

Campbell-Walker, "in the shape of temporary or permanent damage to agricultural districts by the deposit of stones and shingle brought from the mountains by the flood-waters cannot be estimated, still less the damage to pastoral lands on the mountains themselves. It may be stated generally that the results of excessive clearing of forests and abuse of pasturage on the French Alps and Pyrenees have reduced their capacity as a sheep- and goat-carrying area to such an extent that they cannot carry half of what they did fifty years ago; whilst the damage resulting to the agricultural districts below from the drying-up of springs and streams, the torrents caused by heavy rains and the melting of the snows, and their effect on the river banks and channels, followed by long droughts in summer, is simply incalculable, and such as cannot be repaired, even at a large expenditure, within two generations."

It is easy to understand how the process of erosion must ultimately result in floods; and these, indeed, are among the earliest and most strongly marked consequences of sweeping away indigenous bush without making any systematic attempt to replace it. In America, where so large an area of the native forest has been cut out with reckless disregard of all precautions, the effects of these devastating floods have already been carefully studied. "One small neglected stream," we are told, "has been found by actual measurement to wash enough soil from its hills to deposit silt equal to $1\frac{1}{2}$ tons per acre of its watershed in a year. The quantity of silt deposited every year by all the streams in the United States would cover a territory 900 miles square a foot deep. Our rivers have washed 783,000,000 tons of the best soil of the United States from the upland farms, and carried it into the rivers, where it has formed bars, impeded navigation, and finally lodged in the great harbours. The Government has already spent \$553,000,000 for river and harbour improvements," and this outlay has been rendered necessary almost entirely through the indirect effects of deforestation. The National Conservation Commission estimates that soil-erosion reduces farm-production in America from 10 to 20 per cent.; and that the annual loss to the farms alone is \$500,000,000. The direct damage from floods has increased from \$45,000,000 in 1900 to \$238,000,000 in 1907—and all this enormous expenditure and loss is attributed by this responsible Commission of experts to the reckless slaughter of the forests.

So far as New Zealand is concerned, the country is still too young to have experienced the worst effects of deforestation either in regard to erosion or floods. But, even as it is, it is no exaggeration to say that there is not a single district in the Dominion in which the native bush has been cleared away round the head-waters of the rivers that does not exhibit some of the disastrous consequences above described. It is only necessary to mention the matter to recall to the recollection of the general public the extent to which floods have increased in recent years throughout these Islands, in all the districts watered by rivers flowing down from hills where the bush has been partially or wholly cleared away. This is a subject on which, no doubt, a large amount of valuable information could be compiled from the reports of engineers and other experts submitted to County Councils and Road Boards from time to time in both North and South Islands." Some years ago Mr. R. W. Holmes, now Engineer-in-Chief to the Public Works Department, reported to the Feilding Borough Council on a serious washout at the junction of the Oroua and Kīwitea Rivers, involving the loss of over 50 acres of valuable land, and he attributed this disastrous flood entirely to the destruction of the bush along the upper courses of the rivers. Throughout the Wellington and Wanganui Districts the same tale can be told. The Manawatu, the Wangaehu, the Rangitikei, the Turakina have all followed the same course, with the same unfortunate consequences. In the Hawke's Bay District similar conditions have produced similar results; and all over New Zealand, wherever the bush around the sources of streams has been cut away, floods of varying degrees of intensity and destructiveness have inevitably followed. Already the penalty paid for our recklessness has been a heavy one, reckoned only in the money-value of land washed away or overlaid with *débris*, in stock drowned and property destroyed, and in the huge and increasing outlay on bridges that must be constantly repaired, and approaches that must be continually lengthened, and groins and embankments that must be perpetually strengthened against the encroachments of these turbulent streams. (*Vide* photographs opposite page 96.)

So far back as 1870 Sir James (then Doctor) Hector, addressing a Select Committee on Colonial Industries, said that the complete destruction of our native bush was most wasteful and unnecessary. "It is not at all necessary," said this eminent scientist, "that the forest should be completely removed in the way that it usually is, either for the purposes of agricultural settlement, or the obtaining of timber for mills, firewood, and fencing. The thinning-out of the forest would be ample in most cases to supply all our wants." No doubt our system of deforestation is just as extravagant as it was forty years ago in New Zealand; and, so far as the rest of the world is concerned, there seems to be a general consensus of opinion that careful and scientific methods of timber-cutting would make a vast difference to the present position and the future prospects of the industry.

Rudolf Cronau, an authority who has had wide experience of American forests during the past thirty years, tells us in an article on "A Continent despoiled" in a recent issue of *McClure's Magazine* that the lumbermen waste half of every tree they cut. "One-fourth of the standing timber is left or otherwise lost in logging. The loss in the mill is from one-third to two-thirds of the timber sawed. The loss in the mill-product through seasoning and fitting for use is from one-seventh to one-fourth. Only 320 ft. of timber are used for each thousand feet that stood in the forest." This estimate corresponds closely enough with the opinion advanced by Dr. Bristol, of the United States Forestry Department, who states that at least 50 per cent., if not more, of the average tree as it stands in the forest is wasted before reaching the market in the form of timber. In similar terms Mr. M. I. Seckendorf, writing on "The Elimination of Waste" in *Munsey's Magazine*, has shown that some seventy-five per cent. of America's forest-products is wasted, and that most of this disastrous loss is due to preventable fires, careless logging, and wasteful mill operations.