

Climate change and the Shark Bay World Heritage Area: Foundations for a climate change adaptation strategy and action plan



The Shark Bay World Heritage Area in Western Australia is one of 19 listed World Heritage properties in Australia.

Extending across 2.3 million hectares – 70% of which is marine – the site has 1500 km of coastline. Located at a transition between temperate, sub-tropical and temperate zones, and with unique biogeochemical features – including hypersaline pools and extensive seagrass beds – Shark Bay is home to assemblages of plants and animals, terrestrial and marine, that are not encountered anywhere else.

The Earth Systems and Climate Change Hub is working with the people responsible for managing Shark Bay to understand how climate change will impact the World Heritage Area.

The workshop

In September 2018, the Shark Bay World Heritage Advisory Committee convened a workshop to lay the foundations for the development of a climate change adaptation strategy and action plan for the Shark Bay World Heritage Property using a rapid assessment tool (Climate-change Vulnerability Index).

Shark Bay World Heritage Area

Shark Bay was listed as a World Heritage property in December 1991 on the basis of its outstanding universal value; that is, it has:

- outstanding examples representing the major stages of the Earth's evolutionary history (including the stromatolites and microbial mats of Hamelin Pool)
- outstanding examples representing significant ongoing geological process, biological evolution and man's interaction with his natural environment (including steep salinity gradients, three biotic zones, Wooramel seagrass bank, seagrass meadows, *Fragum erugatum* shell deposits)
- superlative natural phenomena, formations or features (including Faure Sill, Hamelin Pool, Zuytdorp Cliffs, Dirk Hartog Island, inundated birridas and lagoons)
- the most important and significant natural habitats where threatened species of animals or plants of outstanding universal value still survive (including five endangered mammal species, 12 threatened reptile species, marine megafauna including dugongs)

Climate changes such as changes in air temperature and in the intensity and frequency of storms and extreme marine heat events are expected to threaten the resilience of areas in Shark Bay and the outstanding universal value of the area that led to its World Heritage listing.

Climate change

Climate change refers to long-term changes in the average pattern of weather that occur over decades, centuries or longer. Climate variability, for example, due to the El Niño Southern Oscillation, occurs at shorter timescales of years to decades, while weather occurs on the timescale of hours to days.

Climate change projections are not predictions, but they tell us about the response of the climate system to possible future scenarios. Our confidence in projections is determined by considering climate model results along with our physical understanding of the climate system and past observations.

Climate projections for Shark Bay include:

- increased average temperatures in all seasons (very high confidence)
- More hot days and warm spells with a substantial increase in the temperature reached on hot days, the frequency of hot days, and the duration of warm spells (very high confidence)
- decreasing winter and spring rainfall (high confidence); rainfall changes in summer and autumn are not as clear
- more intense extreme short-duration rainfall (high confidence) and the wettest day of the year will get wetter
- fewer but more intense tropical cyclones (medium confidence)
- a small winter decrease in wind later in the century; a small increase in spring wind speeds (low confidence).

- increased fire weather risk (low confidence)
- increased potential evapotranspiration in all seasons (high confidence)
- decreased humidity in winter and spring (high confidence) and in summer and autumn (medium confidence) later in the century
- increased winter radiation (medium confidence) later in the century
- rising mean sea level and increased height of extreme sea-level events (very high confidence).

Detailed climate change projections are available at climatechangeinaustralia.gov.au – Shark Bay is in the Rangelands (South) sub-cluster. Sea-level rise projections for coastal councils are also available at coastadapt.com.au.

Climate-change vulnerability index

The Climate-change Vulnerability Index (CVI) is being developed to provide method for systematically assessing climate change impact across all World Heritage properties.

In determining the CVI for the Shark Bay World Heritage Area, storm intensity and frequency, extreme marine heat events and air temperature change were identified as the climate stressors with the greatest potential impact on Shark Bay's outstanding universal value (OUV). The vulnerability of Shark Bay's OUV to each of these drivers was HIGH (on a three-point scale: low, moderate, high), resulting in an overall assessment of HIGH vulnerability to climate change.

Next steps

The Hub will work with the Shark Bay World Heritage Advisory Committee to conduct a case study using climate change science information to determine the impact of climate change on Shark Bay's seagrasses. We will also work closely with stakeholders to facilitate the use of climate change science to inform climate risk assessment and the development of the climate change adaptation strategy for Shark Bay.

The Shark Bay World Heritage Advisory Committee will develop a climate change adaptation strategy and action plan, identifying knowledge gaps along the way. The Western Australian Marine Science Institution will facilitate implementation of the plan and develop an appropriate science plan to support the ongoing management of Shark Bay in a changing climate.

The full report from this workshop is available on the Earth Systems and Climate Change Hub website at www.nespclimate.com.au.

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