

William Stanley Jevons and the climate of Australia

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(Manuscript received October 1997; revised March 1998)

William Stanley Jevons published the first thorough and scientific study of the climate of Australia, in 1859, after only five years in Australia (working as an assayer for the Mint in Sydney). Excerpts from the Jevons study, along with comments on his conclusions from a late twentieth century perspective, are provided. Jevons was a most remarkable person, with an inexhaustible curiosity and a highly developed intuitive sense for recognising patterns in sparse datasets. Brief descriptions of Jevons's other contributions to economics, logic, the philosophy of science, statistics, and photography, are provided, along with some biographical information.

Introduction

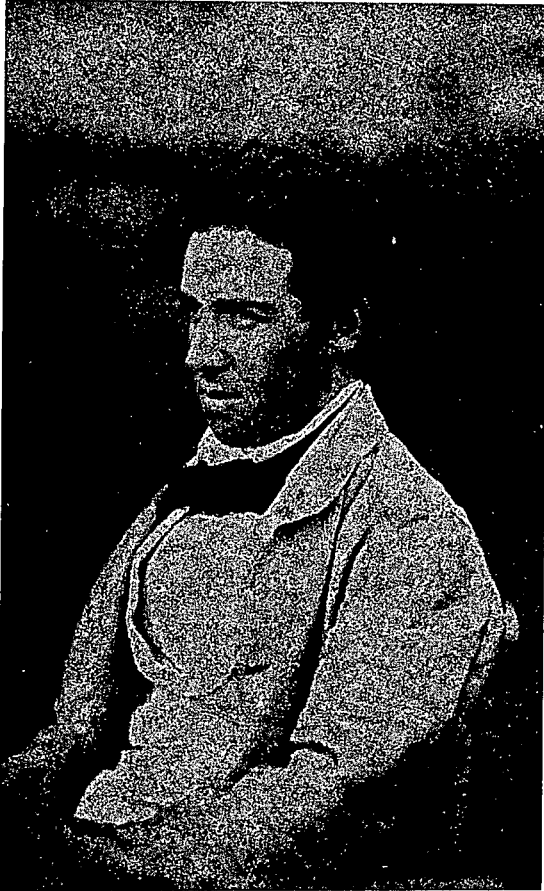
The first thorough description of the Australian climate was published in 1859 by William Stanley Jevons, a gold assayer at the Sydney branch of the Royal Mint (Fig. 1). Jevons was described by Lord Lionel Robbins as 'one of the great Englishmen of the nineteenth century' (Robbins, 1932), not because of his meteorological work, but because he developed what has become known as the marginal utility theory of value, and because of his contributions to statistics and logic. His writings on economics were so well regarded that Lord Maynard Keynes delivered a centenary lecture on Jevons's life and work as an economist and statistician (Keynes 1936). Inoue and White (1993) provide a complete bibliography of works published by Jevons.

Jevons developed his initial interest in economic questions during five years he spent as a young man in Sydney (White 1982), and his first empirical work in economics seems to have been inspired by his interest in meteorology during his stay in Sydney (Stigler 1982). He interrupted his studies in natural sciences at

University College, London, in 1854 to take up the assayer position in Sydney. After five years in Sydney he returned to London where he soon completed two seminal papers: 'General mathematical theory of political economy' and 'A serious fall in the value of gold'. He was appointed to a chair of political economy at Owens College, Manchester in 1866 and moved to University College, London, in 1876. His other notable works include *The theory of political economy* (1871) and *The state in relation to labour* (1882). Keynes deemed the *Theory* the 'first modern book in economics' (Keynes 1936). Jevons also made major contributions to statistics and logic - he was the first person to use the word 'Contrapositive', a term in formal logic meaning a conditional statement derived from another by negating and interchanging antecedent and consequent. His *Principles of Science* (1874) synthesised the informal inductive logic of John Stuart Mill and the formal deductive logic of George Boole and Augustus De Morgan, and foreshadowed modern discussions on the philosophy of science and the scientific method (Schabas 1990). He built a 'Logical Machine' to mechanise the operations of logical inference (Kassler 1996). Gardiner (1958) calls it 'the first of its kind'.

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Fig. 1 Photograph of William Stanley Jevons from a photograph taken in Australia on 6 February 1858.



His contributions to statistics were considerable. He demonstrated the value of the geometric mean over the arithmetic mean, introduced the use of a chart with a logarithmic vertical scale for charting proportional changes in prices (a chart now referred to as a 'ratio chart'), documented the problems involved in the construction of index numbers (index numbers include, for example, the consumer price index), and devised statistical means of examining time series for secular trend, seasonal variation and cyclical fluctuations (FitzPatrick 1960). Jevons also appears inadvertently to have been the inspiration for Francis Galton's introduction of the word 'correlation' in its modern statistical sense (Stigler 1978). Jevons is also remembered for the theory that sunspot cycles produced business cycles (Sparkes 1974; Peart 1996). His last published paper, prior to his death, was on this theory (Jevons 1882). Jevons was a member of the Statistical Society of London (and its honorary secretary from 1877 to 1880), and the Manchester Statistical Society.

One of his early attempts at an index series was to count and classify (by date and type) all the published works of Shakespeare, as an early social indicator (Stigler 1982):

As these works are universally allowed to be the best ornament of the English language, it seemed likely that the comparative degrees of attention bestowed upon them at different periods would afford some measure, or at least some imperfect indication, of the degree of good taste then prevailing (Jevons 1864).

Many of his economic works used what we now call time series. He was influential in inspiring greater use of such diagrams, instead of the tabulations previously in common use. These diagrams were analogue's of meteorological time series and he even referred to their focus as the study of the succession of 'commercial storms' (Stigler 1982). Stigler noted that:

Jevons's diagrams may not be the first of their kind – Playfair antedated him by over seventy years – but they may well be the finest and the most fruitful.

The groundwork for many of his later contributions was laid during his time in Sydney as a young man. His duties at the Mint in Sydney were not arduous – he wrote in a letter in January 1857 that:

I should not wonder if several days of each week I am not occupied over the assays more than half an hour per day; but I nearly always attend the full six hours, and fill up the time by preparations for larger numbers, or various things of my own (Black 1973, p. 261).

These 'various things' included meteorology as well as economic and social issues. Jevons was the Meteorological Observer for the *Empire*, a newspaper owned by Henry Parkes. He had two scientific papers presented to the Philosophical Society while in Sydney, one on clouds, the other describing a sun-gauge. He was very shy, and had the papers presented by a more experienced colleague, Dr John Smith. At the end of his university career, many years later, he wrote:

Sometimes I have enjoyed lecturing, especially on logic, but for years past I have never entered the lecture room without a feeling probably like that of going to the pillory (quoted in Keynes (1936)).

On the occasion of the reading of his sun-gauge paper he noted in his diary:

In evening to Philosophical Society, where I put a very good face upon the matter and heard my paper read by Dr Smith; no question being asked I got through the evening with great composure (quoted in Black and Könekamp (1972)).

Jevons was not sure why he became attracted to meteorology, as he points out in a letter in October 1856:

I am, however, awfully deep in Meteorology at present. I cant [sic.] say exactly why, but I began it near-

ly two years since and having invested something like £60 or £70 in apparatus, feel bound as well as well-inclined to follow it up while I am in Australia. (Black 1973, p. 244).

The paper by Jevons on clouds (Jevons 1858) describes the use of an instrument he constructed and called a 'section-glass' to make 'miniature representations' of clouds. He used this to reproduce and explain various cloud forms. His work was a convincing demonstration that these forms were the result of simple dynamical causes, and that it was 'unnecessary to suppose that electricity possesses any active agency in the production or modification of clouds'. This paper seems to have been the first to entirely discard electricity as having a role in cloud formation. At the time, electricity and magnetism were often advanced as explanations of meteorological phenomena. Jevons, in this paper, notes:

The new work of Lieutenant Maury on the "Physical Geography of the Sea" contains one of the worst examples of these vicious theories; for the safest conjecture which he can offer, as the result of the splendid system of observation of which he is the head, is that the winds are probably directed in their course by terrestrial magnetism. As a general rule we may look upon all electrical theories as utter nonsense.

In the same paper, Jevons observed what are now called salt fingers and known to be due to double diffusion (Schmitt, 1995a, 1995b). Jevons, in a letter to his cousin in 1858; with respect to this paper, observed that 'I am quite reconciled to the expectation that every thing which I have said will be attributed to some previous writer or adopted by some subsequent one, so that I shall be quite shorn of all credit'. In the case of the salt fingers Jevons was correct in his expectation – until recently Melvin Stern (1960) has been credited with the discovery of double diffusion.

Later, on his return to London, Jevons (1861) demonstrated that the well-known tendency for rainfall to be greater at the ground level than at higher elevations was attributable to wind (Hughes et al. 1993). Until Jevons, many meteorologists believed this tendency indicated that 'part of the rain which falls upon the surface of the earth does not proceed from the clouds, as we should naturally suppose, but is derived from the lower strata of the atmosphere' (Jevons 1861, p. 421). Jevons constructed a glass-sided wind tunnel, and observed wind flow over obstructions by using smoke as a marker. He showed that a rain gauge acts as an obstruction, causing the wind to speed up over the top, thereby carrying some drops beyond the gauge and reducing the catch. Since this demonstration by Jevons there have been many attempts to reduce the problem caused by wind, and also to standardise the height of gauges and their exposure.

Jevons explored Sydney thoroughly, and wrote extensive descriptions of the various parts of the town. He went on several extended excursions, including to the gold fields, and again wrote these up. He was devoted to music, and wrote a book on the field (Kassler 1996). As well, he was a pioneer of wet-plate photography in Australia and took a large number of photographs of friends and places in Sydney and the surrounding area. The excellence of his work was recognised by the presentation to his son of a medal, by *Australasian Photo-Review* in 1954, 'in recognition of the excellence of his photography during the years 1857 and 1858'. His photographic work is described by Burke (1955). The National Library of Australia holds a microfilm master of his photographs.

The topic of the present paper, however, is not his photography, nor his economics studies, nor his meteorological reporting, nor his scientific papers, but his attempt to provide as complete a description of the Australian climate as was possible given the limited amount of data available to him (Jevons 1859a). I will describe some of his speculations, and how they have stood the test of time. Jevons provided some remarkably accurate descriptions of climate fluctuations in this country, based on very limited data. Perry (1966) briefly discussed some of Jevons's description of the climate; the intention here is to provide a fuller account, and to examine Jevons's conclusions from a late twentieth century point of view. Few copies of his description of the climate (Jevons 1859a) appear to exist – it seems appropriate to provide a relatively complete description, to document what Jevons first noted about the climate of Australia.

While in Sydney, Jevons wrote - in a letter to his sister in England – the following analysis of his own powers:

I have scarcely a spark of imagination and no spark of wit. I have but a poor memory, and consequently can retain only a small portion of learning at any one time, which great numbers of others possess. But I am not so much a storehouse of goods as I am a machine for making those goods. Give me a few facts or materials, and I can work them up into a smoothly-arranged and finished fabric of theory, or can turn them out in a shape which is something new. My mind is of the most regular structure, and I have such a strong disposition to classify things as is sometimes almost painful. I also think that if in anything I have a chance of acquiring the power, it is that I have some originality, and can strike out new things. This consists not so much in quickness of forming new thoughts or opinions, but in seizing upon one or two of them and developing them into something symmetrical. It is like a kaleidoscope; just put a bent pin in, or any little bit of rubbish, and a new and symmetrical pattern will be produced (quoted in Keynes (1936)).

His ability to take a few facts and 'work them up into a smoothly arranged and finished fabric of theory' is evident in his discussion of Australia's climate.

'Some data concerning the climate of Australia and New Zealand'

This was the title of the 52-page section contributed by Jevons to Waugh's *Australian Almanac for the Year 1859*. The section is divided into seven chapters. I will briefly highlight the more interesting conclusions reached by Jevons. He described his intention thus:

My object has been to present in an available form such accurate numerical data as are attainable, and secondly, to group together general information as to the winds, rains, rivers, floods, the geographical features of the country, and the meteorological circumstances of this part of the globe, so as to show what remarkable problems have to be solved, and what interesting connections of cause and effect may ultimately be traced and proved (p. 96).

Chapter I. Temperature of the air in Australasia

The first task Jevons undertook was to estimate the mean annual temperature for most of the Australian settlements. He recognised that he could not just quote mean annual noon temperatures to represent the mean temperature, as others before him had, but needed to estimate the diurnal cycle of temperature and use this to adjust noon temperatures. He used hourly temperatures at Hobart and Sydney and found that the adjustment necessary to estimate mean daily temperature from noon temperature was approximately the same in both locations. He then assumed that this adjustment will apply elsewhere and used it, with noon temperatures at other locations, to estimate mean annual temperatures. In this way he was able to produce the first estimate of mean annual temperature at 16 locations, each with only a few observations taken at noon. The estimates seem quite good, although different exposures at the time mean they are not exactly comparable to 20th century observations (Nicholls et al. 1996). Jevons then compares the temperatures in Australia with those in Europe concluding, for instance, that the east coast is comparable with Portugal.

Jevons includes a table showing 16 years of annual mean temperatures at Sydney, and shorter periods of observation at Hobart, Port Macquarie and Melbourne. He compares the range of annual mean temperatures at these locations with the variations in Geneva, Paris and London. He concludes that:

The following table is of interest, because it shows, as I think, that the annual mean temperature is almost invariable in Australia. If this prove true, after a prolonged series of observations, it will, in conjunction

with the extremely variable character of the annual rainfall, be an important fact with regard to the Meteorology of the Southern hemisphere (p. 50).

The years following Jevons's observation, through to the end of his century, suggest that there may be some truth in this. The mean annual temperature at Sydney ranged from 16.6°C to 17.9°C between 1859 and 1900. Over the same period Geneva's mean annual temperature ranged from 8.4°C to 10.8°C. Of course this difference may simply reflect the maritime nature of Sydney's climate. No one, to my knowledge, has done an exhaustive examination of the relative interannual variability of temperature.

Jevons proceeded to determine that the daily range of temperature in Sydney was large relative to that at Greenwich, but that the extremes of heat and cold were not as great as in London. This latter result was, apparently, 'contrary to general opinion'. Jevons used reports from Sturt and other explorers to demonstrate that in the interior the fluctuations of temperature are 'immensely increased'.

Chapter II. Rain in Australia

Jevons was often poetic in his use of language:

Rain is, as it were, an accidental product of the atmospheric commotions which the Meteorologist studies; it is pretty constantly formed, but the how, the when, and the where no one attempts to say. It is like a sediment falling from a stream of water; every little cranny of the channel, every little eddy of the stream, arrests the sediment or leaves it to be borne away (p. 52).

He used the limited data available to describe the annual rainfall totals and the seasonal distribution around the coast. He contrasts the frequency of rainfall events at Sydney and London thus:

Any one who is acquainted with the usual weather both in London and Sydney, will scarcely be satisfied when told that for every 17 rainy days in London there are 14 in Sydney. His impression will be that the comparatively fine and sunny weather of the southern land is not fairly expressed, and I think this is so. By examining more closely we should find that the showers of rain are more heavy and quick in Australia and that this is a distinction of no slight importance (p. 56).

The first Europeans were surprised at the intensity and variability of the Sydney rainfall (Tench 1793; Nicholls 1988a). Jevons seemed to be the first, however, to demonstrate that the interannual variability of rainfall was large. This high variability is now, of course, well known and attributed to the effect of the El Niño - Southern Oscillation (Nicholls 1988b). Jevons stressed that the rainfall over Australia was highly variable, from year to year:

I shall have to show in the course of this part of the work that the Australasian climate is one of irregular rains, and is thus distinguished from most climates where the rains are pretty equable and constant although less in total amount (p. 56).

Jevons reached this conclusion from only 18 years of data at Sydney, with even fewer data at Port Macquarie, Hobart and Melbourne. He 'failed to detect in the variation of these 18 yearly results for Sydney, any law, or regular recurrence whatever'.

Jevons noted that Western Australia did not appear to suffer from long droughts as was the case in the rest of Australia, so that 'we may perhaps conclude, that the climate of this part, shows less variations in the yearly rainfall than the climate of the other colonies' (p. 60). He also observed that Hobart and Melbourne appeared less variable than the east coast. Recent work indicates that the annual rainfall is indeed less variable in the southwest corner and along the south, relative to other parts (Nicholls et al. 1997).

Chapter III. History of the floods and droughts of New South Wales

Jevons was the first person to construct a comprehensive history of flood and drought for the colony. Jevons used information from the earliest explorers as well as newspaper reports and other documentary sources. He found that floods were most frequent in autumn and least frequent in summer, and concluded that:

Those sudden and excessive falls of rain, therefore, which occasion floods conform themselves pretty nearly to the same law which governs the average amount of rain falling in each season. This adds probability to the assumption which will be necessary in the following discussions that the frequency of floods during any period indicates a large total rain-fall during the same period (p. 76).

Chapter IV. Periodicity of floods and droughts discussed

Jevons, although shy in person, was not so reticent in print, for instance:

Climate, indeed, is a subject upon which the most extravagant and unreasonable statements are made. Not only do many men, even of much scientific information, imagine that within the short scope of their own recollection they can detect a permanent change in weather or some other phenomenon, which would involve a connected change over all the regions of the earth, but they even assert that man's muscular strength and mental ingenuity can effect such changes. The clearing away of trees they say will render a climate dry; extensive reservoirs of water may increase the moistures of the atmosphere (p. 79).

The possibility that reservoirs might result in the amelioration of the Australian climate surfaced again in the middle of the 20th century, with the Bradfield scheme to flood inland Australia (Commonwealth Meteorological Bureau 1945). The effect of massive tree plantings or clearings on the climate was a hot topic at the end of the 19th century (Nicholls 1997).

Jevons observed that there were a variety of observations suggesting that the climate of Australia had 'undergone great and long-prevailing changes', but finally concluded that '...the history of the Australian colonies comprehends only two complete and two incomplete climate periods' (p. 81). Jevons then provides the following table:

Period	Commencing	Terminating	Characterised by
1st	-	1798	Drought
2nd	1799	1821	Flood
3rd	1822	1841	Drought
4th	1842	not terminated	Flood

Jevons thought that these periods were somewhat suggestive of a periodicity in rainfall. He declined, however, from suggesting a possible cause: 'But it is interesting to consider whether the doctrine of chances and that alone may not govern many meteorological phenomena' (p. 82).

Chapter V. Watercourses of Australia

Jevons pointed out that the nature of Australian rivers reflected the high rainfall variability:

In general their high sloping earthy banks enclose but little water which lies at intervals in pools or long clear reaches. A feeble stream such as would not fill a moderate sized English ditch is all that often unites these pools, and during severe drought even the largest rivers (the Murray excepted) cease running, as is said, while the water in the holes and reaches, gradually sinks by evaporation (p. 85).

Jevons divided Australia into half, with a curved line stretching from the southeast to the northwest - west of this line 'may be truthfully described as riverless, so far as we at present know'. His wit surfaces again when discussing this line:

How intolerable is Australian Nomenclature! This supposed dividing line has a Glenelg river at each extremity, and it passes through one colony and near two large rivers named after Queen Victoria, all totally unconnected (p. 87).

He stressed the importance of this dividing line:

The Easterly and Northern portion has an abundant exterior and a large and most peculiar interior drainage; it comprehends the tropical region of summer rains, the Easterly region of autumn rains, and

the colony of Victoria which has a preponderance of spring and autumn rains; it is the part of Australia over which moist easterly winds, or a moist N. W. tropical monsoon blows; it is that part of Australia which is mostly explored and is in most places comparatively fertile and habitable.

The Westerly half of Australia is in all these respects the reverse. With the exception of the Swan, Torrens and a few inconsiderable rivers, its water-courses are small and filled merely during winter, when almost the whole of the annual amount of rain descends; it is a region where the wind seldom blows but from West and South, or where, as on the N. W. coast no decided wind prevails at all; it is a region almost totally unexplored, and probably quite uninhabitable (p. 87).

Chapter VI. The barometer

Jevons reported pressure observations taken by him, dismissing some other Australian observations because they were taken with barometers that had not been compared with a standard barometer. He reports a biannual cycle of pressure at Sydney, with minimum pressures in June and December, coinciding with the solstice months. April and August, near the equinoxes, showed the highest pressures. He did not find such a biannual cycle at Hobart, to his surprise.

Jevons also compared wind directions with pressure observations. He observed that the connection between rises and falls in the barometer and wind direction was more evident in Australia than elsewhere. These connections translated into forecast rules. So, in Sydney in summer:

So long as a moderate N. E. sea breeze or quasi-monsoon blows, the barometer will slowly fall; if it do not, which rarely happens, a continuance of gentle winds and fine weather will follow. When the barometer is falling rapidly, a N. W. current is approaching, which may produce either a hot wind or a thunderstorm, according to circumstances...

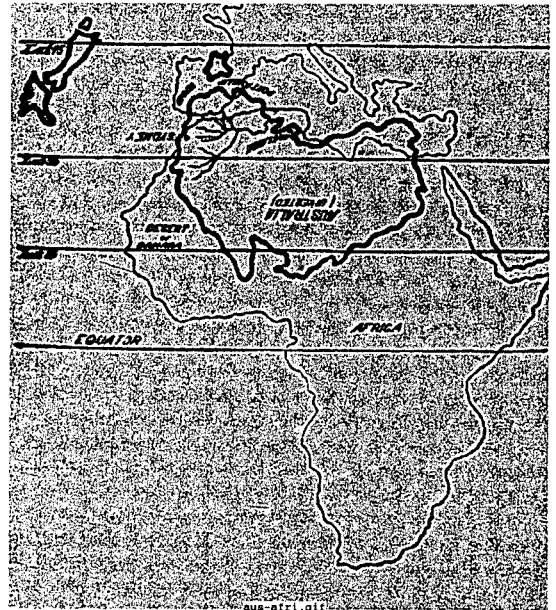
He reported similar relationships from Victoria. Jevons also reported observations by others indicating that during storms the barometer would fall when the wind was from the north and rose when the wind shifted to the southwest.

Chapter VII. Concluding remarks

This Chapter includes an inverted map of Australia and New Zealand placed on a map of northern Africa, to reveal the similarity in latitudes, and thus presumably in climate (Fig. 2). This technique has been used frequently since Jevons, but he appears to have been the first to use this device.

In this final chapter Jevons returned to the problem of the variable rains:

Fig. 2 Comparison of Africa and Australia (inverted), from Jevons (1859a).



The average rainfall is comparable with that of other countries, but what still remains as an anomalous fact is the extraordinary irregularity of the mode in which it falls (p. 95).

Jevons attributed the uniform temperatures and variable rainfall to the proximity of the oceans:

Australia is more sea-surrounded than any other large surface of land, and as it is only over the wide ocean that the winds perform their normal course, meteorology is perhaps a simpler problem in this land than any where else. From this freedom of the winds may follow the unusual constancy of the annual mean temperature; from their wide range and unrestricted supply we may be less surprised at the eccentricity of the rain-fall and at the large amounts which are from time to time precipitated, filling the rivers with torrents, and converting the plains into lakes (p. 96).

Present-day weather forecasters may be slightly surprised at Jevons assertion that 'meteorology is perhaps a simpler problem in this land than any where else'. He noted that:

These are all instances of the Meteorological simplicity of Australia, corresponding as one is tempted to exclaim, with its simplicity or monotony in other respects (p. 96).

At this point he was referring mainly to the fact that:

The rains of the interior plains are also simultaneous over a wide area. Some of the droughts have had a similarly wide extension (p. 96).

We now know that the wide expanse of droughts reflects the large-scale influence of the El Niño–Southern Oscillation, and the lack of detailed orography in the interior (Nicholls 1991).

Jevons attributed the droughts to the moisture bearing ‘monsoon-like summer wind’ on the southeast coast of the continent being ‘overpowered’ by the mid-latitude westerlies. This theory does not accord with our modern understanding of the role of the El Niño - Southern Oscillation. For a start, the droughts affect winter and spring perhaps more than summer. Secondly, during east Australian droughts the mid-latitude westerlies usually are weaker and further south than usual, so they cannot ‘overpower’ the easterly winds on the coast. If anything, the easterly component of the wind is stronger over southeast Australia during El Niño episodes (i.e., droughts) than otherwise (Drosowsky and Williams 1991).

Jevons concluded with a caveat on his tentative hypotheses regarding the Australian climate and its variations:

Let me grant that many of my conclusions are more speculative than necessarily true and logical...The patient observer will, in time, comprehend the subordination of innumerable perplexing details to a uniform, simple, and grand design, here as everywhere in Nature (p. 96).

Despite the length (50 pages) of Jevons (1859a), considerable material had to be omitted. This material, which was published elsewhere (Jevons 1859b, 1859c), included a chronology of hot winds and bush fires (back to 1827), a chronology of thunderstorms in New South Wales (back to 1788), and extensive descriptions of the wind systems affecting Australia.

Reactions of his contemporaries

Jevons’s article greatly impressed the local critics (La Nauze 1949). The *Sydney Morning Herald* called it ‘a most valuable and elaborate accumulation of facts relating to the climate of this part of the world’. The Rev. W. B. Clarke, one of the leading scientists of the time in Australia, referred at length to the authority of the Jevons’s study. Years later (after Jevons’s death) the New South Wales Government Astronomer, H.C. Russell, referred to the article thus:

This was the most valuable contribution to the meteorology of Australia that had been made up to the time of its publication; perhaps the most valuable chapter is that upon the history of the floods and droughts; but every part of it bears marks of most

careful work in consulting all the available data then known, and the clear and logical mind of its author...he presented the most concise and accurate account of the climate which had been written (Russell 1889).

Jevons clearly was a remarkably observant scientist, and his departure was recognised as a loss to the colony. The editors of the *Sydney Magazine of Science and Art* (January-February 1859, p. 161) noted:

We much regret to learn that Australia is about to lose this laborious and unassuming yet most promising natural philosopher. We fear it will be long ere we shall find another observer so industrious, so talented, and so modest.

So why did Jevons leave? He wrote to his sister in July 1858:

I do not know whether I have before explained why I desire at once to leave Sydney. It is because I believe my education is but now continuing, and that by staying here it is checked, and irretrievably deferred. I have gained many advantages by my residence at the Antipodes ... But I feel sure that a few additional years’ savings ... are far outbalanced by the irremediable injury to future fruits of greater value. I have done something here, but a change of life from easy to hard and busy, from Sydney to London, a better knowledge of the world both physical and human, the mixture with enlightened men and great objects ... are what I seek (quoted in La Nauze (1949)).

Earlier he had noted that:

of all the enervating employments perhaps a well paid Government post is the worst, and adding to this the isolation of colonial life the many difficulties in the way of study, and the few other pleasures which present themselves, and you have the sum of what I object to in my residence here (quoted in Black and Könekamp (1972)).

A few years later he concluded that:

it was a bold & momentous decision which brought me out of Australia. I shall not regret [it] even if my remaining days be spent in poverty (quoted in Schabas (1990)).

Concluding remarks

As we can see, many of the observations regarding Australia’s climate made by Jevons, based on very limited data, have proven to be correct, viz.:

- the highly variable rainfall
- the large spatial coherence of rainfall
- the similarity of Australian climate to that of Africa and southern Europe.

Jevons was only 24 years of age when he left Australia for good in April 1859. But he was right to have concluded ‘I have done something here’. Keynes

(1936) observed that Jevons's 'long period of solitary thought in Australia, at an age when the powers of pure originality are at their highest, had been abundantly fruitful'. While Keynes was thinking principally of Jevons's statistical and economic thinking, there is no doubt that his originality and hard work left a major achievement in climatology as well.

Although his involvement in meteorology occupied less of his time once he returned to England, he still continued to contribute articles on meteorology to various publications. He continued to recognise its uses, as in a letter to his brother (who, at the time was in America):

...if you intend to stay a year or more in Wayzata, I think Meteorology would prove very interesting to you and it is just that pursuit which fills up leisure time and demands no more drudgery or severe work beyond the adding up of many figures. (Black 1973, p. 404).

His later contributions in the fields of economics, logic, and statistics were well recognised by his peers. He was elected a Fellow of the Royal Society in 1872. In 1875 he received the honorary degree of LLD from the University of Edinburgh. In 1882, at the age of 46, he drowned while swimming.

The early death of such a man was a shock to many. His obituary in the Proceedings of the Royal Society of London (volume 35, 1883, i-xii) ran to twelve pages. The writer noted that:

...it is in his essays on the application of economics to the theory of governmental action that his full greatness is best seen. There is no other work of the kind which is to be compared to them for originality, for suggestiveness, and for wisdom.

The obituary described his character thus:

Jevons was a man as remarkable for modesty of character and generous appreciation of the labours of others as for unwearied industry, devotion to work of the highest and purest kind, and thorough independence and originality of thought.

Jevons's friend, the banker and poet John Mills, wrote two sonnets 'To W. S. Jevons (Drowned, August, 1882)', published in Mills (1897):

*DEAD! For the old pale mystery once again
Sits silent on cold lips. Mere swoon of will
Beneath, a tyrannous wave, - can such thing kill
At once the noble heart and strenuous brain...*

A final personal description of Jevons was provided by his younger colleague, H. S. Foxwell. He told Keynes (1936) that Jevons:

did not talk much, there never was a worse lecturer, the men would not go to his classes, he worked in flashes and could not finish anything thoroughly. The only point about Jevons was that he was a genius.

Acknowledgments

Laurie Long, Andrew Hollis, and Jill Nicholls, all at the National Meteorological Library provided invaluable help in obtaining obscure references to Jevons and his works. R. D. Collison Black, Raymond W. Schmitt, Margaret Schabas, Michael V. White, and Ian Castles all kindly guided me to many useful sources on Jevons. Willem Bouma, Dale Hess and David Jones provided helpful comments on earlier versions of this paper. The photograph of Jevons is from Black and Könekamp (1972) and is copyright, R. D. Collison Black and Rosamond Könekamp. It is reproduced with the permission of Professor Black and Macmillan Press Ltd.

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