

and flocks, is an immediate response to the distribution of vegetation, as thus determined.

The prevailing absence of trees is the most notable feature of the vegetation. There were open groves of poplars close by some of the streams, but where the more important trails followed the valleys the trees had been unmercifully trimmed or felled for firewood, and few remained standing. In one of the branch valleys of the Alabuga a single large tree serves as so notable a landmark that it is entered upon the large-scale Russian map. On our way from the Narin Valley up to Son Kul, we passed through fine groves of coniferous trees, but their occurrence was exceptional. Nothing of the sort was seen at similar altitudes when descending from Son Kul into the Tuluk Valley. Again, during our ascent into one of the south-opening valleys of the Kungei Ala-tau, north of Issik Kul, fine groves of conifers occupied the more shaded slopes of the side ravines. The line between trees and herbage was often very sharply defined. This was noted by Severtzof, who ascribed the general absence of trees to a recent change from a moister to a drier climate (1875, 66, 67); but it is difficult to believe that the prevailing absence of trees is natural on mountain slopes where flourishing groves are occasionally found. It seems more reasonable to ascribe the treelessness of the mountain sides to their long occupation by nomadic pastoral tribes, to whom pastures were of greater value than forests. It would be interesting, in this connection, to inclose and protect certain of the mountain tracts from grazing, and to plant them with tree seeds or young trees; and it would be surprising if a thrifty growth did not result. It is also noteworthy that the absence of trees is not accompanied either by small rainfall or by barrenness on the mountain sides. Rains were abundant in the higher ranges in July, and grassy herbage grew there luxuriantly.

An interesting contrast in the relation of vegetation to insolation was noted in passing from the deeper valleys to the higher mountains. In the bad-lands of the Narin basin, at altitudes of 6,500 or 7,000 feet, the sunny slopes were prevailingly bare and minutely dissected, while the shady slopes were occupied by a sparse herbage and were of smoother form. On the high spurs of the Kungei Ala-tau, at altitudes of 10,000 feet or more, and above the tree line, the sunny slopes had the better cover of grass, while the shady slopes were relatively barren. In the first case, sunshine promotes aridity and excludes vegetation. In the second case, sunshine promotes snow-melting and favors vegetation.

#### DEVELOPMENT OF THE TIAN SHAN MOUNTAINS.

A number of the mountain ranges that we saw were of vigorous form, with sharp peaks and deep-carved valleys, in which it was impossible to recognize any trace of the original unsculptured mass; but certain observations made in the central and northern ranges, near Lakes Son Kul and Issik Kul, and on the steppes that border the mountains on the north, led to the belief that the region had been very generally worn down to moderate or small relief since the time of greater deformation, which probably occurred in the Mesozoic age; that large areas of subdued or extinguished mountain structures are still to be seen in the low ranges and in the