



NEW ZEALAND  
ARCHAEOLOGICAL  
ASSOCIATION

**NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION NEWSLETTER**



This document is made available by The New Zealand Archaeological Association under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

To view a copy of this license, visit  
<http://creativecommons.org/licenses/by-nc-sa/4.0/>.

## CLIMATIC CHANGE IN NEW ZEALAND ARCHAEOLOGY

K. Gorbey

The recent warning to archaeologists by Pullar (1966) on the use in their work of hypotheses of climatic change is most timely. By the uncritical acceptance of tentative conclusions, along with some misquotation, a very confused situation has developed. In documenting this confusion it is hoped to add to the point already made by Pullar.

Three broadly defined groups of scholars are involved in the climatic change dispute in New Zealand. Each has their parallel in other areas of the world. The first group will here be termed the palaeoclimatologists. Although weather pattern changes in the recent past can be discerned from geological evidence, most comes from the study of vegetational changes resultant upon shifts in climate. This is so in New Zealand where forest studies are the best climate indicators. The second group are the archaeologists. Many of their number have used climatic change as the determining factor for some cultural changes. The European prehistorian, Gordon Childe, saw much of the important matter of prehistory in terms of climatic shifts putting certain resources beyond the reach of a primitive technology and so determining innovations that led directly to some new stage in cultural development. Similarly in North America prehistorians have looked to climatic changes to explain some of their evidence. Droughts have forced the abandonment of some types of settlement patterns or territories, forests have changed to grasslands because of drops in effective rainfall and so on. But there are dangers in the continual application of this and other physical factors to any study of man for, although they undoubtedly affect man's way of life on earth, all too often this determinism or environmentalism slips into full-scale environmental determinism - that is environment controlling man's development. The third group is a reaction against this all too frequent slip and is perhaps best seen in the work of some human geographers, notably Carl Sauer. As has been noted previously much evidence for climatic change comes from climatically induced changes in vegetation patterns. But man is also capable of upsetting vegetation and so producing patterns that could be interpreted as climatic. Such is the basic argument of this group; that man and not climate is the most important agent in destroying one type of vegetation and so introducing another.

New Zealand palaeoclimatologists who have provided evidence for the last 1,000 years are dominated by two men, Raeside and Holloway. Both worked in the South Island where they independently found evidence of a recent change in climate somewhere about the 12th to 13th centuries. Raeside (1948: 156-166) based his views on three types of evidence. The first was vegetational. Many areas of the South Island uplands had remnant patches of tussock grass and the fallen trunks of long dead totara trees scattered on slopes well above today's forest line. To explain the growth of this vegetation at such an altitude Raeside postulated a former climate with temperatures some  $1\frac{1}{2}$  to  $2^{\circ}\text{C}$  above that of today. Secondly, river gravel sections showed differential sedimentation rates that could be explained by climatically induced vegetation instability. The third area of evidence was from South Canterbury soils where he found many to be polymorphic - that is, they had some features that were consistent with forest cover and some with grass cover. All this led Raeside (1948: 166) to suggest "A climatic change from a previously wetter cycle (forest) to the present drier one (grassland) ...". This was dated by analogy with the Northern Hemisphere to about the 13th century.

Holloway's evidence is taken from the "mal-adjustment" of South Island forests and is more complex and better documented than that of Raeside. He found that the Podocarp forest (warm and moisture loving trees) was not regenerating and was being replaced by a younger beech forest (*Nothofagus* - colder and drier conditions preferred). Holloway's case is widely misunderstood. For this reason some lengthy quotes might be more fair than a layman's summary. After presenting his evidence from Western Southland, Holloway (1954: 354) writes:

"The logical conclusion must be that there has been a progressive drying out of the forest accompanied, perhaps, by a fall in temperature, a change adverse to matai and its associated species and favouring, first, silver beech and, finally, the xerophytic mountain beech. And a few long-living survivors from the ancient forest outlast all changes but are incapable of self-reproduction."

Yet Holloway, as a rather cautious scientist, was prepared to look beyond just climatic factors to explain the state of South Island vegetation. In dealing with evidence from Waiiau Valley he found the following from the soil profile:

"The final decay and breaking up of the forest was undoubtedly accelerated by fire. Thus, at an altitude of 3,000 ft on the western slopes of the Takitimu Mts., and in the midst of a waste of rock rubble, scree and bed-rock gullies, the soil under a remnant patch of tussock grassland showed ten inches of a dark, crumb structured grassland soil over two inches of fine, slightly weathered rock fragments which overlay, in turn, a shallow bed of charcoals. Below the charcoals there was a truncated fossil soil, strongly leached with traces of iron pan and marked root channels. The climate must, at one time, have been such as to support forest growth on these exposed high altitude sites. This forest was destroyed by fire, presumably following deterioration in the climate and when the forest was no longer in a condition to re-establish. Following the fire the site was occupied, after a short period of accelerated erosion, by tussock grassland which persisted for a sufficiently long period of time for formation of an appreciable depth of true grassland soil on top of the charcoals and erosion detritus until destroyed, in turn, on initiation of the present erosion cycle. Today, in respect to this particular site, the climate would appear too severe to permit re-establishment of any type of indigenous forest." (Holloway 1954: 361-362).

Holloway's point is that even though the forest was here destroyed by fire the climate was such that grassland and not forest grew in the ashes. Grassland could then well be a culturally induced vegetation. His view on the matter of cultural interference is best shown in The Descriptive Atlas of New Zealand.

"The belief that pre-European man interfered little with the vegetation of this country cannot be sustained .... in eastern parts of the South Island, the same factor (fires lit by Maoris) hastened the replacement by tussock grassland of forest areas, already adversely affected by climatic changes." (Holloway 1959: 23).

All through his 1954 work Holloway was careful not to overstate his case. He stressed that his hypothesis, a climatic change about the 13th century from warm moist conditions to colder drier conditions, was no more than a hypothesis. But he further pointed out that it was the one that fitted the major part of the evidence. No attempt was made to define the change beyond broad warm and moist to cold and dry terms. Any evidence that did not appear to fit was admitted and documented. His conclusion was that to prove or disprove the hypothesis much more work was required. It is a pity that Holloway had to record in 1964 that little new evidence had been published in the intervening ten years.

Putting Holloway and Raeside together seemed to give a change in climate within the era of the Polynesian occupation of New Zealand. This "fact" was eagerly seized upon by some archaeologists much to the embarrassment of Holloway in particular. Even before the forest story had been told one archaeologist had recognised the possible significance of Raeside's article (Lockerbie 1950). However it was not until Holloway gave a talk to the Second Annual Conference of the New Zealand Archaeological Association in 1957 that prehistorians began to weave climatic change into their reconstructions and even then it was a misunderstood answer to a question that became the basis of the prehistorians' climatic determinant. It would appear from present published evidence that Holloway, when referred to the possible prehistoric climate at one site (Pounawea?), answered:

"... that, with reference to this particular sheltered, climatically favoured coastal site, but without reference to South Otago as a whole or any reference to Bluff, I said that it was conceivable that, at the peak of the warm period, the local climate at that spot could have approached that of present-day Bay of Plenty." (Holloway 1964: 5).

Unfortunately this answer was misconstrued by two of the archaeologists present (see Note end of article). Lockerbie (1959: 75) recorded the following:

"As Holloway (footnote to Holloway's 1957 talk) has pointed out, the climate of South Otago in the 12th century A.D. would be some four to five degrees warmer than at present and would be similar to the present climate of the Bay of Plenty in the North Island of New Zealand."

Golson (1957: 274) on the other hand applied this climatic data, plus a rainfall of about 110 inches, to the climatic optimum.

"A major and apparently universal climatic landmark in the post-Pleistocene was the climatic optimum, 5,000-4,000 B.C., when New Zealand climates were both warmer and wetter than at present. Very rough estimates would indicate a mean annual temperature some 5° warmer than today, a Bay of Islands (my underline) temperature prevailing at Bluff, with rainfalls on the East Coast of the South Island of the order of present day Hokitika. ... The deterioration in climate that followed this period affected the ability of the forests to regenerate ....

"The period 800-1200 A.D., however, saw a partial reversal of this trend with a temporary warming-up of the climate, and there was some regeneration of the eastern forests; but since

1200 A.D. the change to cooler and drier conditions has been accelerated with major expansion of the tussock grasslands."

Cumberland (1962: 95) in his attack of the climatic change thesis, misquotes Golson somewhat when he writes:

"According to Golson's account of Holloway's statement, the conditions during the Climatic Optimum to which there was a reversion (my underline) during the period 800 A.D.-1200 A.D. would indicate ..."

and then goes on to quote Golson above on the climatic optimum.

It was these misunderstandings that Cumberland (1962) the human geographer, attached to Holloway's thesis and attacked.

As has been noted previously, the part of some human geographers in this study has been to argue against the determining ability given climate by some students of man. In its place has been put the "cultural interference" concept. This has been most successfully applied in North America to the extensive Mid-West grasslands. At first a climatic change was used to explain this vegetation but later work has emphasised more the part of man, the fire-maker. Essentially, all that Cumberland has done has been to transfer this argument to New Zealand with the moa-hunter "incendiaries" replacing the Red Indian as the fire-lighting agent. But as has been seen Holloway (1954) never denied cultural interference, merely stating that climatic change prepared the forest for fire. Cumberland therefore goes further and argues that the climatic change, if it existed at all, either was not great enough to affect vegetation, or came after the fires had transformed the vegetation. But not content with limiting the effectiveness of climatic change, Cumberland (1962: 110-114) turns completely about and draws another 'red herring' into the field with his own postulated climatic change - not to colder and drier but to colder and wetter. This is based on the theories of Willet whereby solar radiation fluctuations are translated into climatic fluctuations. A major problem is the acceptability of this theory. Cumberland (1962: 111) seems quite convinced but Critchfield (1966: 380) is not. Then again, the cyclic theory can be applied to New Zealand only "if climatic change in New Zealand has followed synchronously the fluctuations of meteorological patterns exhibited in the northern hemisphere..." (Cumberland 1962: 113). This change is even more doubtful if it is considered that the only evidence offered in New Zealand demands a change to dry conditions.

Yet one archaeologist, Green (1963), has made this suggested, but highly suspect, change part of his framework of fact and has used it as the determining factor in the development of New Zealand agriculture.

Further, in writing a prehistory of a northern province, he has used a South Island hypothesis. This is most dangerous for the little work done in the North Island suggests a somewhat different sequence of events. The change here appears to have been at a much later date - perhaps at the beginning of the 17th century (McKelvey 1953: 446). If the agricultural changes postulated by Green did actually take place and in the period of time he suggests, it would appear that climate might not have been the determining factor for the simple reason that there might have been little change in this period. However the whole argument on the development of agriculture tends to be rather speculative.

Green's handling of postulated climatic changes is most unfortunate. The evidence for such changes comes from very technical fields such as forestry, pedology, and pollen studies. Archaeologists, in general, are not distinguished by any deep understanding of these studies and make a great mistake in accepting hypotheses in these fields as fact. The evidence is not conclusive - climatic change is not proved. It is up to New Zealand archaeologists to be more careful and perhaps to abstain completely from offering climatic reconstructions in their work, at least until the palaeoclimatologists themselves are more sure of their findings.

#### NOTE

It is conceivable that the account by Golson (1957) of the talk at the Second Annual Conference of the New Zealand Archaeological Association is the most accurate. Both Lockerbie (1959) and Holloway (1964) are recalling this event after some years. Holloway (1964), when forced by Cumberland (1962) to defend his hypothesis, could well have mistaken the period to which he applied the Bay of Plenty (Islands?) climate, for although Cumberland (1962: 88) quotes Lockerbie (1959) he is not accurate in recording what Golson (1957) said. Golson's account does Holloway no real injustice.

#### REFERENCES

- Critchfield, H. J.            1966    General Climatology, 2nd Ed.  
Englewood Cliffs, Prentice-Hall.
- Cumberland, K. B.            1962    "Climatic Change or Cultural  
Interference? New Zealand in Moa-  
hunter Times", in Land and Livelihood,  
ed. M. McCaskill. Christchurch,  
Geographical Society, pp. 88-142.
- Golson, J.                    1957    "New Zealand Archaeology, 1957". J.P.S.,  
66: 271-290.

- Green, R. C. 1963 A Review of the Prehistoric Sequence in the Auckland Province. Auckland. Auck. Arch. Soc. Pub. No. 1. N.Z.A.A. Pub. No. 2.
- Holloway, J. T. 1954 "Forests and Climates in the South Island of New Zealand". Trans. Roy. Soc. N.Z., 82: 329-410.
- 1959 "Pre-European Vegetation in New Zealand", in A Descriptive Atlas of New Zealand, ed., A. H. McLintock. Wellington, Government Printer, pp. 23-24.
- 1964 "The Forests of the South Island: The Status of the Climatic Change Hypothesis". N.Z. Geographer, 20; 1-9.
- Johns, R. J. 1967 Soil and Vegetation in the Hunua Ranges. Unpublished Masters Thesis for the Geography Dept., University of Auckland.
- Lockerbie, L. 1950 "Review of Raeside (1948)". J.P.S., 59: 87-90.
- 1959 "From Moa-Hunter to Classic Maori in Southern New Zealand", in Anthropology in the South Seas", eds., Freeman and Geddes. New Plymouth, Avery and Sons, pp. 75-110.
- McKelvey, P. J. 1953 "Forest Colonization after Recent Volcanicity at West Taupo". N.Z. Jour. Forestry, 6: 435-448.
- Pullar, W. A. 1966 "Climatic Interpretation in New Zealand Archaeology". N.Z.A.A. Newsletter, 9: 74-76.
- Raeside, J. D. 1948 "Some Post-glacial Climatic Changes in Canterbury and their Effect on Soil Formation". Trans. Roy. Soc. N.Z., 77: 153-171.