

Paganoni Swamp; a case study in protection of wetlands and woodlands on the Swan Coastal Plain.

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Paganoni Swamp is one of the most significant conservation reserves in the metropolitan region south of the Swan River. A part of the Rockingham Lakes Regional Park, the 700 hectare site lies within the City of Rockingham (Fig. 1). Paganoni represents the largest wetland in the Stake Hill Wetlands chain and the only one with its upland ecosystems still intact. The central wetland running north-south through the reserve is surrounded by large old Tuarts (*Eucalyptus gomphocephala*) and mixed Banksia/Sheoak (*Allocasuarina fraseriana*) woodlands. To the east on the older Bassendean sands, Tuarts give way to Jarrah/Banksia woodlands and along the western boundary heathlands occur on limestone ridges. One of the key threatening processes to the wetlands and woodlands of Paganoni is invasion from the introduced perennial herb Geraldton Carnation Weed (*Euphorbia terracina*) (Fig 2 & 6).



Figure 1: Location of Paganoni Swamp

Since 2005 the Friends of Paganoni Swamp and Department of Environment and Conservation's Urban Nature Program together with staff from Regional Parks have focused efforts on applying established control methods to prevent the spread of Geraldton Carnation Weed from the western and northern edge of the reserve into relatively undisturbed Tuart, Banksia and Jarrah Woodlands. The methods employed have included spraying metsulfuron methyl (0.1 gms/15L) + the penetrant Pulse® on seedling and younger plants in July/August and hand weeding adults across the site in November.

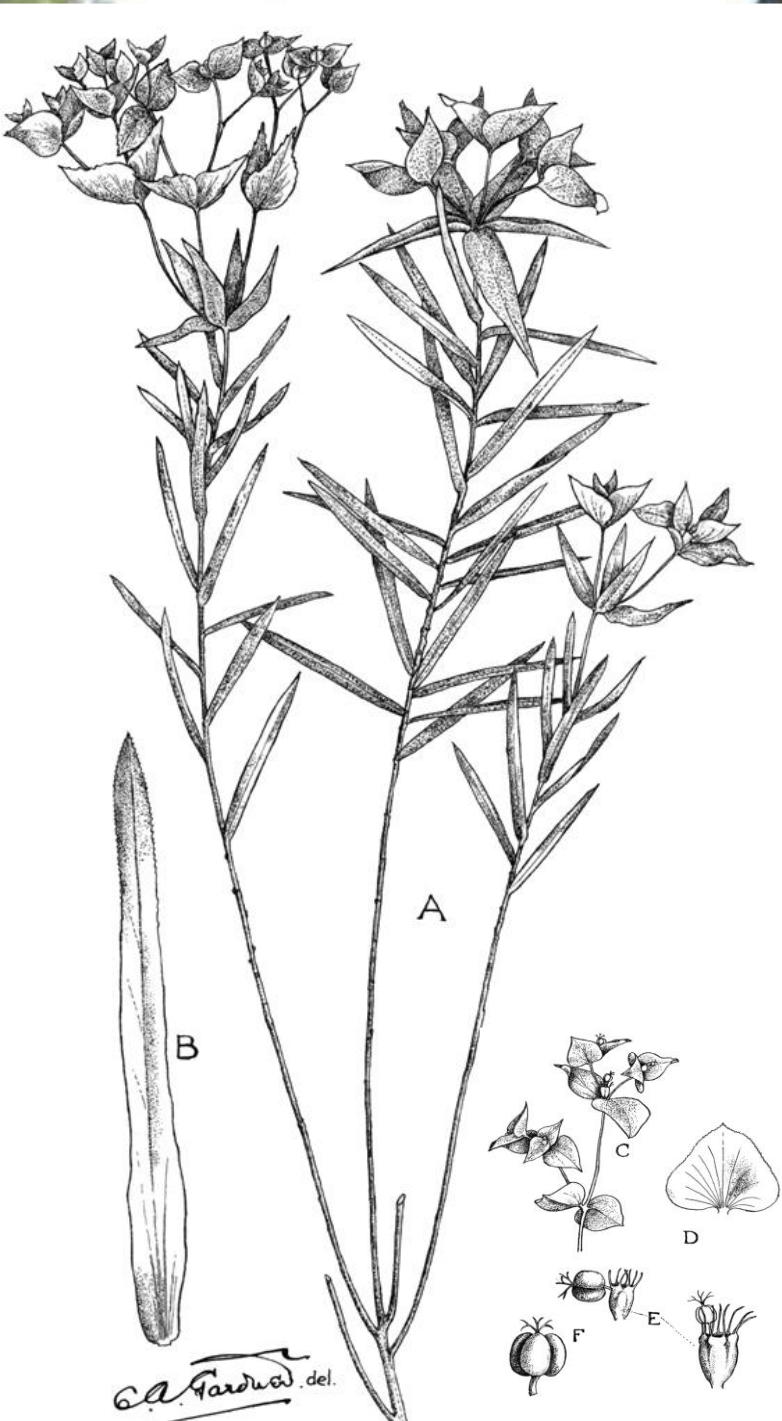


Figure 6: *Euphorbia terracina*. A-flowering stems, B-distinctive leaf shape, C-F various detail of flower parts and fruit (illustrations by C.A. Gardner)



Figure 7: Distribution of Geraldton Carnation Weed (□) invading wetlands and woodlands of Paganoni Swamp



Figure 2: Geraldton Carnation Weed invading the understorey of Banksia Woodland, western boundary Paganoni Swamp.



Figure 3: Tuart Woodlands, Paganoni Swamp



Figure 4: *Banksia littoralis*, central wetland, Paganoni Swamp

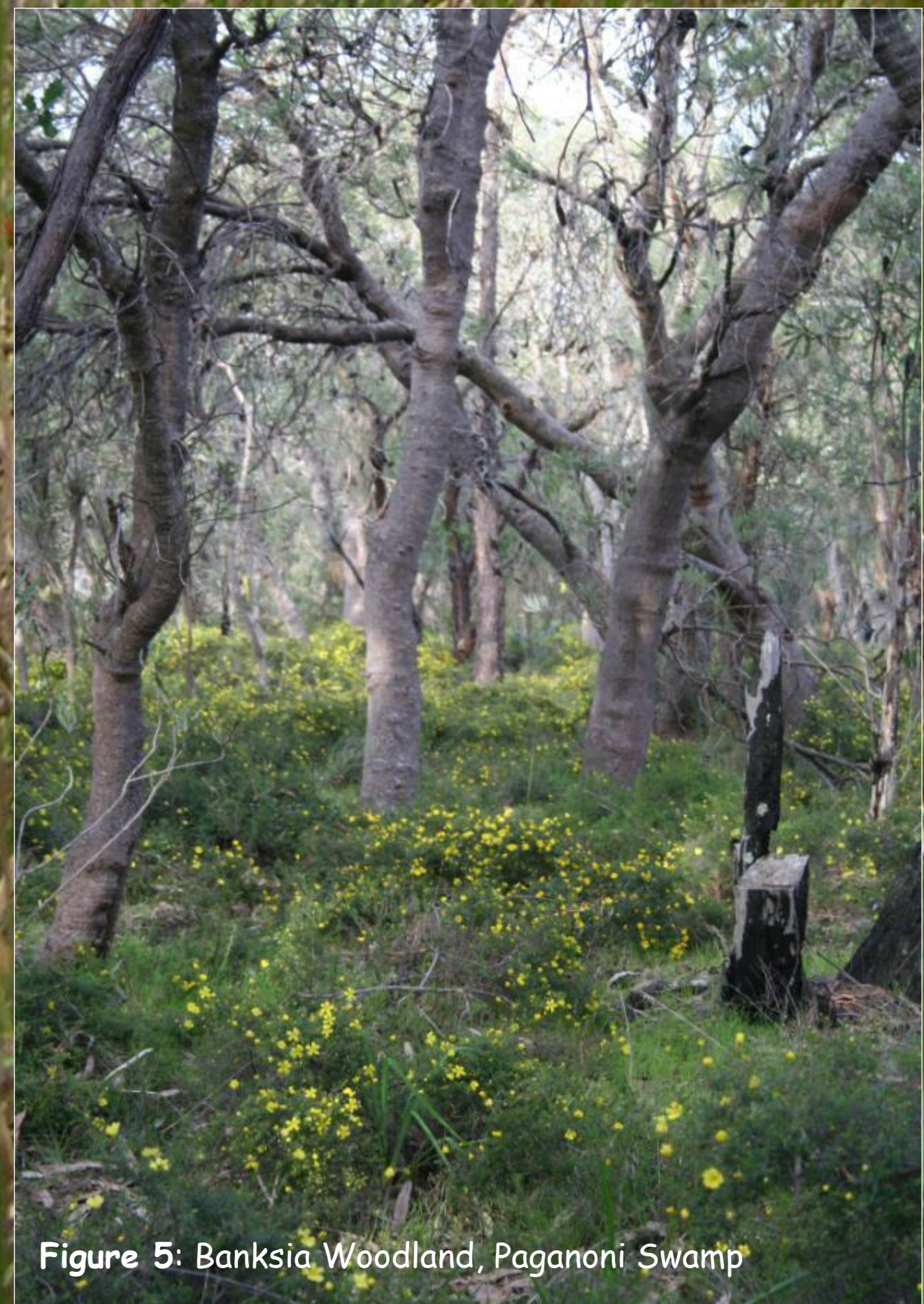


Figure 5: Banksia Woodland, Paganoni Swamp

Twice yearly monitoring of 15 permanent quadrats as well as detailed mapping indicates a reduction in cover of Geraldton Carnation Weed from an average of 34.7% in 2005, before any treatment to less than 2% cover in 2008 (Table 1). Over this time there has been a significant increase in cover some native species across the treatment area (Fig.8, Table 1). However there has also been a significant decrease in the cover of others possibly due to off target damage from herbicide application. The reduction in cover of these species is of concern, however the treatment covers a very small area on the western edge of the reserve (Fig.7) and overall this work has clearly protected the remaining 700 hectares of intact woodlands and wetlands of Paganoni from the impacts of invasion by Geraldton Carnation Weed.

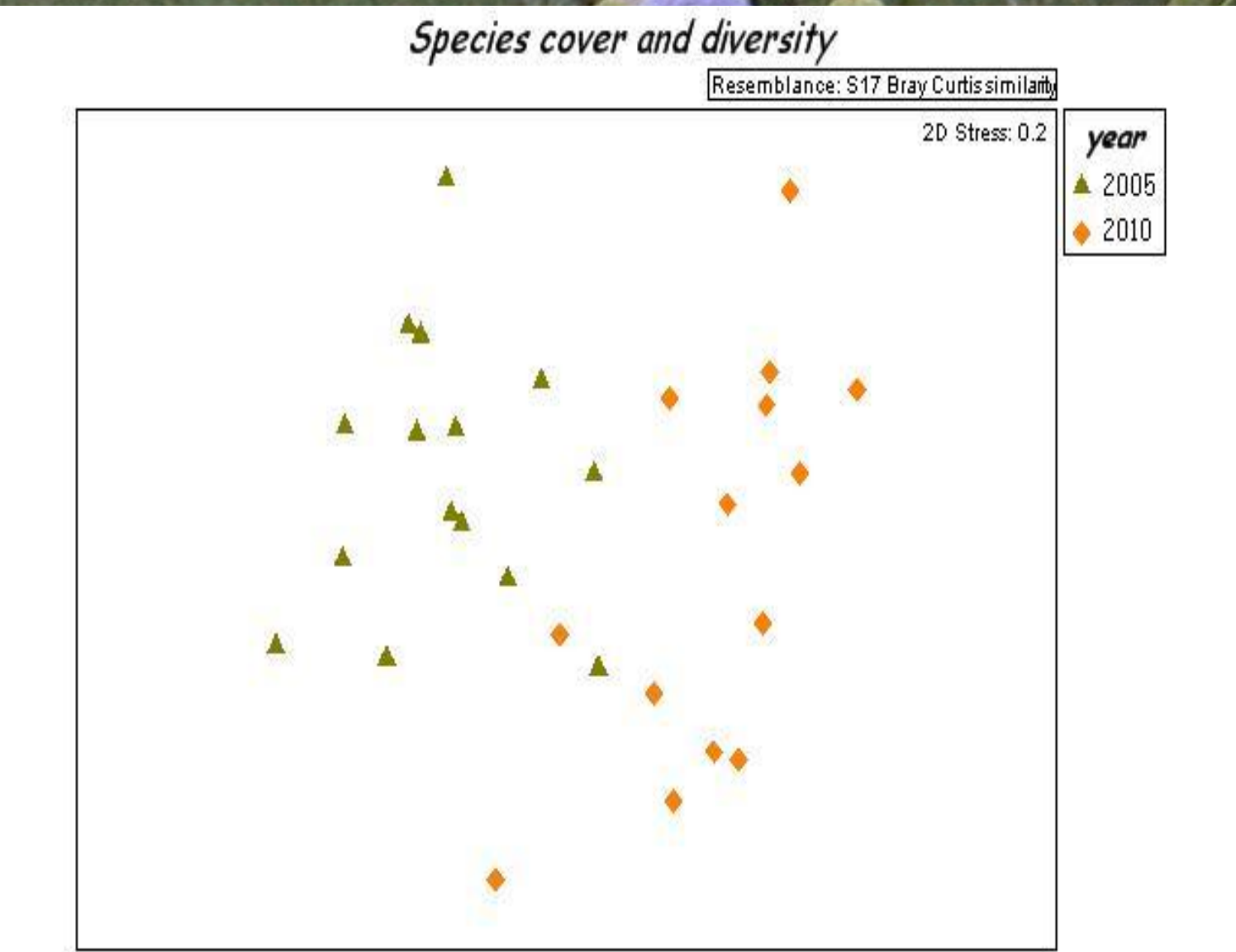


Figure 8: Cover and diversity of species was significantly different between 2005 and 2010 along the treatment area, western boundary of Paganoni Swamp



Figure 9: Friends of Paganoni Swamp and Department of Environment and Conservation staff working together on a field herbarium for the reserve.

Table 1: There were significant changes in cover of species in the treatment area between 2005 and 2010. * indicates weed

Species	2005	2006	2007	2008	2009	2010
* <i>Euphorbia terracina</i>	34.7	1.1	10.3	1.5	0.4	0.5
<i>Dichopogon capillipes</i>	17.7	6.2	25.2	42.5	26	32.3
<i>Hibbertia hypericoides</i>	18.7	12.7	15.9	13.8	2.1	5.4
<i>Rhagodia baccata</i>	9.2	2.1	2.6	1.1	0	0.1
<i>Banksia grandis</i>	4.5	4.5	4.5	4.6	4.8	6.3
<i>Macrozamia riedlei</i>	4.6	4.6	4.6	2.5	0	0
<i>Microlaena stipoides</i>	1.9	1.9	2.8	4.1	5.8	3.9
<i>Drosera erythrorhiza</i>	4.5	0.2	2.5	0	0	0
<i>Lasiopetalum membranaceum</i>	1	2.5	2.5	2.5	2.7	0
<i>Geranium retrorsum</i>	0.7	0.6	1.3	3.4	2.1	5.6
* <i>Briza sp.</i>	0.5	1.5	3.6	3.8	7.0	8.5



Figure 10: Some of the common native flora occurring along the western boundary. a) Swan River Daisy (*Brachyscome iberidifolia*) (photo Colin Prickett), b) Native Geranium (*Geranium retrorsum*), c) *Hibbertia hypericoides*, d) Rottneist Island Daisy (*Trachymene coerules*) (photo Colin Prickett), e) Native Oxalis (*Oxalis exilis*) f) Chocolate Lily (*Dichopogon capillipes*).

Further Reading

Brown, K.L., Cullity, J.C., Paczkowska, G. and Bettink, K. (2010) Managing Geraldton Carnation Weed in the Wetlands Woodlands and Heathlands of the Swan coastal plain. Abstract. Australian Network for Plant Conservation annual conference, Perth Western Australia.

Brown K.L. and Cullity, J.C. (2007) Geraldton carnation weed; managing invasion into a Threatened Ecological Community, the Holocene dune swales at Point Becher. In Urban Nature eds.), Proceedings of the Geraldton Carnation Weed (*Euphorbia terracina*) Workshop and Field Day, Naragebup Rockingham Regional Environment Centre (Inc.), Peron, Western Australia, June 21 2007. Department of Environment and Conservation, Western Australia. <http://www.dec.wa.gov.au/content/view/5892/2325/>

Riordan, E.C., Rundel, P.W., Brigham, C. and Tiszler, J. (2005) Morphological traits and invasibility of the non-native *Euphorbia terracina* (Euphorbiaceae) in coastal southern California, *Madroño*.