

are distributed through the formations, and have been the source of some coaly products; but never abundantly. The trunks of *Lessonia*, as large as a man's thigh, lie piled in great quantities on the shores of the Falkland Islands. Moreover, the growth of sea-weeds is very rapid. On the coast of Scotland, and below low-tide level, "a surface chiseled smooth in November, was thickly covered in the following May with ribbon kelp 2 feet long, and ordinary kelp 6 feet long." But no peat-like compact beds of marine Fucoids are known. Fucoids contain 74 to 80 per cent of water, some nitrogen, and are very mucilaginous; and hence "when they begin a decay and become disorganized, they melt down into a very small bulk, and seem almost to dissolve away." (Storer.)

The great interest to the geologist in this subject of peat-beds is the essential identity between their method of origin and that of the great accumulations of vegetable debris out of which coal-beds were made. Both were accumulations of leaves and stems of terrestrial (not marine) plants, and occupy, as a general thing, the region where the plants to a large extent grew. The chemical processes of change were also essentially the same. The burial of the ancient beds beneath thick sediments in many successions, as explained on page 712, has made the chief differences.

PROTECTIVE AND OTHER BENEFICIAL EFFECTS.

The protective effects of life come chiefly from vegetation.

1. Turf protects earthy slopes from the wearing action of rills that would wear a bare surface into gullies; and even hard rocks receive protection in the same way.

2. Tufts of grass and other plants over sand-hills, as on seashores, bind down the moving sands by their long creeping stems or spreading roots.

3. Lines of vegetation along the banks of streams prevent wear during freshets. When the vegetation consists of shrubs or trees, the stems and trunks entangle and detain detritus and floating wood, and serve to increase the height of the margin of the stream.

4. Vegetation on the borders of a pond or bay serves in a similar manner as a protection against the feebler wave-action. In many tropical regions, plants like the mangrove, growing at the water's edge, drop new roots from the branches into the shallow water. These roots act like a thicket of brush-wood, to retain the floating leaves, stems, and detritus; and, as the water shallows, other roots are dropped farther out; and thus they keep marching outward, and subserve the double purpose of protecting and making land. The coarse salt-marsh grasses along seashores perform the same kinds of geological work, being very effectual agents in entangling detritus, and in protecting from erosion.

5. Patches of forest-trees, on the declivities in Alpine valleys, serve to turn the course of the descending avalanche, and entangle snows that, but for the presence of the trees, would only add to its extent. Such groves are usually guarded from destruction with great care.

6. Forests retard the melting of snow and ice in spring, and thus lessen the devastations of floods.