# ‘Seven Lean Years, Seven Fat Years’: Climate Theory in Australia, 1820–1830

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In the 1820s and 1830s, British settlers in Australia relied on folk theories, memories and patchy weather data to understand the past and future climate of their new settlements.[1] A lengthy drought in New South Wales from 1826–1829 buoyed belief in a folk climate theory called ‘the septennial theory’ – the idea that south-eastern Australian climate was dominated by drought periods of seven years in length, followed by a seven-year period of good rainfall – and challenged the way British settlers had understood Australian weather and climate during the preceding 40 years of colonization. In the late 1700s, while Australia’s suitability as a penal colony was assessed, it was presumed that the temperate climate could support the ample production of both traditional English goods and produce, as well as exotic tropical crops in only a few short decades.[2] South-eastern Australia’s expansive, temperate regions, lacking Britain’s wintery extremes, were brimming with agricultural and pastoral possibility.

However, 30 years later, British settlers had faced lengthy, desiccating droughts interspersed with periods of high rainfall. In those few short decades, a wider understanding of Australia’s highly variable climate had started to emerge. The ‘septennial theory’ pre-dated the widespread establishment of meteorological weather stations that occurred in later decades. In the absence of long-term meteorological observations, it was preconceptions and theories that coloured the way colonisers viewed weather and climate in Australia and the way settlers reacted to its extremes. With a focus on the 1820s and early 1830s, this paper shows the way weather and climate was conceptualised in Australia in the absence of a strong meteorological tradition.

In the emerging field of Australian meteorological history, a strong focus is directed to the data collection activities, analysis and theories that developed during the latter half of the 19th century. This is a sensible starting point, as it was only in 1838 that

[1] David Day, *The Weather Watchers*, (Carlton: Melbourne University Press, 2007), 8–10.
[2] Claire Fenby, Don Garden and Joëlle Gergis, ‘“The usual weather in New South Wales is uncommonly bright and clear…equal to the finest summer day in England”: Flood and Drought in New South Wales, 1788–1815,’ *Climate, Science, and Colonization: Histories from Australia and New Zealand*, James Beattie, Emily O’Gorman, and Matthew Henry (eds.), (New York: Palgrave Macmillan, 2014), 43.

the Colonial Office ordered the establishment of a small meteorological network in Australia. In November 1838, the British government department ordered the Governor of New South Wales, Sir George Gipps, to establish and maintain meteorological records at stations across south-eastern Australia (Sydney, Melbourne and Port Macquarie) in order to better understand the weather and climate, promote scientific enquiry and boost immigration.[3] The establishment of a larger network of meteorological observatories accelerated from the late 1850s.[4] Julia Miller's recent paper, 'What's Happening to the Weather? Australian Climate, H.C. Russell and the Theory of a Nineteen-Year Cycle,' examines 19th century scientist H. C. Russell's theories of 'good and bad seasons' and situates Russell's work on climate periodicity within 'a wider interest in climate and weather prediction in the late 19th and early twentieth centuries.[5] This paper shows that, while public debate about climate variability was more vigorous in late 19th century Australia, an interest in wet and dry periodicity emerged much earlier in Australia's meteorological history, formed in response to forty years' experience of climate variability.

A recent compendium of Australian and New Zealand climate history, *Climate, Science, and Colonization,* highlights new historical understanding for this region and in this field. Historian Kirsty Douglas argues that later in the 19th century, 'schemes emerged for correcting climate 'deficiencies'…[which] included competing agricultural and forestry maxims like 'rain follows the plow' and 'trees bring rain'.'[6] This is supported by Stephen Legg's research published in the same volume, which outlined a longitudinal survey of Australian newspapers between 1827 and 1949 on whether forests influenced Australian climate. Figure 6.2 in Legg's chapter shows no relevant newspaper articles on this debate were identified from 1827 to the mid-1850s, but that a 'rapid rise in total press coverage on the debate occurred from the early 1860s, before a resurgence in the early 1880s and a decline to the early 1890s.'[7] The debate that circulated these popular maxims 'remained open because of the continued failure of scientists like [H.C.] Russell to predict the weather.'[8] The septennial theory, outlined in this paper, was an embryonic theory that sought to highlight Australian climate 'deficiencies', pre-dating later discussions about the periodicity of drought and the climate-correcting measures that could be employed in the face of it.

This paper shines a light on a climatic theory that was prevalent in Australia in the 1820s and 1830s. It is one of the earliest examples of a 'periodicity' theory, which became more widely debated in Australia in the latter half of the 19th century, and it pre-dated the lively wider debate about exerting climate control through landscape changes,

[3] David Day, *The Weather Watchers*, 4.
[4] Ibid; Kirsty Douglas, 'Under Such Sunny Skies': Understanding Weather in Colonial Australia, 1860–1901,' Metarch Papers No. 17, May 2007, Bureau of Meteorology, 20.
[5] Julia Miller, 'What's Happening to the Weather? Australian Climate, H.C. Russell and the Theory of a Nineteen-Year Cycle,' *Historical Records of Australian Science* 2014: 25, 20.
[6] Kirsty Douglas, 'For the sake of a little grass': A Comparative History of Settler Science and Environmental Limits in South Australia and the Great Plains,' *Climate, Science, and Colonization*, James Beattie, Emily O'Gorman, and Matthew Henry (eds.), 102.
[7] Stephen Legg, 'Debating the Climatological Role of Forests in Australia, 1827–1949: A Survey of the Popular Press,' *Climate, Science, and Colonization*, James Beattie, Emily O'Gorman, and Matthew Henry (eds.), 121–122.
[8] Ibid, 132.

which was also prevalent in the latter half of the 19th century. It informed early debate around climate 'boosterism' which became more prevalent in the mid-1830s with the establishment of the colony of South Australia. The septennial theory pre-dated the systematic creation of meteorological observatories across south-eastern Australia from 1838 onwards. British colonisers arrived in foreign lands 'oblivious in the beginning to environmental extremes and ways to deal with them.'[9] Colonisation, as Gergis *et. al.* identify in 'The Influence of Climate on the First European Settlement in Australia', 'is largely about the processes of coming to terms with…environmental limitations, and finding ways of overcoming them.'[10] This paper highlights the progression of colonial meteorological understanding, and uncovers a meteorological folk theory – an early attempt to understand and come to terms with the long-term variability in south-eastern Australia's climate and to predict with greater accuracy periods of drought and good rainfall.

## 40 Years of Variability

Since their arrival in 1788, Europeans in south-eastern Australia had experienced oscillating periods of significant droughts interspersed with wet periods marked by major floods. Serious droughts were experienced in coastal New South Wales from 1790–1792, in 1798–1799, from 1802–1803, 1809–1815, 1824 and 1826–1829, with settlers experiencing widespread crop failures, livestock death and water shortages. Destructive floods marked the early years of settlement at the Hawkesbury River, 80km northwest of Sydney, in 1805, 1806, 1809 and 1816.[11] These climatic extremes, which threatened the viability of the new colony in Australia, also challenged the way settlers conceptualised climate.

By the end of 1827, reports of grain harvest failures had increased, heralding the beginning of a long succession of drought-affected crops in the Australian colony of New South Wales. Throughout 1827, settler Christiana Brooks wrote of her delight whenever it rained at her Denham Court property, southwest of Sydney. When March was ushered in with nearly a week of rain, 'the most striking improvement was visible – the grass [was] looking green, the trees refreshed, and the whole face of the country beautiful.'[12] Brief periods of rainfall, however, were inadequate for agricultural purposes on the Brooks' farm, which meant that the December harvest was quickly completed in a week, and was described as 'a harvest of straw rather than grain.'[13] Their crop return was reduced to four bushels an acre.[14] Good rainfall was welcomed in Sydney in April 1828

[9] Dennis B. Blanton, 'The Weather is Fine, Wish You Were Here, Because I'm the Last One Alive: "Learning" the Environment in the English New World Colonies,' *Colonization of Unfamiliar Landscapes: The Archaeology of Adaptation*, eds. Marcy Rockman and James Steele (Routledge: London, 2003), 195.
[10] Joëlle Gergis, Don Garden and Claire Fenby, 'The Influence of Climate on the First European Settlement of Australia: A Comparison of Weather Journals, Documentary Data and Palaeoclimate Records, 1788–1793,' *Environmental History* 2010 (15:3), 503.
[11] Claire Fenby and Joëlle Gergis, 'Rainfall variations in south-eastern Australia part 1: consolidating evidence from pre-instrumental documentary sources, 1788-1860,' *International Journal of Climatology* 11/2013; 33(14):2956-2972. DOI:10.1002/joc.3640
[12] Christiana Brooks, *Diary*, National Library of Australia, MS 1559/24 Folder 3, 18 March 1827.
[13] Christiana Brooks, 15 December 1827.
[14] Ibid.

but drought persisted elsewhere, particularly in the western districts where *The Monitor* reported that 'drought extends all the way from Bathurst to Wellington Valley, and eighty miles beyond.'[15] The mid-1828 harvest 'produced scarcely grain enough for the internal wants of the people.'[16] The hopes of the Agricultural and Horticultural Society had been buoyed by rainfall towards the end of 1828, which broke up the soil enough to allow ploughing and cultivation to go ahead. This meant that 'considerable crops were got into the ground,' but unfortunately, in spring 1829 'the hoped-for rain vanished, the earth dried up so that the wheat, barley, rye, and oat crops sown were deprived of moisture, sufficient to cause more than one-half to vegetate.'[17] By October 1829 'every mind was filled with the dreaded alarm of famine' as empty barns and granaries were common features in New South Wales.[18] This lengthy drought, bringing the colony of New South Wales close to famine, provoked discussion about climate 'periodicity' within the colony.

**Conceptualising Australian Climate**

In the early decades of the 19th century, Australia's climate was often understood through favourable comparison to European countries like Italy or Spain, or through some aspects of British climate. It was a way for new arrivals to conceptualise the climate of a new continent. Ann Bourke, the daughter of the newly appointed New South Wales governor Richard Bourke, had arrived in Sydney with her family in 1831. Shortly after their arrival they experienced 'the only disagreeable part of this climate which is the hot northwest wind…The next day was like a beautiful summer's day in England. They say that these winds occur perhaps twice in the summer.'[19] Public servant Edward Deas Thomson, in an 1829 letter to his father written not long after his arrival in New South Wales, wrote that 'the climate is certainly very fine' and was adamant that there was 'nothing oppressive in the heat' experienced in Australia.[20] To him the 'nights are always cool and the air so pure and elastic that one's dreams of the Italian climate are more than realized in a fine moonlight evening such as we are now enjoying.'[21] Earlier in that same letter he had acknowledged Australia's infamous droughts, stating that they were 'the greatest drawback to its advancement'.[22] It was lamented in New South Wales that the colony would 'produce a great deal more food, clothing and commodities, than it does, if its seasons were as regular as those in England.'[23] By the 1820s and 1830s, a more complex picture of Australian climate had begun to emerge. While comparisons between the Australian climate and favourable aspects of Mediterranean and Western European

[15] 'Sydney Markets,' *The Monitor*, 19 April 1828, 1.
[16] 'Shipping Intelligence,' *The Sydney Gazette*, 11 July 1828, 2.
[17] 'Address by the President of the Agricultural and Horticultural Society,' *The Sydney Gazette*, 1 October 1829, 2.
[18] Ibid.
[19] Diary of Ann Bourke, 19 August – 27 December 1831, 8 December 1831,
Bourke Family - Papers [M1863], 1809-1855, in *Australian Joint Copying Project* 1809–1855, M 1863, 54, State Library of New South Wales (hereafter, SLNSW).
[20] Edward Deas Thomson, Letter 17 March 1829, in *Thomson Family Correspondence, 1827-1837*, ML MSS 7270, SLNSW.
[21] Ibid.
[22] Ibid.
[23] 'The Monitor,' *The Sydney Monitor*, 13 December 1828, 4.

climate were made, an understanding of marked climate variations and severe drought was emerging.

Despite the occurrence of scorching drought and damaging wet periods, the British opinion of Australia's climate and environment remained positive during the decades that followed. Letitia Wyndham, who lived in Britain and was the mother of New South Wales farmer George Wyndham, addressed the mythological status that the colony of New South Wales had attained in Britain stating: 'it would be difficult to persuade anyone in this country that there was a foot of bad land in New South Wales, they suppose it to be a fine rich alluvial soil producing almost without labour all that is necessary to the comfort and enjoyment of Man.'[24] This letter was written in 1829, towards the end of the 1826–1829 drought in New South Wales. While Letitia Wyndham did not directly mention climate, her statement is indicative of the way Australia's environment was portrayed in the United Kingdom, particularly to potential immigrants.

The precariousness of agriculture and the capriciousness of Australian climate could be swiftly forgotten when good rain set in after drought. Surveyor Felton Mathew, working in the Hunter River region near George Wyndham's Dalwood farm in January 1830, remarked:

> The scenery is everywhere of the same magnificent description - immense ranges and rocky hills 4 or 500 feet in height, enclosing level vallies, partly swamp, but still of the richest and most luxuriant alluvial soil and wanting only English capital and English industry to render them productive in the highest degree.[25]

With climatic difficulties out of sight, colonisation alone could transform the Australian landscape, wild and unutilised, to a region that was productive and useful for the colonists.

Despite these bold statements, the idea that Australia's climate was not entirely suitable for British agricultural practices was reaching England. Robert Dawson, the former company agent for the Australian Agricultural Company, also published an account of his experience in New South Wales. In his 1830 publication he noted that 'the failure of the last two harvests in succession, from drought and blights, with a similar prospect for the third…are well known to every one connected with the colony.'[26] Dawson alleged that few farmers were guaranteed agricultural success—those who settled along riverbanks and those who were granted only the best forest and lowlands could succeed.[27] The long 1826–1829 drought and multiple crop failures had shaken some British confidence in Australia's 'fine' climate.

Simple comparisons to a British summer were no longer enough to understand what the climate or weather of Australia was like and these comparisons could not be relied on in the future. British settlers were even starting to learn that similar rainfall in

[24] Letitia Wyndham, Dinton, October 28 1829, *Letters to George and Margaret Wyndham, 1827-1869*, ML MSS 190, CY 1069, SLNSW.
[25] Felton Mathew, 24 January 1830, Surveying Diary 1 Jan. 1830–13 Sept. 1832, *Diaries of Felton and Sarah Mathew, 1829–1834*, MS 15, National Library of Australia.
[26] Robert Dawson, *The Present State of Australia: A description of the country, its advantages and prospects, with reference to emigration: and a particular account of the manners, customs and condition of its Aboriginal inhabitants* 2nd Ed. (London: Smith, Elder and Co., 1831), 366.
[27] Ibid.

northern hemispheric countries would not have the same effect on livestock and agriculture if the rate of evaporation in the southern hemisphere was much higher.[28] *The Sydney Gazette* drew on its readers' knowledge of British landscape and climate to drive home their theory, noting: 'we understand, that in the year 1823 fell 35 inches of rain [in Sydney]…about the medium of the West Coast of Scotland and Ireland.'[29] Despite this similarity in rainfall with Ireland, *The Gazette* declared, 'how inadequate this quantity of moisture is for the useful wants of nature' in Australia.[30] *The Gazette* hoped that their published 'observations of these phenomena may determine some periodicity of season' to help them deal better with periods of drought.[31] Observations like these acknowledged that comparisons between Australian and British weather were flawed, and that a more nuanced understanding of Australia's weather and climate was needed to ensure pastoral and agricultural success.

Here we can also see that historical meteorological observations were being used to understand weather and climate in Sydney, and that this data was compared with observed rainfall in Ireland. Weather records were being kept in Sydney and other areas in New South Wales during the 1820s and 1830s. However, these records do not contain data for all years, and often only recorded some variables. For example, only barometric pressure and rain days were recorded in Sydney from 1826–1831.[32] In the 1788–1830 period, researchers have identified at least 12 meteorological records kept in New South Wales and Tasmania – ten and two datasets, respectively. Weather data was recorded by naval and military officers, astronomers, Colonial secretaries, interested amateurs and unnamed record-makers. Some meteorological records were kept daily, others monthly.[33] Despite the long-standing colonial interest in meteorology, numerical data does not appear to be the basis for the septennial climate theory that developed in Australia in the 1820s.

## An Emerging Climate Theory

By the end of the 1820s, nearly 40 years of European settlement had allowed long-term residents of Australia to notice and propose theories about climatic patterns. Settlers were developing a more nuanced understanding of Australian meteorology and climate variation, but it was their memories of weather and climate events, rather than quantitative data, that helped shape their theories. One of the most persistent and earliest climate theories in Australia was the 'septennial' theory of climate variation. This theory proposed that settlers in Australia could expect seven wet years, followed by a seven-year period of drought or below-average rainfall. This cycle (essentially a 14-year cycle, although it was never described as such) would then repeat itself.

Evidence of this theory as it pertained to Australian climate appeared in newspaper print as early as 1822, in *The Sydney Gazette*, as part of a letter to the Editor

[28] 'The Seasons,' *The Sydney Gazette and New South Wales Advertiser*, 10 March 1825, 2.
[29] Ibid.
[30] Ibid.
[31] Ibid.
[32] Linden Ashcroft, Joelle Gergis and David John Karoly, 'A historical climate dataset for southeastern Australia, 1788–1859,' *Geosci. Data J.* (2014), doi: 10.1002/gdj3.19, 4.
[33] Ibid.

from 'A Resident'. The author noted that 'the oldest inhabitants of this Colony have observed an alternate succession of septennial drought and moisture' and believed that the latest 'period of moisture' was coming to an end. The 'Resident' also remarked that 'the years of moisture commenced with the flood [in the Hawkesbury River] of 1805, and continued to 1811.'[34] In private letters written in 1824, farm overseer Michael Hindmarsh explained:

> I have been informed by people that have been in the Colony for many years that the droughts and wet seasons prevail for 5 or 7 years in succession and I am inclined to believe it as I have experienced two years of very dry weather in the dry seasons.[35]

This material indicates that the theory was possibly widespread and popular in New South Wales' society, appearing in newsprint, published works and private letters over a number of years.

A flurry of reports about the 'septennial' phenomenon surfaced in 1828 and 1829, inspired by the long and difficult drought in New South Wales, which lasted from 1826–1829. Sydney newspaper *The Monitor* was hoping that the current 'droughty sextennial/septennial' would be coming to an end, and that with 'every new moon, it will, by a fall of rain sufficient to flood the Hawkesbury [River] once more.'[36] Following the 1820s drought, the beginning of the next rainy seven-year period was highly anticipated and used as a cue for when serious farm work could resume. A report in *The Sydney Monitor* from the Australian Agricultural Company at Stroud, north of Newcastle in New South Wales, detailed the problems that the station experienced due to drought. By October 1828, an estimated 200 acres of unfenced wheat was killed by cattle, kangaroos and the effects of drought. Subsequently, it was thought unwise to 'plow and sow any more, until the rainy septennial sets in'[37] and to not do so would be a 'useless investment of capital and labour.'[38] *The Monitor* was a strong proponent of this septennial theory, often mentioning the seven-year cycle as one of the environmental disappointments that one could expect from Australia. According to this newspaper, 'besides a poor arid soil, [New South Wales] is afflicted with extremes of drought and flood every seven years.' [39]

Editorials published in *The Sydney Monitor* throughout 1829 dared to challenge the idea of New South Wales as a bounteous food bowl for the world, writing that:

> 'The crop of wheat in England varies from 20 to 40 bushels…The average crop of New South Wales during the rainy septennial, may be estimated at 20 bushels – during the periodical four years of droughty weather, about ten…Thus, England is a populous and great Country. New South Wales can never *by farming*, be either.'[40]

[34] 'To the Editor of the Sydney Gazette,' *The Sydney Gazette and New South Wales Advertiser*, 9 August 1822, 4.
[35] Michael Hindmarsh, *Michael Hindmarsh Papers, 1824–61*, Letter, 21 September 1824, CY 1678, ML MSS A 3164, SLNSW.
[36] 'The Monitor,' *The Monitor*, 19 April 1828, 4.
[37] 'The Monitor,' *The Sydney Monitor*, 4 October 1828, 5.
[38] Ibid.
[39] 'The Monitor,' *The Sydney Monitor*, 13 December 1828, 4.
[40] 'The Sydney Monitor,' *The Sydney Monitor*, 25 July 1829, 2. Italics in original.

The initial optimism attached to Australia's perceived climate was beginning to wane in the face of prolonged drought that reduced the effect of wet seasons. The *Colonial Times* newspaper in Hobart, Tasmania, published its support of the *Sydney Monitor* editor Edward Smith Hall and what they called his 'honest candour'. The *Colonial Times* joined the *Sydney Monitor* in criticising the New South Wales Agricultural Society for down-playing the true state of New South Wales' climate and weather, who they claimed had used 'artifices and efforts to beguile the British Public to settle in that Colony.' The *Colonial Times* remarked:

> 'Why conceal from the British Public and the world at large, that New South Wales is subject to periodical drought, and inundating rains alternately, like the Cape of Good Hope, the River Plate, and Ancient Syria and Palestine? … Why should a society of Philosophic and Scientific Men, seem to juggle and be guilty of trickery or silent prevarication, equally tending to deceive many ignorant British adventurers, who may be desirous of becoming our fellow Colonists.'[41]

Where Australia's climate was previously compared to a British summer and to highly productive tropical zones, it was now compared with arid regions or regions with quite variable climates. Climate reality had caught up with climate myth, and threatened to dissuade valuable immigrants from making a life in Australia.

The septennial, and other theories of rainfall variation, were formalised versions of the folk knowledge of climate and weather; experienced, remembered and passed on by the colony's 'oldest settlers.' In October 1829, *The Sydney Monitor* heralded the end of drought noting: 'We trust that as the droughty septennial expires at Christmas, according to forty years experience which old settlers have had of the climate, this fall of rain is only the prelude to a thorough breaking-up of the drought; which, with more or less severity, the Colony has now been visited with three years.'[42] Writing in 1830, after the drought broke towards the end of 1829, *The Monitor* expected that the wet phase would be long-lasting, and even rescinded their negative advice to future Colonists, but only for a set period of time: 'The coming harvest, and the abundance which may now be expected for ten years to come, causes us to begin to think of recommending the Colony to emigrants…we can and shall recommend it strongly to emigrants for the next seven years.'[43] The drought had broken not long after *The Monitor* predicted it would, vindicating their folk theory and offering hope that future immigrants could achieve agricultural and pastoral success during the intermitting wet 'septennial'.

The septennial theory was not just confined to the pages of Sydney newspapers – by 1830 it reached an international audience through published works. In Edward Smith Hall's 1830 publication, *The State of New South Wales in December 1830*, the climate theory that he so often expounded in the local New South Wales press was now available to potential immigrants and the interested British public. Smith Hall (the editor of *The Sydney Monitor*) remarked that forty years of experience had 'shown that our seasons are septennial. Seven years of dry weather have hitherto been found to succeed seven of wet.' However, he also argued that, in the 19 years he had lived in New South Wales, the

[41] 'Colloquial Answer,' *Colonial Times*, 12 June 1829, 3.
[42] 'The Weather,' *The Sydney Monitor*, 17 October 1829, 3.
[43] 'A Good Thing!' *The Sydney Monitor*, 9 October 1830, 2.

drought had 'never yet been extreme.'[44] It is obvious that Smith Hall had experienced a severe drought, and that his newspaper remarked often on the septennial theory while fervently hoping that a wet cycle would bring an end to that drought. Smith Hall does state, however, that had settlers in New South Wales irrigated their land 'from wells, tanks, and rivers, as is pursued by the farmers, gardeners, and vineyard dressers of Spain, Italy, and Portugal, the effects of our droughts on all our most valuable crops, might have been partially avoided.'[45] Smith Hall may have been reluctant to accurately depict the severity of Australian drought, as negative reports of severe drought could deter potential immigrants. However, it appears that Smith Hall believed the effects of drought could be greatly tempered through efficient water management technology – something that had been sorely lacking in the Australian colonies in the preceding forty years.

Interestingly, Smith Hall's *The State of New South Wales in December 1830* was not a standalone book. Rather, it formed part of a wider discussion sparked by an 1829 publication authored by Edward Gibbons Wakefield, the colonial immigration promoter, titled *A Letter from Sydney.* At the time of publication, however, the authorship of this book was widely attributed to one of Wakefield's associates, Robert Gouger. Wakefield and Gouger asserted that 'in all that has been written of the un-timbered, grassy regions, and the glorious climate of Australasia, there is not a word of exaggeration.'[46] In *A Letter from Sydney*, 'drought' is mentioned only once and is framed not as a natural feature of Australian climate, but simply the effects of mismanagement, labour shortage and ignorance of irrigation techniques:

> Englishmen being used at home to consider water an enemy, and to exercise much skill in getting rid of it, are ignorant of the means by which, in countries where the sun exerts great power, water becomes the first agent of production. When an Englishman, therefore, laments over the blasting effects of drought in New South Wales, he should be reminded that in Italy, Greece, and Asia Minor, 'the dry season' is the season of vegetation. But it is not owing to their ignorance only that Englishmen in New South Wales have neglected the management of water. It is owing, principally, to the scantiness of their number in proportion to the soil at their disposal.[47]

Smith Hall, in his *State of New South Wales* publication, agreed with Gouger and Wakefield's assessment of water management and the productive potential associated with widespread irrigation. He did, however, use his publication to clarify or further explain the cyclical nature of dry and wet periods in the colony of New South Wales, alerting potential immigrants to the septennial theory and tempering Wakefield and Gouger's references to Australia's 'glorious' climate.

Historian Tony Rogers delves into the phenomenon of climate 'puffery' or climate 'boosterism' in his history of weather and the settlement of South Australia. Rogers argues that for South Australia to flourish and establish as a colony from the mid-1830s, the South Australian Company had to resort to climate 'puffery' to lure potential immigrants from the United Kingdom. This 'puffery', which accompanied promotions in

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[44] Edward Smith Hall, *The State of New South Wales in December, 1830 : In a Letter* (London: Joseph Cross, 1831), 4.
[45] Ibid.
[46] Edward Gibbon Wakefield, edited by Robert Gouger, *A Letter From Sydney, The Principal Town Of Australasia* (London : Joseph Cross, 1829), 70.
[47] Ibid, 120.

the early 1830s, would counter the established knowledge of Australian weather and climate as variable and prone to serious, desiccating droughts. The South Australian Company argued that 'warm summer days were followed by cool nights, [and] the droughts that were reported from New South Wales did not affect South Australia,'[48] even though there was no evidence to prove otherwise. Robert Gouger, who was by then the secretary of the South Australian Land Company and the South Australian Colonization Commission, was now using the history of recurrent drought in New South Wales as a twisted tool of immigration propaganda, designed to draw potential settlers away from New South Wales and to establish homes in South Australia.

During the 1830s, Australia's recurrent lengthy droughts were also acknowledged in general emigration guides. Henry Carmichael's 1834 publication *Hints Relating to Emigrants and Emigration* acknowledged that 'long continued droughts' occurred in Australia, with calamitous results, but Carmichael attempted to couch these significant problems in positive terms. Periods of drought would act as a learning curve, with 'every succeeding year…adding to the experience which enables the settler to counteract more effectually so serious a calamity, and extending the cultivation so as to lessen, every succeeding season, the probability of their general or very extensive recurrence.'[49] Here Carmichael acknowledges the climatic difficulties that settlers faced in New South Wales, and could expect to face in the future, while also acknowledging that British settlers were still adapting to an unknown climate.

Writing of drought in 1835, *The Sydney Gazette* reminded its readers of the benefits of irrigation:

> 'We have frequently directed the attention of settlers who reside contiguous to rivers, to the advantages that might be derived from adopting the process of irrigation, which is found to be attended with such complete success in other parts of the world. In a country so subject as this is to the periodical visitation of so disastrous a calamity as drought, it might surely be expected that every precaution would be taken even partially to avert its consequences.'[50]

It is clear from *The Gazette's* statement that there was discussion in the colony about drought mitigation and adaptation measures and an understanding that drought would return to Australia periodically. However, the article also shows that even six years after the end of the previous drought, drought-relieving irrigation techniques were not widely implemented.

## The Origins of Periodicity Theories in Colonial Australia

While the septennial theory was discussed in south-eastern Australia during the 1820s, the specific origins of this particular theory is unclear. It is possible that the septennial climate theory is connected to Judeo-Christian ideology, in which the number seven is prominent. Most relevant to the septennial theory, is Chapter 41 in the Book of Genesis,

[48] Tony Rogers, *Weather and the Science of Settlement: South Australia 1836–1860* (Australian Meteorological Association: Kent Town, 2011), 15.
[49] Henry Carmichael, *Hints Relating to Emigrants and Emigration: Embracing Observations and Facts Intended to Display the Real Advantages of New South Wales* (London: D. Walther, 1834), 6.
[50] 'Drought,' *The Sydney Gazette*, 5 March 1835, 2.

the first book of the Jewish Torah and the Christian Bible. In this chapter, the Egyptian Pharaoh dreamt that seven plump, healthy cows appeared on the banks of the Nile, feeding on the grass. These were followed by seven gaunt, ugly cows, which proceeded to devour the plump cows. The biblical figure Joseph interpreted the Pharaoh's dream:

> God has shown to Pharaoh what he is about to do. There will come seven years of great plenty throughout all the land of Egypt, but after them there will arise seven years of famine, and all the plenty will be forgotten in the land of Egypt. The famine will consume the land, and the plenty will be unknown in the land by reason of the famine that will follow, for it will be very severe.[51]

The Pharaoh's dreams were a prophecy sent from God; after seven years of plenty, a devastating seven-year famine would follow. Joseph advised the Pharaoh to appoint overseers who would take a fifth of the grain produced in the productive years and store it. This would act as insurance against starvation during the lean years to follow.

The weather cycle theories of 18th and 19th century Europe evolved from a longer tradition of attempts at weather prediction or prognostication. Historian Jan Golinski's *British Weather and the Climate of Enlightenment* highlights these attempts. In Classical Greece, almanacs called *parapegmata* were used to track astronomical and weather cycles. *Parapegmata* were used for both predictive purposes and to guide daily activities. The publication and use of weather almanacs continued throughout the early modern period in Europe and in European colonies.[52] During the 18th century, however, there was a shift towards the systematic recording of weather. Golinski remarks that 'the program of systematic recording suggested new ways in which these seasonal patterns might be studied and methods of prediction perhaps devised.'[53] Golinski notes that, while those collecting weather data in 18th century Europe did not always use their data to make weather predictions, 'the aspiration to predictability was inherent in their enterprise.'[54] The weather cycle theories in the 18th and 19th centuries built on a long tradition of attempts at weather prediction.

Katharine Anderson's history of Victorian-era meteorology indicates that weather cycle theory, connecting economic data and climate data, had also emerged during the 1820s in the United Kingdom.[55] In 1829, George Mackenzie, a lieutenant in Scotland's Perthshire militia, derived a 54-year weather cycle theory from his 'Register of the Weather', a registry of meteorological data collected in Dornoch, Scotland, from 1803. In this instance, Mackenzie's theory was developed through the practice of recording, compiling and analysing data – 'daily and hourly observations…were inserted at the time of observation, and the Register is still continued in the same manner; so that each day's recorded observations include what may be termed a natural history of the appearance and operation of the elements for the time.'[56] Sean Munger's paper in this volume

[51] Genesis 41:28–31, *The Holy Bible*, English Standard Version (Crossway: Wheaton, Ill., 2001).
[52] Jan Golinski, *British Weather and the Climate of Enlightenment* (Chicago: The University of Chicago Press, 2007), 92.
[53] Ibid, 96.
[54] Ibid, 107.
[55] Katharine Anderson, *Predicting the Weather: Victorians and the Science of Meteorology* (Chicago: The University of Chicago Press, 2005), 154–155.
[56] George Mackenzie, *Manual of the Weather for the Year MDCCCXXX: Including a Brief Account of the Cycles of the Winds and Weather, and the Circle of the Prices of Wheat* (Edinburgh: William Blackwood, 1829 and London: T. Cadell, 1829), 12.

highlights the work of the early 19th century 'weather watchers' George Mackenzie and British chemist Luke Howard. In 1818, drawing on personally-collected weather data, Howard proposed that climate patterns in Britain followed a 17-year cycle. By 1841, Howard had refined his cycle to 18 years.[57] While the British in Australia had been recording weather data since their arrival in 1788, it is not evident that they were relying on data to develop the septennial theory of periodicity during the 1820s in the way that Mackenzie and Howard were during the same period.

A septennial theory was also evident in early 19th century sea-lore. For example, when ships were delayed, *The Monitor* expressed fears the vessels had struck icebergs. It was noted in the report that sailors familiar with the south seas alleged that icebergs were more numerous in the lower latitudes 'every seventh year, than during the other six.'[58] The article remarked that 'there appears to us some affinity between this fact and the drought and rainy seasons of New South Wales which are also sexennial or septennial.'[59] It is not clear, however, whether this aspect of sea-lore contributed to the development of the septennial theory or was merely coincidental.

The septennial theory that emerged during the 1820s was one of the earliest conceptual theories in Australian meteorology but it does not appear to have been informed by either quantitative or qualitative data. Over the course of the 19th century, as more weather and climate data was collected, the seven-year theory was competing with other attempts to explain Australia's climate variations.[60] In 1877, Government Astronomer and meteorologist H.C. Russell compiled quantitative and qualitative weather data and proposed that different regions of Australia were subject to different patterns of variation. Russell remarked that 'the shortest is that which for many years pleased meteorological observers in Tasmania, viz., two years – a wet and a dry one alternately…but after some twenty or five-and-twenty years of regular recurrence, during which observers naturally thought it was fully proved and established, a change came.'[61] Russell noted that 'a period, however, of between six and seven years may be traced in our dry years a long way back; thus: 1872, 1865, 1858, 1852, 1845, 1838, 1832, 1826, 1820, 1814, 1808.'[62] Interestingly, he neglected to include some of the very dry years of the 19th century (missing the 1826–1829 drought entirely) and includes years that were not particularly dry like 1820 and 1832.[63] Russell, however, was not fully convinced by the septennial theory and stated that 'no period has found such general favour as that known as the sun-spots, or eleven-years period. Its advocates assert that meteorological

[57] See Sean Munger's paper in this issue.
[58] 'Domestic Intelligence,' *The Monitor*, 5 July 1828, 8.
[59] Ibid.
[60] The seven-year theory of climate variability persisted even into the 20th century: "The Nineteen-Year Drought Cycle," *The Queenslander*, 23 June 1900, 1184S; "Queensland's State Tenants," *The Brisbane Courier*, 14 August 1902, 10; "A Cycle of Good Seasons," *The Advertiser*, 7 January 1909, 7.
[61] Russell, *Climate of New South Wales*, 170. For further analysis of H.C. Russell's theories about 'periodicity' see Don Garden, *Droughts, Floods and Cyclones: El Niños That Shaped Our Colonial Past* (North Melbourne: Australian Scholarly Publishing, 2009), 251–253 and Emily O'Gorman, "Soothsaying" or '"Science?": H. C. Russell, Meteorology, and Environmental Knowledge of Rivers in Colonial Australia,' in *Climate, Science, and Colonization*, 177–194.
[62] Ibid.
[63] J. Gergis and L. Ashcroft, 'Rainfall variations in south-eastern Australia part 2: a comparison of documentary, early instrumental and palaeoclimate records, 1788–2008,' *International Journal of Climatology* 2013 (33:14), 2973–2987.

phenomena vary as the area of spots on the sun's surface.'[64] By 1896, Russell had proposed another theory of wet and dry periodicity, this time in a nineteen-year cycle.[65] Russell's work, continuing into the late 19th century, built on the first hand weather knowledge and data collected by government officials and independent observers and reflects the struggle of British settlers in Australia to ascribe patterns to an erratic climate.

## Conclusion

Meteorological records were kept in the Australian colonies of New South Wales and Tasmania, and had been kept in Australia since the arrival of the British in 1788. Despite the availability of numerical weather data in Australia and colonial interest in recording weather data during the first forty years of British settlement, climate was not often understood or examined using the quantitative meteorological data that had been accrued and, in many cases, shared publicly. Despite this, meteorological theories regarding climate 'periodicity' or the cycles of wet weather and drought in Australia were proposed. The septennial theory formalised settlers' memories of weather and climate and provided a proto-framework for understanding the quite variable climate of an unfamiliar country. This was one of the earliest discussions of 'periodicity' of wet and dry periods in colonial Australia, pre-dating by over forty years the more rigorous discussions that took place in colony.

Public discourse surrounding the septennial theory and the regular recurrence of lengthy periods of drought cemented these years-long droughts as a cyclical feature of Australian climate, rather than an aberration or a one-off event. For British settlers, drought had become a potentially recurrent feature of future climate. This prompted discussions in the late 1820s and early 1830s about the need to implement innovative water management techniques, inspired by the irrigation habits of people in arid climates around the world. While the theory that New South Wales, in particular, was subject to an alternating seven-year period of drought, followed by a seven-year period of good rainfall, was not widely accepted, the discussions about septennial theory sparked wider public discourse about recurrent drought events. However, the discussions do not appear to have incited widespread change in the way water was managed or inspired British settlers to prepare for potential future droughts. Despite this, the discussion of Australian climate and septennial theory marks an important moment in Australian meteorological history and understanding.

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[64] Russell, *Climate of New South Wales*, 172.
[65] Emily O'Gorman, "Soothsaying" or '"Science?": H. C. Russell, Meteorology, and Environmental Knowledge of Rivers in Colonial Australia,' in *Climate, Science, and Colonization*, 177–194.

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