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MOUND SPRING ECOSYSTEMS IN THE WESTERN AUSTRALIAN RANGELANDS

S.J. Black

CMAE, c/o PO Box 51, Wanneroo WA 6946

INTRODUCTION

As permanent sources of water within arid and seasonally dry landscapes, mound springs provide refuge habitat for flora and fauna, and historically have been a focus for Aboriginal culture and European exploration. In addition to their significant ecological diversity and cultural values, this distinct group of wetlands is recognized for its geological features and value to science. Occurring at natural discharge points for groundwater, these ecosystems are characterized by mounds; rare landforms built up by sediments transported to the surface, such as clay and/or calcareous precipitates, as well as accumulated peat from onsite vegetation.

In Australia, mound springs are best known from the edges of the Great Artesian Basin, which spans central and inland eastern Australia. Also known to occur on the Swan Coastal Plain near Perth, and in the northern Wheatbelt region, the existence of mound springs in the rangelands of Western Australia (WA) is poorly documented. This paper provides a broad overview of their biotic and abiotic features, anthropogenic processes threatening the springs and conservation management requirements. It highlights the need for these wetlands to be managed holistically, as part of surface water catchment areas and as groundwater dependent ecosystems, and through coordinated long-term projects.

FEATURES

Extant mound springs of WA's rangelands are currently known from the Kimberley Region, and in and on the edge of the Great Sandy Desert, both inland and on coastal intertidal mudflats. They occur singularly or in clusters of up to around 20, separated by several metres, kilometres or tens of kilometers, and are known from at least 11 areas and five bioregions. In contrast to those of the Great Artesian Basin (and one now extinct example on the Pilbara coast), these wetlands contain organic mounds comprised entirely of peaty soils, rather than calcareous tufa. Rising as high as two meters above the surrounding landscape and ranging up to several hundred meters across, the mounds are generally surrounded by a moat of fresh or brackish water. Carbon dating and pollen records from core samples at two mound springs in the Great Sandy Desert show that deposition of organic sediment has occurred at the sites uninterrupted for at least the last 6,000 years, pointing to general groundwater and climatic stability over this time (Wyroll *et al.* 1986).

Mound spring vegetation ranges from sedgeland-herbfields, to *Melaleuca* forests, to *Sesbania* woodlands, and to the State's southern-most occurrences of monsoon vine thickets. In addition to some unusual species assemblages, interesting flora records include inland occurrences of the mangrove *Avicennia marina*, an undescribed sedge species, one priority species *Utricularia aurea*, and several northern Australian species, including trees, which are not recorded from elsewhere in the State. Utilized by a variety of vertebrate fauna, the Kimberley mound springs also stand out as relatively rich aquatic habitats for invertebrates. Those sampled to date contain a high proportion of northern species and a strong Indo-pacific or Asian element, particularly among the micro-invertebrates. Several described species were first records for the State.

THREATS AND CONSERVATION MANAGEMENT

Situated in remote areas on pastoral stations, Aboriginal reserves, Unallocated Crown Lands, and proposed conservation reserves, mound springs are highly vulnerable and at risk from a range of threatening processes, acting directly on the ecosystem and/or indirectly on the groundwater and other hydrologic and landscape processes upon which they depend. Current impacts are, or derive, from:

overgrazing, trampling and fouling by cattle and feral camels; severe gully erosion; inappropriate fire regimes; weed invasion; horticulture; invasion by feral fish; feral pig damage; dumping of litter, and; groundwater aquifer contamination through concentrated stock access and septic tank effluent. A serious potential risk is aquifer drawdown by proposed groundwater resource developments (current proposals exist for groundwater irrigated timber plantation and cotton farming enterprises).

Conservation management implemented to date has included: the fencing of several springs by pastoralists, LCDCs and other community groups with Natural Heritage Trust funding; some survey and documentation and listing as threatened ecological communities; capping of a free flowing bore; acquisitions by State Government for addition to the reserve system, and; the development of environmental water requirements in State Government water allocation and planning processes. However, management has been sporadic – limited by the availability of resources, subject to short-term funding and delayed by difficulties in achieving management agreements between stakeholders.

Three urgent onsite priorities for the management of mound springs are: (1) more fencing; (2) immediate repairs and an ongoing commitment to regular maintenance of existing fencing, and; (3) erosion control works – onsite, in the immediate area, and at strategic locations within broader catchments. These operations can be problematic, expensive, labour intensive and subject to delays due to: the remoteness of mound spring locations; the location of some of them on intertidal mudflats or inland salt flats (subject to periodic inundation and salinity); the extremes of tropical climates (cyclone, fire and flood damage), and; pressure on the fences by free ranging cattle and feral camels.

So far, mound spring wetlands have been fenced individually with little or no buffer zone. Similarly, the majority of proposed acquisitions to the reserve system are limited to the immediate area of wetlands. Ideally, larger areas should be sought to enclose groups of springs and maximize buffer areas around them, in order to address gully erosion (a landscape scale process) and to reduce animal pressure on fences in the immediate area of wetlands. However, this ideal is currently dependent on the willingness of pastoralists and incentives to pastoralists to alter their management, enter into joint management agreements, or sell off larger parcels of land than previously.

More strategic fencing and vehicle access track alignments are required in relation to topography and surface water flow patterns, as well as animal behaviour. For example, fencelines and tracks running down slope are likely to cause gully erosion on fragile soils, particularly where animals form pads along them in their attempts to access wetlands for water and green feed. Fencing has been most successful in two instances where water was pumped from the spring (by solar pump) to a water tank and trough well outside the fenced area. This also satisfied the pastoralist by maintaining a quality water source and preventing cattle from bogging.

There is a requirement for research on, and monitoring of, the ecology and ecosystem processes of mound springs, including groundwater regimes and requirements, and the likely impacts of change, as well as management (or lack of) on the ecology. It is essential to monitor groundwater levels and flow rates at springs where abstraction is proposed, and responses where abstraction is proceeding.

Despite recent increased interest in mound springs and their conservation, these outstanding ecosystems are still in the process of degradation and destruction, and at risk from future threatening processes. Their integrity and survival will depend on long term coordinated commitments to funding and management with partnerships between government land and water management agencies, pastoralists, Aboriginal and other local people, Aboriginal organizations, and community groups.

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