

may be protected by the green sward of grass; and this may be renewed, in the manner before described, from elements derived from rain-water and the atmosphere. Hence, while the river is continually bearing down matter in the alluvial plain, and undermining the cliffs on each side of every valley, the height of the intervening rising grounds may remain stationary.

In this manner, a cone of loose scoriæ, sand, and ashes, such as Monte Nuovo, may, when it has once become densely clothed with herbage and shrubs, suffer scarcely any farther dilapidation; and the perfect state of the cones of hundreds of extinct volcanos in France, Campania, Sicily, and elsewhere may prove nothing whatever, either as to their relative or absolute antiquity. We may be enabled to infer, from the integrity of such conical hills of incoherent materials, that no flood can have passed over the countries where they are situated, since their formation; but the atmospheric action alone, in spots where there happen to be no torrents, and where the surface was clothed with vegetation, could scarcely in any lapse of ages have destroyed them.

During a tour in Spain, in 1830, I was surprised to see a district of gently undulating ground in Catalonia, consisting of red and grey sandstone, and in some parts of red marl, almost entirely denuded of herbage; while the roots of the pines, holm oaks, and some other trees, were half exposed, as if the soil had been washed away by a flood. Such is the state of the forests, for example, between Oristo and Vich, and near San Lorenzo. But, being overtaken by a violent thunder-storm, in the month of August, I saw the whole surface, even the highest levels of some flat-topped hills, streaming with mud, while on every declivity the devastation of torrents was terrific. The peculiarities in the physiognomy of the district were at once explained; and I was taught that, in speculating on the greater effects which the direct action of rain may once have produced on the surface of certain parts of England, we need not revert to periods when the heat of the climate was *tropical*.

In the torrid zone the degradation of land is generally more rapid; but the waste is by no means proportioned to the superior quantity of rain or the suddenness of its fall, the transporting power of water being counteracted by a greater luxuriance of vegetation. A geologist who is no stranger to tropical countries observes, that the softer rocks would speedily be washed away in such regions, if the numerous roots of plants were not matted together in such a manner as to produce considerable resistance to the destructive power of the rains. The parasitical and creeping plants also entwine in every possible direction, so as to render the forests nearly impervious, and the trees possess forms and leaves best calculated to shoot off the heavy rains; which, when they have thus been broken in their fall, are quickly absorbed by the ground beneath, or, when thrown into the drainage depressions, give rise to furious torrents.*

* De la Beche, Geol. Man., p. 184., 1st ed.