7 Survey of Assemblages of Big Springs organic mound springs of the west Kimberley

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7.1 Introduction

The assemblages of Big Springs organic mound springs were endorsed as Vulnerable threatened ecological community (TEC) by the WA Minister for the Environment on 8 May 2002.

7.1.1 Setting

Big Springs organic mound springs (Figure 44) are situated on the eastern shore of King Sound, adjacent to the boundary of Meda Station. They are situated 12 km east of the mouth of Meda River and 80 km north of Broome (Figure 45) and surrounded by saline coastal flats (Appendix 1). There are 23 occurrences covering a total of 62.7 ha recorded across a range of 3 km.

The occurrences are confined to unallocated Crown land (UCL) surrounded by Meda Pastoral Lease. Access overland to the TEC is through Meda Station.

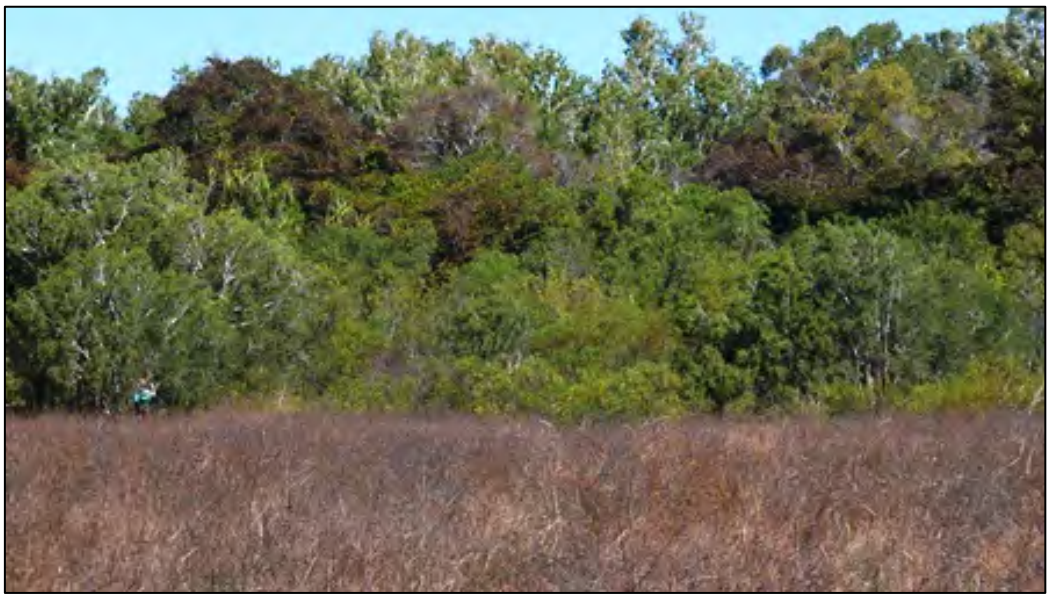

Figure 44. Big Springs organic mound springs – photo J. Pryde.

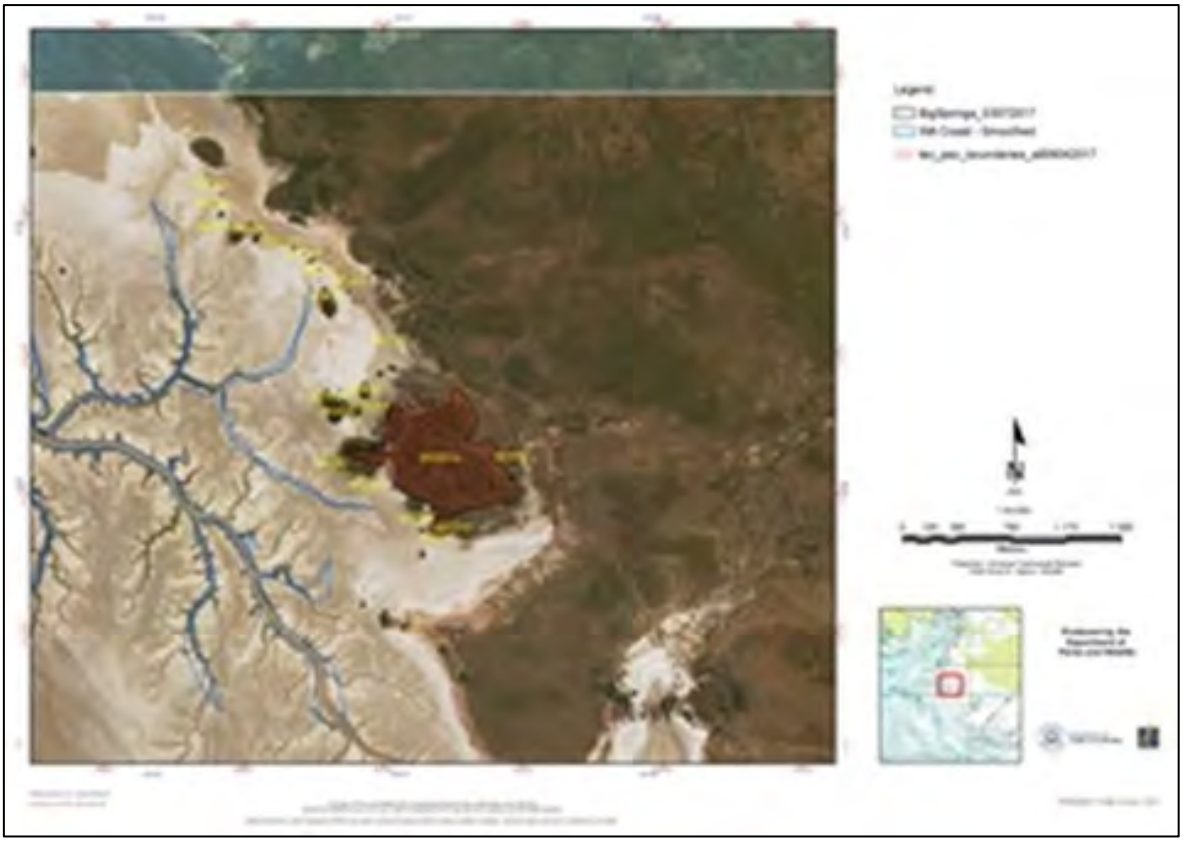

Figure 45. Mapped occurrences of Big Springs Mound springs.

7.1.2 Current description

A complex system of freshwater seepages and peaty springs with internal moats with broad tidal flats on the seaward margin and cracking clay flats on the landward margin. A further feature is the scattered clusters of small outlying, densely vegetated mound springs. The main seepage area has an extensive outflow swamp on its north west side. Within the complex, the substrate varies from peat through to peaty grey clay to grey clay. The main seepage area supports well developed rainforest vegetation (Figure 46) dominated by forests of *Terminalia microcarpa*, a species not otherwise known south of Walcott Inlet, 90 km to the north east. Several mistletoe species (Loranthaceae) have been recorded in the *Terminalia* canopy, which reaches 20 m in places. Other trees present include cluster fig *Ficus racemosa,* banyan fig *F. virens,* the paperbark *Melaleuca leucadendra*, *Pandanus* sp., dragon tree *Sesbania formosa* and *Timonius timon*. Many fewer common species noted were *Antidesma ghaesembilla, Diospyros maritima* and Leichardt *tree Nauclea orientalis*. The understory varies from central open glades with turf of *Cyperaceae* to pure leaf litter under the *Terminalia* canopies. Internal moats support the mangrove fern *Acrostichum speciosum*. Patches of duckweed *Lemna aequinoctialis* and less commonly, hornwort *Ceratophyllum demersum* occur. One population of climbing swamp fern *Stenochlaena palustris* was noted. The outer perimeter of the large seepage feature is relatively dry in most places with this ring generally dominated by dense thickets of *Melaleuca alsophila* and/or *Acacia ampliceps* with scattered *Bauhinia cunninghamii*, Chinese lantern *Dichrostachys spicata* and occasional boabs *Adansonia gregorii* of small stature. In the north west there is a perimeter swamp with extensive beds of narrowleaf cumbungi *Typha domingensis* and the sedge *Schoenoplectus litoralis*, with the

occasional white-flowered black mangrove *Lumnitzera racemosa*. Outlying mound spring islands on tidal flats vary markedly in size and diversity of vegetation. Some of the smallest islands consist solely of *Typha domingensis*. Larger examples often feature *Pandanus spiralis, Sesbania formosa, Acacia neurocarpa* and occasionally *Terminalia microcarpa* and *Ficus* sp., with a range of *Cyperaceae*. Several islands were noted with unusual associations such as *Typha* growing with the mangrove *Lumnitzera* sp.

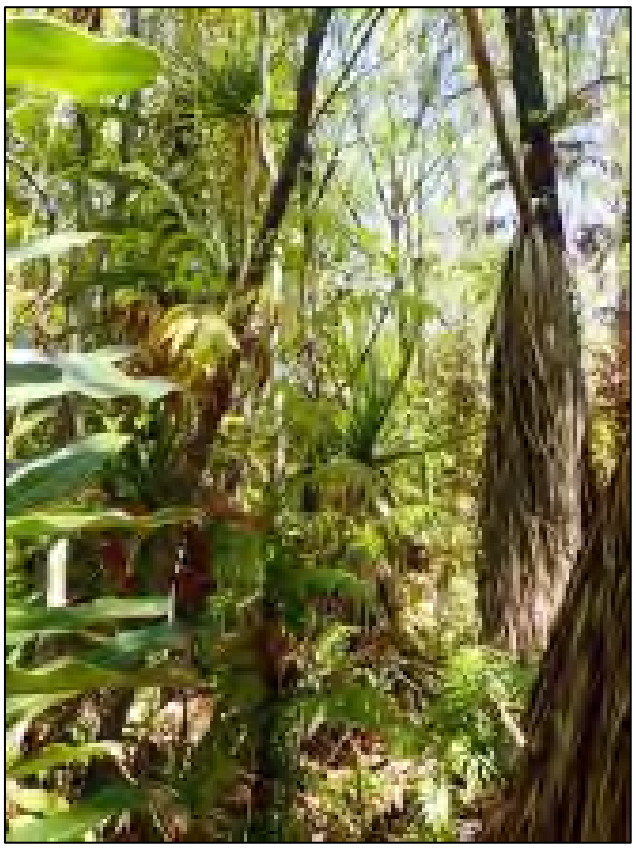

Figure 46. Diverse overstorey of Big Springs mound springs - photo M. Lyons.

7.1.3 2017 survey

A survey of Big Springs organic mound springs was undertaken on 9 August 2017 by a team with expertise in TEC identification and inventory, biological survey including flora and vegetation, aquatic invertebrate fauna identification and wetland inventory. The survey was coordinated by the Kimberley District Nature Conservation Coordinator, with collaboration of Traditional Owner group, Warwa and Meda Pastoral Station management.

The aim of this survey was to update TEC baseline information, including description, condition and threats to the TEC, to establish permanent quadrats to record flora and vegetation, inventory of aquatic invertebrate and water chemistry and soils, and to update boundaries of the wetland communities as required.

This section covers the TEC aspect of the survey, will assist with the development of a recovery plan and provides recommendations for management.

7.2 Methods

7.2.1 Big Springs (Occurrence 01)

BigS01a and BigS01b

- general vegetation description, condition and structure across the mapped community were recorded;
- A fora list for vegetation within the quadrat and at random locations throughout the mound spring community;
- threatening processes noted; and
- management recommendations compiled.

In conjunction with the above, one site was selected to establish a permanent $50x50^2$ m quadrat in the north west of occurrence in the well-developed, tall, dense rainforest community, in main seepage area. The quadrat was permanently marked with one 1.6 m star picket at NE corner, site id KMS018A (Figure 47). Quadrat data (held by M. Lyons) for site include:

- GPS location;
- vegetation description, stratum and structure;
- soil and landform;
- flora specimens were taken from the mound springs seepage areas and damplands surrounding the springs. Flora specimens were collected by Mike Lyons and Jill Pryde. Opportunistic collections by M. Coote and A. Turnbull.

and

- Aquatic invertebrate survey, peat core and water chemistry in areas of standing water (Figure 48) by A. Pinder, K. Quinlan and T. Sonneman.
- Assessment and mapping by the Wetlands group (M. Coote and A. Turnbull) using a handheld GPS in conjunction with aerial photography.
- Photographs taken of occurrence and surrounding landscape.

These data will be added to the corporate TEC/PEC database.

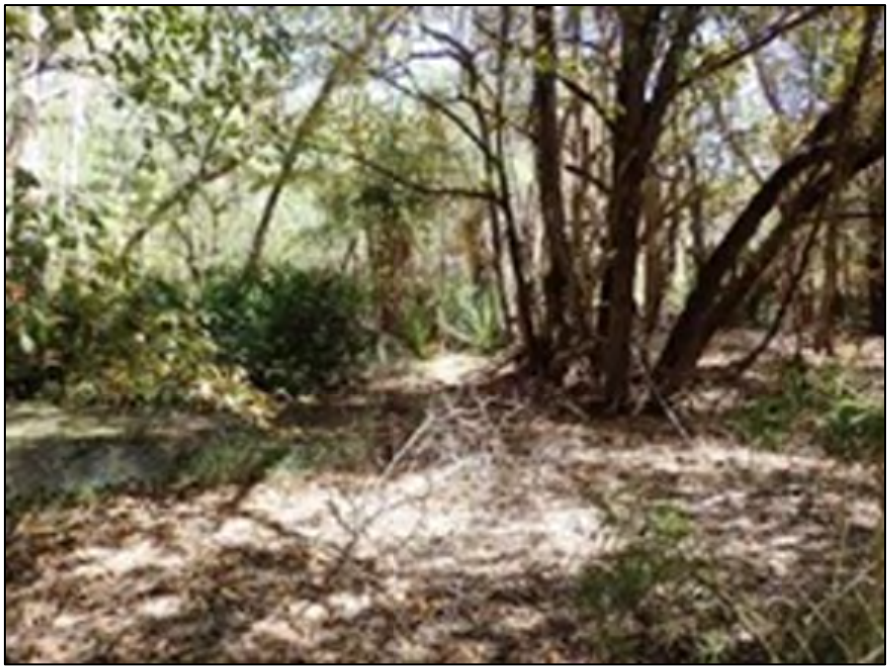

Figure 47. Location of Quadrat KMS018A – photo J Pryde.

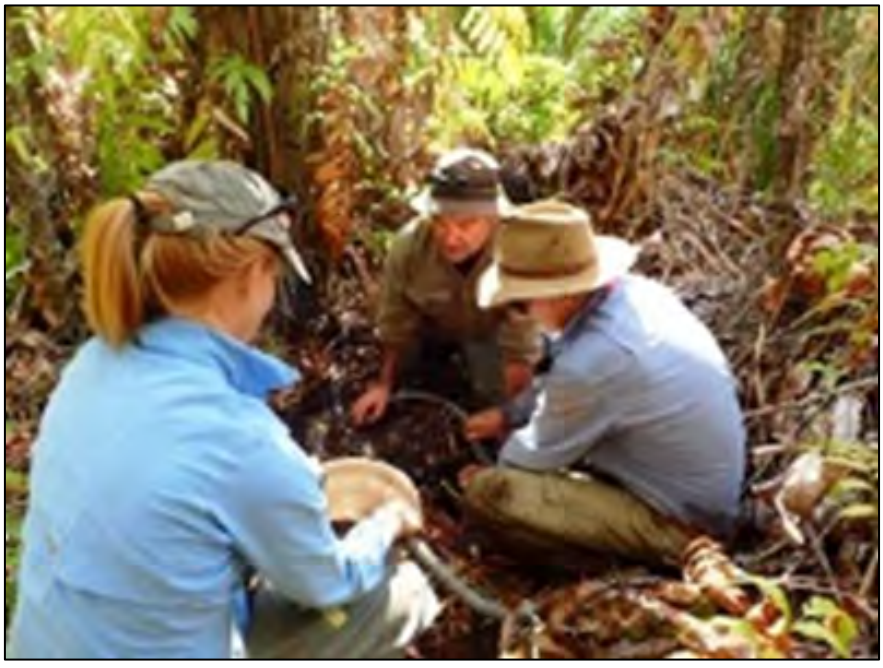

Figure 48. Core samples taken within central mound – photo T. Sonneman.

7.2.2 All remaining occurrences BigS03-BigS23

Smaller outlying occurrences that are recorded on the TEC database and potential new occurrences investigated:

No survey undertaken of flora and vegetation; aquatic invertebrate, peat core or water chemistry.

Wetlands assessed and mapped boundaries of mound spring occurrences that met criteria of a mound spring, using a handheld GPS in conjunction with aerial photography. Photographs taken of vegetated mounds.

7.3 Limitations

One day was allocated to survey Big Springs organic mound springs TEC and as a result limited the capacity to conduct a full assessment on status and condition across the entire community.

7.4 Results

Survey of Assemblages of Big Springs organic mound springs TEC was undertaken on 9 August 2017 to coincide with low tide. The TEC is comprised of one large densely vegetated mound which occupies (~8.5 ha), ~128 m offshore, with 22 outlying mounds, much less developed and considerably smaller in area, ranging between ~0.20 ha -1.3 ha (Figure 49). These occurrences extend northward for approximately 3 km, along salt flat margins.

Figure 49. One of the smaller vegetated mounds to the north – photo M. Coote.

7.4.1 Big Spring (Occurrence 01)

The largest occurrence of Big Springs organic mound springs is a heavily vegetated mound to an elevation (~8m). The mound contains a mosaic of freshwater seepages, peaty springs and pools. Internal moats surround peaty mounds supporting large mature trees. Soils are brown peaty loam, mostly damp with light to very heavy leaf litter and decaying vegetation (Figure 50).

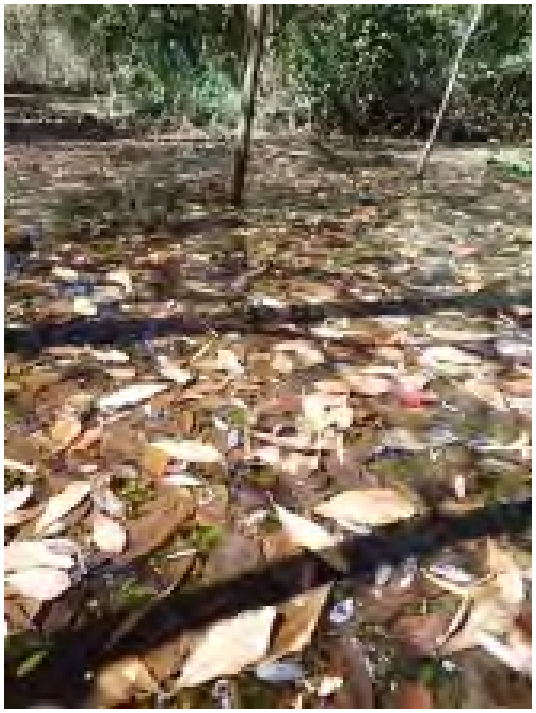

Figure 50. Dense leaf litter with aquatic herbs within extensive internal moats – photo M. Lyons.

The community structure is a tall dense rainforest (Figure 51). occurring on rises and comprising *Melaleuca. leucadendra* (>20m) with *Terminalia microcarpa, Timonius timon, Sesbania formosa, Nauclea orientalis, Carallia brachiata, Ficus virens* and *F. aculeata* var*. indecora*. Patches of understory vegetation are more open and dryer, containing *Pandanus spiralis* over small grasses and herbs including *Fimbristylis* spp. and *Eleocharis spiralis*. Below the densely covered rainforest canopy include climbers, *Gymnanthera oblong,* climbing swamp ferns, *Stenochlaena palustris* which surround trees and form dark impenetrable barriers.

Mistletoes (*Amyema* spp.) are present high in the overhanging canopy. Internal moats across the mound ranged in water depth (> 0.75 m) (Figure 52). Dominant in the moats are stands of *Acrostichum speciosum*, a large fern spreading to 3 km (Figure 53). Moats were covered with leaf litter, aquatic herbs of *Lemna aequinoctialis, Ceratopteris thalictroides* and an aquatic submerged hornwort, *Ceratophyllum demersum* forming a thick mat below the surface of the water (Figure 54). Present but not dominant was *Typha domingensis* and *Cyperaceae* spp*.*

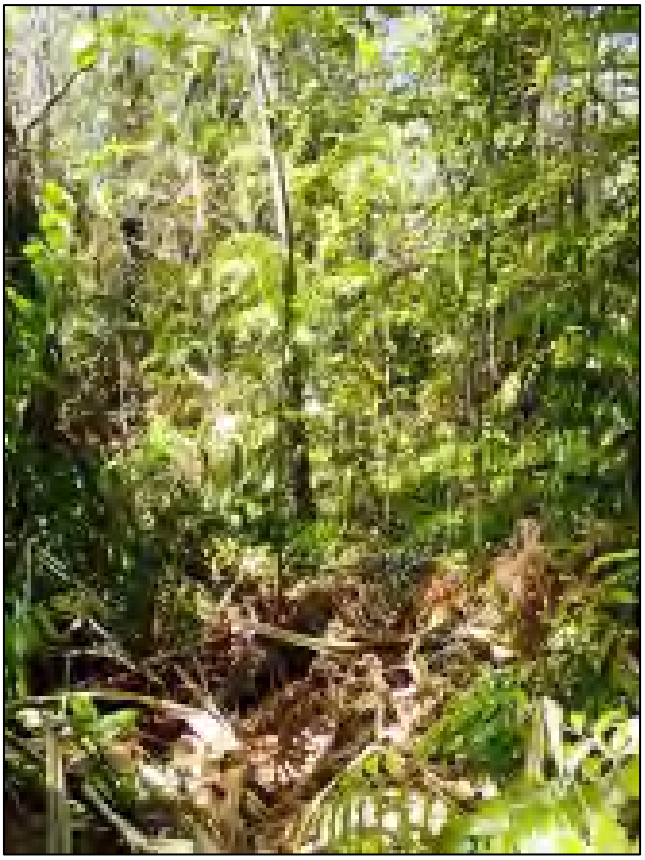

Figure 51.Dense rainforest patch – photo M. Lyons

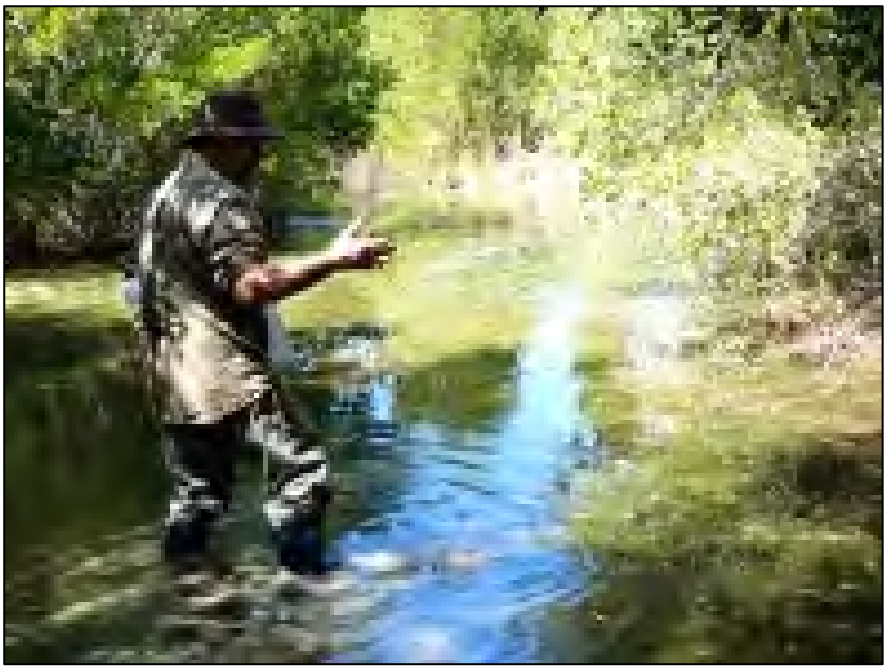

Figure 52. Woodland and moats surround the internal mound – photo K. Quinlan

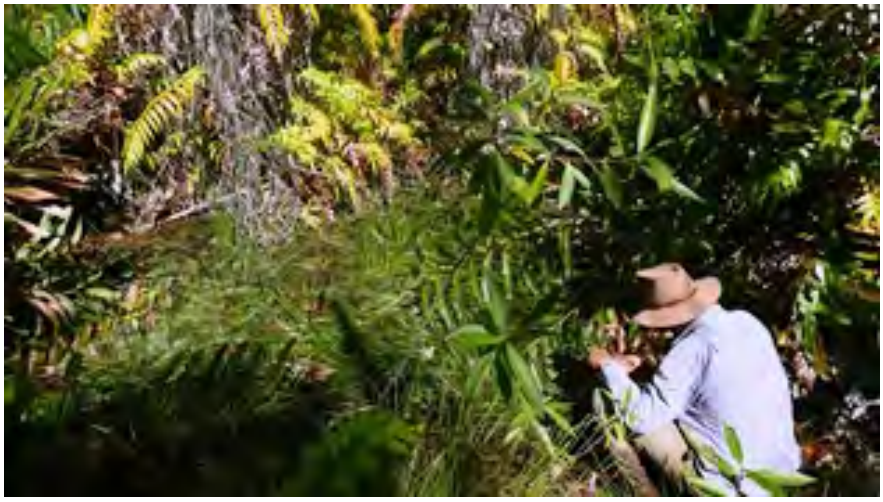

Figure 53. Aquatic herbs and ferns form dense layers within internal moats – photo J. Pryde.

Figure 54. Submerged aquatic herbs – photo M. Lyons.

A woodland emerging into a shrubland encircled the mound and included dense stands of *Melaleuca* spp. with occasional stands of *Pandanus spiralis*, together with *Sesbania formosa*, *Terminalia. microcarpa, Acacia* spp. *and Fuirena umbellata.*

General condition of Big Springs was Excellent (Bush Forever scales). The number of weed species was low, however two that have potential to become a threat, including date palms located adjacent to the quadrat (Figure 55) and *Passiflora foetida* var*. hispida*. A fence that was installed in 2016 by the Kimberley District appears to have controlled cattle access (Figure 56).

Figure 55. Introduced date palms located within mound spring – photo J. Pryde.

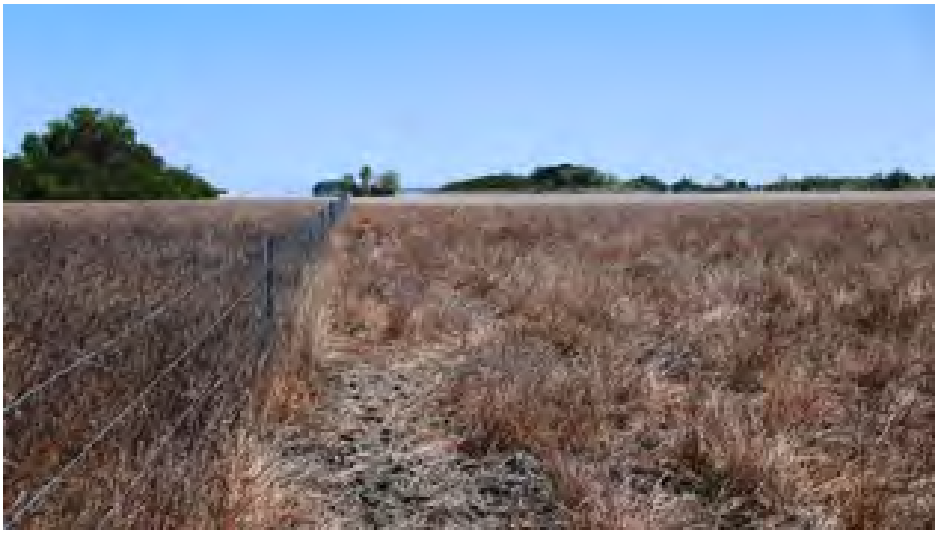

Figure 56. Looking north along cattle exclusion fence with smaller occurrences in the distance – photo J. Pryde.

Partial survey of the remaining outlier occurrences specified less developed mounds, mostly with no standing water. All mounds lacked well-developed vegetation structure and appeared low in floral species diversity. Mounds were restricted to one or combinations of *Melaleuca* spp*. P. spiralis*, *S. formosa*, *A. neurocarpa, T. microcarpa, Ficus* sp*., Lumnitzera* spp., *T. domingensis and Schoenoplectus subulatus*. General condition of these occurrences ranged from Very Good-Degraded (Bush Forever scales). Dead tree stands and vegetation destroyed or impacted by cattle trampling was evident at some of the mounds.

The cracking clay tidal flats, surrounding these mounds is mostly devoid of vegetation at the time of survey. Stands of *Melaleuca* spp. *Acacia* sp. *P. spiralis*, *Bauhinia cunninghamii, Adansonia gregorii,* mangroves and *Sporobolus* sp. were occasionally present. A tall grassland flanks Occurrence01 and is flourishing because of the fencing that excludes cattle. There is potential for the established grassland to increase fire risk to the mound springs. Management of the grass requires consideration.

Preliminary findings of the August 2017 flora and vegetation survey is mostly consistent with the TEC database record. Flora species previously recorded were found across the mound springs, however additional flora recorded will be added to the TEC database in future. No DRF or Priority flora were found, however range extensions for flora taxa were documented. Plant species considered useful indicators of rainforest communities and associated mound springs were present. The key threats identified for the mound springs include grazing, weed invasion, altered fire regimes, feral animals and potential hydrological changes (e.g. groundwater extraction) and tourism development.

For most occurrences recorded on the TEC database, source locations were derived using aerial photography and therefore often inaccurate. Following the August 2017 survey, point location of occurrence and boundary mapping will be updated. Occurrences that do not constitute the TEC will be deleted and newly identified occurrences will be added to the TEC database.

Once all results of the August 2017 survey are available, the TEC database will be updated including amendment and refinement of TEC description and boundaries and updated flora lists and records of other biota.

7.5 Recommendations

- Design and implement a project to determine the hydrological drivers of the mound spring ecosystems and further investigate historical report that the spring is man-made.
- Design and implement a monitoring program that utilises quadrats established during the current survey. This will probably require establishment of a more comprehensive network of quadrats, and should be designed to provide information about the success of land management in the sensitive environment of the mound spring ecosystem
- Map weeds across the community and seek ways to control of the most invasive weeds.
- Devise management of the grassland occurring between Occurrence01 and the cattle exclusion fence to limit fire risk to the adjacent mound spring.
- Determine whether the small mounds constitute the TEC. This would require vegetation survey and hydrological investigation

7.6 Conclusions

The most significant threat to the integrity of Big Springs organic mound springs is disturbance from cattle. Other threats include weed invasion, too frequent fire, and potential hydrological change. Fencing was constructed in 2016 to control impacts of cattle disturbance in Occcurrence01 and as a result the vegetation in this occurrence is in Excellent condition. Date palms are likely to become a major threat if not removed.

The newspaper reports from around 1993 that stated that the spring was man made, having arisen from water seeping from a bore installed in the 1960s, and that this requires investigation. It was considered that this was very unlikely to be the case however, based on observations during the August 2017 survey, such as the presence of the large peat-rich mound, providing a stable, permanently moist suite of microhabitats that would have taken

many years to form and the age of plants present. Water continues to penetrate the increasingly elevated peat layers that are likely to be the result of pressure created by local and regional hydrological forces.

7.7 References

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