OBSERVATIONS FOLLOWING A HEAVY RAINFALL ON THE RIMUTAKA RANGE

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SUMMARY

On 26 December, 1962, very heavy rain fell on the Rimutaka Range, causing severe erosion in some places. The writers visited the range shortly after the storm and were able to determine, to some extent, the area in which the main erosion had occurred. Although the rain was widespread, most of the damage appears to have been confined to about 16 sq. miles. Damage occurred in some catchments in which the forests had not been seriously depleted by animals. Some implications of these facts are discussed.

INTRODUCTION

During November and December of 1962, the Forest Research Institute conducted a survey of the vegetation of the Rimutaka Range. Permission was obtained from the Wellington City Council to examine catchments under its control, and the writers became closely familiar with the condition of catchments and streams throughout the range.

On the evening of 25 December a depression, which had developed over South Westland, moved quickly north-eastwards along the west coast of the South Island, and was accompanied by extensive heavy rain. During the afternoon of 26 December the depression deepened and moved slowly eastwards over the southern half of the North Island, together with an associated frontal system. This led to heavy rain in the Wellington area.

RAINFALLS AND RIVER DISCHARGES

Particularly heavy rain fell on the mid Rimutaka Range on the late afternoon of 26 December. The greatest concentration appeared to be in the vicinity of the Wellington City Council waterworks "intake" in the Orongorongo valley, and waterworks installations there and in an adjacent valley of the Wainuiomata catchment sustained considerable damage.

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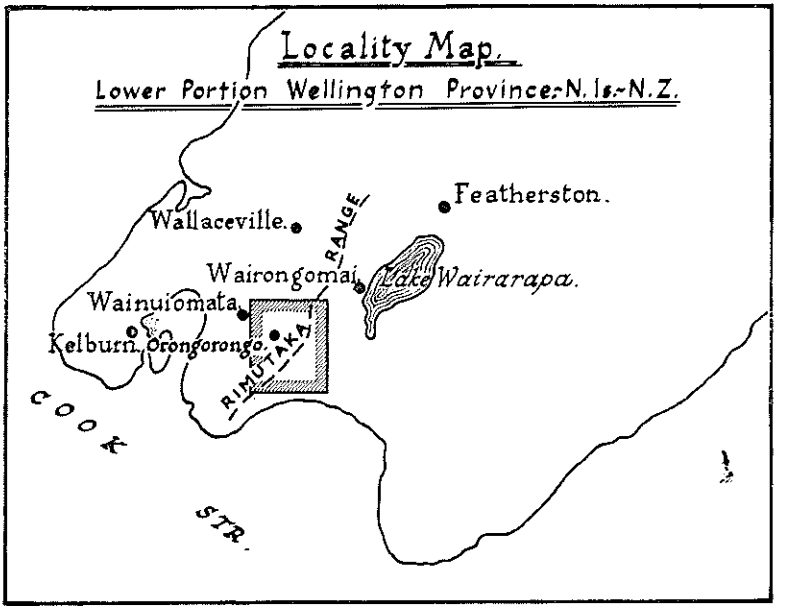

Fig. 1 — LOCALITY MAP

The following are rainfall figures for various places in the vicinity (Fig. 1), for the 24 hours prior to 9 a.m. on 27 December, 1962:

Station	Station Number	Altitude (ft)	Rainfall (in.) For 24 hours to 9 a.m. on 27/12/62	Average Annual
Kelburn	E 14272	415	2.00	49.2
Wallaceville	E 15102	215	2.30	50.8
Wainuiomata Reservoir	E 14294	411	6.80	80.5
Orongorongo	D 15301	800	8.02	127.0
Wairongomai	D 15211	70	2.88	61.9
Featherston	D 15131	160	1.52*	52.1
			(* Derived)	

A recording rain gauge has been in operation at Wainuiomata reservoir for 13 years. From this source the cumulative rainfall of 26 December has been plotted (Fig. 2). The inferred cumulative rainfall for Orongorongo is plotted on the same graph on the basis of the respective 24-hour rainfalls of 6.80in. and 8.02in.

Also from this source the Meteorological Service has provided the following table of maximum rainfall intensities recorded at

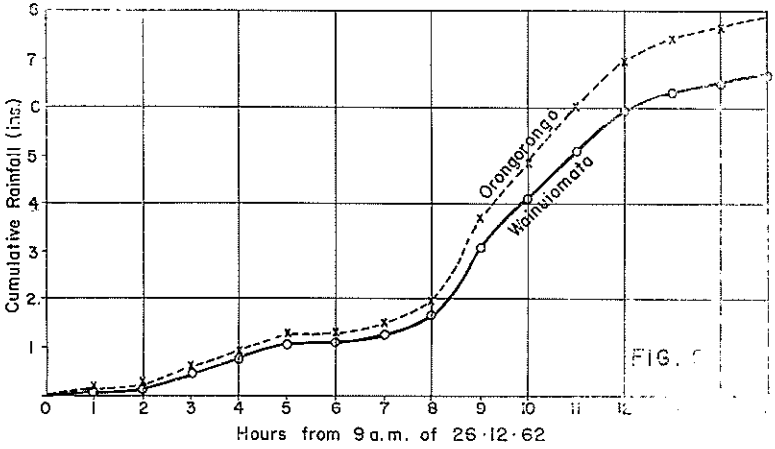

Fig. 2 — CUMULATIVE RAINFALL AMOUNTS of 26 December, 1962. The Orongorongo curve has been derived.

Wainuiomata during 26-27 December for periods from 10 minutes to 12 hours, together with the previous maxima there from 1950 onwards:

Period	Rainfall (ins.) 26-28 December, 1962	Previous Highest
10 minutes	0.46	0.34
20 minutes	0.71	0.54
30 minutes	1.02	0.57
1 hour	1.54	0.88
2 hours	2.68	1.34
6 hours	5.10	3.40
12 hours	6.39	4.94

The 6.80in. recorded at Wainuiomata reservoir for 26 December, 1962, is by no means the highest rainfall for one day. Since 1884, when the site became an official rainfall station, the following highest daily rainfalls have been recorded:

12.60in. on 15 April, 1895
10.28in. on 27 June, 1947
10.19in. on 11 December, 1939
9.93in. on 1 May, 1913

It is known that the rain of May, 1913, fell in 19 hours.

At the Orongorongo intake, where there has been an official rainfall station since 1924, the highest daily rainfalls recorded so far have been:

10.44in. on 27 June, 1947
9.94in. on 14 July, 1956
9.11in. on 15 August, 1928

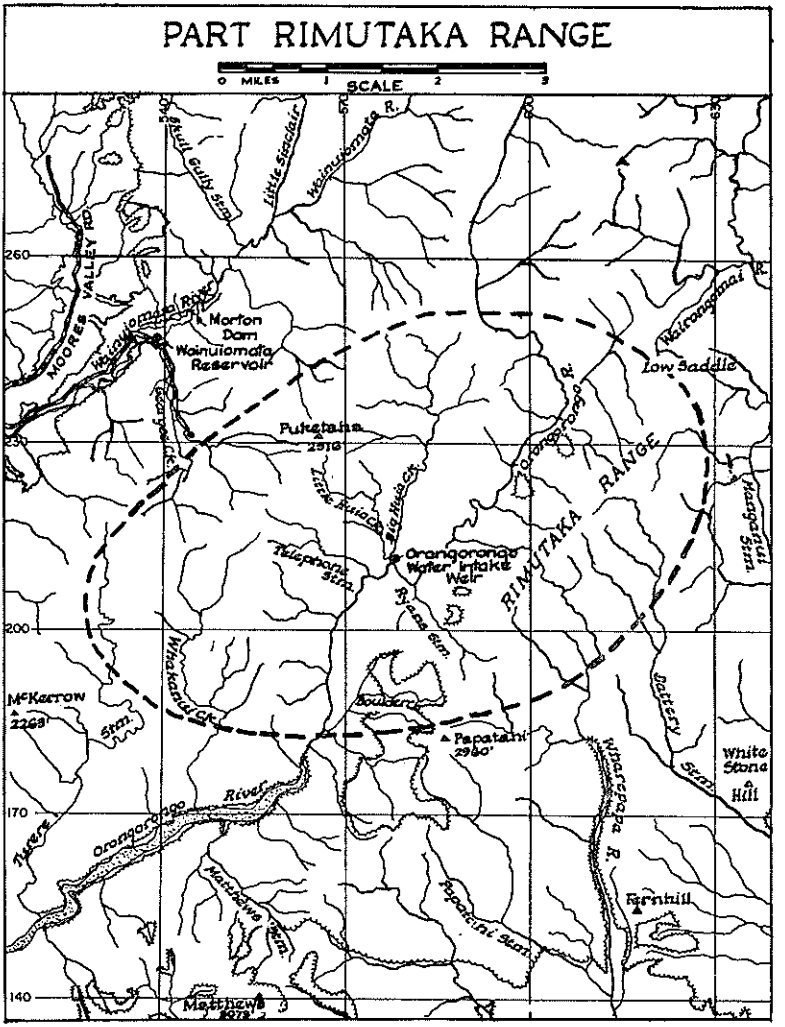

Fig. 3 — PART OF THE RIMUTAKA RANGE. The suggested perimeter of the main erosive damage, caused by the heavy rainfall of 26 December, 1962, is shown by the thick broken line.

Water levels at Morton Dam (Fig. 3) have been recorded continuously since 1955, the long-term average annual flow being 45 cusecs. On 26 December, 1962, the flood peak was 1,800 cusecs. This peak has been exceeded on at least five occasions, the highest being that of 1956, measured at 2,700 cusecs.

As the water levels at the Orongorongo weir are not recorded on charts and the peaks occur only briefly, no regular figures are available, but floods of about 2,000 cusecs have been observed in the past. The December 1962 flood would be of this order.

Officers of the Wellington City Council had completed ground and aerial inspections of the area within three weeks of the flood date, and came to the conclusion that the very heavy precipitation was restricted to a comparatively small area.

The purpose of this paper is to try to define the boundaries of this small area and to comment upon the implications of high-intensity rainfall on indigenous protection forest.

OBSERVATIONS

Between 10 and 12 January, 1963, the writers travelled from the Wairongomai down the Orongorongo valley, over the saddle west of Mt Matthews, and down the Mukamuka valley. Parts of this country (Fig. 3) had been severely eroded during the "Boxing Day floods". Immediately before this journey, quite heavy rain had again fallen in the area, and throughout the trip rain fell intermittently. Details of this rainfall as read by the caretaker at the Orongorongo weir are as follows:

7 January,	0.66in.	10 January,	0.05in.
8 „	1.48in.	11 „	0.56in.
9 „	0.91in.	12 „	0.11in.

Although this rain was insufficient to cause flooding or serious erosion on its own account it was enough to wash soil down from areas that had been freshly exposed during the Boxing Day floods. The streams that had suffered damage on 26 December were now, in January, greatly discoloured with silt and fine sand. Thus, through the fortuitous choice of these days for travelling through the heart of the storm-smitten country, we were able to obtain some appreciation of the extent of the Boxing Day flood damage.

On 10 January we travelled up the valley of the Wairongomai. This river was swollen and very discoloured, and much recent flood debris was seen along its banks. At the point where a large unnamed tributary enters the Wairongomai from the west (grid ref. 636259 on Fig. 3) we found that the discoloured water was entering from the western tributary, and that the main stream contained clear water. A few hundred yards up the western tributary the stream forks again (grid ref. 631258). At this point the branch from the NW was noted to be quite clear and appeared to have suffered no recent flood damage. The branch from the south, however, was very dirty, and was in the process of flowing in ever-changing courses over a large fan of recently deposited sand and stone particles (Fig. 4).

Fig. 4 — ALLUVIAL FAN being built up by the southern tributary of the Wairongomai, which has a catchment area of 380 acres. The NW tributary (770 acres), which is not contributing to the detritus, enters at the right of the photo.

FIG. 5 — RECENTLY DEPOSITED SHINGLE partly burying plants along the banks of the southern tributary of the Wairongomai. Goats, which are common in this area, had not yet heavily browsed these plants, many of which are palatable to them. The crown of a tree fern with foliage of this size would be at least 6ft above the ground.

We travelled up this southern tributary, the lower section of which, to judge from half buried trees, ferns, and other plants along the bank, appeared to have been recently aggraded by several feet (Fig. 5).

We inspected the headwaters of this stream and although old erosion scars were little changed, the stream bed indicated the passage of great quantities of detritus. We did not determine the exact source of this material, but it must have come from the extreme southern headwaters of the catchment.

We then retraced our steps and crossed into the Orongorongo catchment via the low saddle at grid ref. 618248. The forest here was in reasonably good condition; although modified, it displayed no evidence of severe animal damage. Travelling westward, we came into the basin of a tributary of the Orongorongo. Here again, at a point where the streams from the north meet those from the south (ref. 613245) was the phenomenon of clear water from the north flowing into dirty water from the south. The stream from the south had recently deposited along its gently graded course an even bed of fine shingle, about 12 or 15 ft across, which extended to the Orongorongo River. Here the pattern was similar — above this junction (ref. 606237) the main Orongorongo from the north was quite clear, although slightly swollen, and its bed showed little sign of recent flood damage. Our tributary was adding enough silt to discolour the Orongorongo River south of this point.

The following morning we travelled down the Orongorongo River to the weir, or "intake". Dirty water was flowing from the tributaries on the eastern side of the valley, and on both sides tributaries had disgorged large quantities of shingle and rocks into the river bed, so that it comprised in most places a new surface of alluvial material that made walking quite easy. The large old slip-faces on the eastern slopes of the valley did not appear to have suffered much from the downpour. The largest of these tributaries, entering the Orongorongo from the SE just above the weir, and locally known as Ryans Creek, appeared to have suffered most. Mr E. V. Wiffen, overseer for the Wellington City Council Waterworks, estimated that the detritus at the confluence of Ryans Creek with the Orongorongo had accumulated to a depth of about 12ft (pers. comm.).

We also inspected weir sites in the Little Huia and Big Huia creeks. When visited in August, 1962, both streams appeared to be reasonably stable; detritus had backed up behind the weirs, but vegetation growing down to the water's edge indicated that serious flooding had been infrequent in the past. In January, 1963, these streams were a scene of devastation. Field notes made by a Forest

Survey party in November, 1962, indicate that the forest in the headwaters of these streams was in a fairly satisfactory condition. Aerial photographs taken in February, 1961, show two minor slips in the Little Huia catchment and three small slips in the Big Huia catchment.

Below the Orongorongo weir the river bed was composed of fine shingle instead of the large boulders noted on previous visits. Its level here appears to have been raised by more than 4 ft (Mr E. V. Wiffen, pers. comm.). This deposit of fine shingle extended most of the way down to "Baines", with the exception of one long straight section (about ref. 568196) where the bed of small rounded boulders appeared much the same as it did in November. For the rest, the river bed had completely changed; not only had there been deposition of detritus in most places, but many of the river terraces had been undercut and altered to a great extent. It was noticeable that there was little change in the tributary, locally called Boulder Creek, flowing west from Mt Papatahi; or in those flowing NW from Mt Matthews, locally called Matthews Stream. Although Matthews Stream was in quite high flood, the water was clear.

After crossing the saddle west of Mt Matthews, we travelled down the Mukamuka valley. In this severely eroded region the stream was carrying much fine debris and the lower reaches had recently become aggraded to some extent. It did not appear, however, to have suffered to anything like the same extent from the Boxing Day floods as the catchments about 6 miles NW along the range.

Thus it seemed that we had travelled through the zone of most intensive damage. The NE perimeter clearly lay across the southern tip of the Wairongomai catchment, and the southern perimeter appeared to lie just to the south of Mt Papatahi.

On 12 January we walked round the coast to Wharekauhau Station. We were unable to revisit the Wharekauhau and Wharepapa catchments, but the station owner, Mr Eglinton, was able to tell us that a great deal of detritus had been brought down from the headwaters of the Wharepapa, but that not so much had come down the Wharekauhau. This strengthened our opinion concerning the southern perimeter of the downpour, and suggested that the maximum-intensity rainfall had its eastern perimeter in the headwaters of Wharepapa Stream, and probably also of Battery Stream.

In November, 1962, both writers had made a close inspection of the Wainuiomata catchment above Morton Dam. On 16 February one of us (Cunningham) returned to this area with the

object of trying to locate the western perimeter of the Boxing Day downpour. This was again made easier by the falling of fairly heavy rain in the previous 24 hours. Severe damage in the headwaters of Georges Creek, which drains the SW slopes of Puketaha, had caused the formation of several large slips and the deposition of considerable amounts of alluvium down valley. The stream flowing to the NW from Puketaha had also carried down some detritus. Skull Gully Stream was unchanged, and none of the other tributaries of the Wainuiomata showed signs of recent severe flooding. The western perimeter of the deluge thus appears to have been just west of Puketaha. In February, 1963, the area SW of Puketaha was inspected by a Forest Service party who recorded the location of the Georges Creek slips and also recorded the existence of even more extensive new slips in the headwaters of the Turere Stream (D. Franklin, pers. comm.). Although the forest in the Turere catchment is not as satisfactory as that to the north-west, the lower stream bed in November appeared to be fairly stable. A large amount of detritus was carried down the Turere as a result of the Boxing Day deluge.

CONCLUSIONS

From the foregoing observations it seems reasonable to suggest that the most intensive damage resulting from the Boxing Day downpour lies in an oval area with its centre about 1½ miles SE of Puketaha. The suggested perimeter is marked on Figure 3 and encloses an area of some 16 sq. miles.

This review, if it presents the facts accurately, indicates that a rainfall of damaging intensity in the ranges may affect only a limited area. If this rainfall is typical, it is unlikely that the whole of one of our North Island ranges would be severely damaged in the course of one storm. By the same reasoning, small catchments may be expected to have greater fluctuations of maximum flood discharges than large catchments; and this should not be overlooked when control measures are being considered.

Neither the 8.02 in. of rain recorded at the Orongorongo intake, nor the 6.80 in. recorded at Wainuiomata for the 24 hours prior to 9 a.m. on 27 December, 1962, was the highest daily rainfall recorded at these places. Although the intensity of the fall was the highest on record for either place (1.54 in. for one hour at Wainuiomata and an estimated 1.81 in. for one hour at Orongorongo) these are far from being record-breaking intensities for New Zealand (Garnier, 1958). The Orongorongo and Wainuiomata records were obtained from valley sites, but most of the direct erosion damage occurred in the headwaters of streams. Whether this was due to higher rainfall there, or to the

steeper terrain, cannot at present be determined. It seems, however, that rainfall intensities in excess of 8 in. per day and 1½ in. for one hour may lead to serious damage in forested country in this area.

Finally, one of the most alarming features of this case is the discovery that such rains can cause serious erosion under forest conditions which we at present regard as reasonably satisfactory. Serious damage occurred in Georges, Little Huia and Big Huia catchments, in all of which the forest cover and soils were in much better condition than many we are familiar with in the Aorangi, Tararua, Ruahine, and Kaweka ranges.

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REFERENCE

Garnier, B. J. 1958: **The Climate of New Zealand.** Arnold, London.