

CLIMATE CHANGE AND RIVERSLEIGH, BOODJAMULLA NATIONAL PARK

Australian Mammal Fossil Sites World Heritage Area

The Riversleigh World Heritage Area (WHA) provides a unique opportunity to understand and learn from the impacts of past climate change on Australia's mammals. It is the only place in the world where we have a fossil record of rich fauna during and following a major climatic event- the Mid Miocene Climatic Optimum (MMCO). Studying this amazing resource can help develop strategies to mitigate climate change impacts, and potentially conserve species in the wet tropics and other parts of Australia.



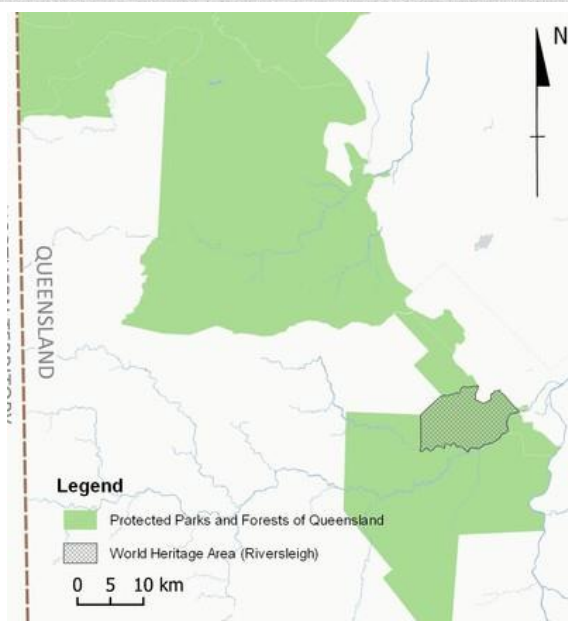
The Riversleigh World Heritage Area is part of Australia's serial listing known as the Australian Fossil Mammal Sites, which includes Naracoorte in South Australia. Riversleigh is located in the south-eastern section of the Boodjamulla National Park (Doomadgee dancers pictured at Riversleigh above), in Far North Queensland in the traditional lands of the Waanyi people. Riversleigh was inscribed for its outstanding natural values. It is one of the most significant fossil deposits in the world and the richest known fossil mammal deposit in Australia. It has even revealed descendants of ancient Gondwanan groups that once occupied the united lands of Australia, South America and Antarctica.

Existing climate and landscape context

The Riversleigh Fossil site is no stranger to climate change. Indeed, Australia's changing climate and its impact on our fauna is the backdrop to the story it reveals about Australia's deep past. The location was once, in a period of time called the early to middle Miocene, a very wet rainforest that became more arid as the Australian continent moved north. The mammal fossil assemblages reflect changes in habitat through time from humid lowland rainforest in the middle Miocene to drier eucalypt forests and woodlands in the late Miocene and demonstrate the rainforest origins for the majority of mammal groups that today occupy arid Australia.

Today, Riversleigh has distinct Wet and Dry seasons. Most rain falls over the warmer months from November to April and the dry season extends from May to October. Temperatures mirror this pattern with the average temperature in the middle of the wet season in January ranging from a min of 22 degrees Celsius to a max of 35.2 degrees Celsius and in the dry colder month of July from a min of 4.3 degrees Celsius to a max of 19.7 degrees Celsius. The vegetation is tropical savannah and characterised by extensive grasslands with denser vegetation along the major water sources such as the Gregory River.

parks.des.qld.gov.au/parks/boodjamulla-riversleigh





Riversleigh's future climate

	3°C by 2070 and 4.3°C by 2090.
	Dry season increasing in duration. Rainfall will fluctuate and in fact slightly increase although dry season will be drier.
	Heatwaves, prolonged extreme heat events will become more common with the number of extreme hot days per year increasing from 27 in 2030 to 84 by 2070. The duration of extreme heat events will also increase from 0.8 days in 2030 to 9.8 days in 2090.
	Extreme precipitation events are also expected to increase.
	In Queensland, increased precipitation is usually associated to specific drivers such as La Niña years and extreme events (e.g., convective storms, low pressure systems and tropical cyclones). Understanding future changes in precipitation is paramount for impact reduction.

Challenges

Heatwaves have implications for workers (park rangers, road workers, Aboriginal communities, emergency responders), researchers and tourists in the region. Extreme temperatures contribute to the deaths of over 1000 people aged over 65 each year across Australia.

Flooding events can significantly impact infrastructure, cutting access to remote locations, with financial implications of significant damage.

Climate change is expected to increase the frequency of heatwaves and extreme heat events and is also likely to increase the length of fire seasons which may limit the opportunities for prescribed or cultural burning practices.

Despite current best practice bushfire risk management, the actions are likely to have little or no impact on bushfires during extreme, and compounding conditions, for example drought, high winds and heatwaves.

Management of vandalism and theft of fossils may increase if visitor management decreases due to climate change factors.

How will the changing climate impact the heritage values of the site?

The Outstanding Universal Value of the property lies in the fossil deposits. For the most part, this is a robust resource embedded in stone which will not be negatively impacted by climate change. However, flood events in 2023 caused extreme erosion in Boodjamulla National Park, destroying large areas of potential archaeological and fossil bearing soil deposits along river valleys and in low elevation rock shelters.

Such damage compromises the potential for research that helps us understand the human – environment relationships from the more recent part of the fossil record.

Extreme weather events may also impact on site interpretation and visitor facilities which in turn can have negative flow-on effects to sustainable management of the World Heritage property.

Climatic change that reduces the tourism season or adds additional costs to tourism activities can impact the sustainability of such enterprises and can reduce the potential of the site to positively contribute to the economic future of the traditional owners.



Before floods



After floods



The devastating impact from the 2023 floods can be seen in the above photos of the Indarri falls at Boodjamulla gorge where the loss of riparian vegetation is significant, exposing the banks to extreme heat. A rockslide on the side of the gorge has decimated the walking track, which, due to the sheer angle that this slide has created, may not be able to be repaired.

Recommendations

- Tourism operators and property managers need to consider how heatwaves can impact their operations and visitor and staff wellbeing, including how heatwaves may:
 - dramatically increase underlying bushfire risk to potentially extreme levels, and
 - increase health and safety risks, particularly when walking and climbing.
- During days of extreme fire danger, bushfires can become uncontrollable even if fuel levels are minimal – this may require regular review of fuel management practices including how seasonal shifts may require modification of traditional burning practices.
- Park Rangers and emergency responders should plan for the added pressure to local and regional emergency management capability and capacity and increase the risk of impact to the community for extreme weather events such as the 2023 floods which saw widespread evacuation.
- Monitoring of local climate changes is needed in this area to complement regional climate projections and refine management practices at the local scale.
- Increased likelihood of extreme weather events means that on-site visitor interpretation and other facilities need to be robust and may require investment in innovative design.
- Increased systematic archaeological research is required to salvage cultural information at risk of loss and destruction.
- Support current research and research opportunities utilising the fossil records to help predict climate change affects.
- Post flood surveys will facilitate identification of exposed fossils and identify potential deposits at risk.

Opportunities

Riversleigh's fossil record provides a globally unique resource to anticipate likely climate change impacts on the diversity of animals when temperatures rise to the anticipated 2050 levels.

17 million years ago, global temperatures rose an average of 2°C, plateaued, and then, from 15 million years ago, declined by 2°C. Individual fossil deposits at Riversleigh span this prehistoric rise and fall in temperature, and hence reveal the changes that occurred during this time. The fossil record reveals that approximately 25% of the species present became extinct for each one degree rise in temperature.

Conversely, when temperatures began to cool again, there was approximately a 25% increase in species numbers for each degree decline in temperature over this two-degree range.

The Riversleigh fossil record provides the opportunity to anticipate changes that are likely to occur to Australia's fragile modern animal and plant species as current climate characteristics commence following a similar path.

Riversleigh provides a window in time that reveals insights into the impacts of climate change on both the landscape and the animals within these changing ecosystems. The World Heritage listed fossils could help to save endangered species.

A great example is the Burramys Project, which is focused on saving the critically endangered Mountain Pygmy possum. Ancestors of the Burramys are found in Riversleigh's fossil record, living at a time when the environment was lowland rainforest. A trial population has been successfully translocated from its contemporary alpine environment to a lowland rainforest breeding facility, the habitat that has kept this very specialized group of possums comfortable for the majority of the past 25 million years.

References

- <https://www.longpaddock.qld.gov.au/qld-future-climate/adapting/heatwaves/>
- <https://www.climatechangeinaustralia.gov.au/en/>
<https://newsroom.unsw.edu.au/news/science-tech/how-mountain-pygmy-possum-can-be-saved-climate-change>

Cover photo: Waanyi Doomadgee dancers (E. Thyer).
Page 2 Top left to right: Boodjamulla National Park gorge taken in 2022 (E. Waugh).

Fossil at Riversleigh World Heritage D Site walking trail (E. Waugh).

Riversleigh D Site entrance signage (E. Waugh).

Bottom right Boodjamulla gorge aerial photos.

Top taken during 2023 floods (A.

Undery);

bottom taken prior to floods (B. O'Grady)

Page 3: Boodjamulla National Park photo taken before the floods (P. Creaser).

Boodjamulla National Park photo taken after 2023 floods. (B. O'Grady).

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