)	*Acacia longifolia* - *Melaleuca nodosa*
5.	Open heath	- Foliage cover:	30-70%
		Height:	0-2 m
		No single dominant spp.	

Table 3. Effect of 2,4-D, dicamba and glyphosate on shoot growth of wandering jew in glasshouse trials.

Treatment		Dry weight (g) of shoot growth per pot
Dicamba	250 g/ha	24.2*
	500 g/ha	30.1
Glyphosate	2 kg/ha	16.1
	4 kg/ha	7.8
2,4-D	500 g/ha	32.7
	1000 g/ha	23.8
Untreated		28.7

* Average of 4 replicates.

(i) herbicides - glyphosate (2.4 kg/ha)
- paraquat (400 gm/ha)
- paraquat plus tetrapion (400 gm + 6.75 kg/ha)
- dicamba (500 gm/ha)

(ii) mechanical weed control
- cutting with a petrol driven weed trimmer i.e. "Weedeater"
- burning with a portable gas burner
- hand weeding including the "Bradley Method" (Bradley, n.d.)

Plots of various sizes (depending on the weed infestation) were treated by the methods outlined, and observation on weed regrowth carried out (Table 4).

RESULTS AND DISCUSSION

Much of this work is still being evaluated but results to-date are as follows:

The weeds present in the park were classified into the three main groups as shown in Table 1. The major weeds were those which were either occupying considerable area of the parks or which had completely taken over areas of natural bush. Also several weeds were present which were considered as being of a potentially greater problem than at the moment and these are noted.

Trial work is being concentrated on the weeds considered to be of major importance at the moment.

Table 4. Weed control methods tested in the field against the various weeds listed

Weed	Weed control method used		
	Burner	Mechanical cutter	Herbicides*
Asparagus sprengerii	x	x	x
Acetosa sagittata	x	-	x
Chrysanthemoides monilifera	-	x	-
Ipomea spp.	x	x	x
Tradescantia albiflora	x	x	x
Pennisetum clandestinum	x	x	x

* included glyphosate, paraquat, dicamba and tetrapion.

Only 3 weeds have so far been studied in glasshouse trials for sensitivity to herbicides. Wandering jew was most sensitive to glyphosate, but shoot growth was not completely suppressed and follow-up treatment appears necessary for complete eradication (Table 3).

Turkey rhubarb plants appeared to be completely destroyed by glyphosate or dicamba in the glasshouse but field trials did not substantiate this as considerable regrowth occurred.

Dicamba reduced topgrowth of asparagus fern, but no herbicide showed any effect on the tubers and root system. Asparagus fern possesses an extensive system of roots with swollen water storage organs (tubers) which enables this plant to survive extensive water stress and to produce new shoots from the crown after damage to the plant.

In the field trials the weed burner used was very slow at burning weeds and regrowth was extremely rapid especially from the perennials. It was considered to be an unsatisfactory method where larger areas are involved and for perennials.

The weed cutter was more satisfactory depending on the extent of infestation, size of weed and the blade used (nylon thread or metal blade). It appeared useful for clearing dense infestations of weeds such as morning glory, lantana etc. but regrowth is a problem.

Herbicides appear promising for control of the perennial weeds, although care needs to be exercised to choose materials that are not soil residual or a threat to the environment (Table 5).

Hand weeding appears useful where infestations are scattered for species such as lantana, crofton weed, (*Eupatorium adenophorum*) and boneseed (*Chrysanthemoides monilifera*), however this method is not suited to most perennials, especially asparagus fern, turkey rhubarb and kikuyu (*Pennisetum clandestinum*). The Bradley Method of selective control while time consuming and of a long term nature appears effective if one has the patience and devotion to the method.

Table 5. Effect of three herbicides on several perennial weeds

Weed	Dicamba	Glyphosate	Paraquat
Asparagus sprengerii	xxx	x	x
Acetosa sagittata	xxx	xx	x
Ipomea spp.	xxx	xxx	x
Tradescantia albiflora	x	xxx	x
Pennisetum clandestinum	-	xx	x

x slight effect for short time only
xx 80% or greater dieback for 1-2 months
xxx 80% or greater dieback for 3 or more months.

In all cases it was found that re-invasion by weedy exotics occurred rapidly whenever the existing grounc cover was killed. This problem was most evident where mixed annual weeds were present i.e. plantain (*Plantago* spp.) and beggar's tick (*Bidens* spp.) being the quickest to establish.

In areas where weeds were present in small numbers or where native bush formed a canopy or shrub layer re-invasion was at a minimum. Work is in progress to determine the effectiveness of native cover and mulching in preventing regrowth of exotics, but results will not be available for 1 to 2 years.

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