Articles

Documentary accounts of the impacts of past climate variability on the early colony of New South Wales, 1788–1791: a preliminary analysis.

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An unwritten history?

No country in the developed world is more vulnerable to the effects of climate change than Australia. We are a country defined by dramatic weather extremes: irregular climate variability influences every aspect of our lives. But how much do we really know about our pre-20th century climate history? How did the first European settlers deal with past climate variability? Is the current drought just another extreme part of our natural climate variability, or are the signs of global warming already with us?

Records of Australia's past climate are essential for providing a stronger basis for evaluating the historical context of extreme events – like the current drought gripping southern Australia – helping us define our natural range of climate variability. Currently our description of Australian rainfall and temperature patterns are largely confined to the 20th century. It is astounding to learn that in the early 21st century, we still do not have a robust, long-term history of cycles of drought in south-eastern Australia where most of our population lives.

Immense opportunity exists to use historical records to develop our understanding of our climate history and its impact on past societies. Unlike Europe and the Americas, Australia's documentary archives remain virtually unexplored for climate information. Archival colonial reports, personal diaries and newspaper stories provide us with rich accounts about past drought, floods and other significant weather events since first European settlement in 1788, before modern meteorological data is available. Importantly, documentary records provide a societal record of the impact of past climatic conditions in areas of Australia where early weather records or annually resolved palaeoclimate data are still very limited. Importantly, these records give us a fascinating glimpse into what life 'behind the numbers' would have been like centuries ago.

Aside from the pioneering works of the 19th century (e.g. Jevons, 1859), there have been very few attempts to reconstruct Australian pre-20th century drought using documentary records (e.g. Nicholls, 1988; Grove 1997). Even less work has been directed toward reconstructing south-eastern Australia's flood, bushfire, dust storm and cyclone history and past societies' response to historical climate variability. To address this, researchers at the University of Melbourne are now using documentary records – along with early station data and palaeoclimate records – to compile a multi proxy history of climate conditions since first European settlement of Australia in 1788. The aim of this article is to present some preliminary evidence of wet and dry periods in the colony of New South Wales (Sydney) between 1788–1791 using a small number of First Fleet documentary sources.

Evidence of the 1788-1789 La Nina

Many people are surprised to learn that when Governor Arthur Philip arrived with the First Fleet in January 1788, Sydney was in the middle of a particularly wet summer. The colony's chief bureaucrat, David Collins, meticulously recorded all the activities of the infant settlement, detailing convict deaths, legal hearings and agricultural production. Collins also made specific mention of weather conditions, the first of which reads: 'The weather during the latter end of January and the month of February was very cold, with rain, at times very heavy, and attended with much thunder and lightening, by which some sheep, lambs and pigs were destroyed'.

More 'inclement, tempestuous weather' persisted throughout the winter of 1788 making life in the new colony difficult. Collins writes: 'During the beginning of August much heavy rain fell, and not only prevented the carrying on of labour, but rendered the work of much time fruitless by its effects; the brick-kiln fell in more than once, and bricks to a large amount were destroyed; the roads about the settlement were rendered impassable; and

some of the huts were so far injured as to require nearly as much time to repair them as to build them anew. It was not until the 14th of the month, when the weather cleared up, that the people were again able to work'. Watkin Tench recounts: 'we were eager to escape from tents, where a fold of canvas, only, interposed to check the vertic beams of the sun in summer, and the chilling blasts of the south in winter… under wretched covers of thatch lay our provisions and stores, exposed to destruction from every flash of lightning'.

By the second year of settlement, the foreign landscape and erratic weather were wreaking havoc on the establishment of agriculture in Sydney. By February 1789 the young colony was still experiencing wet conditions, making life increasingly desperate. Collins reports: 'the weather was extremely unfavourable; heavy rains, with gales of wind, prevailing nearly the whole time. The rain came down in torrents, filling up every trench and cavity which had been dug about the settlement, and causing much damage to the miserable mud tenements which were occupied by the convicts'.

Meanwhile on Norfolk Island, a severe cyclone slammed into the fledgling colony on the 25 February 1789 causing widespread destruction. The Governor of Norfolk Island, Philip King, vividly paints the devastating destruction of the event: 'towards noon, the wind blew a heavy gale, and kept increasing in violence. At midnight, it shifted east-south-east, and blew with a great fury, attending with constant deluges of rain… from four in the morning until noon, the wind increased to a very severe hurricane, with the heaviest rain I ever saw or heard of. Pines, and oak trees of the largest size, were blown down every instant; the roots were torn up together with rocks that surrounded them, frequently leaving pits at least ten feet [3m] deep'.

'Some of the very large trees, which measured 180 feet [55m] in length, and four feet [1.2m] diameter, were thrown by the violence of the tempest to a considerable distance from the place where they grew; and others, whose roots were too deep in the earth to be torn up, bent their tops nearly to the ground. In addition to the horror of this scene, a very large tree fell across the granary and dashed it to pieces…the gale now raged with most violent fury, which defies all description: whole forests seemed, as it were, swept away by the roots, and many of the trees were carried to a considerable distance. By one o'clock in the afternoon, there were as many trees blown down round the settlement as would have employed fifty men for a fortnight to cut down…everything in the gardens was nearly destroyed, and an acre of Indian corn, which was in a promising state, and nearly fit for reaping, was laid flat and covered with water four feet deep… at three o'clock, the wind veered round to south … and at sunset, the weather was very pleasant'.

Unsettled conditions appear to have persisted into autumn 1790. As Sydney endured more flooding, soon they learned of the devastating loss of the cargo ship *Sirius* on Norfolk Island on 19 March 1790. When news of the wreck of the *Sirius* reached Sydney by the *Supply*, the mood of the colony sunk deeper into despair. Collins writes: 'The weather had been very wet during this month; torrents of rain again laid every place under water; and many little habitations, which has withstood the inundations of the last month, now suffered considerably... At this time the *Supply* returned from Norfolk Island, with an account of a disaster which depressed even the unthinking part of the inhabitants, and occasioned universal dismay. A load of accumulated evils seemed bursting upon their heads. The ships that had so long been expected with supplies were still anxiously looked for; and the *Sirius*, which was to have gone in quest of relief to their distress, was lost upon the reef at Norfolk Island... bad weather immediately ensued, and, continuing for several days, the provisions could not be landed, so high was the surf occasioned by it'.

The loss of the *Sirius* brought Sydney Cove to the brink of famine as drastic ration reductions were enforced. Collins writes 'it was unanimously determined, that martial law should be proclaimed; that all private stock (poultry excepted) should be considered as property of the state… the general melancholy which prevailed in the settlement when the above unwelcome intelligence was made public, need not be described; and when the *Supply* came to an anchor in the cove everyone looked up to her as to their only remaining hope...it was determined to reduce still lower what was already too low…very little labour could be expected from men who had nothing'.

Dropping off like fox bats

By September 1790, the weather started to improve, lifting the spirits of the settlers. They were fast realising just how unpredictable Australia's weather could be. Watkin Tench remarks 'it is changeable beyond any other I ever heard of… clouds, storms and sunshine pass in rapid succession'. On 27 December 1790 he describes the first European account

of a summer heatwave in Sydney. He likened the north-west wind to the 'blast of a heated oven', recording the temperature of the heatwave in impressive detail (table 1).

27 December 1790	Temp. °F (°C)	28 December 1790	Temp °F (°C)
9am	85 (29.4)	8am	86 (30.0)
12 noon	104 (40.0)	10am	93 (33.9)
12.30pm	107.5 (41.9)	11am	101 (38.3)
1pm–2.20pm	108.5 (42.5)	12 noon	103.5 (39.7)
2.20pm	109 (42.8)	12.30	104.5 (40.3)
Sunset	89 (31.7)	1pm	102 (38.9)
11pm	78.5 (25.8)	1.15pm	89 (31.7)
		5pm	73 (22.8)
		Sunset	69.5 (20.8)

Table 1: Watkin Tench's temperature record of 27-28 December 1790.

No doubt the early settlers were stunned as the temperature plummeted 8.6°C in less than an hour as it did on 28 December 1790. It is hard to imagine what it would have been like coping with the intense heat in the stiff finery of the day. In those days, the fashionable 'suit' for a gentleman consisted of a coat, a waistcoat and white shirt with lace ruffles at the neck and wrists, and breeches or pantaloons. At this time, suits were made of rich velvets, silks and satins and were highly decorated. To make matters worse, their trousers were skin-tight, as during this period, close fitting pantaloons were a key indicator of status. Looser cut trousers and drop fronts were the sign of a labourer. If this wasn't enough, soft fabric cravats tied at the neck and wigs were worn for formal occasions. Remember, that in the 1790s, household electricity was still a century off and modern air-conditioners were effectively light years away.

And so the long hot summer of 1790–91 rolled on. Watkin Tench describes the impact of the drought on the food supply: 'vegetables are scarce… owing to want of rain. I do not think that all the showers of the last four months put together, would make twenty-four hours rain. Our farms, what with this and a poor soil, are in wretched condition. My winter crop of potatoes, which I planted in days of despair (March and April last), turned out very badly when I dug them about two months back. Wheat returned so poorly last harvest'.

Early in 1791 Governor Philip writes: 'the dry weather still continued, and many runs of water which were considerable at this season the last year [1790], were now dried up…at Sydney, the run of water was now very small'. Watkin Tench reflects: ' Even this heat [of December 1790] was judged to be far exceeded in the latter end of the following February [1791], when the north-west wind again set in, and blew with great violence for three days. At Sydney, it fell short by one degree of [December 1790] but at Rose Hill [Parramatta], it was allowed, by every person, to surpass all that they had before felt, either there or in any other part of the world… It must, however, have been intense, from the effects it produced. An immense flight of bats driven before the wind, covered all the trees around the settlement, whence they every moment dropped dead or in a dying state, unable longer to endure the burning state of the atmosphere. Nor did the 'perroquettes', though tropical birds, bear it better. The ground was strewn with them in the same condition as the bats.'

David Collins also comments on the incredible effect of the heat on the local wildlife: 'Fresh water was indeed everywhere very scarce, most of the streams or runs about the cove being dried up. At Rose Hill [Parammatta], the heat on the tenth and eleventh of the month, on which days at Sydney the thermometer stood in the shade at 105°F [40.6°C], was so excessive (being much increased by the fires in the adjoining woods), that immense numbers of the large fox bat were seen hanging at the boughs of trees, and dropping into the water… during the excessive heat many dropped dead while on the wing... In several parts of the harbour the ground was covered with different sorts of small birds, some dead, and others gasping for water'.

Governor Arthur Philip elaborates on the staggering scale of the scene: 'from the numbers that fell into the brook at Rose Hill [Parramatta], the water was tainted for several days, and it was supposed that more than twenty thousand of them [bats] were seen within the space of one mile'. Imagine walking through somewhere like the modern day Botanic Gardens in Sydney to be met by a writhing carpet of bats and birds dying of heat stress! It is surprising to learn that such events are not unheard of in more recent times. For example, on 12 January 2002 temperatures in

excess of 42°C killed more than 1300 grey-headed flying foxes in Dallis Park in northern New South Wales. State-wide, more than 3500 flying foxes are reported to have fallen from the soaring temperatures on that single day. Although it may not be unprecedented, the number of the bats killed in the summer of 1791 is likely to have been greater due to the denser population of bats that would have been supported by Sydney's bushland before large-scale urbanisation.

In modern day Sydney, autumn and winter rains are important for recharging reservoirs and rejuvenating parched land. The failure of these rains can have a devastating effect on agriculture as it did two centuries ago. In April 1791 Arthur Philip writes 'the dry weather continued… the quantity of rain which fell in the month of April [1791], was not sufficient to bring the dry ground into proper order for sowing the grain… this continuance of dry weather, not only hurt their crops of corn very much, but the gardens likewise suffered greatly; many being sown a second and a third time as the seed never vegetated, from want to moisture in the soil'. As a result of the drought, Governor Philip tightened rations as the food supply of the struggling colony began to dwindle: 'Little more than twelve months back, hogs and poultry were in great abundance, and were increasing very rapidly...but as this time [April 1791] there was seldom any to sell'. Watkin Tench laments 'I scarcely pass a week in summer without seeing it rise to 100 degrees [Fahrenheit i.e. 37.8°C]; sometimes to 105 [40.6°C]'.

David Collins describes the dry conditions that persisted into June 1791: '…the ground was so dry, hard and literally burnt up, that it was almost impossible to break it with a hoe; and until this time there has been no hope or probability of the grain vegetating'. On returning back from Norfolk Island John Hunter, ex-Captain of the doomed *Sirius*, described the scene at Sydney Cove: 'all the streams from which we were formerly supplied… were entirely dried up, so great had been the drought; a circumstance, which from the very intense heat of summer, I think it probable we shall be frequently subject to'. Indeed, the boom–bust cycle of rain still defines life in 21st century Australia.

By November 1791, the worsening drought led to the first documented account of water restrictions imposed on Sydney. The small freshwater stream that ran into Sydney Cove proved an irregular source of water. To try and control the amount of water flowing out of the colony, 'holding tanks' were cut into the sandstone banks to provide storage for the water. Collins writes: 'By the dry weather which prevailed the water had been so much affected, besides being lessened by the watering of some transports, that a prohibition was laid by the Governor on the watering of the remainder of Sydney… to remedy this evil, the Governor had employed the stone-mason's gang to cut tanks out of the rock, which would be reservoirs for the water large enough to supply the settlement for some time.' This became known as the 'tank stream', and may be the earliest example of water regulation in Australia's European history.

One swallow doesn't make a summer

As scientists working in 21st century Australia, many of us might recognise that this seesaw in rainfall bears the marks of the quintessential flood/drought cycle caused by the El Niño–Southern Oscillation (ENSO). But of course, one swallow doesn't make a summer. To determine whether these years were in fact ENSO events, we need to examine independently developed palaeoclimate reconstructions.

A comparison with a multi proxy reconstruction of El Niño and La Niña events since A.D. 1525 (Gergis and Fowler, 2008) indicates that, indeed, a very strong La Niña event was centred on 1788 and extended to 1790. A characteristic 'phase flip' seems to occur in the year 1791 which is classified as a very strong El Niño year in the Gergis and Fowler (2008) record and noted elsewhere in the literature (Allan and D'Arrigo, 1999; Whetton and Rutherfurd 1994; Quinn and Neal 1992). Recently, using a composite coral record to reconstruct tropical rainfall runoff over the Great Barrier Reef since A.D. 1661, Lough (2007) showed that the years 1788 and 1790 were periods of high freshwater flow into the Great Barrier Reef, consistent with north Queensland's contemporary La Nina teleconnection pattern. Interestingly, while southern Australia appears to have experienced very dry conditions, the year 1791 only registers as a year of 'average' runoff in northern Australia (Lough, 2007).

It is fascinating to see how, from the first days of European settlement, the ENSO climate cycle has influenced so many aspects of Australian life. However, to ensure that reconstructions of past weather and climate variability are reliable, it is important to cross-verify with other data sources such as early meteorological observations recorded in

weather journals or other palaeoclimate indicators.

Clearly, abundant potential exists to revisit our colonial archives for early weather and climate information. By doing so, we can better define a 'baseline' of natural climate variability in south-eastern Australia. Given the large number of very extreme climate events Australia has been experiencing, such an assessment would provide timely context for understanding and attributing recently observed changes and for constraining future climate change projections.

References

Allan, R. and D'Arrigo, R. (1999). 'Persistent' ENSO sequences: how unusual was the 1990-1995 El Niño? *The Holocene,* **9** (1), 101-118.

Collins, D. (1798). *An account of the English colony in New South Wales: with remarks on the dispositions, customs, manners, &c. of the native inhabitants of that country. To which are added, some particulars of New Zealand, compiled, by permission from the mss. of Lieutenant-Governor King*. Cadell and David, London.

Gergis, J. and Fowler, A. (2008). A history of El Niño-Southern Oscillation (ENSO) events since A.D. 1525; implications for future climate change. *Climatic Change* in press.

Grove, R. (1997). The East India Company, the Australians and the El Niño. In: *Ecology, Climate and Empire: Colonialism and Global Environmental History 1400–1940,* by R.H. Grove, White Horse, Cambridge, 237pp.

Hunter, J. (1793). *An historical journal of the transactions at Port Jackson and Norfolk Island: including the journals of Governors Phillip and King, since the publication of Phillip's voyage: with an abridged account of the new discoveries in the South Seas*. John Stockdale, London.

Jevons, W., (1859). Some data concerning the climate of Australia and New Zealand, pp 47–98 in: *Waugh's Australian almanac for the year 1859*, James William Waugh, Sydney.

Lough, J. (2007). Tropical river flow and rainfall reconstructions from coral luminescence: Great Barrier Reef, Australia. *Paleoceanography*, **22**, PA2218, doi: 10.1029/2006PA001377

Nicholls, N. (1988). More on early ENSOs: evidence from Australian documentary sources. *Bull. Amer. Met. Soc.*, **69** (1), 4–6.

Quinn, W. and Neal, V. (1992). *The historical record of El Niño events. Climate Since A.D. 1500.* R. Bradley and P. Jones, Eds. Routledge, London, pp 623–648.

Tench, W. (1789). *A Narrative of the Expedition to Botany Bay, with an account of New South Wales, its productions, inhabitants, &c*. Chamberlaine, Wilson, White, Byrne, Gruebier, Jones, and Dornin, Dublin.

Tench, W. (1793). *A Complete Account of the Settlement at Port Jackson*. Nicol and Sewell, London.

Whetton, P. and Rutherfurd, I. (1994). Historical ENSO teleconnections in the Eastern Hemisphere. *Climatic Change* **28,** 221-253.