OUTBURST OF SPRINGS IN TIME OF DROUGHT.

By W. E. Abbott, Wingen.

[Read before the Royal Society of N. S. Wales, September 1, 1897.]

The outburst of springs, and, as a consequence, the increased flow of water in creeks and rivers without apparent cause, just at the climax of a long continued and widespread drought, has occasioned a good deal of interest in New South Wales; and many theories have been offered in explanation through the press. As the phenomena were very pronounced on my own property at Wingen in May, up to which time there had been a rainfall of only about four inches, I carefully noted what was taking place, with the object of arriving at the immediate cause of the outburst, hoping by this means to be in a position to say whether it is or is not an indication of the termination of drought conditions in the area affected. I do not propose to deal with all the theories offered in explanation, but will endeavour to clear the ground by getting rid of those, which, from the position of the men by whom they have been put forward, or from other causes, have been most widely accepted; and which yet do not accord with the facts, as they have come under my own observation, both now and in former droughts, and which are well known to many people long engaged in pastoral pursuits in Australia, pursuits in which the occurrence of drought is a factor of prime importance.

First we have the explanation offered by Mr. Clement Wragge of Queensland, that the recent outburst of springs is a result of the late earthquake disturbances, having their centre in South Australia. This I think is untenable, because we who have had to suffer many droughts by which large pecuniary interests were affected, know that the increased flow of springs and creeks at some stage of a general widespread drought is almost, if not quite invariable, while earthquakes in drought or at any other time are exceptional. That this fact was probably unknown to Mr. Wragge
accounts for his having put forward an explanation which ignores well known facts.

Next we have the theory that the increased flow of water is due to barometric changes. Apart from the fact that Mr. H. C. Russell has shown that in the Bathurst and Orange districts, where the phenomena were very pronounced, there was no barometric change, it has always seemed to me that the explanation is inadequate. As far as my observations go, and I think they will be borne out by those of other observers, the increased flow invariably begins in creeks that have a drainage area of from a few hundred yards to a few miles in extent, and though it ultimately affects the larger creeks and rivers, this secondary effect is produced by the accumulated flow of the many little creeks working down gradually from the upper watershed, and does not begin in the main creeks or rivers in their lower courses.

In considering how barometric changes of pressure could produce an increased flow of water, it will be clear that there must be a high pressure at the source of the spring and a low pressure at its outlet. A low or high pressure which was the same at both could produce no effect, and as it is impossible that there could be innumerable areas of high and low pressures at distances of only a few hundred yards or a few miles apart all over the country, and continuing permanent for weeks or months, I think this explanation is disposed of. Of course it is possible that a high and a low pressure following each other across the country might effect the source of supply and outlet of a spring alternately in some cases, but even then, I think the pressures would have changed long before the effect could be transmitted from the source to the outlet.

Another explanation which has been put forward with some authority, is that the increased outflow of water is the result of the cracking of impervious dams of clay by which bodies of water had been held back in the gravels and sands of the smaller creek beds. The theory is that the long continued dry weather has caused these clay formations to crack to a point below the
water level, and so released the water dammed back, which then
made its appearance as a running stream lower down. At first
sight this explanation seems feasible; but to those who, having
been in the habit of storing water above the surface in artificial
dams made of clay, have noted what takes place in dry weather,
its inadequacy is apparent. Even in a surface dam, no matter
how dry the weather, and even though the dam be exposed to
wind and sun for a length of time, it never cracks while there is
any water on the upper side; nor is it possible that it could do
so, because as long as the water remained it would be kept moist,
when it cracked there would be no water to flow through. Some
other explanations which have been offered, such as the action of
cray-fish, supposed in extremely dry weather to undertake the
sinking of artesian bores on their own account, seem to me to be
too fantastic to be worth consideration.

The theory, which seems to me to cover all the facts that I
have observed or seen recorded in the papers, is simple enough,
but I do not claim for it any credit on the ground of originality,
as I believe it is held in a vague and indefinite way by many of
those who have been in a position to make a close and continuous
observation of what takes place, not in one, but in many droughts,
when, as stated, creeks and springs have at various times shown
an increased outflow of water in the absence of rainfall. That
this increased outflow of water at some stage of a general drought,
of which we have heard so much lately, is not exceptional, but
may be seen to a greater or less extent in every drought, is proof,
I think, that it is in some way a result of what may be called
drought conditions. The most notable of these is the extreme
dryness of the atmosphere. For many months, sometimes extend-
ing into years over large areas of Australia, we find dry winds
blowing, no dew, no rain, all vegetation parched up, and the
ground cracked to a depth of many feet. Even when at the sur-
face the ground is reduced to fine dust by the trampling of stock,
at a little depth the soil is divided up by a network of cracks
extending many feet downwards, and allowing evaporation to go
on freely even as far down as five or six feet, or possibly in places even still further. This I recently found to be the case when I attempted at the height of the late drought to irrigate a small area of old cultivation land shewing no surface cracks. When the water was turned on through an eight inch pipe, after spreading a few yards, it broke through the old cultivated surface and disappeared at once in cracks from three to four inches wide, without effecting the surface in any way. In a time of general or pronounced drought we do not usually have extremely hot weather, but fairly cool nights and bright clear days; anything like exceptional heat, more particularly at night, is a sure indication that the drought is but local and likely to be of short duration. A dry, clear, and not abnormally hot atmosphere, is the invariable accompaniment of a general and prolonged drought, and it is the extreme dryness of the atmosphere which I regard as the indirect cause of increased outflow of water in springs and creeks, always observed at some stage in such droughts, and so noticeable in the drought which now seems drawing to a close. To understand the apparently uncaused increase in the flow of water in many, but not in all of our creeks and springs, occurring in most cases towards the close of a general drought, it will be necessary to refer to the character of the sources from which the flow of such creeks and springs is derived in normal seasons when they are permanent.

The generally accepted theory of springs found in all books on the subject, is that on high ground there is an underground reservoir with very free openings to the surface, through which it is kept full by the rainfall. Then there is a narrow or restricted opening, not unlike a pipe line; which may be of any length, connecting this reservoir with the outlet of the spring. The reservoir being filled by rainfall much more rapidly than it is emptied by the spring, gives the spring a permanent outflow not affected by the seasons. The Prospect Water Supply with its reservoir and pipe line to Sydney is an artificial reproduction on the surface of this kind of spring, but when we come to examine the sources of
supply of the creeks and springs, which after having dried out or dwindled down in the late drought, suddenly and without apparent cause began to flow again, we find that the generally accepted theory, though applicable to some of our permanent and unvariable springs, does not apply.

The creeks and springs, of which I have carefully examined a considerable number, are fairly permanent in their flow in ordinary seasons, though many of them were not so until after the natural growth of Eucalyptus timber on the upper part of their watersheds had been ringbarked from twenty to thirty years ago. In all of them the source from which the water flowing in their channels is derived is a quantity of porous and somewhat spongy soil, of no great depth, resting on impervious strata of rock or clay, with a slope more or less steep in the direction of the creek or spring. In some cases this spongy soil is only a few hundred yards in extent, and in others a few miles; nowhere, as far as I am aware, is there any holding back of the water by an impervious bar or dam of rock or clay. In normal seasons the sponge is filled to the point of saturation by the inflow of the rainfall from the surrounding hills, and as it is held back like the water in an ordinary sponge by capillary attraction and friction, it escapes slowly at the lowest level into the channel of the creek, thus maintaining an even and regular flow from one rainfall until the next. When the country is suffering from one of our general droughts, the characteristic of which is an atmosphere of extreme dryness and an almost total absence of rainfall for many months, evaporation of course proceeds very rapidly over the whole surface of the sponge which forms the source of supply of these little creeks and springs, until at the lower levels, which are generally quite shallow, the rate of evaporation is so great as to dry it up, down to the impervious underlying strata. Then the water disappears from the creeks and the springs dry up, but all the time the water stored in the upper and thicker parts of the sponge which have not yet been dessicated, is still moving down slowly along the slopes towards the creeks or outlet of the springs. The rate of
evaporation, however, is sufficiently great to exhaust it before it reaches these channels and outlets. All at once from causes of which as yet we have no accurate knowledge, the atmospheric conditions are changed. The whole country is covered with a moist atmosphere in which evaporation almost, if not wholly, ceases. Then the conditions are reversed in the spongy sources of our creeks and springs. Evaporation having ceased, the water from the upper and thicker parts of the sponge soon works downward and resaturates the lower shallow parts and consequently reappears in the creeks and at the outlet of the dried-up springs.

This explanation seems to me to embrace all the facts covered by my observation, but whether the breaking out of springs and increased flow of water in creeks in time of drought is an indication of the near approach of its termination or not, is a matter which cannot be decided off hand. That an extremely dry atmosphere is a characteristic of drought periods, we know, but is it the cause of the drought? We also know that in a general drought which covers half or all Australia there are always small areas not suffering therefrom, and the situation of these areas vary in different droughts. For example, that Bourke, which has not suffered this time, will also escape in the next drought is very unlikely, from what we know of the past. What I would be inclined to infer is, that when the outburst of springs and increased outflow of creeks is confined to a small area of the country in a general drought, it is not an indication of a break up as small local changes are common to every drought. When however, the outflow of water covers a wide area or the whole of the drought stricken country, then it is to be regarded as the indication of the near approach of the end, since the most distinctive characteristic of a general and widespread drought—an extremely dry atmosphere—has disappeared.

**View This Item Online:** https://www.biodiversitylibrary.org/item/130955  
**DOI:** https://doi.org/10.5962/p.359268  
**Permalink:** https://www.biodiversitylibrary.org/partpdf/359268

**Holding Institution**  
Missouri Botanical Garden, Peter H. Raven Library

**Sponsored by**  
Missouri Botanical Garden

**Copyright & Reuse**  
Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the Biodiversity Heritage Library, the world’s largest open access digital library for biodiversity literature and archives. Visit BHL at https://www.biodiversitylibrary.org.