



Lessons learned in outback Western Australia

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Introduction

The Northern Australia Climate Program (NACP) is a partnership between the Queensland Government (with funding from the Drought and Climate Adaptation Program), Meat and Livestock Australia, and the University of Southern Queensland (USQ) to bring together expert climate scientists, advisors, and regional producers to deliver innovative research, development, and extension outcomes for helping the grazing industry manage drought and climate risk across northern Australia.

In the last week of May 2021, I was fortunate to represent the Bureau's involvement in the research component of the project with a climate roadshow to the Gascoyne and Pilbara shires of outback Western Australia (Figure 1). The focus of the trip was to help producers find, understand, and use forecasting information through the dissemination of weather and climate knowledge relevant to their specific region.



Figure 1: The Gascoyne (left) and Pilbara (right) regions of Western Australia (source: en.wikipedia.org).

My role was to discuss important climate drivers and their impacts through a series of workshops held at outback stations, to enable producers to make more informed assessments of seasonal climate forecasts. Reciprocally, participants provided practical advice and feedback for improving the Bureau's delivery of forecast information for these arid regions.

Alongside me were Dr Chelsea Jarvis from USQ, and two 'Climate Mates' employed by the program to liaise with pastoralists – Alys McKeough for the first half of the trip to Wyloo, and Jardine Macdonald for the second half. They organised a detailed and exciting roadshow comprising ten station visits over eight days, totalling more than 2,000 km and 27 hours of driving (Figure 2).



Figure 2: Itinerary for the NACP roadshow in the Gascoyne and Pilbara shires of Western Australia.

THE GASCOYNE, 24-25 May: Carnarvon – Wahroonga – Bidgemia – Eudamullah

I departed from Hobart on Sunday 23 May and flew into Carnarvon the following morning after an overnight stay near Perth Airport. Alys, Chelsea and I promptly took to the road, passing fields of bananas, avocado, pumpkins, mango, and asparagus on our way out of town, all of which grow year-round due to Carnarvon's two peaks in annual plant growth – one in summer and one in winter.

A couple of hours later we arrived at our first station, Wahroonga, where we learnt that the impacts of our climate's warming trend are being noticed on the ground. The effects of the southward expansion of the tropics (e.g., Lucas et al. 2014) are apparent to producers here, having noticed an increase in summer rain and a decrease in winter rain over the last few decades. We would learn over the next few days that this long-term reduction in winter rain is a common concern throughout these arid regions, which sit under the influence of the subtropical ridge and its poleward trend of around 0.2 degrees (≈ 20 km) per decade (Hu et al., 2011).

We drove into Bidgemia Station around 4 pm and met our friendly hosts Jodie and Hamish, and half a dozen local producers, for our first workshop. Our meet-and-greet soon morphed into a feedback session on the utility of the Bureau's seasonal forecasts: While they find the forecasts generally useful, the probabilistic rainfall forecast is often misunderstood. For example, deep blue shading on the rainfall outlook map can create a visual impression of heavy rain, when in fact it represents a high likelihood of above average rainfall – which does not necessarily translate to heavy rain. This became an important distinction to highlight throughout the roadshow.

The folks at Bidgemia Station, and at Eudamullah on the following day, most valued learning about the key drivers of weather and climate and how they shift the odds in favour of rainfall. In preparing for this trip, I discovered that individual climate drivers tend to have a minimal impact on Gascoyne and Pilbara rainfall on average, yet they can influence and interact with one another to produce compounding and significant effects. That is, on multi-week to interannual timescales, the strongest impacts on rainfall here are typically seen when two or more of the tropical modes occur in combination: the Madden-Julian Oscillation (MJO), El Niño – Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD). My mantra quickly became '...but every event is different!'. For example, while the average summer rainfall response to La Niña shows near-average rainfall for these regions, the 2010-2011 La Niña event - which occurred with a negative IOD event - produced record high rainfall for the Gascoyne (Figure 3; December to February total rainfall exceeded 400 mm in some parts) and flooding up to the rooflines at Bidgemia Station. We heard how Jodie and Hamish were stranded on their tin rooftop during the summer of 2010-2011 waiting for the rescue helicopter to arrive.

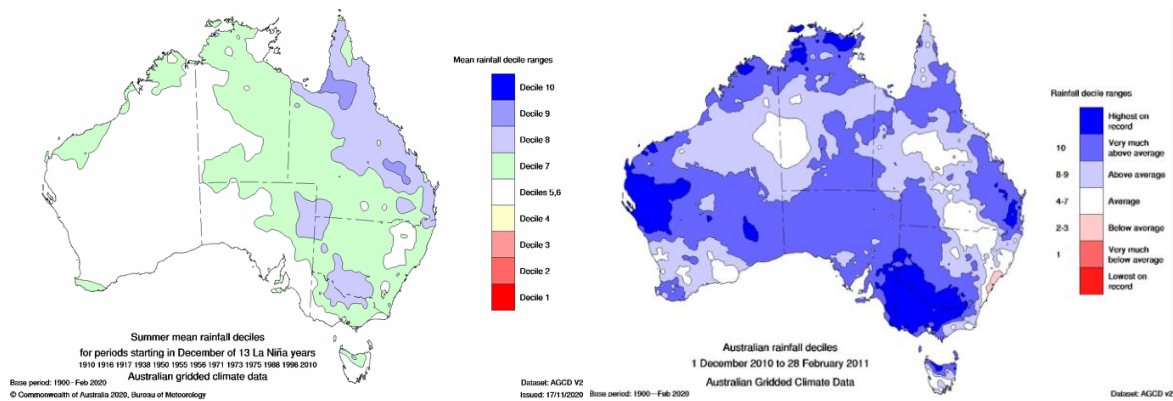


Figure 3. Left: December-February mean Australian rainfall deciles of 13 La Niña years (source: <http://www.bom.gov.au/climate/enso>). Right: Australian rainfall deciles for the period 1 December 2010 to 28 February 2011 (source: <http://www.bom.gov.au/climate/maps/rainfall>).

THE PILBARA, 25-31 May: Emu Creek – Wyloo – Cheela Plains – Marble Bar – Yarrie – De Grey

Our first stop upon entering the Pilbara was Emu Creek, a pastoral lease and cattle station run by new caretakers Denise and Andrew. Emu Creek has been running a Bureau weather station since 1898 (ID 006072). The group here was small (~ 5 people) but highly engaged as they asked many questions during and after our presentations. They were quick to understand about climate drivers and their impacts, particularly the MJO – aided by 'Climatedog MOJO¹' and Chelsea's 'MJO dance'. This highlighted the value of thoughtful and creative communication in delivering interesting and memorable information.

Our next visit, to Wyloo station on the 26th, was a considerably larger meeting with a group of about 10 people. Established prior to 1897 as Peake Station, Wyloo is a pastoral lease that operates as a sheep and cattle station. Our hosts Clint and Shannon, their three sons, resident employees and neighbouring station owners came together for the evening science discussion – and viewing of the total lunar eclipse. I managed to set the tone for the evening with a groanable 'dad joke' about a total eclipse of the (weather) chart...just as a distant tumbleweed rolled by.

During the evening we fielded several questions about climate change, with the long-term decline in winter rainfall being at the forefront of their thinking, in addition to probing questions about forecast model accuracy. This gave me the opportunity to talk about varying timescales of predictability for the different drivers of weather and climate. For example, the longer-term modes such as ENSO and the IOD can provide useful prediction skill on the seasonal timescale, whereas short-term weather events such as blocking highs and cut-off lows are more difficult to predict beyond a week or two ahead. These varying timescales will influence a seasonal outlook and how it can change as the target season approaches. I have found this to be an important concept to convey in my climate briefings to customers over the years, for building and maintaining trust in the

¹ <https://www.youtube.com/watch?v=SwoB-2nSnJ0>

Bureau's products and services, and this point was also appreciated by the discerning crowd at Wyloo Station.

Our following station visits in the Pilbara were as educational for me as they were for the producers. This included:

- Cheela Plains, where owners Robin and Evan had learned the importance of diversifying for getting through the bad (low rainfall) years. Since 2012 their business has been spread across tourism, machinery contracting, pasture growing and agistment. We also learnt here that summer rain can boil on the ground and kill seeds, making winter rain more effective for growth (and fuelling the ongoing concern about tropical expansion).
- Limestone Station in Marble Bar, where the Bureau has been operating a weather station since 2000 (ID 004106). Here, Grant and Wendy head up an Angus cattle breeding business in one of the hottest places in the country. Recognised by the Guinness Book of Records as 'the hottest town in Australia', the highest temperature recorded at Marble Bar was 49.3 degrees on 27 Dec 2018, and on average more than 100 days per year are recorded at or above 40 degrees.
- Yarrie, where Annabelle and Thomas hire a young international crew of workers for their 2,500 square kilometre cattle station. Annabel and Thomas noted that expressions of empathy from the Bureau in media interviews go a long way when discussing rainfall forecasts, particularly when predicted rains do not eventuate for these regions. They would prefer to receive heavy rainfall from a tropical cyclone and then clean up afterwards than to get little to no rainfall at all.



Figure 4. Left: an outback dog at Bidgemia Station. Right: Alys (closest to camera) watches on as Chelsea introduces her MJO dance to the assembly at Wyloo.

Our final visit for the week was to De Grey Station on the 30th. It was also probably our largest and most engaged audience. The MJO again became the key focus of discussion, with the 13 producers in the room having not heard of the MJO despite its large influence on the Pilbara. Part of that

influence had likely been felt in the preceding week when the MJO was lined up to bring some rainfall to these regions².

We also spoke about the MJO's role on rainfall in western parts of the state only a few weeks prior with the passage of severe tropical cyclone Seroja, which formed in the Timor Sea on the 5th of April in connection with a strong MJO event. As Seroja developed, it moved southwest well offshore, parallel to the Kimberley and Pilbara coast, before interacting with Tropical Cyclone Odette. This interaction, known as the Fujiwhara Effect, led to Seroja taking a sharp turn towards the southwest coast where it made landfall on the 11th of April as a category 3 cyclone. This rare occurrence of a severe cyclone tracking so far south was also helped by the ocean temperatures being above average off the WA coast, due to the recent La Niña event.

In addition to sharing knowledge about climate drivers and their impacts on the Gascoyne and Pilbara regions, an important aspect of this trip was listening to our customers and validating their experiences. They appreciated my understanding of their frustration towards forecast inaccuracies, and I found they were more likely to engage as a result. On one visit, a producer was eager to talk about the controversial topic of using lunar cycles to predict weather patterns. It was a stimulating and respectful conversation that led to a fruitful discussion of how research, products and services from the Bureau and our UK Met Office project partners could be useful for their business.

Throughout the week I discovered the importance of having a sense of empathy, and humour, when representing the Bureau on the road, as I was often asked "So, why does the Bureau always get it wrong?". I also had a chuckle when referred to as a "dart thrower" on one occasion. Such comments provided the perfect opportunity to start a conversation around drivers of weather and climate and their predictability across a range of timescales from days to seasons and beyond.

The NACP roadshow to outback WA was highly beneficial for producers, the Bureau and project partners, and I wish to extend my thanks to Matthew Wheeler and the Northern Australian Climate Program for the opportunity to participate. Thanks to Chelsea Jarvis, Alys McKeough, and Jardine Macdonald for their great company and for the many hours of driving, hard work, conversation, and laughter that went into making this a thoroughly rewarding experience. I also extend my thanks to Tim Cowan, Ian Foster, Yanhui Blockley and Patrick Ward for their helpful sharing of information, advice, and local WA knowledge prior to the trip. I look forward to my continued involvement as part of the NACP team in 2021-22.

² <http://www.bom.gov.au/climate/mjo/>



Figure 5. Left: Chelsea and Jardine (blue shirts) in conversation with employee Lawson at Cheela Plains. Right: Chelsea and me admiring the stunning rock formation at Marble Bar (photo credit: Jardine Macdonald).

References

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