



South Island foothills "gullied" by the weather after burning and over-stocking.

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while a new structure is being erected. Along the Esk valley road, silt is feet high along its margins and logs are cluttered around stout, old, partly silted willows. Blue gums look disproportionately short and stumpy. Side roads are of silt—loose, yellow-white and wavy. All fences are new; old fences are buried with the old road and are only infrequently to be seen. A petrol pump is now buried deep with a flower garden laid out around the glass bowl on top of it. In the lower Esk valley, 1750 acres were in 1938 silted up to an average of at least three feet six inches and a depth of six to ten feet has been found over wide areas. One estimate (probably high) puts the soil loss over the ninety-three square miles of the Esk catchment at seven and a-half inches (solid).

It is little wonder that station holders complain of the deterioration of their swards, that they are unable to get a strike of surface-grown English grasses, that the countryside is intrinsically worth less for grazing purposes than in 1870-80 and that despite the bringing in of new areas from fern and scrub and despite top-dressings, better management and increased knowledge of stock, carrying capacity remains barely stationary. The brief, exciting and eventful century of European occupation—and especially the latter half of it—has added much to the New Zealand landscape and taken much away. Not all that has disappeared has done so to the Dominion's lasting advantage; nor have all the additions been wholly desirable ones. Yet, in any case, the additions—amongst them the undesirable and ugly forms of soil wastage—do facilitate the regional differentiation of New Zealand's area.

NOR will the author agree—and he is a bold man who disputes the point—that erosion is confined to bush-cleared areas. Here is a passage from his survey of Region IV., the high tussock country of the South Island:

In essence, 80 years of pastoral occupation have decreased the vegetative cover and exposed the soil. Only rarely now do individual tussocks touch their neighbours. In many parts, tussocks reduced in size and vigour lie yards apart. Fire has not only diminished the volume, variety and vitality of the plant cover, but, equally serious, it has devoured the brown dead quilt of rotting growth, which, in its primitive state, was a significant, if not conspicuous, feature of the tussock terrain. Persistent over-grazing—by both sheep and rabbits—of a vegetation of continually declining density and diminishing carrying capacity has assisted fire in exposing the sparse, and discontinuous soil mantle. Both burning and grazing have assisted in undressing the soil and baring it to the ravages of the more extreme weather elements—especially to blowing by strong dry winds,

heaving and prying by frequent frost and scouring by locally-confined southerly (cold front) rainstorms.

IF you say that there has always been erosion—that our South Island high country was slashed and cut about before a white man ever saw it—you are no doubt speaking a part of the truth. Here is another part:

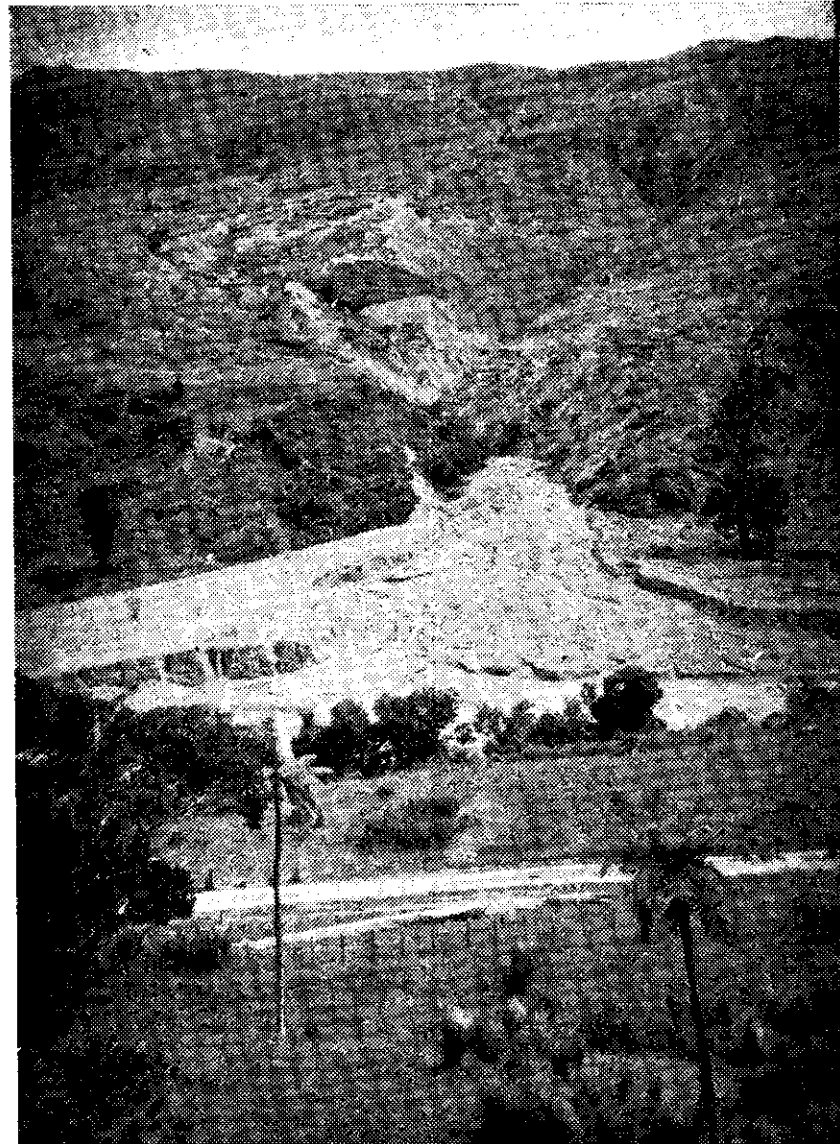
What the high country folk call "guts" or "gutters"—deep steeply-inclined gullies—are the most striking forms of soil wastage through the agency of rainfall or snow-melt. There is little doubt about the absence under primitive—unburned, ungrazed, untenanted—conditions of "gutters." All those examined have, at most, an age of little over forty years. The vast majority are far more recent; they have all the sharp, clean-cut marks of youth and freshness. Nor any have been seen healed or healing; and their counterpart in the pre-pastoral period seems to have been the shallow and gentle, broadly V-shaped and soddied drainage-ways now sometimes the site of shingle slides.

EVEN in the foothills and on the downs the soil wastage is continuous. This paragraph deals with Region VI.

At Heathcote, in a 3½-acre enclosure with an 11 per cent. slope, it took but eight years of arable cultivation and intensive market gardening for sheet wash (and plough-hastened creep) to bury completely a five-foot fence and create a rounded bank eight feet high overlooking the field below. When both enclosures were subsequently put down in lucerne, no fence was needed to prevent dairy cattle moving from one to the other. Eight years previously there was no break of slope. (Under lucerne there is no appreciable erosion.) Nor is it unusual, when prolonged and gentle early spring rains are followed by a rain of some intensity, for thousands of young tomato plants to be uprooted and washed out. Winter rains, too (coincident with the period of intense soil preparation and early planting), have been known to scour hillside potato soils at Governor's Bay, wash out soil and sprouting tubers and pile both thickly against base fences.

BUT, you may say, New Zealand is not all hills and mountains and gullies and precipitous gorges. There are some extensive flat areas, and erosion is not a problem there. Well, Mr. Cumberland does not agree with you. This is from a chapter about the Canterbury Plains:

When the Highbank estate was subdivided in the 'nineties, five-foot deep banks of wind-blown topsoil were found to have accumulated under, and immediately to the lee of, Pinus radiata shelter belts then barely 20 years old. Along the line of one plantation, now being cut out, a mound of some 1400-1500 cubic yards of wind-blown silt occurs within a distance of 300 yards. In another instance, a similar bank of topsoil was respread in a 50-yard-wide belt immediately to leeward of the



Scouring during the last ten years in Kopuapounamu Valley, on the East Coast of the North Island. An example of the effect of a high rainfall on unstable land when the bush disappears.

plantation, as a result of which the "top-dressed" strip yielded almost 60 bushels to the acre of Velvet wheat in two successive years. This was over twice the yield per acre from the remainder of the enclosure the first year, and three times its yield in the second year.

YOU may, if it comforts you, call him an alarmist: he would probably reply that he would be ashamed not to be. There would be something wrong with him if he could remain undisturbed in the presence of the facts as he sees them.

Even ignoring the depredations of wild animals—deer, pigs and so on—in the unoccupied tracts of the country, not less than twenty-eight million acres in the Dominion (and possibly many more) are afflicted with the disease of culturally accelerated erosion to a degree which justifies national concern. This is more than two-fifths of the total area of the Dominion and more than two-thirds of the area in occupation. Proportionately, New Zealand has a soil erosion problem as great as that of any other nation—if not greater. Moreover, soil erosion occurs within the limited area of New Zealand in a great variety of forms. It occurs in different ways in different regions. Some regional combinations of forms are unique: some individual forms are extremely unusual and appear most difficult to arrest and counter.

HAS he then a remedy? Yes and No. He is in no doubt about the cause; but if a man loses an eye or a tooth we usually know why. There are some calamities that cannot be overcome

however humbly we admit our responsibility for them, and some things have happened to New Zealand already that our children's children will still be paying for. But the position is not at all hopeless as a whole if we wake up in time, and it is not Mr. Cumberland's job to tell us what to do when we have at last recovered our senses. He does offer sane, cautious advice:

Research so far conducted has had reference solely to the restoration of vegetation, and, valuable as this would be in saving soil, no effort has yet been expended with the acknowledged and primary object of arresting soil erosion. The restoration of vegetation might well be facilitated for example, if attempts were made at water conservation—that is, if a broader approach were adopted to the many inter-related land problems. Many decades ago gold miners found it possible to construct hundreds of miles of water-races and thus to carry water for sluicing purposes. It should be possible in these days of elaborate digging, ditching, excavating and earth-moving machinery to convert these water channels and construct many others in order to contour-irrigate the depleted pastures of easier slope as a first step towards improving the moisture relations of the soil, restoring the plant cover and saving soil. Similarly, experiments with contour furrowing are necessary.

FINALLY he is careful not to leave us with the impression that erosion is a farming sin only, and that farmers therefore can be left to cope with it:

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