



The Gypsum flora and plant communities of Western Australia Michael N. Lyons



Biological survey of WA

- Integrated plot based biological survey
- Terrestrial and wetlands
- 6100 systematic floristic survey plots
- Conservation status of species and communities
- Conservation planning





- Regional scale
 - Regional conservation planning
 - Reserve system design
 - Determining environmental drivers of compositional patterning



- Sub regional scale
 - More detailed compositional patterns identified
 - Planning for management actions
 - Identifying high conservation value wetlands





Data analysis

Classification and ordination based on species composition











Western Australian Flora

- 12 500 native taxa
- Includes 1200 phrase named taxa
- 300+ new taxa described in last 5 years



WESTERN AUSTRALIAN HERBARIUM VOLUME 27 2016





SWAFR

- Global biodiversity hotspot
- Ancient landscape with nutrient poor soils
- 8379 native vascular plant taxa of which 47% are endemic and 49% have been described since 1970. (Gioia & Hopper, 2017)





- National biodiversity hotspots
- Recognition of the semi-arid transition to the SWAFR
 - Fragmentation
 - Secondary salinization





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GOVERNMENT OF WESTERN KUSTRALIA

Department of **Biodiversity**, **Conservation and Attractions**



Gioia P, Hopper SD (2017).



Gypsum occurrences and landforms

- Holocene
 coastal lagoons
 - Lake McLeod
 - Shark Bay
 - Jurien and Hutt Lagoons





Paleo-river wetland chains

- Formed on vast system of ancient Tertiary river valleys that filled with sediments as flows declined as a result of tectonic shifts and aridification over the late Tertiary/ Quarternary.
- Aquifers within these 'palaeovalleys' have become saline through evapoconcentration of rain-derived salts and weathering and limited flushing.







Mernagh, T.P. (ed.), 2013. Geoscience Australia Record 2013/39.



Figure 2.5 Classification of Australian lake/playa basins across a climatic gradient which extends from humid to arid conditions. Five lake/playa basin types, A to E, are differentiated by morphological and sedimentological features, which reflect successive stages in a hydrological series from surface-water to groundwater dominated systems including the evolution of a sub-playa brine pool. Figure is modified from Figures 2 and 5 of Bowler (1986a). Lake George, NSW, near Canberra, ACT, and Lake Kielembete, western Victoria, both located in the humid climate zone, are endorheic lakes, i.e., closd basins with no outflow.





Gypsum deposits are spatially and morphologically complex

- Size
- Elevation
- Stratigraphy
- Edaphic composition
- Gypsum islands within saline and non-saline soils

ASTER (Advanced Space borne Thermal Emission and Reflection Radiometer)

Radiation of halophytic flora

- Molecular phylogenetic data for Chenopodiaceae (Subfamily Salicornioideae
- Endemic *Tecticornia* diversified from SW coastal ancestors during Late Miocene to Pliocene

Shepherd et al. 2004

Tribe Camphorosmeae

- Most diverse tribe of Chenopodiaceae including Scleroleana, Maireana and Atriplex (99% endemic Aust.)
- Late Miocene to Pliocene radiation from SW

Where are the gypsum deposits?

- Regolith mapping 1:500 000 scale
- Regolith materials mapping 1:250 000

 Limited coverage
- Gypsum mining project database
- ASTER remote sensing

Developing a gypsum flora list for Western Australia

- Data sources for candidate taxa
 - Herbarium specimen data
 - Gypsum, Gypseous or kopi in descriptions
 - GIS intersection with known gypsum mining projects
 - Plots based data
 - Mattiske et al. (1995)
 - Lyons et al (2004)
 - Rick (2010)

Calandrinia sp. Gypsum (F. Obbens & L. Hancock FO 10/14)

WAHERB collections databases

- Records selected based on search terms, gyps* and kopi
- Collectively these taxa have 43500 specimen records

Search term	No. specimen records	No. taxa
Gyps*	1030	463
kopi	157	96
	Unique taxa	499

- 20 gypsophiles
- 40 gypsoclines
- Dominated by
 - Chenopodiaceae
 - Tecticornia spp.
 - Asteraceae
 - 9 genera

Gypsoclines also occur in

- near coastal saline habitats
- calcareous landforms
- arid zone saline wetland fringes

Conservation taxa

- 16 Taxa with limited distributions, poorly known and/or unreserved
- Threatened
 - Frankenia conferta
 - Goodenia integerrima

Gypsum community classification (Lyons et al. 2004, Rick A. 2010)

- Strong biogeographical component in patterning in SW that parallels saline flora
- Gypsum plant communities in SW dominated by gypsovags (e.g. *Casuarina obesa)*
 - Does not hold for species poor berms and raised flats

Conservation impacts

- Gypsum mining
 - Soil structure improver applied to clay soils degraded by tillage
 - Usage economic only within moderate distances <200km
- 895,510 tonnes 2017/18
 - Approvals process for small projects limited

Gypsum species and community conservation

Legislative protection

- Threatened and priority flora
- Threatened and priority ecological communities

Future tasks

- Explore the utility of ASTER remote sensing layers to interrogate specimen and quadrat data
- Finalise contribution to World List
- Undertake combined analysis of all relevant floristic community data
- GYPWORLD expedition to WA 2019