

Weed Survey of Priority Sites in the Bangham District



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Cover photo: *Eucalyptus fasciculosa*, *Eucalyptus leucoxylon* spp. Low Woodland occurring within a Heritage Agreement site in the Bangham district.

Disclaimer

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1. INTRODUCTION

1.1 Background

NGT Consulting was contracted by the Department of Environment Water and Natural Resources (DEWNR) to undertake on-ground weed assessments throughout key remnant vegetation blocks located within the Bangham District in the South East of South Australia. The Bangham District retains extensive areas of remnant woodland vegetation, with the majority of priority areas occurring within large Conservation Parks or perpetually secured on private land under Heritage Agreement. The Biodiversity Plan for the South East of South Australia (Croft *et al* 1999) identifies this district as an area of key biodiversity significance; acknowledging the condition and extent and connectivity of the regionally significant vegetation still remaining in this area.

1.2 Aim of the Project and Report

Project Aim

- To document and map specific weed infestation information for invasive plant species within priority areas of remnant vegetation the Bangham district, to enable prioritisation of follow-up control works.

The aim of this report is to summarise the findings of the field-based weed assessments, provide new information on the current weed distribution and density at these sites, and to evaluate the feasibility of potential control works.

1.3 Location and Regional Description

The Bangham district forms the western extent of a broad east-west geographic area of generally poorer fertility soils that straddles the state border between Victoria and South Australia, situated approximately 40km north-east of Naracoorte. The continuation of the equivalent land system on the Victorian side is known as the Little Desert.

While large tracts of the Victorian portion of the land system are conserved within the Little Desert National Park, clearance activities for agricultural development on the South Australian side have resulted in a patchwork, semi-cleared landscape. Although fragmented, the district retains much higher vegetation remnancy than most areas within the heavily cleared South East region of South Australia, making it a priority zone for conservation management and restoration activities.

The geology of the area was described by the Department of Environment and Planning (1992) as being characterised by undulating plains of Tertiary sand with local ferruginous capping overlain by mobilised dunes of Aeolian sands. The diversity of soil conditions coupled with slight elevation transitions within the sand drift area is responsible for broad ranges of soil fertility and water retention capacities across these landscapes. This has led to the development of a range of largely woodland and heath habitat types (up to ten different vegetation associations), but also includes some shallow, seasonal herbaceous wetlands.

1.4 Site Selection

Sites were pre-selected (where access was granted) and prioritised by DEWNR to achieve the following:

- Effective broad spatial coverage across the high priority Bangham district.
- Representative areas for each vegetation type sampled in each site.
- Coverage across a diversity of site conditions areas.
- Sufficient representation of key threatened vegetation types with a greater risk of weed encroachment such as SA Blue Gum (*Eucalyptus leucoxylon*) woodland

Key sites within the Bangham district included within the survey, totalling over 4,500 hectares, were:

- Bangham Conservation Park (742 ha) and Geegeela Conservation Park (858 ha), which are situated approximately 3 kilometres apart.
- A larger number of (16) individual private remnant vegetation blocks that cover a collective area of approximately 3,050 hectares.

Specific vegetation associations that were assessed as part of this project are described as:

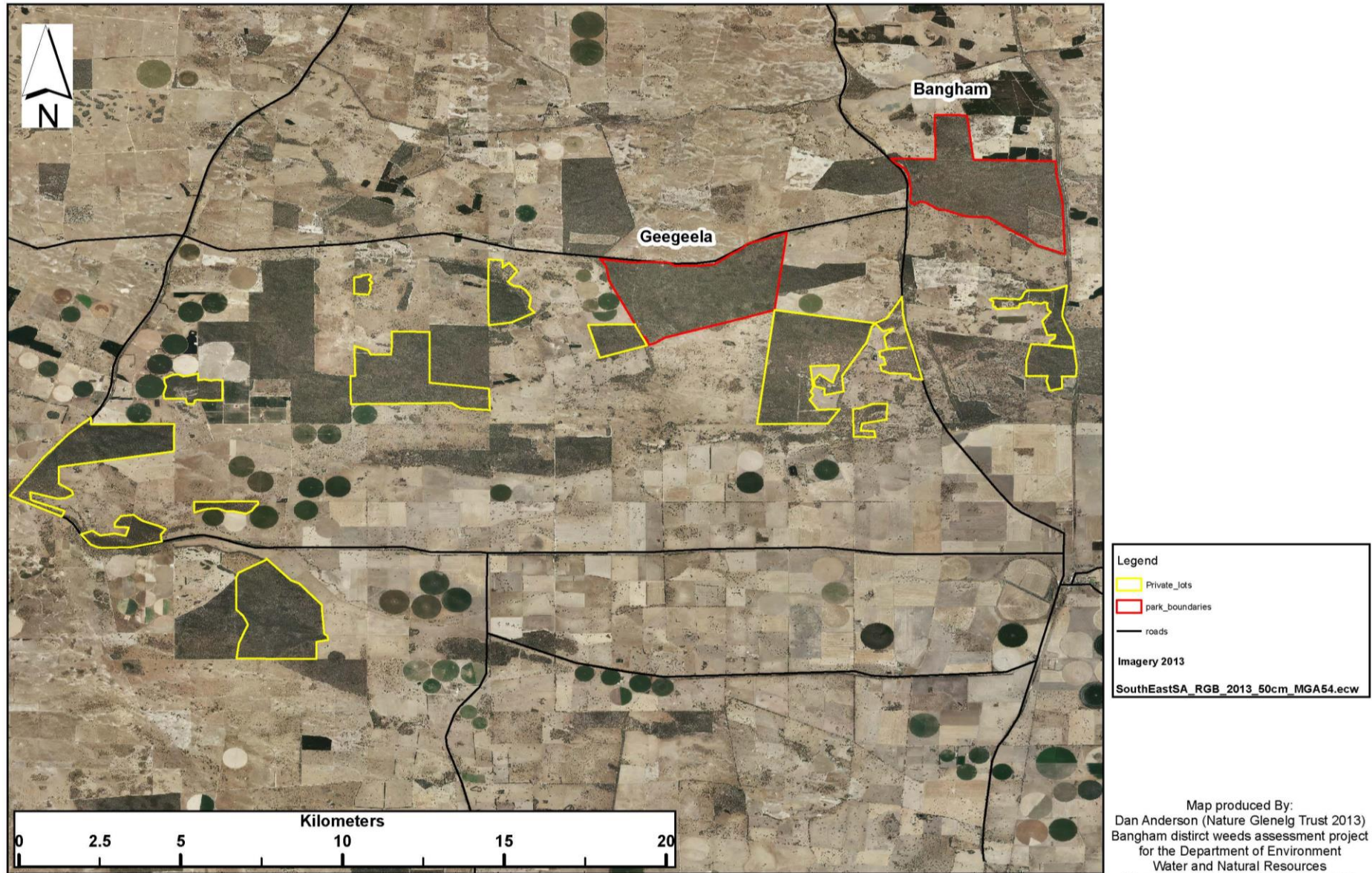
- SA Blue Gum (*Eucalyptus leucoxylon*) / Pink Gum (*Eucalyptus fasciculosa*) Woodland;
- Buloke (*Allocasuarina leuhmannii*) Woodland;
- Brown Stringybark (*Eucalyptus baxteri*) Open Woodland;
- Dwarf Hakea (*Hakea rugosa*) Shrubland;
- Silver Banksia (*Banksia Marginata*) Low Woodland; and
- River Red Gum (*Eucalyptus camaldulensis* var. *camaldulensis*) Woodland.

In addition to ensuring diversity across the vegetation assemblages included within the assessment, other priority target locations were selected due to physical attributes or prescribed observed factors; some of these factors include:

- **Structural composition / vegetative form:**
For example, open woodland environments tend to support a particular habitat for birds (prevalent seed distributors) whilst also presenting a physical environment with less competition that is suited to weed establishment.
- **Soil Type:**
More fertile soil types (ie; higher nutrient loads) with higher vegetative productivity can be more susceptible to weed encroachment.
- **Disturbance:**
Evidence of disturbance or a known history of land use change. Disturbed areas are known to provide more favourable conditions for weed establishment.

By ensuring survey effort included higher risk habitats/sites, such as SA Blue Gum/Pink Gum woodland and River Red Gum woodland, the weed assessment had an increased probability of achieving early detection of emerging weed threats.

Bangham District Weed Assessment Project 2013



2. METHODOLOGY

2.1 The Survey Method

The assessment of each project site included a survey of the perimeter of the block/patch and completion of multiple transects, covering the range of vegetation associations and physical landscape conditions identified within each allotment. Boundaries or internal tracks were generally surveyed from a vehicle at slow speed, while transects through uncleared terrain were undertaken on foot by two field staff. The project area was surveyed during field trips to the area during July, August & September 2013.

Individual weed specimens were recorded either as part of a broader transect record (line feature) or as individual point locations (point features). This determination was dependent upon whether the weed specimen was found along a defined transect route as opposed to being identified (randomly) during other movements within the project area.

Both weed point records and site transect records were spatially recorded using a hand held GPS unit. The specific features associated with each weed specimen were recorded via the use of a mobile phone database (field data entry) application known as an 'Open Data Kit'. Information relating to each weed record includes a photo of the weed specimen, a photo of the associated surrounding vegetation type and a range of specific features that may help in prioritising future works.

2.2 Database

Site information was collected using an 'Open Data Kit' application; an open-source set of data collection and storage tools that make it possible for users to enter and manage mobile electronic data collection. Provided below are the data entry tables used to collect weed observation points (Table 1) and assessment transects (Table 2) information for this project. The completed data forms for each weed record are stored within the project database files.

2.3 Weed point observations

Weed point observations refer to weed outbreak observations that were made during the process of moving between transect locations or identified as part of the perimeter assessment task. Significant weed species outbreaks, such as listed or declared weeds or regionally significant weeds that are known to pose a significant threat to native vegetation, were also individually identified as a point record to ensure that the location of such specimens was clearly defined in the spatial database.

Column1	Column2	Column3	Weed record as a point feature	Column4	Column5	Column6	Column7	Column8	Column9
Location name:	Dominant veg type:	Enter GPS location:	Weed observed:	Enter photo:	Number of plants observed:	Vegetation strata impacted by weed sp.	Weed age class:	Comments:	Treated by staff:
<i>Text</i>	low open forest; (Brown Stringybark)		Boneseed		<5	Canopy	Dominant: Flowering / Fruiting, Adult	<i>Text</i>	Yes
	low open forest; (Rough bark manna gum)		Italian Buckthorn		5 - 10	Midstorey	Secondary: Juvenile / seedling		No
	woodland; (Blue gum)		Gorse		10 - 50	Understorey			
	woodland; (Blue gum, manna gum)		African box thorn		>50	Ground			
	woodland; (River red gum)		Sallow wattle						
	woodland; (Bullock)		Cape wattle						
	wetland		Cootamundra wattle						
	modified		Flinders range wattle						
			Golden wreath wattle						
			Tree lucerne						
			Cotoneaster						
			Polygala						
			Pine wildling						
			Olive						
			Blackberry						
			Bridal creeper						
			Sollya (bluebell creeper)						
			Pine wildling						
			Asparagus fern						
			Phalaris						
			Gazania						
			Veldt grass						
			Serrated tussock						
			Dolichos pea						
			<i>Other: text</i>						

Table 1: Weed observation points data collection table

Column1	Column2	Column3	Transect undertaken recorded as line feature	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Column12	Column13	Column14
Location Name:	Transect number:	Dominant veg type:	Start GPS Point:	Insert Photo:	End GPS Point:	Insert Photo:	Weed observed:	Insert Photo:	Number of plants observed:	Vegetation strata impacted by weed sp.	Weed age class:	Comments:	Establish a polygon survey:	Treated by staff:
Text	Text	low open forest; (Brown Stringybark)					None		< 5	Canopy	Dominant: Flowering / Fruiting, Adult	Text	Yes	Yes
		low open forest; (Rough bark, manna gum)					Boneseed		5 - 10	Midstorey	Secondary: Juvenile / seedling		No	No
		woodland; (Blue gum)					Italian Buckthorn		10 - 50	Understorey				
		woodland; (Blue gum, manna gum)					Gorse		> 50	Ground				
		woodland; (River red gum)					African box thorn							
		woodland; (Bullock)					Sallow wattle							
		wetland					Cape wattle							
		modified					Cootamundra wattle							
							Flinders range wattle							
							Golden wreath wattle							
							Tree lucerne							
							Cotoneaster							
							Polygala							
							Pine wildling							
							Olive							
							Blackberry							
							Bridal creeper							
							Sollya (bluebell creeper)							
							Pine wildling							
							Asparagus fern							
							Phalaris							
							Gazania							
							Veldt grass							
							Serrated tussock							
							Dolichos pea							
							Other: text							

Table 2: Transect assessments data collection table

2.4 Weed transect walks

Multiple transect walks were undertaken within each of the project site areas. Transect routes were specifically selected by field staff to achieve extensive spatial coverage, and to ensure that a diversity of vegetation, soil and vegetation structural types were covered. Each completed transect walk was represented by a line feature in the database, and such features were established to be greater than a minimum distance of 100 metres from start to end.

Each line feature represented in the database contains specific weed information that reflects the viewed area along each individual line. If a transect walk did not identify any weeds; it was attributed in the database as 'no weeds observed'. Where weeds were observed, the species description and physical features for each outbreak were recorded against the line feature. If a significant number of the same weed species (>5) were identified within proximity to the transect path then a separate point record for these features was also collected to ensure these more substantial weed outbreaks were clearly identified. Additional information about each transect, along with representative photos of the weed specimen(s) and surrounding vegetation structure, are also linked to transect records in the database.



Image 1: *Photo showing the location of a typical transect walk through open woodland*

2.5 Data products

This project has developed two specific data products:

- Spatial location coordinates for points and transects features.
- Weed records and documented attributes within in a excel database.

The two data forms are linked via GIS, forming a 'layer file', to provide a useful spatial dataset that describes the weed type and location significance of weed infestations recorded across the project area. Spatial datasets that accompany this report have been provided to DEWNR, both for the weed point observations records and the transect walk features.

3 RESULTS

3.1 Overview

The site assessment work culminated in the identification of seventy two (72) individual weed observation points for priority weeds, stored in the weed observation database and one hundred (100) transect records stored in the transect line feature database.

General vegetation condition and weed outbreaks were more variable across the private Heritage Agreement sites than within the two large Conservation Parks. This is probably due to a range of more recent land management influences and disturbances associated with human activity occurring within these allotments.

3.2 Prevalent weeds species

The site survey work recorded seventy two (72) individual weed point observations across all project sites for priority weeds. Other weed specimens were also observed; however, these records were recorded against a transect record and not individually identified as weed points. The most common weed species recorded as individual points were *Olea europaea* (European Olive) with forty (40) specimens recorded and *Pinus radiata* (Monterey Pine) with nine (9) specimens.

Table three shows the representation of each individual weed species listed within the weed point observation database.

<i>Olea europaea</i> (olive)	40
<i>Pinus radiata</i> (monterey pine)	9
<i>Ehrharta calycina</i> (veldt grass)	7
<i>Acer</i> sp. (deciduous maple)	1
<i>Asparagus asparagoides</i> (bridal creeper)	1
<i>Phalaris aquatica</i> (phalaris)	5
Other	9
Total	72

Table 3: Number of priority weed species recorded

3.3 *Olea europaea* (European Olive)

It should be noted that on the Teate Heritage Agreement, located south of Gap Road, there is a large infestation of olives. For this location only, representative points were provided simply to indicate the extent of the olive infestations. Here individual specimens were not individually recorded as point observations, simply due to the large number of individuals present. It was considered that this particular olive infestation was most efficiently recorded by mapping the spatial extent of the infestation rather than the number of individuals. Transects that record these large infestations are: Teate S45 – Teate S49.

Olives were found to have an association with more fertile, grassy woodland environments and most specimens were found within the Heritage agreement sites located in the southern portion of the project area.



Image 2: *Mature olive specimen located within a Heritage Agreement woodland allotment*

3.4 *Pinus radiata* (Monterey Pine)

Pines were the second most prevalent woody weed encountered within the project area. Pine wildings were generally identified in locations where mature stands of planted trees were situated on adjacent private properties. Three specific properties were found to contain a moderate number of pine wildings growing in close association with each other. Pines were found on the 'Shepherd', 'Frith East' and 'Saint' blocks. Most notably a grove of pines was found on the 'Pridham' property where a former pine plantation was reverting to native vegetation. Point records for *Pinus radiata* show a total of nine (9) point records, with many of these sites having multiple individuals recorded in the attributes table of the database.



Image 3: *Remnants of a previous pine plantation area now reverting to native vegetation located within the 'Pridham' private allotment.*

3.5 *Ehrharta calycina* (Perennial Veldt Grass) & *Phalaris aquatica* (Pharlaris)

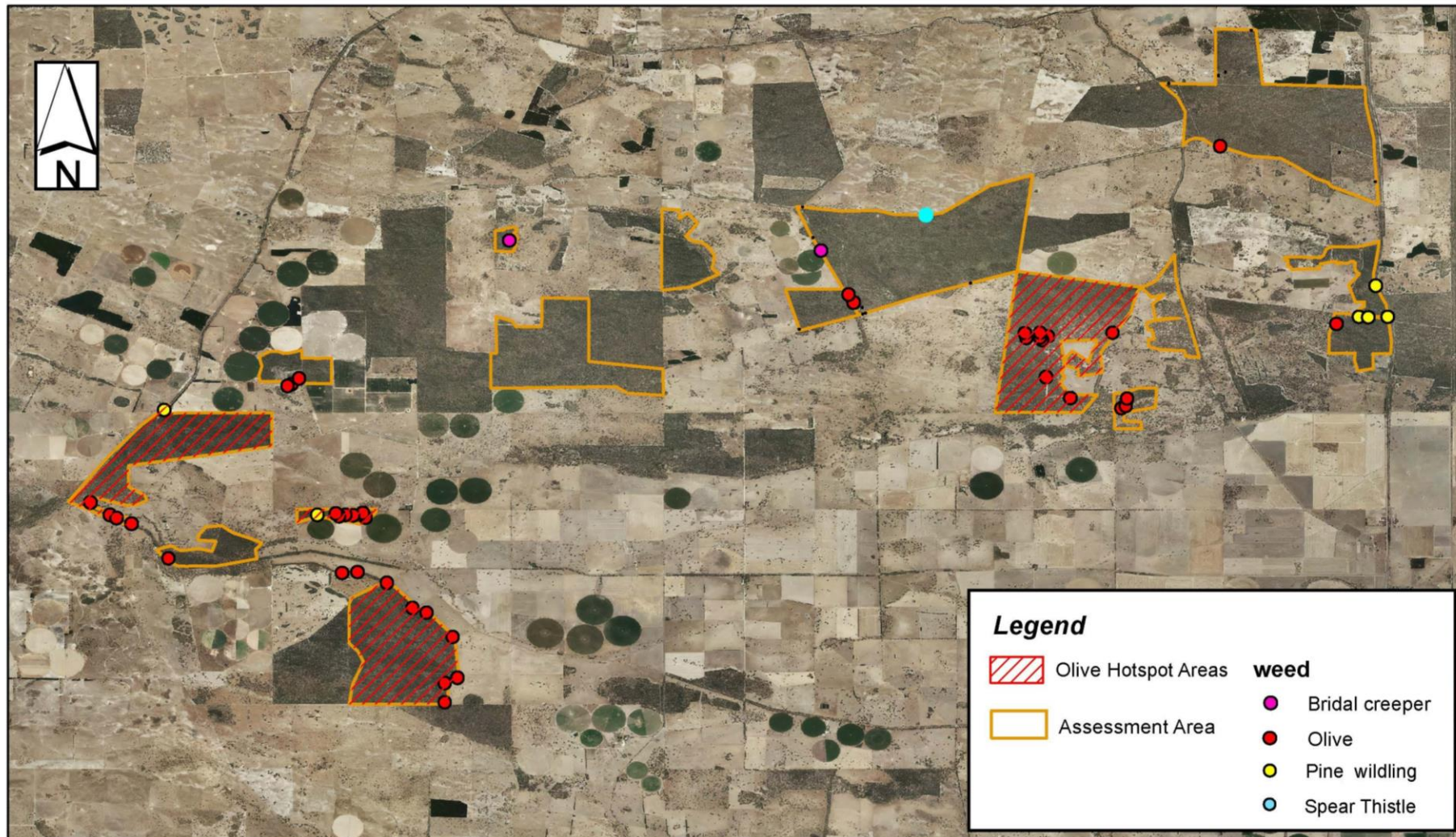
Ehrharta calycina and *Phalaris aquatica* were the most common and widespread weeds identified across the project area. Both species are herbaceous exotic grasses that are widely cultivated across the Bangham agricultural district. All of the conservation allotments adjoin a production pasture on at least one (often more) boundary, and both species have been widely used by local farmers trying to promote perennial pastures for grazing practices in different soil types. Unfortunately these practices have now enabled these invasive grass species to flourish widely across the broader landscape. Most sites are affected by encroachment of these two species, with the impact generally most prevalent along the boundary edges of blocks/patches. Some private bushland areas that have previously been grazed have a grassy understorey more widely infiltrated by these species.

Given the extensive nature of these infestations most of the impacted locations have been identified via the transect records. Some specific point observations have been recorded to identify the presence of these species; these records however were recorded to highlight areas where the level of infestation is either isolated or important to highlight relative to surrounding vegetation condition, for example if an isolated outbreak of Veldt Grass was observed within a high condition zone. In general terms, all vegetation boundaries were affected by exotic grass encroachment consistent with notion of an 'edge effect' – a bush regeneration term describing a key threatening process affecting bushland reserves that are being impacted from weeds establishing and moving into good condition patches from the boundary interface. In this example, both species were widespread and demonstrated to be the most prevalent and commonly encountered 'edge-effect' weeds encountered across the survey district.



Image 4: *An observed 'edge effect' - exotic grass species such as Ehrharta calycina and Phalaris aquatica dominating the woodland groundcover.*

Priority Weed Locations Bangham District Weed Assessment Project 2013



4 DISCUSSION

4.1 Spatial Distribution

As predicted, the concentration of woody weeds – particularly olives – were generally more closely associated with higher fertility grassy woodland environments, such as SA Blue Gum woodlands. The map on the previous page should be interpreted in the following way in relation to olives:

- Point records for olives outside of mapped “Olive Hotspot Areas” are typically representative of a single plant or small groups of plants. Olives are not widely established in these areas.
- Point records for olives in blocks marked as “Olive Hotspot Areas” are representative of the general geographic location of the outbreak, but indicate that larger populations (that have not yet been fully mapped) occur in these areas.

Pinus radiata had an increased presence in the Stringybark vegetation types; an association explained by the presence of mature pine trees occurring near the observed outbreaks, and the fact that pines are well suited to growing in less fertile, well-drained soil types.

Herbaceous and grassy weed species such as Perennial Veldt Grass, Phalaris and Spear Thistle were particularly associated with vegetation block edges / boundary zones. The process of encroachment into more intact bushland areas was also observed, with the invasion “front” moving further inwards near many boundary locations. The infiltration of such weeds was less prevalent in the sandy / lower fertility woodland and shrub land environments, aided by their typically denser, shrubby understory. Note that with the exception of Spear Thistle (single record) these species have not been presented on the map on the previous page, due to their ubiquitous occurrence in the project area.

4.2 Survey limitations

While the weed surveys were probably the most comprehensive ever completed within the remnant vegetation blocks visited, a glance over the map confirms that the survey did not manage to visit every last priority patch in the district. Some of these patches are of significant size and are situated immediately adjacent to areas surveyed.

With this factor in mind the results summarised within the report, and the work program proposed, should be viewed with full awareness of this key information gap.

5 RECOMMENDATIONS

5.1 Priority locations for weed management

Priority locations for active weed control are early outbreaks of high risk weeds within (or near) high quality native vegetation – under imminent threat of further weed spread or establishment.

Olive prevalence is noted both across the south eastern extent of the project area in association with the ‘Saint, Gardner and Teate’ properties and also in the central region of the project area on the ‘St Aubins, Munga Park’ properties. The potential for olive to spread within the open woodland environments, distributed by local bird populations, is of most concern.

Pinus radiata recruitment was observed in the eastern extent of the project area on the ‘Pridham and Saint’ properties. Pine wildlings were also observed in clusters on the ‘Frith’ property located in the far western extremity of the project area.

One single *Asparagus asparagoides* (Bridal Creeper) specimen was located within a SA Blue Gum woodland area located on the ‘Reardon’ property. This species poses a particularly high risk and hence a wider search and eradication should be considered of the utmost priority.

Perennial herbaceous weeds *Ehrharta calycina* and *Phalaris aquatica* were commonly identified across most of the project area. The infested areas were concentrated along the edges / boundaries of the remnant vegetation. Given the ubiquitous nature of these weeds in the wider landscape, a containment strategy for these species – preventing establishment in high priority areas – is the most feasible approach for longer-term management.

Additional searching and GPS based mapping of treated areas will be required during implementation of on-ground works, to enable the tracking of works and control effort, accurate mapping of full outbreak extent and, importantly, to enable the effectiveness of control to be evaluated through time.

5.2 Future surveys to fill information gaps

As mentioned in the discussion, some areas that are now a priority for weed control works (on the basis of the survey findings) are immediately adjacent to significant remnant vegetation areas that have not yet been surveyed for weeds.

It is strongly recommended that this key information gap be addressed, and may be done so in conjunction with on-ground works, as there is a clear need to understand the potential invasion pathways for weeds situated in adjacent areas to those already surveyed and prioritised for works. Due to the magnitude of the area already covered, the scale of this task is not overwhelming and could be strategically planned (using the findings to date to determine relative priority of sites) and completed over the next 6-12 months - as the project begins to deliver on grounds works.

As it becomes available, new information should be integrated into project planning to update and inform the delivery of on-ground works.

5.3 Initial prioritised work plan for weed control

The following weed species are recommended for control. Priorities have been identified based on the following criteria:

- Current prevalence of the weed species across the project area.
- Projected ability of the species to further invade the remnant vegetation areas.
- The potential impact of the weed to diminish habitat and ecological value.
- The capacity required to respond to the specific weed control requirements.

Priority	Species	Declared under <i>NRM Act 2004</i>	Description	Estimated control resources
Very High	<i>Asparagus asparagoides</i>	Yes	The one remaining individual specimen found on the 'Reardon property' should be removed, and a wider search undertaken and repeated there and in the vicinity of the single plant removed from the Geegeela CP western boundary. If left un-checked, the infestation potential of bridal creeper in these environments is extensive. Any specimens located should be dug out and removed as a matter of the highest priority.	1 day total (1 hr to locate & remove known plant, plus wider thorough search to ensure eradication)
High	<i>Olea europaea</i>	Yes	All areas where olive plants were identified should be targeted for weed control, commencing with more isolated outbreaks and working towards the more established infestations. Existing specimens can be treated using (cut and paint) or (drill and frill) herbicide application measures. It is important that all herbicide application occurs at the lowest stump base on each plant to reduce the potential of coppice re-growth from older specimens.	12-15 days for a small work crew
Medium	<i>Ehrharta calycina</i> and <i>Phalaris aquatica</i>	No	These entrenched species are having the most serious district-scale impact, but controlling the full extent of these infestations is not feasible. It is recommended to attempt to contain the spread of these grassy weeds in the highest values patches as they migrate in from native vegetation boundaries. Small infestations can be hand pulled or spot sprayed; slashing boundary areas to reduce seeding could also reduce migration pressure.	N/a – target for control works will be dependent upon the priority patches chosen and the available budget
Medium-High	<i>Pinus radiata</i>	No	This species is seen as a less invasive threat to the remnant vegetation in this district than in higher rainfall parts of the region and can be feasibly controlled. Existing pines should be cross cut felled where possible. Herbicide application is not necessary if a basal fell cut is applied.	3-4 days for a small work crew
High	<i>Cirsium vulgare</i>	Yes	This species can become highly invasive; however it was only observed at one location during the assessment project. A small outbreak on the central northern boundary of Geegeela CP, associated with a wetland zone. Individual plants can be hand removed, or emerging patches of juvenile weeds can be sprayed. Where mature plants are found flowers and seed heads need to be removed to limit the spread of wind borne seeds.	½ to 1 day for a small work crew

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