WEEDS AND FIRE

GREG KEIGHERY

GARDEN ISLAND MANAGEMENT WORKSHOP
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Introduction

Garden Island contains a series of fire prone, rare plant communities (Keighery and Keighery, 1992). These are the *Melaleuca* and *Callitris* woodlands, and the Acacia shrublands. As with most west coast island plant communities these are relatively simple in structure and floristics (Table 1). This may render them susceptible to weed invasion, especially after gross disturbance, for example fire, or any other form of ground disturbance.

General Notes on the Weed Flora of Garden Island

The weed flora of Garden Island is listed in Table 2. Currently a total of 106 taxa of naturalised plants have been recorded from the Island. This weed flora is not static and since the last published listing there have been additions, deletions and other changes which are detailed in Table 2 and below.

A) CHANGES
Three aspects of the weed flora of the Island that have changed greatly since the last major suvey in 1979 (Marchant and Abbot, 1981).
1) Cessation of uncontrolled introductions occurring around the settlement and northern shacks.
Most of the species grown in these areas listed in previous reports have:
(a) died - *Auricaria heterophylla* (Norfolk island pine), *Punices granatum* (Pomegranate), *Creetagus* (Hawthorn), *Ixora* sp.and *Vitis vinifera* (grapes)
(b) just persisted without spreading - *Euphorbia dendroides* (Tree Spurge), *Schinus terrebinthifolius* (Japanese Pepper) *Nerium oleander* (Oleander), *Melia azederach* (Cape Lilac), *Eucalyptus gomphocephala* (Tuart).

2) Capping of the old bores where numerous weeds grew.and flourished.
This has apparently resulted in the demise of several naturalised species listed in previous reports; *Anredra cordifolia* (Potato Vine), *Nasturtium officinale* (Water Cress), *Musa sapentium* (Plaintain Bannana), ?*Arundo donax* (Bamboo), ? *Mauraholdya barcaliana* and *Typha orientalis* (Bullrush).

3)Increase in the number of weeds present on the beaches of Garden Island.
During our brief studies on the island we have located 6 new weeds - *Mesembryanthemum crystallinum* (Ice Plant), *Arctotheca calendula* x *populifolia*, *Conyza parva* (Fleabane), *Euphorbia paralias* (Sea Spurge), *Elymus distichus* (Sea wheat) and *Lycium ferocissimum* (Box thorn). This increase reflects the increased usage of these areas, by recreational boaters and searching of rocky headlands by the author.
Heyliger (1989) reported a single plant of Sea Spurge on the beach at Rockingham, and postulated that this species was introduced from the Busselton area. In 1992 this species was found in abundance along the seaward face of the dunes at Herring Bay. This population probably arrived on a boat or in gear which had seeds present on it. The size of the population suggests that this species has been resident for some time. In 1993 numerous plants were also located on the beaches to the north and south of Herring Bay and scattered plants on the eastern side of the island. The plant at Rockingham almost certainly came from Garden Island, not the Busselton area. Since this abundant and highly visible species was not recorded previously, it must have arrived since the date of the last survey in 1979.
The single plant of Sea Wheat probably came from Woodmans Point, where the species is abundant on the fore dunes. However it is unlikely these specialized weeds will ever pose a threat to the rest of the island, and they do not seem to displace other species on the beach itself.

Overall there has been a net loss of 10 weed species.

B) DISTRIBUTION, ABUNDANCE AND THREAT OF WEEDS RECORDED

There is little information available on the distribution, abundance or threat potential (ability of the species to both multiply and invade native plant communities) of most of the weeds recorded for Garden Island. Most weed lists simply record the presence of a species, rather than detailing their occurrence or threat potential. Except for a few major weeds this is the case for Garden Island.

In Table 2 all recorded weeds of Garden Island are listed with notes on the major area of occurrence and the species threat potential (this is based on information in Goble-Garret and Keighery, 1992). From Table 2 it can be seen that:

- the most serious weed is Arum lily
- another potentially serious weed is Bridal Creeper
- there are
  - 30 widespread weeds (*Homeria* and *Trachyandra* could be serious)
  - 9 beach weeds
  - 6 weeds of rocky headlands (including *Lycium* and *Lavatera*)
  - 10 Settlement weeds
  - 27 weeds with no data
  - 11 "Extinct" weeds
  - 6 weeds just persisting
  - 4 very localized weeds (*Agonis* needs to be removed)

This information shows that there are seven serious or potentially serious weeds present on the Island. The potential for a weed to become serious can be illustrated by *Agonis flexuosa* (Peppermint). It is recommended that the *Agonis flexuosa* plants be removed as soon as practicable, as these are seeding, and already are major weeds in Kings Park and Yanchep. They will spread rapidly after fire into the woodlands. Continual vigilance is required to prevent the development of more serious weeds. Both *Homeria* (Cape Tulip) and *Trachyandra* are unpalatable and could spread after disturbance, such as fire. Bridal Creeper is controlled by Tammar grazing. *Lycium* (Boxthorn) and *Lavatera* (Tree Mallow) are serious weeds of rocky islets, and probably would only be of concern on headlands on Garden Island.

Weeds and Fire in similar Plant Communities

Plant communities similar to those of Garden Island are found in relatively fire free enviroments on the adjacent mainland at Woodman's Point and the Trigg Dunes Reserve. They were once common on Rottnest Island also.

Species diversity of unburnt woodlands and shrublands ranges from 16 - 25 species per $100m^2$ (Table 1). The percentage of weeds in these sites ranges between 14 and 37%. These weeds are nearly all small annuals, except for the tuberous herb *Trachyandra divaricata*.

At Woodmans Point most of the *Callitris* Forest was burnt in summer 1991. A series of quadrats were established in this area in early 1993 (Table 3). Here the species diversity ranged from 19-23 species per $100m^2$. However, the percentage of weeds ranged from 42-55%! Of particular concern was the appearance of two perennial shrub weeds, *Leptospermum laevigatum* (Victorian Tea Tree) and *Nicotiana glauca* (Tree Tobaco).

Another observation of interest was that in most quadrats the tubers of the Bridal Creeper were killed by the fire. This tuberous herb is a serious weed of calcareous soils in southern Australia. On Garden Island the native herbivores (Tammars) keep this species under control but in areas where they are absent (like Woodmans Point) this species becomes a rampant weed.

Also at Woodmans Point there is heavy grazing on the young *Callitris* trees in late summer by rabbits. Numerous seedlings were found uprooted by these animals. Tammars apparently also graze young seedlings.

Currently we can observe that on the mainland weed invasion occurs markedly after fire in these communities. Some of these weeds are long lived shrubs that could permanently alter these communities. The effects of fire on species such as Bridal Creeper suggest that weed and rabbit control programs need to be in place in the winter/spring after the fire to be effective.

Weeds and Fire on Garden Island

Past studies on fire on Garden Island (Baird,1958) dealt with the regeneration of native species after fire. There are no studies on the weed flora and it's response. The effects of a small fire near the disposal area shows no major increase of weed species, however the current areas of severe weed impact are in the *Acacia* shrublands on the central and southern areas of the island. Currently we have little data on the weeds of this plant community, either on the island or elsewhere. Secondly many of the weeds recorded in the burnt *Callitris* Woodland at Woodmans Point are present on Garden Island. In small fires there is severe grazing pressure by Tammars, who remove many of the herbaceous weeds.

Summary

*Garden Island contains a number of very significant plant communities.
*Little is known about the abundance, distribution and effects of weeds on the Island.
*Major changes have occured in the weed flora over the last 14 years.
*The communities have been less severely impacted by weeds , fire, clearance and other disturbance than similar communities on the mainland, or Rottnest Island.
*Serious weed invasion occurs after fire in mainland sites.
*Many of the same weeds are present on Garden Island.

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TABLE ONE: UNBURNT CALLITRIS/ MELALEUCA/ ACACIA SITES

Key

G1,3,4	Woodland quadrats on Garden Island, Swan Coastal Plain Survey (SCP).
GB	Burnt Melaleuca quadrat on Garden Island
WP	Unburnt quadrat at Woodmans Point, SCP Survey
TD	Unburnt Callitris quadrat at Trigg Dunes, SCP Survey

	G1	G3	G4	GB	WP	TD
Calltris preissii	*	*			*	*
Acacia rostellifera		*		*	*	
Acanthocarpus preissii	*	*	*	*		*
Acrotriche cordata					*	
Agrostis preissii		*				
*Aira cupiana	*		*	*		*
*Anagallis arvensis	*		*			
Apium anuum	*	*				
*Briza maxima					*	
Calandrinia calyptrata				*	*	
*Catapodium rigidum		*			*	
*Cerastium glomeratum		*	*			
Clematis microphylla	*	*	*		*	*
Comesperma integerrimum		*		*		
Conostylis candicans					*	
Crassula colorata				*		
*Crassula glomerata	*			*		*
*Daucus glochidiatus					*	
Eremophila glabra	*			*		
*Erhrata longiflora				*		
Eucalyptus gomphocephala					*	
*Euphorbia peplus					*	
*Galium murale	*	*	*	*	*	*
Hardenbergia comptoniana		*			*	
*Lagurus ovatus	*					*
Lasiopetalum oppositifolium			*			
Lepidium puberulum	*	/ /				
Leucopogon australis		*			*	
Melaleuca acerosa					*	
Melaleuca lanceolata	*	*	*	*		
Myosotis australis	*					
*Myrsiphyllum asparagoides		*		*		
Oxalis perrenenans	*					
Parietaria debilis	*	*		*		
Phyllanthus calycinus	*	*		*		
Poa poiformis			*			
Poranthera microphylla	*	*				
Rhagodia baccata	*		*		*	*
Santalum acuminatum				*		
Spyridium globulosum	*		*	*	*	*
Senecio lautus					*	
*Sonchus oleraceus	*				*	*
*Solanum nigrum	*					*
Solanum symonii	*			*		
Stipa flavescens	*	*				
Thomasia cognata				*		
Thysanotus patersonii	*					
*Trachyandra divaricata	*		*	*	*	
Trachymene caerulea	*	*		*		

Trachymene pilosa	*	*	*	*		
*Vulpia myorus		*				
*Zantdescia aethiopica	*		*			
Total	25	21	16	20	18	16
No. Weeds	9	3	7	5	6	6
% Weeds	36	14	44	25	33	37

TABLE TWO: ANNOTATED LIST OF GARDEN ISLAND NATURALISED PLANTS

Key

{ } Garden plants, listed in Marchant and Abbott (1981) but not apparently naturalised.
\+ Naturalised plants not recorded previously from Garden Island.
\# Naturalised plants only found around the northern bore and unlikely to spread further, apparently died out before re-survey in 1993.
McA McArthur, 1957, or McArthur and Bartle, 1981
M/A Marchant and Abbott, 1981

AGAVACEAE	
Agave americana	Status unknown (1980 Management Plan), not in McA or M/A.
AIZOACEAE	
+Mesembryanthemum crystallinum	Point Atwick Headland only.
Tetragonia decumbens	McA, M/A, beaches only.
ALLIACEAE	
Allium ampeloprasum	M/A, A garden escape, scattered on tracks around the settlement.
AMARYLLIDACEAE	
Narcissus tazetta	McA (as N.jonquilla), garden escape, status unknown.
ANACARDIACEAE	
Schinus terrebinithifolius	In 1980 Plan not mentioned in McA or M/A, a few persisting individuals found around old settlement at Beacon Head.
ARACEAE	
Zantdeschia aethiopica	McA, M/A, common serious weed.
ARAUCARIACEAE	
{Auricaria heterophylla}	
APIACEAE	
+Conium maculatum	Uncomon weed found on roadverges in the Naval Base.
APOCYNACEAE	
{Nerium oleander}	M/A, a few persisting plants between Dance Head and Beacon Head.
ASCELPIDACEAE	
Gomphocarpus fruticosus	McA, status unknown.
ASPARAGACEAE	
Myrsiphyllum aspargoides	McA, M/A, common potentially serious weed.
ASPHODELACEAE	
Asphodelus fistulosus	McA, M/A,common weed of tracks, disturbed areas.
Trachyandra divaricata	McA, M/A, common weed of disturbed woodlands.
ASTERACEAE	
Arctotheca calendula	McA, M/A, scattered weed, dunes and headlands.
A.populifolia	McA, M/A, beaches only.
+A. calendula x populifolia	Rare hybrid 1 plant, beaches only.
Carduus pycnocephalus	M/A, still relatively common around the northern half of the Island in disturbed areas and regenerating valleys.
+Conyza albida	Around Stirling Base and picnic area at Herring Bay.
Conyza bonariensis	McA, around Stirling Base and picnic areas at Herring Bay.

+Conyza parva	Abundant on recent beach dunes at Broun Bay.
Dittrichia graveolens	McA, found only on road verges.
Hypochaeris glabra	McA, M/A, found only in picnic sites, settlement.
Osteospermum clandestinum	McA, not re-found.
Sonchus asper	McA, in old clearings at Beacon Head.
Sonchus oleraceus	McA, M/A, scattered throughout island.
BASELLACEAE	
#Anredera cordifolia	
BRASSICACEAE	
+Brassica tournefortii	On dunes at Broun Bay, settlement.
Cakile maritima	M/A, beaches only.
Hymenobolus procumbens	M/A, on rocky headlands.
#Nasturtium officinale	
Sisymbrium orientale	M/A, status unknown.
CARYOPHYLLACEAE	
Cerastium glomeratum	M/A, scattered minor weed in woodlands.
Petrorhagia velutina	M/A, weed of rocky areas.
Polycarpon tetraphyllum	M/A, headlands, valleys.
Sagina apetala	M/A, headlands, dunes.
+Silene nocturna	In Melaleuca Woodland at Second Head.
Silene gallica	M/A, headlands, tracks, valleys.
Stellaria media	M/A, valleys.
CHENOPODIACEAE	
Chenopodium murale	McA, under Melaleuca Woodland at Second Head.
COLCHICACEAE	
+Ornithogalium arabicum	In valleys west of Stirling Base.
CONVOLVULACEAE	
#Ipomaea indica	? Convolvulus sp in McA and M/A.
CRASSULACEAE	/ /
Crassula glomerata	M/A, scattered throughout island.
EUPHORBIACEAE	
+Euphorbia dendroides	Edges of tracks at Beacon Head.
Euphorbia peplus	M/A, headlands, valleys, tracks.
+Euphorbia paralias	Beaches only, see notes.
Riccinus communis	McA, M/A, disturbed areas.
FUMARIACEAE	
Fumaria muralis	M/A, status unknown.
GENTIANACEAE	
Centaurium erythraea	McA, M/A, scattered, headlands, woodlands.
GERANIACEAE	
Erodium cicutarium	McA, M/A, scattered in woodlands.
Gerianium molle	M/A, status unknown.
Pelargonium capitatum	McA, M/A, status unknown.
IRIDACEAE	
Homeria ?miniata	McA, M/A, status unkown.
Watsonia	McA, M/A, status unknown.

MALVACEAE	
Lavatera arborea	McA, this species is a serious weed on the Safety Bay Islets, status unknown.
MELIACEAE	
{Melia azederach}	
MUSACEAE	
#Musa sapentium	
MYRTACEAE	
Agonis flexuosa	Plants of this species recorded at Herring Bay, and between Second Head and Beacon Head, able to produce numerous seedlings.
{Eucalyptus gomphocephala}	
OXALIDACEAE	
Oxalis pes-caprae	McA, M/A, status unknown.
PAPAVERACEAE	
Argemone ochroleuca	McA, M/A, Status unknown.
PAPILLIONACEAE	
Medicago polymorpha	M/A, status unknown.
Meliotis indica	M/A, headlands.
Trifolium scabrum	McA, status unknown.
PHYTOLACCACEAE	
+Phytolacca octandra	Around the old settlement at Beacon Head.
POACEAE	
+Aira caryophyllea	Often confused with A.cupiana, ?Widespread.
Aira cupiana	M/A, common weed of woodlands.
Avena barbata	McA, M/A, headlands,settlement,valleys.
#Bambusa sp/?Arundo donax	M/A.
Bromus diandrus	McA,M/A, scattered along tracks,headlands.
Bromus rubens	McA, M/A, status unknown.
Catapodium rigidum	M/A, common on headlands, rare in woodlands.
Cynodon dactylon	M/A, woodlands around settlement.
Ehrharta longifolia	M/A, scattered in woodlands.
Critesion leporinum	M/A, status unknown.
Critesion vulgare	M/A, status unknown.
+Digitaria sanguinalis	Tracks in settlement.
+Elymus distichus	Beaches only.
Eragrostis curvula	McA, status unknown.
Lagurus ovatus	McA,M/A, headlands, woodlands.
Lolium sp	M/A, status unknown.
Paralophis incurva	M/A, headlands only.
Poa annua	McA,M/A, tracks, scattered in woodlands.
Polypogon monspeliensis	McA, M/A, status unknown.
Stenotraphum secundatum	M/A, around settlement.
Vulpia myuros	M/A, valleys, woodlands.
POLYGONACEAE	
Emex australis	McA,M/A, status unknown.
PRIMULACEAE	
Anagallis arvensis	McA,M/A, comon but minor weed of whole island.

PUNICACEAE
{Punica granatum}

ROSACEAE
{Crataegus sp. }

RUBIACEAE

Galium murale	M/A, widespread weed of woodlands.
{Ixora sp. }	McA
Sherardia arvensis	M/A, scattered in valleys and woodlands.
Verbascum virgatum	McA, status unknown.

SCROPHULARIACEAE

Dischisma arenarium	McA,M/A, widespread weed of woodlands,beaches and headlands.
Parentucellia latifolium	M/A, status unknown.
#Cymbalaria muralis	Most likely Maurandya barcalaiana. Status unknown mentioned in 1980 Plan as occuring at old bore site, not in McA or M/A.

SOLANACEAE

+Lycium ferocissimum	Rocky headlands only.
Nicotiana glauca	M/A, status unknown.
Solanum nigrum	McA,M/A, scattered throughout island.

TYPHACEAE

#Typha orientalis	McA, M/A.

URTICACEAE

Urtica urens	M/A, Scattered weed of Melaleuca Woodlands near coast.

VALERIANACEAE

Centranthus ?ruber	McA, status unknown.

VITACEAE
{Vitis vinifera}

TABLE THREE: WEEDS and FIRE - WOODMAN'S POINT, 1992

Key

a, b, c, d, e — $100m^2$ quadrats
- a — Foredune in recreation area
- b — Swale in recreation area
- c,d,e — Woodman's Point Conservation Area

R — Regeneration mode after fire: S=from seed; R= from rootstocks, bulbs or rhizomes.

Gl — Weed recorded from Garden Island.

	a	b	c	d	e	R	Gl
Calltris preissii	*	*	*	*	*	S	
Acacia cyclops	*	*		*	*		
Acacia cochlearis		*	*		*		
Solanum symonii		*	*			S	
Melaleuca acerosa		*		*	*	R	
Melaleuca huegelii		*				S	
*Leptospermum laevigatum	*	*				S	
*Nicotiana glauca	*				*	S	*
Spyridium globulosum	*	*	*	*	*	S	
Hardenbergia comptoniana	*					R	
Scaevola crassifolia	*	*	*	*	*	R	
Anthocercis littorea	*	*	*	*	*	S	
Olearia axillaris	*					S	
Leucopogon parviflorus	*					R	
Acanthocarpus preissii	*					R	
Clematis microphylla	*					R	
Hardenbergia comptoniana	*	*		*		R	
Rhagodia baccata	*			*	*	R	
Comesperma integerrimum	*				*	R	
Schoenus grandiflora			*	*		S	
*Trachyandra divaricata	*	*	*	*	*	R	*
Threlkeldia diffusa		*				R	
*Myrsiphyllum asparagoides	*	D	D	D		R	*
*Pelargonium capitatum	*			*		R/S	
*Anagallis arvensis		/	*	*		S	*
*Avena barbata		/				S	*
Carpobrotus virescens		*				S	
*Carpobrotus edulis		*	*		*	S	
*Arenaria serpyllifolia		*				S	
*Brassica tournefortii				*		S	*
*Conyza albida	*					S	?
*Dishisma arenaria			*			S	*
*Erhrata longiflora		*	*	*	*	S	*
*Galium murale				*		S	*
*Galium aparine				*		S	
*Lactuca serriola	*					S	
*Bromus diandrus	*		*			S	*
*Lagurus ovatus	*	*	*	*		S	*
*Lolium rigidum		*				S	*
*Sonchus oleraceus	*		*		*	S	*
*Solanum nigrum				*		S	*
*Euphorbia terricina			*			S	
Crassula colorata				*	*	S	
*Crassula glomerata	*		*	*	*	S	*
*Dittrichia graveolens	*		*			S	*
*Phytolacca octandra		*				S	*
*?Corrigola littoralis				*	*	S	

Totals	23	20	21	21	19
No. Weeds	10	11	11	11	8
% Weeds	43	55	52	52	42